Technical Guidance WM2

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Hazardous waste

Interpretation of the definition and classification of hazardous waste

NIEA www.ni-environment.gov.uk | Northern Ireland Environment Agency

Environment Agency

SEPA Scottish Environment Protection Agency

Publishing Organisations

Environment Agency
Horizon House
Deanery Road
Bristol
BS1 5AH

Tel: 03708 506506
www.environment-agency.gov.uk

Scottish Environment Protection Agency
Corporate Office
Erskine Court
The Castle Business ParK
Stirling
FK9 4TR

Tel: 01786 457700
Fax: 01786 446885
www.sepa.org.uk

Northern Ireland Environment Agency
Land and Resource Management Unit
Klondyke Building, Cromac Avenue
Gasworks Business Park
Lower Ormeau Road
Belfast, BT7 2JA

Tel: 028 90549710
Fax: 028 90549310
www.ni-environment.gov.uk

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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 Northern Ireland Environment Agency. In this document, they are known collectively as “the Agencies”.

A consultation document was released externally by the Agencies in September 2002 and amendments made to the to version 1.0. The Second Edition updated this document, and has itself been updated three times.

Keywords

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

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Project Team

The following Project Team provided valuable input into the finalisation of this document:

Nick Bethel (Project Manager)	Environment Agency	Chris Hall	Environment Agency
Robin Adams	Environment Agency	Jonathan Hofton	Environment Agency
Gary Bower	Environment Agency	Bob McIntyre	Environment Agency
Terry Coleman	Environment Agency	Jane Stratford	DEFRA
Paula Coopland	SEPA	Alison Townley	NIEHS
Roy Watkinson	Environment Agency	Gary Walker	SEPA

Contents

List of Abbreviations

ASTM American Society for Testing and Materials
ATSDR Agency for Toxic Substances and Disease Registry
BCF bioconcentration factor
BOD biological oxygen demand
BSI British Standards Institute
CAS Chemical Abstract Service
CD-ROM Compact Disk – Read Only Memory
CDS Chemical Detection System
CFC chlorofluorocarbon
CHIP Chemicals (Hazards Information and Packaging) [Regulations]
CIS Chemical Information System
CLP European regulation on the classification, labelling and packaging of chemicals
DIN Deutsche Industrie Normen
DOSE The Dictionary of Substances and their Effects
EC European Communities
ECB European Chemicals Bureau
EEC European Economic Community
EHC Environmental Health Criteria
EINECS European Inventory of Existing Commercial Chemical Substances
ESIS European chemical substances information system
EU European Union
EWC European Waste Catalogue
HSDB Hazardous Substances Data Bank
HSE Health and Safety Executive
IARC International Agency for Research on Cancer
IPCS INCHEM International Programme on Chemical Safety
IRIS Integrated Risk Information System
ISCS International Chemical Safety Cards
ISO International Standards Organisation
IUCLID International Uniform Chemical Information Database
L/S Liquid to Solid
LC Lethal concentration
LD Lethal dose
LEL Lower Explosive Limits
MEC Minimum effective concentration
MECA Minimum effective concentration in adult
MECD Minimum effective concentration in developing embryos
MFSU Manufacture, formulation, supply and use
MSDS Material Safety Data Sheets
NCEC National Chemical Emergency Centre
NFPA National Fire Protection Association
NIOSH National Institute of Safety and Health
OHMTADS Oil and Hazardous Materials Technical Assistance Data Systems
PAH polycyclic aromatic hydrocarbon
PCBs polychlorinated biphenyls
rWFD revised Waste Framework Directive
RTECS Registry of Toxic Effects of Chemical Substances
SCA Standing Committee of Analysts
SDSs Safety Data Sheet(s)
SEPA Scottish Environment Protection Agency
SIRI MSDS Safety Information Resources and Material Safety Data Sheets
STP Standard temperature and pressure (25°C, 1 atmosphere pressure)
TER transcutaneous Electrical Resistance
TSCA Toxic Substances Control Act
UEL Upper Explosive Limits
UK United Kingdom
UKEMS UK Environmental Mutagen Society
URL Uniform Resource Locator
USA United States of America
USEPA United States Environmental Protection Agency
WAF Water-accomodated Fraction
WHO World Health Organisation

Introduction

This Technical Guidance document has been developed to provide guidance on the assessment and classification of hazardous waste based on the revised Waste Framework Directive[1] 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 European Waste Catalogue (EWC).
Appendix A	Presents the EWC and provides guidance on its use.
Appendix B	(this appendix has now been deleted).
Appendix C	Hazardous Property Assessment, providing guidance on the assessment of hazardous properties H1 to H15.
Appendix D	Data Sources, providing users with information on data sources and origin of the information from different sources.
Glossary	A Glossary of terms (the index has been deleted)

[1] Council Directive 2008/98/EC

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Regulatory Framework

This chapter sets out:

- the legal context to the definition of hazardous waste as set out by the revised Waste Framework Directive; and
- how it is linked to chemicals legislation.

2.1 Revised Waste Framework Directive (2008/98/EC)

The revised Waste Framework Directive (rWFD) (2008/98/EC) replaced both the Waste Framework (75/442/EC) and Hazardous Waste (91/689/EEC) Directives.

The rWFD provides a European-wide definition of hazardous waste and requires the correct management and regulation of such waste. The starting point of the rWFD is to identify which wastes are considered to be hazardous.

Hazardous waste is defined as a waste possessing one or more of the 15 hazardous properties set out in Annex III of the rWFD. The hazardous properties are detailed here in Table 2.1.

The rWFD also provides for a list of wastes, known as the European Waste Catalogue (EWC), to classify wastes and identify those which are considered to be hazardous because of the hazardous properties set out in Annex III. This list is subject to periodic review.

2.2 European Waste Catalogue (EWC)

The EWC was implemented by Commission Decision 2000/532/EC and subsequently amended by Commission Decisions 2001/118/EC, 2001/119/EC and 2001/573/EC.

The EWC is a catalogue of all wastes, grouped according to generic industry, process or waste type. It differentiates between non-hazardous and hazardous by identifying hazardous waste entries with an asterisk (*).

Details of how to use the EWC 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. This outlines the methodology for assessing wastes based on the EWC.

A consolidated version of the EWC, incorporating subsequent amendments, and a description of how to use the catalogue are set out in Appendix A.

2.2.1 Links to Chemical Legislation

The rWFD indicates that the classification of waste as hazardous waste should be based on the European legislation on chemicals.

Annex III of the rWFD attributes the 15 hazardous properties by reference to:

- The Dangerous Substances Directive (67/548/EEC), and
- The Dangerous Preparations Directive (1999/45/EEC)

The EWC links the classification of certain hazardous wastes to the concentrations of "dangerous substances" within the waste and threshold concentrations derived from these directives.

This chemicals legislation is implemented in the UK through the Chemicals (Hazard Information and Packaging for Supply) Regulations 2009, which are known as CHIP4. Details of how CHIP4 relates to the classification of hazardous waste are set out in the Hazardous Waste Assessment Framework in Chapter 3.

From 1st June 2015 Regulation (EC) No. 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP), replaces Directives 67/548/EEC and 1999/45/EC. However it is being implemented in stages leading up to that date with substantial amendments to those Directives.

2.2.2 Domestic Legislation

The implementation of the rWFD and the EWC in England, Northern Ireland, Scotland and Wales may differ. Further guidance on each regulatory regime is published by the Agencies on their respective websites.

This document provides the common technical basis for the definition of Hazardous Waste in the United Kingdom.

Table 2.1: Hazardous Properties (Waste Directive Annex III) [1]

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	"Oxidizing": substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.
H3-A	"Highly flammable" - liquid substances and preparations having a flash point below 21°C (including extremely flammable liquids), or - substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or - solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or be consumed after removal of the source of ignition, or - gaseous substances and preparations which are flammable in air at normal pressure, or - substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.
H3-B	"Flammable": liquid substances and preparations having a flash point 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 and preparations containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.
H10	"Toxic for reproduction": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce non-hereditary congenital malformations or increase their incidence.
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	Waste which releases toxic or very toxic gases in contact with water, air or an acid.
H13	"Sensitizing": substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction of hypersensitization such that on further exposure to the substance or preparation, characteristic adverse effects are produced. [As far as testing methods are available].
H14	"Ecotoxic": waste which presents or may present immediate or delayed risks for one or more sectors of the environment.
H15	Waste capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics above.

[1] see Appendix C for Hazardous Property Assessments

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Hazardous Waste Assessment

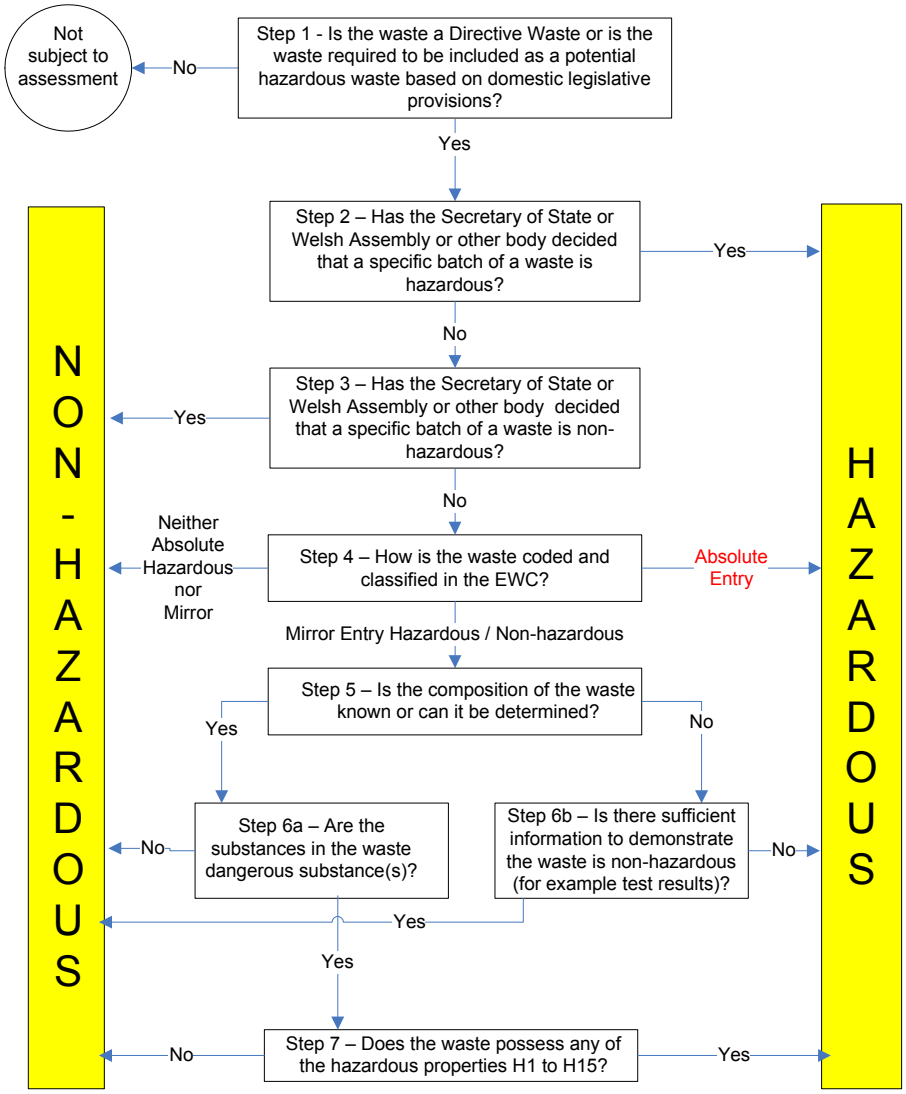
This chapter provides a practical approach to classifying hazardous waste by:

- outlining the methodology for assessing wastes based on the European Waste Catalogue; and
- highlighting where to find more detailed advice in this Technical Guidance Note.

3.1 Hazardous Waste Assessment Methodology

There are a number 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 this Technical Guidance Note.

Figure 3.1 Hazardous Waste Assessment Methodology



The flowchart and the text below is provided for the following purposes:

- to determine what type of code(s) in the EWC a waste is classified under - absolutely hazardous, absolutely non-hazardous or whether the waste is a “mirror” entry (when it might be hazardous or non-hazardous), and
- then to assign the appropriate EWC code to a waste.

Steps 5 to 7 are used to support this and assign hazardous properties to a waste. They must be used to determine hazardous properties for completion of consignment notes.

The flowchart must not be used in isolation. The supporting text must be considered.

3.1.1 Step 1: Is the waste Directive waste or is the waste required to be included as a potential hazardous waste based on domestic legislative provisions ?

Nearly all household, commercial and industrial waste is “Directive Waste” and should be assessed to determine if they are hazardous waste.

“Directive waste” is the term given to wastes which are regulated under the rules given in the revised Waste Framework Directive.

Directive waste is any waste that is not excluded from the scope of the revised Waste Framework Directive by Article 2 of that Directive.

“Waste” is defined in Article 3 of that Directive as any substance or object which the holder discards or intends or is required to discard.

If waste is not Directive Waste, it cannot be hazardous waste. This should be determined prior to proceeding to step 2 of the flowchart.

The following are not Directive Waste:

a) gaseous effluents emitted to atmosphere.

b) land (in situ) including unexcavated contaminated soil and buildings permanently connected to land.

c) uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated.

d) radioactive waste. (Most radioactive waste is not Directive Waste. However, if radioactive waste is exempt from requiring an environmental permit by virtue of Section 15 of the Radioactive Substances Act 1993, and has one or more of the hazardous properties listed in Appendix A, this waste can be classified as hazardous waste according to domestic legislation.)

e) decommissioned explosives

f) faecal matter, if not covered by (h) below, straw and other natural non-hazardous agricultural or forestry material used in farming, forestry or for the production of energy from such biomass through processes or methods which do not harm the environment or endanger human health.

The following are not Directive waste where they are regulated by other Community legislation:

g) waste waters

h) animal by-products including processed products covered by Regulation (EC) No 1774/2002, except those which are destined for incineration, landfilling or use in a biogas or composting plant;

i) carcasses of animals that have died other than by being slaughtered, including animals killed to eradicate epizootic diseases, and that are disposed of in accordance with Regulation (EC) No 1774/2002;

j) waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries covered by Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries. If you hold mining waste that is covered by the mining waste directive you may use the guidance in this document to identify an EWC code for your waste and its hazardous properties for the purposes of categorising your site in accordance with the Mining Waste Directive.

Household waste is Directive waste and is not excluded from the scope of the Directive. Article 20 of the revised Waste Framework Directive indicates that mixed municipal waste from households is not subject to certain controls applicable to hazardous waste. Separated fractions of hazardous household waste are subject to controls on recording keeping and labelling once they have been accepted at a collection point.

3.1.2 Step 2: Has the Secretary of State, the Welsh Assembly, Scottish Executive or Northern Ireland Department of the Environment decided that a specific batch of waste is hazardous?

3.1.3 Step 3: Has the Secretary of State, the Welsh Assembly, Scottish Executive or Northern Ireland Department of the Environment decided that a specific batch of waste is non-hazardous?

The EWC lists wastes using a six-digit code and general description. It also includes an Annex which details the steps to be used to decide which code to use for any particular waste.

The entries in the EWC can be automatically hazardous (absolute hazardous waste), automatically non-hazardous (absolute non-hazardous waste), or possibly hazardous / possibly not hazardous (mirror entries). This is described in 3.1.4 below.

The Secretary of State, the Welsh Assembly, Scottish Executive or Northern Ireland Department of the Environment can decide that a waste identified as absolute non-hazardous on the EWC should be hazardous waste, because it possesses hazardous properties.

They can also decide that a waste identified as absolute hazardous on the EWC should be non-hazardous waste, because it does not possess any hazardous properties.

They will make any decisions in consultation with other parties. The Agencies will publish decisions that are accepted by the Secretary of State, the Welsh Assembly, Scottish Executive or Northern Ireland Department of the Environment on their websites.

The Secretary of State, the Welsh Assembly, Scottish Executive or Northern Ireland Department of the Environment will not make decisions that mirror entries are absolute hazardous or absolute non-hazardous.

3.1.4 Step 4: How is the waste coded and classified on the EWC?

The EWC consists of 20 chapters that are related either to the process that generated the waste or to specific waste types. The chapters are given a two-digit number. These chapters must be used in a certain order of precedence which is described in detail in Appendix A.

Each EWC chapter contains sub-chapters that are identified by four-digits. Within each sub-chapter is a list of unique six digit codes for each waste, for example:

20 MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS.

20 01 Separately collected fractions (except 15 01)

20 01 01 paper and cardboard

This six-digit entry 20 01 01 is paper and cardboard, kept separately from other wastes, collected from a householder (or is waste similar to that produced by a householder) but which is not packaging waste (which would be coded in sub-chapter 15 01).

Some of the six-digit codes in the EWC have an asterisk next to them. These are hazardous wastes. Wastes without an asterisk are not hazardous waste.

In Appendix A, some entries are known as:

- "Absolute" hazardous entries;
- "Mirror" hazardous entries;
- "Mirror" non-hazardous entries;
- "Absolute" non-hazardous entries.

"Absolute" hazardous

These wastes are marked in the EWC with an asterisk (*), but the waste description next to the six-digit code does not have a specific or general reference to "*dangerous substances*" in the waste description. They are automatically considered hazardous. You do not need to work out what chemicals are in the waste to find out if it is hazardous or not. You must still find out if what hazardous properties the waste has for consignment and transport purposes.

We call these "*absolute entries*", these are coloured red and are labelled with an 'A' in Appendix A. For example:

13 07 01* fuel oil and diesel A

"Mirror" hazardous and "Mirror" non-hazardous

Some wastes can be either hazardous or not, depending on whether it contains "*dangerous substances*" at or above certain levels. This waste is covered by linked (usually, but not always, two paired) 6-digit entries in the List of Wastes, called "*mirror*" entries.

These wastes have:

- a hazardous waste entry (or entries) marked with an asterisk (*), and
- an alternative paired non-hazardous waste entry (or entries) not marked with an asterisk.

"*Mirror*" entry hazardous wastes, colour-coded blue and are labelled with an 'M' in Appendix A, are identified because they refer to dangerous substances. They can do this in one of two ways:

1. a "*general*" reference to a dangerous substance(s), for example:

07 01 11* sludges from on-site effluent treatment containing dangerous substances M

This entry is chosen if this waste contains any dangerous substance(s) at the required levels.

2. a "*specific*" reference to a dangerous substance(s), for example:

17 03 01* bituminous mixtures containing coal tar M

These wastes are classified as hazardous by looking for a specific dangerous substance in the waste; in the example above that substance is coal tar. This entry is chosen only if this waste contains coal tar at the required levels.

In the two examples above, if the "*mirror*" entry waste doesn't contain general or specific dangerous substance(s) at the required levels, it is not hazardous and the appropriate non-hazardous six-digit mirror code should be chosen. The non-hazardous mirrors for our examples above are:

07 01 12 sludges from on-site effluent treatment other than those mentioned in 07 01 11; and

17 03 02 bituminous mixtures other than those mentioned in 17 03 01

"Absolute" non-hazardous *(neither Absolute Hazardous nor Mirror Hazardous)*

This is an entry in the EWC without an asterisk so it is not hazardous, for example:

03 01 01 waste bark and cork

Steps 5 to 7 below only apply to finding out if waste, listed as "*mirror"* entries, is hazardous or not.

It is important to establish whether a non-hazardous entry is part of a mirror entry, and therefore needs further assessment, prior to assigning the non-hazardous code.

3.1.5 Step 5: 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 or not is to identify the chemical composition of the waste.

The composition of the waste could be identified using:

- for products that become waste, and whose composition is not altered during storage/use, information on the product Safety Data Sheet will give the composition; otherwise
- chemical/microbiological analysis of the waste, which may be supported by knowledge of the process or activity that produced the waste.

Chemical analyses (particularly for inorganic substances) do not always identify the components within a waste, but the individual species such as anions (for example, sulphate, chloride) and cations (for example, metals). In such cases the waste holder would need to determine what substances are likely to be present either by further analysis or on knowledge of 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. The worst case scenario is the substance, or combination of substances, that may reasonably exist within the waste and will make the waste hazardous at the lowest concentration.

In the majority of cases the company producing or storing a "mirror" entry waste should have enough information about the chemical substances in their waste to know if it is hazardous or not (for example from safety data sheets, or knowing how the waste was produced). If they do not know what substances are in their waste and they cannot find this out, they will need to test the waste (see Step 6b). This may not be appropriate for all hazardous properties (see Appendix C).

3.1.6 Step 6a: Are the substances in the waste "dangerous substances"?

Where the composition of a "mirror entry" waste is known, it can be assessed to determine if the substances in the waste are "dangerous substances" or not.

A "substance" is "dangerous" if it is given a "risk phrase". There are three ways to find out the "risk phrase" for a substance:

1. use Annex VI, Table 3.2 to the Classification, Labelling and Packaging of Substances Regulation (CLP)[1]. This shows risk phrases for many common chemicals[2]. Annex VI is the most important source for risk phrases;
2. obtain or derive risk phrases from reliable data sources such as reference books or the internet. These sources must be 'peer reviewed', which means that other professionals have looked at and approved the data;
3. get risk phrases from Safety Data Sheets or other data sources.

If none of the substances in the waste have "risk phrases" the waste is not hazardous[3] and the non-hazardous "*mirror"* EWC code can be used. If any substances do have risk phrases you will need to go to Step 7.

[1] EC No 1272/2008
[2] Chemical is the common term for substances (a chemical element or one of its compounds, including any impurities) and preparations (a mixture of substances).
[3] One of two exceptions to this is clinical waste which could be H9 infectious as there are no risk phrases for infectious agents (see Appendix C - C9). The other exception is H15 which should also be considered (see Appendix C - C15).

Box 3.1: | Example of an entry Table 3.2 of the CLP

Index Number	International Chemical Identification	EC No	CAS No
048-010-00-4	Cadmium Sulphide	215-147-8	1306-23-6

Classification	Labelling	Concentration Limits	Notes
Carc. Cat. 2; R45 Muta. Cat. 3; R68 Repr. Cat. 3; R62-63 T; R48/23/25 Xn; R22 R53	T; R: 45-22-48/23/25- 62-63-68-53 S: 53-45-61	Xn; R22: C ≥ 10 % T; R48/23/25: C ≥ 10 % Xn; R48/2022: 0,1 % ≤ C< 10 %	E 1

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

Some substances have their own specific concentration limits; These are **NOT USED** for hazardous waste assessment unless Appendix C indicates otherwise for a specific hazardous property (for example H14 Ecotoxic).

Supplementary notes that may affect assessment

The **classification** of cadmium sulphide is therefore:

- Carc Cat 2 (Carcinogenic Category 2), Muta Cat 3 (Mutagenic Category 3), Repr Cat 3 (Toxic for Reproduction Category 3), T (Toxic) and Xn (Harmful) indicating the Categories of Danger or hazards; and
- R45, R68, R62,63, R48/23/25, R22 and R53 being the risk phrases.

A full description of all risk phrases is set out in Annex III of Council Directive 67/548/EEC

The **Concentration limits** are not used for assessment.

There are two supplementary **Notes;**

- Note E that has no effect on hazardous waste assessment; and
- Note 1 that indicates that cadmium element concentration is used in the assessment rather than compound concentration.

Note E (Table 3.2):

> *Substances with specific effects on human health (see Chapter 4 of Annex VI to Directive 67/548/EEC) that are classified as carcinogenic, mutagenic and/or toxic for reproduction in categories 1 or 2 are ascribed Note E if they are also classified as very toxic (T+), toxic (T) or harmful (Xn). For these substances, the risk phrases R20, R21, R22, R23, R24, R25, R26, R27, R28, R39, R68 (harmful), R48 and R65 and all combinations of these risk phrases shall be preceded by the word 'Also'.*

Note 1 :

> *The concentration stated or, in the absence of such concentrations, the generic concentrations of this Regulation (Table 3.1) or the generic concentrations of Directive 1999/45/EC (Table 3.2), are the percentages by weight of the metallic element calculated with reference to the total weight of the mixture.*

Using Table 3.2 of the CLP

Table 3.2 of the CLP gives hazard classifications (risk phrases) for many common chemicals. Where a chemical is listed in the CLP (as amended by adaptions to technical progress ATPs) the classification given therein takes precedence over a classification found elsewhere.

An example of the classification of a chemical given in Table 3.2 of the CLP is set out in Box 3.1. To aid identification, each CLP 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 CLP shows risk phrases joined together by 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. A hyphen (-) is used to represent an 'and' in the case of Ecotoxic risk phrases, for example R50-R53 represents R50 and R53.

The CLP contains two series of supporting notes for, and indicated in, Table 3.2, these may also be amended by ATP's:

- The alphabetic (**substance**) series (Note A, B, etc.) are only relevant to hazardous waste where they alter the classification of the substance to which they relate. The assessment of hazardous wastes is based upon the classification.
- The numeric (**preparation**) series (Note 1, 2, etc.) relate to how the concentration limits for a substance are applied to a mixture. These notes can be used where appropriate, but are applied to the concentration limits given in this document for waste assessment, rather than those listed in the CLP.

Approved Classification and Labelling Guide and Other Data Sources

Table 3.2 of the CLP only covers a small proportion of the substances on the European Chemical Substances Information System (ESIS). If a substance is not listed in the CLP then further work 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 other data sources (for example 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 CLP, the available data must be collected and compared against the criteria specified and the appropriate risk phrase assigned. It should be remembered that substances could have more than one category of danger and a number of risk phrases. Therefore each criteria should be considered in turn.

Where a substance is not listed in Table 3.2 of the CLP, other data sources may be considered. Information published on databases supported by the European Chemicals Agency (for example ESIS) or contained in published ATPs arise from a review of available data and a determination in accordance with European Chemical legislation. These take precedence over other data sources.

Other databases supported by the European Commission may provide additional information (for example the Footprint Project pesticide properties database (PPDB) is a useful source of

data for H14 Ecotoxic). Consideration must be given to whether any alternative database is consistent with current European chemicals legislation.

CHIP4 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 preparation.

If the Safety Data Sheets for a chemical indicate a chemical risk phrase, 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 storage or use of the product, remain sufficient to be hazardous; or
- any reactions take place during the storage or use of the product which may remove the hazard or create new/different hazards from those of the product.

Note: considerable care must be taken when using Safety Data Sheets because they may:

- predate current European chemicals legislation and criteria;
- be produced in a country where these European criteria are not in use or fully understood;
- be incomplete, for example "*no information available*" means unknown or not checked rather than no chemical risk phrase applies; or
- be inaccurate or contradict other Safety Data Sheets;

We would always advise that several Safety Data Sheets from different sources are checked and, if in any doubt, the worst case is used.

Labels on chemical containers are not as comprehensive as the information provided on Safety Data Sheets and should not be used for hazardous waste assessment.

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

3.1.7 Step 6b: Is there sufficient information to demonstrate the waste is non-hazardous (for example test results)?

Waste holders have a duty to determine if a "mirror entry" waste is hazardous or non-hazardous. The waste can only be classified as non-hazardous where there is sufficient information to support assessment and demonstrate that the waste has no hazardous properties.

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 Table 3.2 of the CLP or other sources (and considering worst case compounds); or
- for any reason there is insufficient information to assess one or more hazardous properties;

the waste needs to be tested, where appropriate, to determine if it possesses any hazardous properties.

The ACLG identifies the test methods contained in European Commission Regulation (EC) No 440/2008 as the methods to be used to test for chemical risk phrases. Note that the ACLG provides different advice for pure substances than for preparations (mixtures). Most wastes are preparations, and should be tested as such. Note : It may not be appropriate to test for some hazardous properties (see ACLG and Appendix C).

Where a test method in Regulation 440/2008 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.

3.1.8 Step 7: Does the waste possess any of the hazardous properties H1 to H15?

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 H15, 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^{o}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 6b, 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. However testing may not be appropriate for all wastes or all hazardous properties.

Threshold concentrations

Article 2 of the EWC sets out thresholds for hazardous properties H3-A(first indent), H3-B, H4 to H8, H10 and H11,

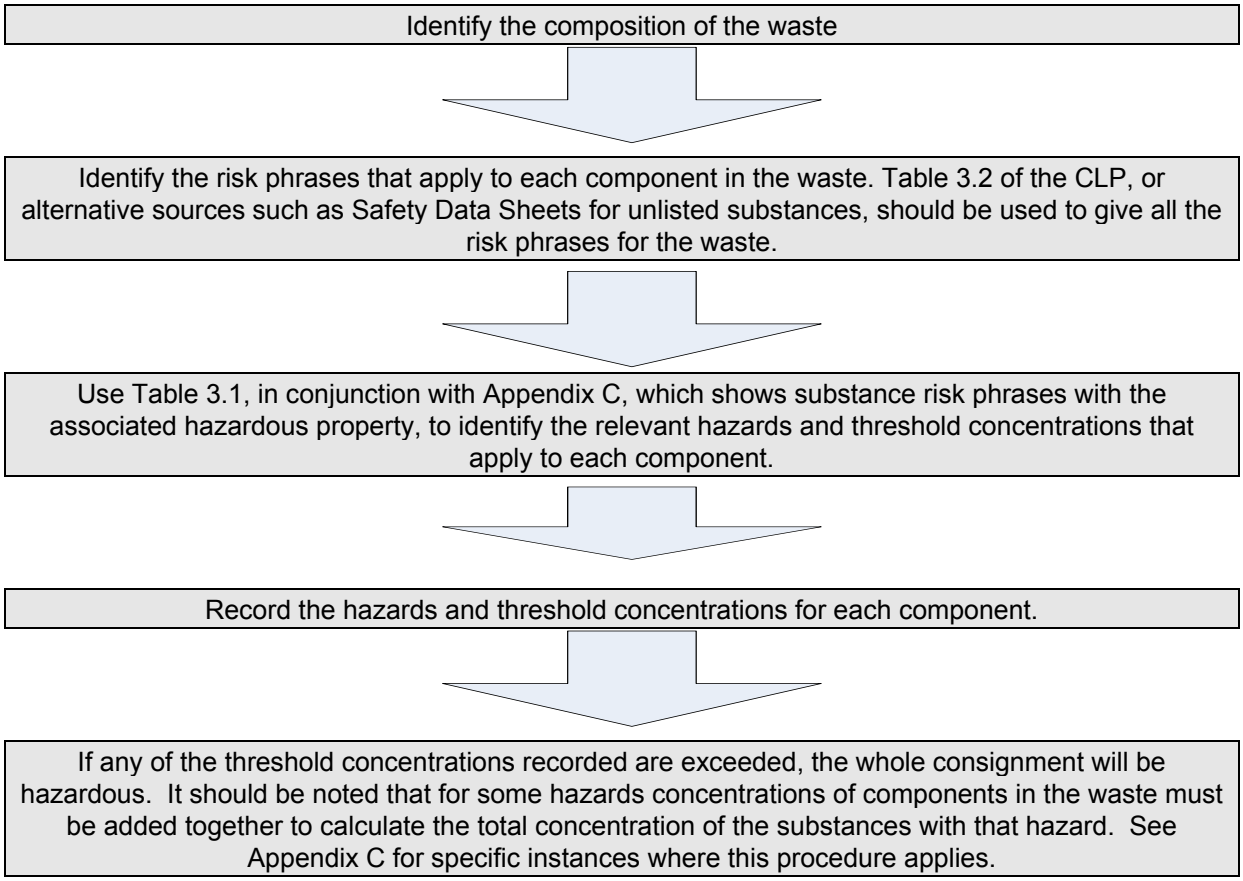
Threshold concentrations for the hazardous properties not covered by Article 2 (H1, H2, H3-A (second to fifth indents), H12, H13, H14 and H15), have been developed based on the classification and risk phrases from CHIP. The thresholds for some of these hazards can be calculated, while others require testing of physical properties. The assessment of H9 has been developed based on the presence of infectious agents 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 5 to 7:



Theoretical Example of Hazardous Waste Assessment Methodology

Waste A, produced in England, from a manufacturing process contains 10% of chemical X and 18% of chemical Y with the remainder being water.

Step 1: Waste A is a Directive Waste. The domestic legislation does not contain specific provisions that relate to this waste.

Steps 2 and 3 : No decisions relating to this waste have been made by the Secretary of State.

Step 4: Waste A is listed as part of a "mirror entry" in the EWC.

Step 5: The composition of the waste is known.

Step 6a: The waste does contain dangerous substances because:

Chemical X is listed in Table 3.2 of the CLP and is classified as F; R11, Xn: R20/22; and

Chemical Y, which is not listed in Table 3.2 of the CLP has the classification of Xi: R36, Xn: R21 and N: R50-53, on its Safety Data Sheets.

Water is not listed in Table 3.2 of the CLP and is not considered to be dangerous.

Step 7: Based on the classifications of the chemicals, waste A could display the hazardous properties H3-A/H3-B (Highly Flammable/Flammable), H4 (Irritant), H5 (Harmful) and H14 (Ecotoxic):

A test is performed on the waste and the flashpoint is 75^{o}C. H3-A "Highly Flammable" and H3-B "Flammable" can be discounted.

The threshold for Xi: R36 identified from Table 3.1 and Appendix C4 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 applicable 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 and Appendix C5. 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 generic threshold concentration limit (see Appendix C14) for a single N: R50-53 chemical 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		Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
Category of Danger	Risk Phrase				
n/a	R1	Explosive when dry	H15 (by H1)	n/a	A waste containing substances with risk phrase R1 is a candidate for hazard H15 because it may become dry during disposal.
E	R2	Risk of explosion by shock, friction, fire	H1	Test for explosive	Tests are given in Appendix C1.
E	R3	Extreme risk of explosion by shock, friction, fire or other sources of ignition			
n/a	R4	Forms very sensitive explosive metallic compounds	H15 (by H1)	n/a	A waste containing substances with these risk phrases is a candidate for hazard H15
	R5	Heating may cause an explosion			
	R6	Explosive with or without contact with air			
O	R7	May cause fire	H2	Test and / or calculation	Tests are given in Appendix C2, however test does not apply to organic peroxides
	R8	Contact with combustible material may cause fire			
	R9	Explosive when mixed with combustible material			
n/a	R10	Flammable	H3-B	Flashpoint >21^{o}C to 55^{o}C	Tests are given in Appendix C3

Classification		Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
Category of Danger	Risk Phrase				
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. H3A(iv) applies to gases Tests are given in Appendix C3
F+	R12	Extremely flammable	H3A(i) (H3B) H3A(iv)	H3A(i) fpt ≤21oC H3A(iv) test	
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	H15 (by H1)	n/a	A waste containing substances with these risk phrases is a candidate for hazard H15.
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	H15 (by H1, H2 or H3)	n/a	A waste containing substances with these risk phrases is a candidate for hazard H15
	R19	May form explosive peroxides			
Xn	R20	Harmful by inhalation	H5	≥ 25%	Threshold limit applies to the total concentration of substances classified as Harmful by CHIP. You should add together the concentrations of substances with risk phrases R20, R21, R22 and R65 to see if the threshold is exceeded. This includes where R20, R21 and R22 are combined together or with R48 or Xn: R68.
	R21	Harmful in contact with skin			
	R22	Harmful if swallowed			

Classification		Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
Category of Danger	Risk Phrase				
T	R23	Toxic by inhalation	H6(H5)	≥3%	Threshold limit applies to the total concentration of substances classified as Toxic by CHIP. You should add together the concentrations of substances with risk phrases R23, R24 and R25 to see if the threshold is exceeded. This includes where R23, R24 and R25 are combined together or with R39 or R48.
	R24	Toxic in contact with skin			
	R25	Toxic if swallowed			
T+	R26	Very toxic by inhalation	H6(H5)	≥0.1%	Threshold limit applies to the total concentration of substances classified as Very Toxic by CHIP. You should add together the concentrations of substances with risk phrases R26, R27 and R28 to see if the threshold is exceeded. This includes where R26, R27 and R28 are combined together or 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.

Classification		Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
Category of Danger	Risk Phrase				
Xi	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			
T T+	R39	Danger of very serious irreversible effects	n/a	n/a	R39 is only used in conjunction with combinations of R23, R24, R25 or R26, R27, R28, which are used to identify the exposure route. Refer to the thresholds given for those risk phrases.
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.
Xi	R41	Risk of serious damage to the eyes	H4	≥10%	The concentrations of substances with R41are additive. However, their concentrations cannot be added with irritant substances assigned R36, R37 or R38.
Xn	R42	May cause sensitisation by inhalation	H13	See Appendix C13	The concentration of an individual substance assigned R42 must be above the threshold limit.
Xi	R43	May cause sensitisation by skin contact	H13	See Appendix C13	The concentration of an individual substance assigned R43 must be above the threshold limit.
n/a	R44	Risk of explosion if heated under confinement	H15 (by H1)	n/a	A waste containing substances with these risk phrases is a candidate for hazard H15.
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				
Xn T	R48	Danger of serious damage to health by prolonged exposure	n/a	n/a	R48 is only used in conjunction with combinations of R20, R21, R22 or R23, R24, R25, which are used to identify the exposure route. Refer to the thresholds given for those risk phrases.
Carc.Cat.1 Carc.Cat.2	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	See Appendix C14	The interrelationship between these risk phrases is complex, with different combinations of 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.
N	R50-53	Very toxic to aquatic organisms and may cause long-term effects in the aquatic environment	H14	See Appendix C14	
N	R51-53	Toxic to aquatic organisms and may cause long-term effects in the aquatic environment	H14	See Appendix C14	
n/a	R52-53	Harmful to aquatic organisms and may cause long-term effects in the aquatic environment	H14	See Appendix C14	
N	R52	Harmful to aquatic organisms	H14	See Appendix C14	
n/a	R53	May cause long-term effects in the aquatic environment	H14	See Appendix C14	

Classification		Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
Category of Danger	Risk Phrase				
N	R54	Toxic to flora	H14	n/a	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 1005/2009 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.
Xn	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.
Xn			n/a	n/a	Xn: R68 is only used in conjunction with combinations of R20, R21, R22, which are used to identify the exposure route. Refer to the thresholds given for those risk phrases.

KEY

n/a not applicable

H3A (i) H3A (first indent) “Highly flammable”: liquid substances and preparations having a flashpoint ≤21°C (including extremely flammable liquids).

H3A (ii) H3A (second indent) “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)H3A (third indent) “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)H3A (fourth indent) “Highly flammable”: gaseous substances and preparations which are flammable in air at normal pressure.

H3A (v) H3A (fifth indent) “Highly flammable”: substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.

3.1.9 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 CLP 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 H3-B "Flammable". At even higher concentrations the flashpoint will be less than 21°C so the waste will be hazardous by H3-A (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 for example H3-A (first indent) (H3-B).

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: that is, 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.
- H3-A (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.

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 Table 3.2 of CLP. 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 H15 (waste capable by any means, after disposal, of yielding another substance which possesses hazards H1 to H14).

3.1.10 Other important notes on the use of CHIP to assess hazardous waste

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

- The "conventional method" used in CHIP to determine the classification of preparations must not be be used for determining the classification of a hazardous waste. The methodology given here differs in many instances. 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 CHIP4 purposes. See "Linked hazardous properties" in Section 3.1.8.
- Articles such as electronic equipment are not classified as hazardous by CHIP. However, determining if such wastes are hazardous means determining whether they, or their components, possess any hazardous properties. This should be done by considering the classifications of the substances within the article, or component, and their threshold concentrations with reference to the weight of the article or component. The availability of substances is not considered when assessing hazardous waste.
- Table 3.2 of the CLP classifies some preparations, such as blends of oils, as substances. These preparation are also treated as substances for the purposes of classifying hazardous wastes.
- Threshold concentrations given in Table 3.2 of CLP do not normally apply when classifying hazardous waste. This is because the EWC provides its own legislative thresholds for many properties. Any exceptions to this are indicated in Appendix C.
- 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: How Categories of danger from Table 3.1 of the CLP relate to Hazardous Properties

Categories of danger	Hazardous Property	Hazardous Waste Threshold Limit (refer to appendix C)
Explosive, E	H1	See Appendix C
Oxidising, O	H2	See Appendix C
Extremely Flammable, F^+	H3-A	See Appendix C
Highly Flammable, F	H3-A	See Appendix C
Flammable, F	H3-B	See Appendix C
Irritant, X_i	H4	≥ 10% or ≥ 20% depending upon risk phrase
Harmful, X_n	H5	≥ 25%
Toxic, T	H5/H6	≥ 3%
Very toxic, T^+	H5/H6	≥ 0.1%
Carcinogenic, Carc.Cat. 1, 2 & 3	H7	≥ 0.1% or ≥ 1% depending upon risk phrase
Corrosive, C	H4/H8	≥ 1% or ≥ 5% depending upon risk phrase
Toxic for reproduction, Repr.Cat. 1, 2 & 3	H10	≥ 0.5% or ≥ 5% depending upon risk phrase
Mutagenic, Muta.Cat. 1, 2 & 3	H11	≥ 0.1% or ≥ 1% depending upon risk phrase
Sensitising, X_n, X_i	H13	≥ 0.1% or ≥ 1% depending upon risk phrase
Dangerous for the Environment, N	H14	See Appendix C

Appendix A:

Consolidated European Waste Catalogue

This aim of this appendix is to provide guidance on the use of the European Waste Catalogue (EWC). It reproduces the EWC in full, including amendments, and includes instructions for for its use.

The structure of the EWC

The EWC contains 20 chapters that are based upon the source that generated the waste or upon the type of waste. The chapter headings are shown in Table A1.

Each chapter is identified by a two-digit number :

e.g., 07 Wastes from Organic Chemical Processes

Each of these chapters contains sub-chapters that are identified by four digits. ;

e.g., 07 01 Wastes from the manufacture, formulation, supply and use (MFSU) of basic organic chemicals.

The unique six-digit code for each waste is contained within the sub-chapters.

e.g., 07 01 01* aqueous washing liquids and mother liquors

The red and blue colour coding of entries is provided in this document to support the instructions on the use of the EWC included below.

Under the Duty of Care, waste producers have a duty to classify and describe their waste correctly; this includes selecting the most appropriate six-digit code from the EWC. Note : The written description must not simply reproduce the description from the EWC that accompanies each classification code.

Using the EWC

The EWC details a series of steps for identifying wastes in the catalogue and determining whether a waste is covered by a hazardous waste entry. Set out below are the steps to be followed when using the catalogue.

Step 1 Identification by Waste Source

Identify the source process generating the waste in chapters 01 to 12 and 17 to 20 and select the appropriate six-digit code. However it should be noted that:

- six-digit codes ending Ò99îwhich represents ìwastes not otherwise specifiedîunder a particular two-digit and four-digit code) should not be used at this stage and are only to be used if no other code applies to a waste (Step 4 below)
- certain producers may need to look in more than one of these Chapters if their activity has a number of different processes.
- source related chapters may contain codes that apply to wastes generated by a manufacturing process (for example chapter 07). However, the manufactured products themselves may be found elsewhere in the EWC .
- Separately collected packaging waste, including mixtures of different packaging materials, should be classified under 15 01 and not 20 01

Step 2 Identification by Waste Type

If no appropriate waste code can be found in Chapters 01 to 12 and 17 to 20, then chapters 13, 14, and 15 must be examined to identify the type of waste.

Step 3 Waste not otherwise specified in the list.

If a suitable waste code can not be found in Chapters 13 to 15, a six-digit code from Chapter 16 should be used to identify the waste.

Step 4 Waste not otherwise specified in the chapter

Only if no suitable six-digit code can be found in Chapter 16 should the most appropriate six digit code ending ÞÞ9îin Chapters 01 to 12 and 17 to 20 be used .

Step 5 Hazardous Waste Classification

There are three types on entry in the EWC

- ÞAbsoluteîhazardous that are colour-coded red and marked with an ÞAîin this document
- ÞMirroríhazardous that are colour-coded blue and marked with an ÞMîin this document
- Non-hazardous that are colour-coded black in this document

"Absolute entries " :

These entries are marked in the EWC with an asterisk (*), but without a specific or general reference to ìdangerous substancesî They are automatically considered hazardous.

There is no requirement to assess the composition of these wastes to determine whether they are hazardous or not; the European Commission has determined that these wastes possess one of more hazardous properties H1 to H15. ÞAbsolute entriesîare colour-coded in red and marked with an ÞAîin this document ;

e.g. 13 07 01* fuel oil and diesel

Þ**Mirror entries " î**

Some wastes have the potential to be either hazardous or not, depending on whether they contain “dangerous substances"î

These wastes are covered by two or more linked entries in the EWC, collectively called ìmirror entriesî that typically comprise:

- a hazardous waste entry (or entries) marked with an asterisk (*), and
- an alternative non-hazardous waste entry (or entries) not marked with an asterisk.

Mirror entry wastes, highlighted in blue and marked with an ÞMî are easily identified because they make a reference to dangerous substances. They can do this in one of two ways:

Step 5 continued

A General Reference to dangerous substances: e.g.,

07 01 11* sludges from on-site effluent treatment containing dangerous substances

and its non-hazardous counterpart

07 01 12 sludges from on-site effluent treatment other than those mentioned in 07 01 11

A Specific Reference to dangerous substances: e.g.,

16 01 11* brake pads containing asbestos

and its non-hazardous counterpart

16 01 12 brake pads other than those mentioned in 16 01 11

In both cases the waste must be assessed to determine if it falls under the hazardous or non - hazardous ìmirroríentry.

- For ìmirroríentries with a general reference to ìdangerous substancesî the classification is determined by looking for the presence of any ìdangerous substanceîin the waste.
- For ìmirror entriesîwith specific references to ìdangerous substancesî the classification is determined by looking for the presence of the specific substance that is identified in the waste description (in the example above this is asbestos).

The assessment procedure is explained in the Hazardous Waste Assessment Framework (Section 3 of this document).

Note: Some entries in the EWC make specific reference to "dangerous substances" where the linked entry is an "absolute entry". These are not considered to be ìmirror entriesî.

Non-Hazardous Entries (neither Absolute hazardous or Mirror hazardous)

Where a waste is not listed in the EWC with an asterisk, and the entry does not form part of a mirror entry, it is non-hazardous and does not need to be assessed, e.g.,

03 01 01 waste bark and cork

Certain wastes are listed in the EWC without an asterisk, but form part of a mirror entry for example ;

08 01 12 waste paint and varnish other than those mentioned in 08 01 11.

These non-hazardous ìmirrorícodes should only be used where assessment of the waste has determined that the linked ìmirroríhazardous code(s) is not applicable.

Table A1	European Waste Catalogue Chapters

No.	Chapter Title (shading relates to hierarchy of use)
01	Wastes resulting from exploration, mining, quarrying, physical and chemical treatment of minerals
02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing
03	Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard
04	Wastes from the leather, fur and textile industries
05	Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal
06	Wastes from inorganic chemical processes
07	Wastes from organic chemical processes
08	Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks
09	Wastes from the photographic industry
10	Wastes from thermal processes
11	Wastes from Chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy
12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics
13	Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12 and 19)
14	Waste organic solvents, refrigerants and propellants (except 07 and 08)
15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not other wise specified
16	Wastes not otherwise specified on the list
17	Construction and demolition wastes (including excavated soil from contaminated sites)
18	Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use
20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions.

"*Absolute Entries*" - Hazardous waste regardless of any threshold concentrations: A

"*Mirror Entries*" - Hazardous waste only if dangerous substances are present above threshold concentrations: M

01	**Wastes Resulting from Exploration, Mining, Quarrying, and Physical and Chemical Treatment of Minerals**

01 01	**wastes from mineral excavation**	
01 01 01	wastes from mineral metalliferous excavation	
01 01 02	wastes from mineral non-metalliferous excavation	
01 03	**wastes from physical and chemical processing of metalliferous minerals**	
01 03 04*	acid-generating tailings from processing of sulphide ore	A
01 03 05*	other tailings containing dangerous substances	M
01 03 06	tailings other than those mentioned in 01 03 04 and 01 03 05	
01 03 07*	other wastes containing dangerous substances from physical and chemical processing of metalliferous minerals	M
01 03 08	dusty and powdery wastes other than those mentioned in 01 03 07	
01 03 09	red mud from alumina production other than the wastes mentioned in 01 03 07	
01 03 99	wastes not otherwise specified	
01 04	**wastes from physical and chemical processing of non-metalliferous minerals**	
01 04 07*	wastes containing dangerous substances from physical and chemical processing of non-metalliferous minerals	M
01 04 08	waste gravel and crushed rocks other than those mentioned in 01 04 07	
01 04 09	waste sand and clays	
01 04 10	dusty and powdery wastes other than those mentioned in 01 04 07	
01 04 11	wastes from potash and rock salt processing other than those mentioned in 01 04 07	
01 04 12	tailings and other wastes from washing and cleaning of minerals other than those mentioned in 01 04 07 and 01 04 11	
01 04 13	wastes from stone cutting and sawing other than those mentioned in 01 04 07	
01 04 99	wastes not otherwise specified	
01 05	**drilling muds and other drilling wastes**	
01 05 04	freshwater drilling muds and wastes	
01 05 05*	oil-containing drilling muds and wastes	M
01 05 06*	drilling muds and other drilling wastes containing dangerous substances	M
01 05 07	barite-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06	
01 05 08	chloride-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06	
01 05 99	wastes not otherwise specified	

02	**Wastes from Agriculture, Horticulture, Aquaculture, Forestry, Hunting and Fishing, Food Preparation and Processing**

02 01	**wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**	
02 01 01	sludges from washing and cleaning	
02 01 02	animal-tissue waste	
02 01 03	plant-tissue waste	
02 01 04	waste plastics (except packaging)	
02 01 06	animal faeces, urine and manure (including spoiled straw), effluent, collected separately and treated off-site	
02 01 07	wastes from forestry	
02 01 08*	agrochemical waste containing dangerous substances	M
02 01 09	agrochemical waste other than those mentioned in 02 01 08	
02 01 10	waste metal	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

02 01 99	wastes not otherwise specified	
02 02	**wastes from the preparation and processing of meat, fish and other foods of animal origin**	
02 02 01	sludges from washing and cleaning	
02 02 02	animal-tissue waste	
02 02 03	materials unsuitable for consumption or processing	
02 02 04	sludges from on-site effluent treatment	
02 02 99	wastes not otherwise specified	
02 03	**wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation**	
02 03 01	sludges from washing, cleaning, peeling, centrifuging and separation	
02 03 02	wastes from preserving agents	
02 03 03	wastes from solvent extraction	
02 03 04	materials unsuitable for consumption or processing	
02 03 05	sludges from on-site effluent treatment	
02 03 99	wastes not otherwise specified	
02 04	**wastes from sugar processing**	
02 04 01	soil from cleaning and washing beet	
02 04 02	off-specification calcium carbonate	
02 04 03	sludges from on-site effluent treatment	
02 04 99	wastes not otherwise specified	
02 05	**wastes from the dairy products industry**	
02 05 01	materials unsuitable for consumption or processing	
02 05 02	sludges from on-site effluent treatment	
02 05 99	wastes not otherwise specified	
02 06	**wastes from the baking and confectionery industry**	
02 06 01	materials unsuitable for consumption or processing	
02 06 02	wastes from preserving agents	
02 06 03	sludges from on-site effluent treatment	
02 06 99	wastes not otherwise specified	
02 07	**wastes from the production of alcoholic and non-alcoholic beverages (except coffee, tea and cocoa)**	
02 07 01	wastes from washing, cleaning and mechanical reduction of raw materials	
02 07 02	wastes from spirits distillation	
02 07 03	wastes from chemical treatment	
02 07 04	materials unsuitable for consumption or processing	
02 07 05	sludges from on-site effluent treatment	
02 07 99	wastes not otherwise specified	

03	**Wastes from Wood Processing and the Production of Panels and Furniture, Pulp, Paper and Cardboard**	
03 01	**wastes from wood processing and the production of panels and furniture**	
03 01 01	waste bark and cork	
03 01 04*	sawdust, shavings, cuttings, wood, particle board and veneer containing dangerous substances	M
03 01 05	sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04	
03 01 99	wastes not otherwise specified	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

03 02	**wastes from wood preservation**	
03 02 01*	non-halogenated organic wood preservatives	A
03 02 02*	organochlorinated wood preservatives	A
03 02 03*	organometallic wood preservatives	A
03 02 04*	inorganic wood preservatives	A
03 02 05*	other wood preservatives containing dangerous substances	M
03 02 99	wood preservatives not otherwise specified	
03 03	**wastes from pulp, paper and cardboard production and processing**	
03 03 01	waste bark and wood	
03 03 02	green liquor sludge (from recovery of cooking liquor)	
03 03 05	de-inking sludges from paper recycling	
03 03 07	mechanically separated rejects from pulping of waste paper and cardboard	
03 03 08	wastes from sorting of paper and cardboard destined for recycling	
03 03 09	lime mud waste	
03 03 10	fibre rejects, fibre-, filler- and coating-sludges from mechanical separation	
03 03 11	sludges from on-site effluent treatment other than those mentioned in 03 03 10	
03 03 99	wastes not otherwise specified	

04	**Wastes from the Leather, Fur and Textile Industries**	
04 01	**wastes from the leather and fur industry**	
04 01 01	fleshings and lime split wastes	
04 01 02	liming waste	
04 01 03*	degreasing wastes containing solvents without a liquid phase	M
04 01 04	tanning liquor containing chromium	
04 01 05	tanning liquor free of chromium	
04 01 06	sludges, in particular from on-site effluent treatment containing chromium	
04 01 07	sludges, in particular from on-site effluent treatment free of chromium	
04 01 08	waste tanned leather (blue sheetings, shavings, cuttings, buffing dust) containing chromium	
04 01 09	wastes from dressing and finishing	
04 01 99	wastes not otherwise specified.	
04 02	**wastes from the textile industry**	
04 02 09	wastes from composite materials (impregnated textile, elastomer, plastomer)	
04 02 10	organic matter from natural products (for example grease, wax)	
04 02 14*	wastes from finishing containing organic solvents	M
04 02 15	wastes from finishing other than those mentioned in 04 02 14	
04 02 16*	dyestuffs and pigments containing dangerous substances	M
04 02 17	dyestuffs and pigments other than those mentioned in 04 02 16	
04 02 19*	sludges from on-site effluent treatment containing dangerous substances	M
04 02 20	sludges from on-site effluent treatment other than those mentioned in 04 02 19	
04 02 21	wastes from unprocessed textile fibres	
04 02 22	wastes from processed textile fibres	
04 02 99	wastes not otherwise specified	

05	**Wastes from Petroleum Refining, Natural Gas Purification and Pyrolytic Treatment of Coal**	
05 01	**wastes from petroleum refining**	
05 01 02*	desalter sludges	A
05 01 03*	tank bottom sludges	A
05 01 04*	acid alkyl sludges	A

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

05 01 05*	oil spills	A
05 01 06*	oily sludges from maintenance operations of the plant or equipment	A
05 01 07*	acid tars	A
05 01 08*	other tars	A
05 01 09*	sludges from on-site effluent treatment containing dangerous substances	M
05 01 10	sludges from on-site effluent treatment other than those mentioned in 05 01 09	
05 01 11*	wastes from cleaning of fuels with bases	A
05 01 12*	oil containing acids	A
05 01 13	boiler feedwater sludges	
05 01 14	wastes from cooling columns	
05 01 15*	spent filter clays	A
05 01 16	sulphur-containing wastes from petroleum desulphurisation	
05 01 17	bitumen	
05 01 99	wastes not otherwise specified	
05 06	**wastes from the pyrolytic treatment of coal**	
05 06 01*	acid tars	A
05 06 03*	other tars	A
05 06 04	waste from cooling columns	
05 06 99	wastes not otherwise specified	
05 07	**wastes from natural gas purification and transportation**	
05 07 01*	wastes containing mercury	M
05 07 02	wastes containing sulphur	
05 07 99	wastes not otherwise specified	

06 Wastes from Inorganic Chemical Processes

06 01	**wastes from the manufacture, formulation, supply and use (MFSU) of acids**	
06 01 01*	sulphuric acid and sulphurous acid	A
06 01 02*	hydrochloric acid	A
06 01 03*	hydrofluoric acid	A
06 01 04*	phosphoric and phosphorous acid	A
06 01 05*	nitric acid and nitrous acid	A
06 01 06*	other acids	A
06 01 99	wastes not otherwise specified	
06 02	**wastes from the MFSU of bases**	
06 02 01*	calcium hydroxide	A
06 02 03*	ammonium hydroxide	A
06 02 04*	sodium and potassium hydroxide	A
06 02 05*	other bases	A
06 02 99	wastes not otherwise specified	
06 03	**wastes from the MFSU of salts and their solutions and metallic oxides**	
06 03 11*	solid salts and solutions containing cyanides	M
06 03 13*	solid salts and solutions containing heavy metals	M
06 03 14	solid salts and solutions other than those mentioned in 06 03 11 and 06 03 13	
06 03 15*	metallic oxides containing heavy metals	M
06 03 16	metallic oxides other than those mentioned in 06 03 15	
06 03 99	wastes not otherwise specified	
06 04	**metal-containing wastes other than those mentioned in 06 03**	
06 04 03*	wastes containing arsenic	M
06 04 04*	wastes containing mercury	M

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M
06 04 05*	wastes containing other heavy metals	M
06 04 99	wastes not otherwise specified	
06 05	**sludges from on-site effluent treatment**	
06 05 02*	sludges from on-site effluent treatment containing dangerous substances	M
06 05 03	sludges from on-site effluent treatment other than those mentioned in 06 05 02	
06 06	**wastes from the MFSU of sulphur chemicals, sulphur chemical processes and desulphurisation processes**	
06 06 02*	wastes containing dangerous sulphides	M
06 06 03	wastes containing sulphides other than those mentioned in 06 06 02	
06 06 99	wastes not otherwise specified	
06 07	**wastes from the MFSU of halogens and halogen chemical processes**	
06 07 01*	wastes containing asbestos from electrolysis	M
06 07 02*	activated carbon from chlorine production	A
06 07 03*	barium sulphate sludge containing mercury	M
06 07 04*	solutions and acids, for example contact acid	A
06 07 99	wastes not otherwise specified	
06 08	**wastes from the MFSU of silicon and silicon derivatives**	
06 08 02*	wastes containing dangerous silicones	M
06 08 99	wastes not otherwise specified	
06 09	**wastes from the MSFU of phosphorous chemicals and phosphorous chemical processes**	
06 09 02	phosphorous slag	
06 09 03*	calcium-based reaction wastes containing or contaminated with dangerous substances	M
06 09 04	calcium-based reaction wastes other than those mentioned in 06 09 03	
06 09 99	wastes not otherwise specified	
06 10	**wastes from the MFSU of nitrogen chemicals, nitrogen chemical processes and fertiliser manufacture**	
06 10 02*	wastes containing dangerous substances	M
06 10 99	wastes not otherwise specified	
06 11	**wastes from the manufacture of inorganic pigments and opacificiers**	
06 11 01	calcium-based reaction wastes from titanium dioxide production	
06 11 99	wastes not otherwise specified	
06 13	**wastes from inorganic chemical processes not otherwise specified**	
06 13 01*	inorganic plant protection products, wood-preserving agents and other biocides.	A
06 13 02*	spent activated carbon (except 06 07 02)	A
06 13 03	carbon black	
06 13 04*	wastes from asbestos processing	A
06 13 05*	soot	A
06 13 99	wastes not otherwise specified	
07	**Wastes from Organic Chemical Processes**	
07 01	**wastes from the manufacture, formulation, supply and use (MFSU) of basic organic chemicals**	
07 01 01*	aqueous washing liquids and mother liquors	A
07 01 03*	organic halogenated solvents, washing liquids and mother liquors	A
07 01 04*	other organic solvents, washing liquids and mother liquors	A
07 01 07*	halogenated still bottoms and reaction residues	A
07 01 08*	other still bottoms and reaction residues	A
07 01 09*	halogenated filter cakes and spent absorbents	A

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

07 01 10*	other filter cakes and spent absorbents	A
07 01 11*	sludges from on-site effluent treatment containing dangerous substances	M
07 01 12	sludges from on-site effluent treatment other than those mentioned in 07 01 11	
07 01 99	wastes not otherwise specified	
07 02	**wastes from the MFSU of plastics, synthetic rubber and man-made fibres**	
07 02 01*	aqueous washing liquids and mother liquors	A
07 02 03*	organic halogenated solvents, washing liquids and mother liquors	A
07 02 04*	other organic solvents, washing liquids and mother liquors	A
07 02 07*	halogenated still bottoms and reaction residues	A
07 02 08*	other still bottoms and reaction residues	A
07 02 09*	halogenated filter cakes and spent absorbents	A
07 02 10*	other filter cakes and spent absorbents	A
07 02 11*	sludges from on-site effluent treatment containing dangerous substances	M
07 02 12	sludges from on-site effluent treatment other than those mentioned in 07 02 11	
07 02 13	waste plastic	
07 02 14*	wastes from additives containing dangerous substances	M
07 02 15	wastes from additives other than those mentioned in 07 02 14	
07 02 16*	wastes containing dangerous silicones	M
07 02 17	wastes containing silicones other than those mentioned in 07 02 16	
07 02 99	wastes not otherwise specified	
07 03	**wastes from the MFSU of organic dyes and pigments (except 06 11)**	
07 03 01*	aqueous washing liquids and mother liquors	A
07 03 03*	organic halogenated solvents, washing liquids and mother liquors	A
07 03 04*	other organic solvents, washing liquids and mother liquors	A
07 03 07*	halogenated still bottoms and reaction residues	A
07 03 08*	other still bottoms and reaction residues	A
07 03 09*	halogenated filter cakes and spent absorbents	A
07 03 10*	other filter cakes and spent absorbents	A
07 03 11*	sludges from on-site effluent treatment containing dangerous substances	M
07 03 12	sludges from on-site effluent treatment other than those mentioned in 07 03 11	
07 03 99	wastes not otherwise specified	
07 04	**wastes from the MFSU of organic plant protection products (except 02 01 08 and 02 01 09), wood preserving agents (except 03 02) and other biocides**	
07 04 01*	aqueous washing liquids and mother liquors	A
07 04 03*	organic halogenated solvents, washing liquids and mother liquors	A
07 04 04*	other organic solvents, washing liquids and mother liquors	A
07 04 07*	halogenated still bottoms and reaction residues	A
07 04 08*	other still bottoms and reaction residues	A
07 04 09*	halogenated filter cakes and spent absorbents	A
07 04 10*	other filter cakes and spent absorbents	A
07 04 11*	sludges from on-site effluent treatment containing dangerous substances	M
07 04 12	sludges from on-site effluent treatment other than those mentioned in 07 04 11	
07 04 13*	solid wastes containing dangerous substances	M
07 04 99	wastes not otherwise specified	
07 05	**wastes from the MFSU of pharmaceuticals**	
07 05 01*	aqueous washing liquids and mother liquors	A
07 05 03*	organic halogenated solvents, washing liquids and mother liquors	A
07 05 04*	other organic solvents, washing liquids and mother liquors	A
07 05 07*	halogenated still bottoms and reaction residues	A
07 05 08*	other still bottoms and reaction residues	A

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

07 05 09*	halogenated filter cakes and spent absorbents	A
07 05 10*	other filter cakes and spent absorbents	A
07 05 11*	sludges from on-site effluent treatment containing dangerous substances	M
07 05 12	sludges from on-site effluent treatment other than those mentioned in 07 05 11	
07 05 13*	solid wastes containing dangerous substances	M
07 05 14	solid wastes other than those mentioned in 07 05 13	
07 05 99	wastes not otherwise specified	
07 06	**wastes from the MFSU of fats, grease, soaps, detergents, disinfectants and cosmetics**	
07 06 01*	aqueous washing liquids and mother liquors	A
07 06 03*	organic halogenated solvents, washing liquids and mother liquors	A
07 06 04*	other organic solvents, washing liquids and mother liquors	A
07 06 07*	halogenated still bottoms and reaction residues	A
07 06 08*	other still bottoms and reaction residues	A
07 06 09*	halogenated filter cakes and spent absorbents	A
07 06 10*	other filter cakes and spent absorbents	A
07 06 11*	sludges from on-site effluent treatment containing dangerous substances	M
07 06 12	sludges from on-site effluent treatment other than those mentioned in 07 06 11	
07 06 99	wastes not otherwise specified	
07 07	**wastes from the MFSU of fine chemicals and chemical products not otherwise specified**	
07 07 01*	aqueous washing liquids and mother liquors	A
07 07 03*	organic halogenated solvents, washing liquids and mother liquors	A
07 07 04*	other organic solvents, washing liquids and mother liquors	A
07 07 07*	halogenated still bottoms and reaction residues	A
07 07 08*	other still bottoms and reaction residues	A
07 07 09*	halogenated filter cakes and spent absorbents	A
07 07 10*	other filter cakes and spent absorbents	A
07 07 11*	sludges from on-site effluent treatment containing dangerous substances	M
07 07 12	sludges from on-site effluent treatment other than those mentioned in 07 07 11	
07 07 99	wastes not otherwise specified	

08	**Wastes from Manufacture, Formulation, Supply and Use (MFSU) of Coatings (Paints, Varnishes and Vitreous Enamels), Adhesives, Sealants and Printing Inks**	
08 01	**wastes from MFSU and removal of paint and varnish**	
08 01 11*	waste paint and varnish containing organic solvents or other dangerous substances	M
08 01 12	waste paint and varnish other than those mentioned in 08 01 11	
08 01 13*	sludges from paint or varnish containing organic solvents or other dangerous substances	M
08 01 14	sludges from paint or varnish other than those mentioned in 08 01 13	
08 01 15*	aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	M
08 01 16	aqueous sludges containing paint or varnish other than those mentioned in 08 01 15	
08 01 17*	wastes from paint or varnish removal containing organic solvents or other dangerous substances	M
08 01 18	wastes from paint or varnish removal other than those mentioned in 08 01 17	
08 01 19*	aqueous suspensions containing paint or varnish containing organic solvents or other dangerous substances	M
08 01 20	aqueous suspensions containing paint or varnish other than those mentioned in 08 01 19	
08 01 21*	waste paint or varnish remover	A
08 01 99	wastes not otherwise specified	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

08 02	**wastes from MFSU of other coatings (including ceramic materials)**	
08 02 01	waste coating powders	
08 02 02	aqueous sludges containing ceramic materials	
08 02 03	aqueous suspensions containing ceramic materials	
08 02 99	wastes not otherwise specified	
08 03	**wastes from MFSU of printing inks**	
08 03 07	aqueous sludges containing ink	
08 03 08	aqueous liquid waste containing ink	
08 03 12*	waste ink containing dangerous substances	M
08 03 13	waste ink other than those mentioned in 08 03 12	
08 03 14*	ink sludges containing dangerous substances	M
08 03 15	ink sludges other than those mentioned in 08 03 14	
08 03 16*	waste etching solutions	A
08 03 17*	waste printing toner containing dangerous substances	M
08 03 18	waste printing toner other than those mentioned in 08 03 17	
08 03 19*	disperse oil	A
08 03 99	wastes not otherwise specified	
08 04	**wastes from MFSU of adhesives and sealants (including waterproofing products)**	
08 04 09*	waste adhesives and sealants containing organic solvents or other dangerous substances	M
08 04 10	waste adhesives and sealants other than those mentioned in 08 04 09	
08 04 11*	adhesive and sealant sludges containing organic solvents or other dangerous substances	M
08 04 12	adhesive and sealant sludges other than those mentioned in 08 04 11	
08 04 13*	aqueous sludges containing adhesives or sealants containing organic solvents or other dangerous substances	M
08 04 14	aqueous sludges containing adhesives or sealants other than those mentioned in 08 04 13	
08 04 15*	aqueous liquid waste containing adhesives or sealants containing organic solvents or other dangerous substances	M
08 04 16	aqueous liquid waste containing adhesives or sealants other than those mentioned in 08 04 15	
08 04 17*	rosin oil	A
08 04 99	wastes not otherwise specified	
08 05	**wastes not otherwise specified in 08**	
08 05 01*	waste isocyanates	A

09 Wastes from the Photographic Industry

09 01	**wastes from the photographic industry**	
09 01 01*	water-based developer and activator solutions	A
09 01 02*	water-based offset plate developer solutions	A
09 01 03*	solvent-based developer solutions	A
09 01 04*	fixer solutions	A
09 01 05*	bleach solutions and bleach fixer solutions	A
09 01 06*	wastes containing silver from on-site treatment of photographic wastes	M
09 01 07	photographic film and paper containing silver or silver compounds	
09 01 08	photographic film and paper free of silver or silver compounds	
09 01 10	single-use cameras without batteries	
09 01 11*	single-use cameras containing batteries included in 16 06 01, 16 06 02 or 16 06 03	A
09 01 12	single-use cameras containing batteries other than those mentioned in 09 01 11	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M
09 01 13*	aqueous liquid waste from on-site reclamation of silver other than those mentioned in 09 01 06	A
09 01 99	wastes not otherwise specified	
10	**Wastes from Thermal Processes**	
10 01	**wastes from power stations and other combustion plants (except 19)**	
10 01 01	bottom ash, slag and boiler dust (excluding boiler dust mentioned in 10 01 04)	
10 01 02	coal fly ash	
10 01 03	fly ash from peat and untreated wood	
10 01 04*	oil fly ash and boiler dust	A
10 01 05	calcium-based reaction wastes from flue-gas desulphurisation in solid form	
10 01 07	calcium-based reaction wastes from flue-gas desulphurisation in sludge form	
10 01 09*	sulphuric acid	A
10 01 13*	fly ash from emulsified hydrocarbons used as fuel	A
10 01 14*	bottom ash, slag and boiler dust from co-incineration containing dangerous substances	M
10 01 15	bottom ash, slag and boiler dust from co-incineration other than those mentioned in 10 01 14	
10 01 16*	fly ash from co-incineration containing dangerous substances	M
10 01 17	fly ash from co-incineration other than those mentioned in 10 01 16	
10 01 18*	wastes from gas cleaning containing dangerous substances	M
10 01 19	wastes from gas cleaning other than those mentioned in 10 01 05, 10 01 07 and 10 01 18	
10 01 20*	sludges from on-site effluent treatment containing dangerous substances	M
10 01 21	sludges from on-site effluent treatment other than those mentioned in 10 01 20	
10 01 22*	aqueous sludges from boiler cleansing containing dangerous substances	M
10 01 23	aqueous sludges from boiler cleansing other than those mentioned in 10 01 22	
10 01 24	sands from fluidised beds	
10 01 25	wastes from fuel storage and preparation of coal-fired power plants	
10 01 26	wastes from cooling-water treatment	
10 01 99	wastes not otherwise specified	
10 02	**wastes from the iron and steel industry**	
10 02 01	wastes from the processing of slag	
10 02 02	unprocessed slag	
10 02 07*	solid wastes from gas treatment containing dangerous substances	M
10 02 08	solid wastes from gas treatment other than those mentioned in 10 02 07	
10 02 10	mill scales	
10 02 11*	wastes from cooling-water treatment containing oil	M
10 02 12	wastes from cooling-water treatment other than those mentioned in 10 02 11	
10 02 13*	sludges and filter cakes from gas treatment containing dangerous substances	M
10 02 14	sludges and filter cakes from gas treatment other than those mentioned in 10 02 13	
10 02 15	other sludges and filter cakes	
10 02 99	wastes not otherwise specified	
10 03	**wastes from aluminium thermal metallurgy**	
10 03 02	anode scraps	
10 03 04*	primary production slags	A
10 03 05	waste alumina	
10 03 08*	salt slags from secondary production	A
10 03 09*	black drosses from secondary production	A

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

10 03 15*	skimmings that are flammable or emit, upon contact with water, flammable gases in dangerous quantities	M
10 03 16	skimmings other than those mentioned in 10 03 15	
10 03 17*	tar-containing wastes from anode manufacture	M
10 03 18	carbon-containing wastes from anode manufacture other than those mentioned in 10 03 17	
10 03 19*	flue-gas dust containing dangerous substances	M
10 03 20	flue-gas dust other than those mentioned in 10 03 19	
10 03 21*	other particulates and dust (including ball-mill dust) containing dangerous substances	M
10 03 22	other particulates and dust (including ball-mill dust) other than those mentioned in 10 03 21	
10 03 23*	solid wastes from gas treatment containing dangerous substances	M
10 03 24	solid wastes from gas treatment other than those mentioned in 10 03 23	
10 03 25*	sludges and filter cakes from gas treatment containing dangerous substances	M
10 03 26	sludges and filter cakes from gas treatment other than those mentioned in 10 03 25	
10 03 27*	wastes from cooling-water treatment containing oil	M
10 03 28	wastes from cooling-water treatment other than those mentioned in 10 03 27	
10 03 29*	wastes from treatment of salt slags and black drosses containing dangerous substances	M
10 03 30	wastes from treatment of salt slags and black drosses other than those mentioned in 10 03 29	
10 03 99	wastes not otherwise specified	
10 04	**wastes from lead thermal metallurgy**	
10 04 01*	slags from primary and secondary production	A
10 04 02*	dross and skimmings from primary and secondary production	A
10 04 03*	calcium arsenate	A
10 04 04*	flue-gas dust	A
10 04 05*	other particulates and dust	A
10 04 06*	solid wastes from gas treatment	A
10 04 07*	sludges and filter cakes from gas treatment	A
10 04 09*	wastes from cooling-water treatment containing oil	M
10 04 10	wastes from cooling-water treatment other than those mentioned in 10 04 09	
10 04 99	wastes not otherwise specified	
10 05	**wastes from zinc thermal metallurgy**	
10 05 01	slags from primary and secondary production	
10 05 03*	flue-gas dust	A
10 05 04	other particulates and dust	
10 05 05*	solid waste from gas treatment	A
10 05 06*	sludges and filter cakes from gas treatment	A
10 05 08*	wastes from cooling-water treatment containing oil	M
10 05 09	wastes from cooling-water treatment other than those mentioned in 10 05 08	
10 05 10*	dross and skimmings that are flammable or emit, upon contact with water, flammable gases in dangerous quantities	M
10 05 11	dross and skimmings other than those mentioned in 10 05 10	
10 05 99	wastes not otherwise specified	
10 06	**wastes from copper thermal metallurgy**	
10 06 01	slags from primary and secondary production	
10 06 02	dross and skimmings from primary and secondary production	
10 06 03*	flue-gas dust	A
10 06 04	other particulates and dust	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

10 06 06*	solid wastes from gas treatment	A
10 06 07*	sludges and filter cakes from gas treatment	A
10 06 09*	wastes from cooling-water treatment containing oil	M
10 06 10	wastes from cooling-water treatment other than those mentioned in 10 06 09	
10 06 99	wastes not otherwise specified	
10 07	**wastes from silver, gold and platinum thermal metallurgy**	
10 07 01	slags from primary and secondary production	
10 07 02	dross and skimmings from primary and secondary production	
10 07 03	solid wastes from gas treatment	
10 07 04	other particulates and dust	
10 07 05	sludges and filter cakes from gas treatment	
10 07 07*	wastes from cooling-water treatment containing oil	M
10 07 08	wastes from cooling-water treatment other than those mentioned in 10 07 07	
10 07 99	wastes not otherwise specified	
10 08	**wastes from other non-ferrous thermal metallurgy**	
10 08 04	particulates and dust	
10 08 08*	salt slag from primary and secondary production	A
10 08 09	other slags	
10 08 10*	dross and skimmings that are flammable or emit, upon contact with water, flammable gases in dangerous quantities	M
10 08 11	dross and skimmings other than those mentioned in 10 08 10	
10 08 12*	tar-containing wastes from anode manufacture	M
10 08 13	carbon-containing wastes from anode manufacture other than those mentioned in 10 08 12	
10 08 14	anode scrap	
10 08 15*	flue-gas dust containing dangerous substances	M
10 08 16	flue-gas dust other than those mentioned in 10 08 15	
10 08 17*	sludges and filter cakes from flue-gas treatment containing dangerous substances	M
10 08 18	sludges and filter cakes from flue-gas treatment other than those mentioned in 10 08 17	
10 08 19*	wastes from cooling-water treatment containing oil	M
10 08 20	wastes from cooling-water treatment other than those mentioned in 10 08 19	
10 08 99	wastes not otherwise specified	
10 09	**wastes from casting of ferrous pieces**	
10 09 03	furnace slag	
10 09 05*	casting cores and moulds which have not undergone pouring containing dangerous substances	M
10 09 06	casting cores and moulds which have not undergone pouring other than those mentioned in 10 09 05	
10 09 07*	casting cores and moulds which have undergone pouring containing dangerous substances	M
10 09 08	casting cores and moulds which have undergone pouring other than those mentioned in 10 09 07	
10 09 09*	flue-gas dust containing dangerous substances	M
10 09 10	flue-gas dust other than those mentioned in 10 09 09	
10 09 11*	other particulates containing dangerous substances	M
10 09 12	other particulates other than those mentioned in 10 09 11	
10 09 13*	waste binders containing dangerous substances	M
10 09 14	waste binders other than those mentioned in 10 09 13	
10 09 15*	waste crack-indicating agent containing dangerous substances	M
10 09 16	waste crack-indicating agent other than those mentioned in 10 09 15	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

10 09 99	wastes not otherwise specified	
10 10	**wastes from casting of non-ferrous pieces**	
10 10 03	furnace slag	
10 10 05*	casting cores and moulds which have not undergone pouring, containing dangerous substances	M
10 10 06	casting cores and moulds which have not undergone pouring, other than those mentioned in 10 10 05	
10 10 07*	casting cores and moulds which have undergone pouring, containing dangerous substances	M
10 10 08	casting cores and moulds which have undergone pouring, other than those mentioned in 10 10 07	
10 10 09*	flue-gas dust containing dangerous substances	M
10 10 10	flue-gas dust other than those mentioned in 10 10 09	
10 10 11*	other particulates containing dangerous substances	M
10 10 12	other particulates other than those mentioned in 10 10 11	
10 10 13*	waste binders containing dangerous substances	M
10 10 14	waste binders other than those mentioned in 10 10 13	
10 10 15*	waste crack-indicating agent containing dangerous substances	M
10 10 16	waste crack-indicating agent other than those mentioned in 10 10 15	
10 10 99	wastes not otherwise specified	
10 11	**wastes from manufacture of glass and glass products**	
10 11 03	waste glass-based fibrous materials	
10 11 05	particulates and dust	
10 11 09*	waste preparation mixture before thermal processing, containing dangerous substances	M
10 11 10	waste preparation mixture before thermal processing, other than those mentioned in 10 11 09	
10 11 11*	waste glass in small particles and glass powder containing heavy metals (for example from cathode ray tubes)	M
10 11 12	waste glass other than those mentioned in 10 11 11	
10 11 13*	glass-polishing and -grinding sludge containing dangerous substances	M
10 11 14	glass-polishing and -grinding sludge other than those mentioned in 10 11 13	
10 11 15*	solid wastes from flue-gas treatment containing dangerous substances	M
10 11 16	solid wastes from flue-gas treatment other than those mentioned in 10 11 15	
10 11 17*	sludges and filter cakes from flue-gas treatment containing dangerous substances	M
10 11 18	sludges and filter cakes from flue-gas treatment other than those mentioned in 10 11 17	
10 11 19*	solid wastes from on-site effluent treatment containing dangerous substances	M
10 11 20	solid wastes from on-site effluent treatment other than those mentioned in 10 11 19	
10 11 99	wastes not otherwise specified	
10 12	**wastes from manufacture of ceramic goods, bricks, tiles and construction products**	
10 12 01	waste preparation mixture before thermal processing	
10 12 03	particulates and dust	
10 12 05	sludges and filter cakes from gas treatment	
10 12 06	discarded moulds	
10 12 08	waste ceramics, bricks, tiles and construction products (after thermal processing)	
10 12 09*	solid wastes from gas treatment containing dangerous substances	M
10 12 10	solid wastes from gas treatment other than those mentioned in 10 12 09	
10 12 11*	wastes from glazing containing heavy metals	M
10 12 12	wastes from glazing other than those mentioned in 10 12 11	
10 12 13	sludge from on-site effluent treatment	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

10 12 99	wastes not otherwise specified	
10 13	**wastes from manufacture of cement, lime and plaster and articles and products made from them**	
10 13 01	waste preparation mixture before thermal processing	
10 13 04	wastes from calcination and hydration of lime	
10 13 06	particulates and dust (except 10 13 12 and 10 13 13)	
10 13 07	sludges and filter cakes from gas treatment	
10 13 09*	wastes from asbestos-cement manufacture containing asbestos	M
10 13 10	wastes from asbestos-cement manufacture other than those mentioned in 10 13 09	
10 13 11	wastes from cement-based composite materials other than those mentioned in 10 13 09 and 10 13 10	
10 13 12*	solid wastes from gas treatment containing dangerous substances	M
10 13 13	solid wastes from gas treatment other than those mentioned in 10 13 12	
10 13 14	waste concrete and concrete sludge	
10 13 99	wastes not otherwise specified	
10 14	**waste from crematoria**	
10 14 01*	waste from gas cleaning containing mercury	M

11	**Wastes from Chemical Surface Treatment and Coating of Metals and other Materials; Non-Ferrous Hydro-Metallurgy**	
11 01	**wastes from chemical surface treatment and coating of metals and other materials (for example galvanic processes, zinc coating processes, pickling processes, etching, phosphatising, alkaline degreasing, anodising)**	
11 01 05*	pickling acids	A
11 01 06*	acids not otherwise specified	A
11 01 07*	pickling bases	A
11 01 08*	phosphatising sludges	A
11 01 09*	sludges and filter cakes containing dangerous substances	M
11 01 10	sludges and filter cakes other than those mentioned in 11 01 09	
11 01 11*	aqueous rinsing liquids containing dangerous substances	M
11 01 12	aqueous rinsing liquids other than those mentioned in 11 01 11	
11 01 13*	degreasing wastes containing dangerous substances	M
11 01 14	degreasing wastes other than those mentioned in 11 01 13	
11 01 15*	eluate and sludges from membrane systems or ion exchange systems containing dangerous substances	M
11 01 16*	saturated or spent ion exchange resins	A
11 01 98*	other wastes containing dangerous substances	M
11 01 99	wastes not otherwise specified	
11 02	**wastes from non-ferrous hydrometallurgical processes**	
11 02 02*	sludges from zinc hydrometallurgy (including jarosite, goethite)	A
11 02 03	wastes from the production of anodes for aqueous electrolytical processes	
11 02 05*	wastes from copper hydrometallurgical processes containing dangerous substances	M
11 02 06	wastes from copper hydrometallurgical processes other than those mentioned in 11 02 05	
11 02 07*	other wastes containing dangerous substances	M
11 02 99	wastes not otherwise specified	
11 03	**sludges and solids from tempering processes**	
11 03 01*	wastes containing cyanide	A
11 03 02*	other wastes	A

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

11 05	**wastes from hot galvanising processes**	
11 05 01	hard zinc	
11 05 02	zinc ash	
11 05 03*	solid wastes from gas treatment	A
11 05 04*	spent flux	A
11 05 99	wastes not otherwise specified	
12	**Wastes from Shaping and Physical and Mechanical Surface Treatment of Metals and Plastics**	
12 01	**wastes from shaping and physical and mechanical surface treatment of metals and plastics**	
12 01 01	ferrous metal filings and turnings	
12 01 02	ferrous metal dust and particles	
12 01 03	non-ferrous metal filings and turnings	
12 01 04	non-ferrous metal dust and particles	
12 01 05	plastics shavings and turnings	
12 01 06*	mineral-based machining oils containing halogens (except emulsions and solutions)	A
12 01 07*	mineral-based machining oils free of halogens (except emulsions and solutions)	A
12 01 08*	machining emulsions and solutions containing halogens	A
12 01 09*	machining emulsions and solutions free of halogens	A
12 01 10*	synthetic machining oils	A
12 01 12*	spent waxes and fats	A
12 01 13	welding wastes	
12 01 14*	machining sludges containing dangerous substances	M
12 01 15	machining sludges other than those mentioned in 12 01 14	
12 01 16*	waste blasting material containing dangerous substances	M
12 01 17	waste blasting material other than those mentioned in 12 01 16	
12 01 18*	metal sludge (grinding, honing and lapping sludge) containing oil	M
12 01 19*	readily biodegradable machining oil	A
12 01 20*	spent grinding bodies and grinding materials containing dangerous substances	M
12 01 21	spent grinding bodies and grinding materials other than those mentioned in 12 01 20	
12 01 99	wastes not otherwise specified	
12 03	**wastes from water and steam degreasing processes (except 11)**	
12 03 01*	aqueous washing liquids	A
12 03 02*	steam degreasing wastes	A
13	**Oil Wastes and Wastes of Liquid Fuels (except edible oils, and those in chapters 05, 12 and 19)**	
13 01	**waste hydraulic oils**	
13 01 01*	hydraulic oils, containing PCBs[1]	A
13 01 04*	chlorinated emulsions	A
13 01 05*	non-chlorinated emulsions	A
13 01 09*	mineral-based chlorinated hydraulic oils	A
13 01 10*	mineral-based non-chlorinated hydraulic oils	A
13 01 11*	synthetic hydraulic oils	A
13 01 12*	readily biodegradable hydraulic oils	A
13 01 13*	other hydraulic oils	A
13 02	**waste engine, gear and lubricating oils**	
13 02 04*	mineral-based chlorinated engine, gear and lubricating oils	A

[1] For the purpose of this list of wastes, PCBs will be defined as in Directive 96/59/EC.

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

13 02 05*	mineral-based non-chlorinated engine, gear and lubricating oils	A
13 02 06*	synthetic engine, gear and lubricating oils	A
13 02 07*	readily biodegradable engine, gear and lubricating oils	A
13 02 08*	other engine, gear and lubricating oils	A
13 03	**waste insulating and heat transmission oils**	
13 03 01*	insulating or heat transmission oils containing PCBs	A
13 03 06*	mineral-based chlorinated insulating and heat transmission oils other than those mentioned in 13 03 01	A
13 03 07*	mineral-based non-chlorinated insulating and heat transmission oils	A
13 03 08*	synthetic insulating and heat transmission oils	A
13 03 09*	readily biodegradable insulating and heat transmission oils	A
13 03 10*	other insulating and heat transmission oils	A
13 04	**bilge oils**	
13 04 01*	bilge oils from inland navigation	A
13 04 02*	bilge oils from jetty sewers	A
13 04 03*	bilge oils from other navigation	A
13 05	**oil/water separator contents**	
13 05 01*	solids from grit chambers and oil/water separators	A
13 05 02*	sludges from oil/water separators	A
13 05 03*	interceptor sludges	A
13 05 06*	oil from oil/water separators	A
13 05 07*	oily water from oil/water separators	A
13 05 08*	mixtures of wastes from grit chambers and oil/water separators	A
13 07	**wastes of liquid fuels**	
13 07 01*	fuel oil and diesel	A
13 07 02*	petrol	A
13 07 03*	other fuels (including mixtures)	A
13 08	**oil wastes not otherwise specified**	
13 08 01*	desalter sludges or emulsions	A
13 08 02*	other emulsions	A
13 08 99*	wastes not otherwise specified	A

14	**Waste Organic Solvents, Refrigerants and Propellants (except 07 and 08)**

14 06	**waste organic solvents, refrigerants and foam/aerosol propellants**	
14 06 01*	chlorofluorocarbons, HCFC, HFC	A
14 06 02*	other halogenated solvents and solvent mixtures	A
14 06 03*	other solvents and solvent mixtures	A
14 06 04*	sludges or solid wastes containing halogenated solvents	A
14 06 05*	sludges or solid wastes containing other solvents	A

15	**Waste Packaging; Absorbents, Wiping Cloths, Filter Materials and Protective Clothing not otherwise specified**

15 01	**packaging (including separately collected municipal packaging waste)**
15 01 01	paper and cardboard packaging
15 01 02	plastic packaging
15 01 03	wooden packaging
15 01 04	metallic packaging
15 01 05	composite packaging

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

15 01 06	mixed packaging	
15 01 07	glass packaging	
15 01 09	textile packaging	
15 01 10*	packaging containing residues of or contaminated by dangerous substances	M
15 01 11*	metallic packaging containing a dangerous solid porous matrix (for example asbestos), including empty pressure containers	M
15 02	**absorbents, filter materials, wiping cloths and protective clothing**	
15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	M
15 02 03	absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02	
16	**Wastes not otherwise specified in the list**	
16 01	**end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**	
16 01 03	end-of-life tyres	
16 01 04*	end-of-life vehicles	M
16 01 06	end-of-life vehicles, containing neither liquids nor other hazardous components	
16 01 07*	oil filters	A
16 01 08*	components containing mercury	M
16 01 09*	components containing PCBs	M
16 01 10*	explosive components (for example air bags)	A
16 01 11*	brake pads containing asbestos	M
16 01 12	brake pads other than those mentioned in 16 01 11	
16 01 13*	brake fluids	A
16 01 14*	antifreeze fluids containing dangerous substances	M
16 01 15	antifreeze fluids other than those mentioned in 16 01 14	
16 01 16	tanks for liquefied gas	
16 01 17	ferrous metal	
16 01 18	non-ferrous metal	
16 01 19	plastic	
16 01 20	glass	
16 01 21*	hazardous components other than those mentioned in 16 01 07 to 16 01 11 and 16 01 13 and 16 01 14	M
16 01 22	components not otherwise specified	
16 01 99	wastes not otherwise specified	
16 02	**wastes from electrical and electronic equipment**	
16 02 09*	transformers and capacitors containing PCBs	M
16 02 10*	discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 09	M
16 02 11*	discarded equipment containing chlorofluorocarbons, HCFC, HFC	M
16 02 12*	discarded equipment containing free asbestos	M
16 02 13*	discarded equipment containing hazardous components[2] other than those mentioned in 16 02 09 to 16 02 12	M
16 02 14	discarded equipment other than those mentioned in 16 02 09 to 16 02 13	
16 02 15*	hazardous components removed from discarded equipment	A
16 02 16	components removed from discarded equipment other than those mentioned in 16 02 15	

[2] Hazardous components from electrical equipment may include accumators and batteries mentioned in 16 06 and marked as hazardous; mercury switches, glass from cathode ray tubes and other activated glass, etc.

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

16 03	**off-specification batches and unused products**	
16 03 03*	inorganic wastes containing dangerous substances	M
16 03 04	inorganic wastes other than those mentioned in 16 03 03	
16 03 05*	organic wastes containing dangerous substances	M
16 03 06	organic wastes other than those mentioned in 16 03 05	
16 04	**waste explosives**	
16 04 01*	waste ammunition	A
16 04 02*	fireworks wastes	A
16 04 03*	other waste explosives	A
16 05	**gases in pressure containers and discarded chemicals**	
16 05 04*	gases in pressure containers (including halons) containing dangerous substances	M
16 05 05	gases in pressure containers other than those mentioned in 16 05 04	
16 05 06*	laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals	M
16 05 07*	discarded inorganic chemicals consisting of or containing dangerous substances	M
16 05 08*	discarded organic chemicals consisting of or containing dangerous substances	M
16 05 09	discarded chemicals other than those mentioned in 16 05 06, 16 05 07 or 16 05 08	
16 06	**batteries and accumulators**	
16 06 01*	lead batteries	A
16 06 02*	Ni-Cd batteries	A
16 06 03*	mercury-containing batteries	A
16 06 04	alkaline batteries (except 16 06 03)	
16 06 05	other batteries and accumulators	
16 06 06*	separately collected electrolyte from batteries and accumulators	A
16 07	**wastes from transport tank, storage tank and barrel cleaning (except 05 and 13)**	
16 07 08*	wastes containing oil	M
16 07 09*	wastes containing other dangerous substances	M
16 07 99	wastes not otherwise specified	
16 08	**spent catalysts**	
16 08 01	spent catalysts containing gold, silver, rhenium, rhodium, palladium, iridium or platinum (except 16 08 07)	
16 08 02*	spent catalysts containing dangerous transition metals[3] or dangerous transition metal compounds	M
16 08 03	spent catalysts containing transition metals or transition metal compounds not otherwise specified	
16 08 04	spent fluid catalytic cracking catalysts (except 16 08 07)	
16 08 05*	spent catalysts containing phosphoric acid	M
16 08 06*	spent liquids used as catalysts	A
16 08 07*	spent catalysts contaminated with dangerous substances	M
16 09	**oxidising substances**	
16 09 01*	permanganates, for example potassium permanganate	A
16 09 02*	chromates, for example potassium chromate, potassium or sodium dichromate	A
16 09 03*	peroxides, for example hydrogen peroxide	A
16 09 04*	oxidising substances, not otherwise specified	A
16 10	**aqueous liquid wastes destined for off-site treatment**	
16 10 01*	aqueous liquid wastes containing dangerous substances	M
16 10 02	aqueous liquid wastes other than those mentioned in 16 10 01	
16 10 03*	aqueous concentrates containing dangerous substances	M
16 10 04	aqueous concentrates other than those mentioned in 16 10 03	

[3] For the purpose of this entry, transition metals are: scandium, vanadium, manganese, cobalt, copper, yttrium, niobium, hafnium, tungsten, titanium, chromium, iron, nickel, zinc, zirconium, molybdenum and tantalum. These metals or their compounds are dangerous if they are classified as dangerous substances. The classification of dangerous substances shall determine which among those transition metals and which transition metal compounds are hazardous.

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

16 11	**waste linings and refractories**	
16 11 01*	carbon-based linings and refractories from metallurgical processes containing dangerous substances	M
16 11 02	carbon-based linings and refractories from metallurgical processes others than those mentioned in 16 11 01	
16 11 03*	other linings and refractories from metallurgical processes containing dangerous substances	M
16 11 04	other linings and refractories from metallurgical processes other than those mentioned in 16 11 03	
16 11 05*	linings and refractories from non-metallurgical processes containing dangerous substances	M
16 11 06	linings and refractories from non-metallurgical processes others than those mentioned in 16 11 05	

17	**Construction and Demolition Wastes (including excavated soil from contaminated sites)**	
17 01	**concrete, bricks, tiles and ceramics**	
17 01 01	concrete	
17 01 02	bricks	
17 01 03	tiles and ceramics	
17 01 06*	mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances	M
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	
17 02	**wood, glass and plastic**	
17 02 01	wood	
17 02 02	glass	
17 02 03	plastic	
17 02 04*	glass, plastic and wood containing or contaminated with dangerous substances	M
17 03	**bituminous mixtures, coal tar and tarred products**	
17 03 01*	bituminous mixtures containing coal tar	M
17 03 02	bituminous mixtures other than those mentioned in 17 03 01	
17 03 03*	coal tar and tarred products	A
17 04	**metals (including their alloys)**	
17 04 01	copper, bronze, brass	
17 04 02	aluminium	
17 04 03	lead	
17 04 04	zinc	
17 04 05	iron and steel	
17 04 06	tin	
17 04 07	mixed metals	
17 04 09*	metal waste contaminated with dangerous substances	M
17 04 10*	cables containing oil, coal tar and other dangerous substances	M
17 04 11	cables other than those mentioned in 17 04 10	
17 05	**soil (including excavated soil from contaminated sites), stones and dredging spoil**	
17 05 03*	soil and stones containing dangerous substances	M
17 05 04	soil and stones other than those mentioned in 17 05 03	
17 05 05*	dredging spoil containing dangerous substances	M
17 05 06	dredging spoil other than those mentioned in 17 05 05	
17 05 07*	track ballast containing dangerous substances	M
17 05 08	track ballast other than those mentioned in 17 05 07	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

17 06	**insulation materials and asbestos-containing construction materials**	
17 06 01*	insulation materials containing asbestos	M
17 06 03*	other insulation materials consisting of or containing dangerous substances	M
17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03	
17 06 05*	construction materials containing asbestos[4]	M
17 08	**gypsum-based construction material**	
17 08 01*	gypsum-based construction materials contaminated with dangerous substances	M
17 08 02	gypsum-based construction materials other than those mentioned in 17 08 01	
17 09	**other construction and demolition wastes**	
17 09 01*	construction and demolition wastes containing mercury	M
17 09 02*	construction and demolition wastes containing PCB (for example PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)	M
17 09 03*	other construction and demolition wastes (including mixed wastes) containing dangerous substances	M
17 09 04	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	

18	**Wastes from Human and Animal Health Care and/or Related Research (except kitchen and restaurant wastes not arising from immediate health care)**

18 01	**wastes from natal care, diagnosis, treatment or prevention of disease in humans**	
18 01 01	sharps (except 18 01 03)	
18 01 02	Body parts and organs including blood bags and blood preserves (except 18 01 03)	
18 01 03*	wastes whose collection and disposal is subject to special requirements in order to prevent infection	A
18 01 04	wastes whose collection and disposal is not subject to special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, diapers)	
18 01 06*	chemicals consisting of or containing dangerous substances	M
18 01 07	chemicals other than those mentioned in 18 01 06	
18 01 08*	cytotoxic and cytostatic medicines	A
18 01 09	medicines other than those mentioned in 18 01 08	
18 01 10*	amalgam waste from dental care	A
18 02	**wastes from research, diagnosis, treatment or prevention of disease involving animals**	
18 02 01	sharps (except 18 02 02)	
18 02 02*	wastes whose collection and disposal is subject to special requirements in order to prevent infection	A
18 02 03	wastes whose collection and disposal is not subject to special requirements in order to prevent infection	
18 02 05*	chemicals consisting of or containing dangerous substances	M
18 02 06	chemicals other than those mentioned in 18 02 05	
18 02 07*	cytotoxic and cytostatic medicines	A
18 02 08	medicines other than those mentioned in 18 02 07	

19	**Wastes from Waste Management Facilities, Off-site Waste Water Treatment Plants and the Preparation of Water Intended for Human Consumption and Water for Industrial Use**

19 01	**wastes from incineration or pyrolysis of waste**	
19 01 02	ferrous materials removed from bottom ash	
19 01 05*	filter cake from gas treatment	A

[4] As far as the landfilling of waste is concerned, Member States may decide to postpone the entry into force of this entry until the establishment of appropriate measures for the treatment and disposal of waste from construction material containing asbestos. These measures are to be established according to the procedure referred to in Article 17 of Council Directive 1999/31/EC on the landfill of waste (OJ L 182,16.7.1999,p.1) and shall be adopted by 16 July 2002 at the latest.

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

19 01 06*	aqueous liquid wastes from gas treatment and other aqueous liquid wastes	A
19 01 07*	solid wastes from gas treatment	A
19 01 10*	spent activated carbon from flue-gas treatment	A
19 01 11*	bottom ash and slag containing dangerous substances	M
19 01 12	bottom ash and slag other than those mentioned in 19 01 11	
19 01 13*	fly ash containing dangerous substances	M
19 01 14	fly ash other than those mentioned in 19 01 13	
19 01 15*	boiler dust containing dangerous substances	M
19 01 16	boiler dust other than those mentioned in 19 01 15	
19 01 17*	pyrolysis wastes containing dangerous substances	M
19 01 18	pyrolysis wastes other than those mentioned in 19 01 17	
19 01 19	sands from fluidised beds	
19 01 99	wastes not otherwise specified	
19 02	**wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)**	
19 02 03	premixed wastes composed only of non-hazardous wastes	
19 02 04*	premixed wastes composed of at least one hazardous waste	A
19 02 05*	sludges from physico/chemical treatment containing dangerous substances	M
19 02 06	sludges from physico/chemical treatment other than those mentioned in 19 02 05	
19 02 07*	oil and concentrates from separation	A
19 02 08*	liquid combustible wastes containing dangerous substances	M
19 02 09*	solid combustible wastes containing dangerous substances	M
19 02 10	combustible wastes other than those mentioned in 19 02 08 and 19 02 09	
19 02 11*	other wastes containing dangerous substances	M
19 02 99	wastes not otherwise specified	
19 03	**stabilised/solidified wastes**[5]	
19 03 04*	wastes marked as hazardous, partly[6] stabilised	A
19 03 05	stabilised wastes other than those mentioned in 19 03 04	
19 03 06*	wastes marked as hazardous, solidified	A
19 03 07	solidified wastes other than those mentioned in 19 03 06	
19 04	**vitrified waste and wastes from vitrification**	
19 04 01	vitrified waste	
19 04 02*	fly ash and other flue-gas treatment wastes	A
19 04 03*	non-vitrified solid phase	A
19 04 04	aqueous liquid wastes from vitrified waste tempering	
19 05	**wastes from aerobic treatment of solid wastes**	
19 05 01	non-composted fraction of municipal and similar wastes	
19 05 02	non-composted fraction of animal and vegetable waste	
19 05 03	off-specification compost	
19 05 99	wastes not otherwise specified	
19 06	**wastes from anaerobic treatment of waste**	
19 06 03	liquor from anaerobic treatment of municipal waste	
19 06 04	digestate from anaerobic treatment of municipal waste	
19 06 05	liquor from anaerobic treatment of animal and vegetable waste	
19 06 06	digestate from anaerobic treatment of animal and vegetable waste	
19 06 99	wastes not otherwise specified	
19 07	**landfill leachate**	
19 07 02*	landfill leachate containing dangerous substances	M
19 07 03	landfill leachate other than those mentioned in 19 07 02	

[5] Stabilisation processes change the dangerousness of the constituents in the waste and thus transform hazardous waste into non-hazardous waste. Solidification processes only change the physical state of the waste (e.g. liquid into solid) by using additives without changing the chemical properties of the waste.

[6] A waste is considered as partly stabilised if, after the stabilisation process, dangerous constituents which have not been changed completely into non-dangerous constituents could be released into the environment in the short, middle or long term.

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

19 08	**wastes from waste water treatment plants not otherwise specified**	
19 08 01	screenings	
19 08 02	waste from desanding	
19 08 05	sludges from treatment of urban waste water	
19 08 06*	saturated or spent ion exchange resins	A
19 08 07*	solutions and sludges from regeneration of ion exchangers	A
19 08 08*	membrane system waste containing heavy metals	M
19 08 09	grease and oil mixture from oil/water separation containing only edible oil and fats	
19 08 10*	grease and oil mixture from oil/water separation other than those mentioned in 19 08 09	A
19 08 11*	sludges containing dangerous substances from biological treatment of industrial waste water	M
19 08 12	sludges from biological treatment of industrial waste water other than those mentioned in 19 08 11	
19 08 13*	sludges containing dangerous substances from other treatment of industrial waste water	M
19 08 14	sludges from other treatment of industrial waste water other than those mentioned in 19 08 13	
19 08 99	wastes not otherwise specified	
19 09	**wastes from the preparation of water intended for human consumption or water for industrial use**	
19 09 01	solid waste from primary filtration and screenings	
19 09 02	sludges from water clarification	
19 09 03	sludges from decarbonation	
19 09 04	spent activated carbon	
19 09 05	saturated or spent ion exchange resins	
19 09 06	solutions and sludges from regeneration of ion exchangers	
19 09 99	wastes not otherwise specified	
19 10	**wastes from shredding of metal-containing wastes**	
19 10 01	iron and steel waste	
19 10 02	non-ferrous waste	
19 10 03*	fluff-light fraction and dust containing dangerous substances	M
19 10 04	fluff-light fraction and dust other than those mentioned in 19 10 03	
19 10 05*	other fractions containing dangerous substances	M
19 10 06	other fractions other than those mentioned in 19 10 05	
19 11	**wastes from oil regeneration**	
19 11 01*	spent filter clays	A
19 11 02*	acid tars	A
19 11 03*	aqueous liquid wastes	A
19 11 04*	wastes from cleaning of fuel with bases	A
19 11 05*	sludges from on-site effluent treatment containing dangerous substances	M
19 11 06	sludges from on-site effluent treatment other than those mentioned in 19 11 05	
19 11 07*	wastes from flue-gas cleaning	A
19 11 99	wastes not otherwise specified	
19 12	**wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**	
19 12 01	paper and cardboard	
19 12 02	ferrous metal	
19 12 03	non-ferrous metal	
19 12 04	plastic and rubber	
19 12 05	glass	

"*Absolute Entries*"	- Hazardous waste regardless of any threshold concentrations:	A
"*Mirror Entries*"	- Hazardous waste only if dangerous substances are present above threshold concentrations:	M

19 12 06*	wood containing dangerous substances	M
19 12 07	wood other than that mentioned in 19 12 06	
19 12 08	textiles	
19 12 09	minerals (for example sand, stones)	
19 12 10	combustible waste (refuse derived fuel)	
19 12 11*	other wastes (including mixtures of materials) from mechanical treatment of waste containing dangerous substances	M
19 12 12	other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11	
19 13	**wastes from soil and groundwater remediation**	
19 13 01*	solid wastes from soil remediation containing dangerous substances	M
19 13 02	solid wastes from soil remediation other than those mentioned in 19 13 01	
19 13 03*	sludges from soil remediation containing dangerous substances	M
19 13 04	sludges from soil remediation other than those mentioned in 19 13 03	
19 13 05*	sludges from groundwater remediation containing dangerous substances	M
19 13 06	sludges from groundwater remediation other than those mentioned in 19 13 05	
19 13 07*	aqueous liquid wastes and aqueous concentrates from groundwater remediation containing dangerous substances	M
19 13 08	aqueous liquid wastes and aqueous concentrates from groundwater remediation other than those mentioned in 19 13 07	

20	**Municipal Wastes (Household waste and similar commercial, industrial and institutuional wastes) Including separately collected fractions**

20 01	**separately collected fractions (except 15 01)**	
20 01 01	paper and cardboard	
20 01 02	glass	
20 01 08	biodegradable kitchen and canteen waste	
20 01 10	clothes	
20 01 11	textiles	
20 01 13*	solvents	A
20 01 14*	acids	A
20 01 15*	alkalines	A
20 01 17*	photochemicals	A
20 01 19*	pesticides	A
20 01 21*	fluorescent tubes and other mercury-containing waste	A
20 01 23*	discarded equipment containing chlorofluorocarbons	M
20 01 25	edible oil and fat	
20 01 26*	oil and fat other than those mentioned in 20 01 25	A
20 01 27*	paint, inks, adhesives and resins containing dangerous substances	M
20 01 28	paint, inks, adhesives and resins other than those mentioned in 20 01 27	
20 01 29*	detergents containing dangerous substances	M
20 01 30	detergents other than those mentioned in 20 01 29	
20 01 31*	cytotoxic and cytostatic medicines	A
20 01 32	medicines other than those mentioned in 20 01 31	
20 01 33*	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries	A
20 01 34	batteries and accumulators other than those mentioned in 20 01 33	

20 01 35*	discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components[7]	M
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	
20 01 37*	wood containing dangerous substances	M
20 01 38	wood other than that mentioned in 20 01 37	
20 01 39	plastics	
20 01 40	metals	
20 01 41	wastes from chimney sweeping	
20 01 99	other fractions not otherwise specified	
20 02	**garden and park wastes (including cemetery waste)**	
20 02 01	biodegradable waste	
20 02 02	soil and stones	
20 02 03	other non-biodegradable wastes	
20 03	**other municipal wastes**	
20 03 01	mixed municipal waste	
20 03 02	waste from markets	
20 03 03	street-cleaning residues	
20 03 04	septic tank sludge	
20 03 06	waste from sewage cleaning	
20 03 07	bulky waste	
20 03 99	municipal wastes not otherwise specified	

[7] Hazardous components from electrical and electronic equipment may include accumulators and batteries mentioned in 16 06 and marked as hazardous; mercury switches, glass from cathode ray tubes and other activated glass, etc.

Appendix B:

Wastes and Potential Hazards for Absolute and Mirror Entries in the European Waste Catalogue

This Appendix

has been deleted

As a result of substantional changes to the classification of many chemicals in the 1st Adaption to technical progress (ATP) to the CLP, and changes to hazardous properties, the examples provided here in version 2.2 of the 2nd edition of this guidance are no longer valid.

Appendix C:

Hazardous Property Assessment

The aim of this appendix is to:

- give advice on the hazards properties H1 to H15 identified in Annex III of Directive 2008/98/EC;
- provide assessment methods and threshold concentrations for the hazards; and
- advise on which test methods should be considered.

The primary aim of the Hazardous Property Assessments is to assist in evaluating wastes covered by “mirror entries” and in determining whether they are hazardous waste or not.

Wastes identified as “absolute entries” in the EWC are hazardous waste.
Assessment determines their appropriate hazards for Duty of Care purposes.

Appendix C:

C1 Assessment of Hazard H1: Explosive

C1.1 Definition of Explosive

Annex III of the rWFD defines H1 "Explosive" as:

"*substances or preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene*".

C1.2 Explosives Act 1875

Materials that are "explosives" within the meaning of the Explosives Act 1875, as amended, and any subsequent regulations issued under the Act, are not directive or controlled waste. The term "explosive" in the 1875 Act means:

(1) *gunpowder, nitro-glycerine, dynamite, gun cotton, blasting powders, fulminate of mercury or of other metals, coloured fires and every other substance, whether similar to those above mentioned or not, used or manufactured with a view to produce a practical effect by explosion or a pyrotechnic effect;*

and includes

(2) *fog-signals, fireworks, fuses, rockets, percussion caps, detonators, cartridges, ammunition of all descriptions, and every adoption or preparation of an explosive as defined above.*

The EWC contains the following absolute entries that relate directly to explosive wastes. Where wastes covered by these entries are regulated by the Explosives Act 1875, as amended, they would not be directive or controlled waste and are therefore excluded by Step 1 of the Hazardous Waste Assessment Methodology (see Chapter 3).

16 01	**end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**	
16 01 10*	explosive components (for example air bags)	A
16 04	**Waste explosives**	
16 04 01*	waste ammunition	A
16 04 02*	fireworks wastes	A
16 04 03*	other waste explosives	A

However, other wastes may contain substances that are classified as explosive, for example picric acid from a laboratory, which could be covered by the mirror entry:

16 05	**Gases in pressure containers and discarded chemicals**	
16 05 06*	laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals	M

Controlled wastes that contain a substance classified as explosive need to be assessed for hazard H1.

C1.3 Risk Phrases

Table 3.2 of the CLP applies the category of danger "E" (explosive) to substances with risk phrases R1, R2 and R3. However, R1 relates to a particular circumstance, "explosive when dry", and so the hazard H1 is applied only in the case of substances with risk phrases R2 and R3:

R2 *Risk of explosion by shock, friction, fire or other sources of ignition*

Substances and preparations including certain organic peroxides but excepting those assigned R3.

R3 *Extreme risk of explosion by shock, friction, fire or other sources of ignition*

Substances and preparations which are particularly sensitive, such as picric acid salts or PETN (pentaerythritol tetranitrate).

Substances classified R3 are more sensitive than the explosive RDX (cyclotrimethylene trinitramine), and it is illegal to transport them. They are unlikely to be moved as hazardous waste.

C1.4 Related Risk Phrases

There are risk phrases that are not related directly to explosive properties, but rather to an ability to cause explosions in the presence of or in combination with other substances. Wastes containing substances with these risk phrases will be candidates for hazard H15, e.g. an R1 substance would not be hazardous when wet but it is clear that those responsible for managing the waste should be informed of its explosive properties in the dry state. The Approved Classification and Labelling Guide gives the following additional risk phrases:

R1	*Explosive when dry*
R4	*Forms very sensitive explosive metal compounds*
R5	*Heating may cause an explosion*
R6	*Explosive with or without contact with air*
R16	*Explosive when mixed with oxidising substances*
R18	*In use may form flammable/explosive vapour-air mixture*
R19	*May form explosive peroxides*
R44	*Risk of explosion if heated under confinement.*

C1.5 Limiting Concentrations

It is not possible to give a generic threshold for this hazard. Therefore directive waste containing any concentration of substances with risk phrases R2 or R3 should be classified as hazardous waste by hazard H1 unless:

- it is known that other substances in the waste modify it to the extent that it is not explosive; and/or
- testing demonstrates that the waste is not more explosive than dinitrobenzene.

Many of the substances classified as explosive also display other hazards. For example, trinitrobenzene is classified as E in table 3.2 of the CLP and carries risk phrase R2. This substance also carries the classification:

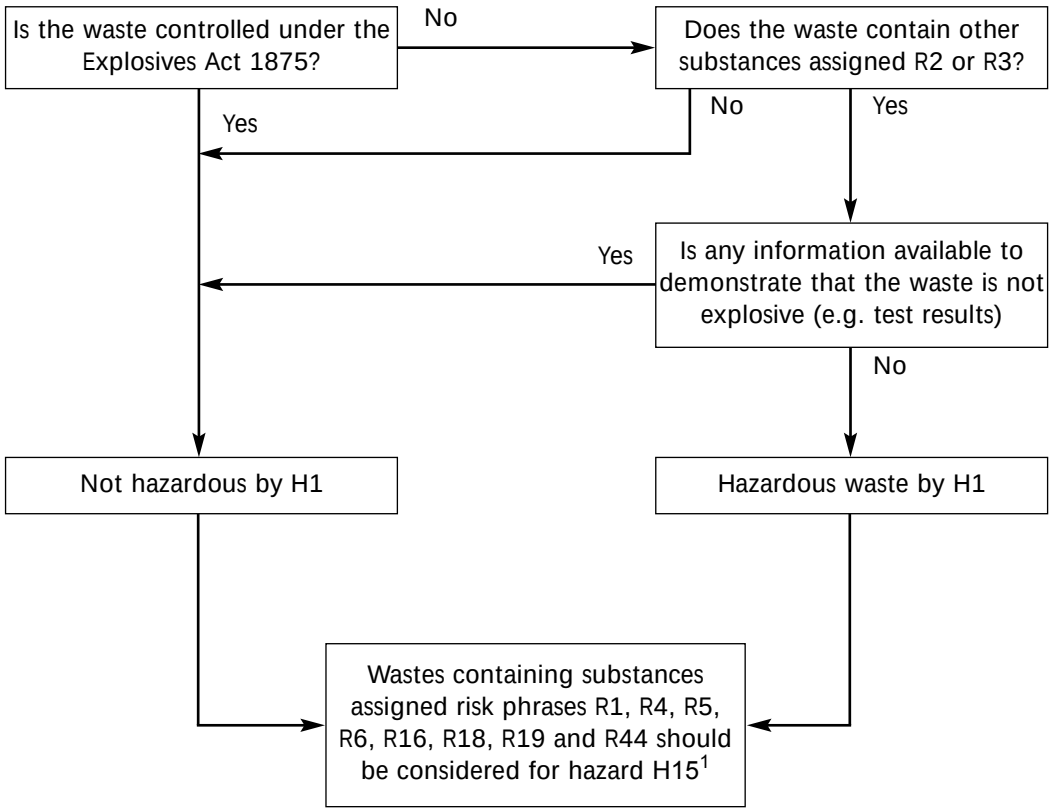
- T+ (very toxic); risk phrases R26, R27 and R28 (very toxic by inhalation, skin contact and by ingestion); and
- N (dangerous to the environment), risk phrases R51-53 (toxic to aquatic organisms and may cause long-term effects in the aquatic environment).

A waste containing ≥ 0.1% of this substance will be hazardous by virtue of its toxicity (see Section C5).

C1.6 Decision Tree

Figure C1.1 sets out the assessment process for the Hazard H1.

Figure C1.1: Decision Tree for the Assessment of Hazard H1



Note:

[1] Except wastes covered by the Explosives Act 1875

C1.7 Test Methods

The EC test method which corresponds best to the definition of H1 "Explosive" is test method A14 from EC Directive 92/69/EEC.

There are significant safety hazards involved in carrying out the test on explosive substances. For these reasons, testing for hazard H1 should only be considered in exceptional circumstances, e.g. where non-test decisions have failed to correctly identify the waste as hazardous or not. Since hazard H1 is only likely to be considered for a number of potentially explosive wastes, it is equally possible to make a non-test decision and classify the waste as hazardous by H1.

C1.7.1 EC Test Method A14. Explosive Properties

Introduction

This method is designed to establish whether a substance or preparation presents a danger of explosion when submitted to the effect of a flame (thermal sensitivity) or to impact or friction (sensitivity to mechanical stimuli).

Principle of the Method

The method comprises three parts:

Test of Thermal Sensitivity. The method involves heating the substance or preparation in a steel tube, with various degrees of confinement being provided by nozzle-plates with different diameters of orifice. This determines whether the substance or preparation is liable to explode under conditions of thermal stress. The substance is considered explosive if an explosion occurs (i.e. the tube bursts into three or more fragments) within the fixed number of tests of thermal sensitivity.

Test of Mechanical Sensitivity (with respect to shock). The method involves subjecting the substance or preparation to the shock from a mass dropped from a specified height. The substance is considered explosive if the results show an explosion (bursting into flame is equivalent to explosion) occurring at least once in six tests with the specified impact apparatus, or if the sample is more sensitive than 1,3-dinitrobenzene in an alternative impact test.

Test of Mechanical Sensitivity (with respect to friction). The method involves subjecting the solid or pasty substance to friction between standard surfaces under specified conditions of load and relative motion. The substance is considered explosive if the results show an explosion (crepitation or bursting into flame is equivalent to explosion) occurring at least once in six tests with the specified friction apparatus, or if the sample is more sensitive than 1,3-dinitrobenzene in an alternative friction test.

Comments

The test method yields data for the likelihood that certain common stimuli will initiate an explosion. It is not intended to ascertain whether or not a substance or preparation is capable of exploding under any conditions.

The method is appropriate for the conditions specified in Directive 84/449/EEC. The tests are irrelevant when available thermodynamic information (e.g. heat of formation, heat of decomposition or absence of certain reactive groups in the structural formula[1]) establishes beyond reasonable doubt that the substance or preparation is incapable of decomposing, forming gases and releasing heat very rapidly (i.e. the material does not present any risk of explosion).

The method is not definitive. It comprises a number of chosen types of specified apparatus which are widely used internationally and which usually give meaningful results. The person conducting the tests may elect to use alternative apparatus in the three methods specified, providing it can be justified scientifically and the apparatus is recognised internationally. In this case he must determine the correlation of his results with those obtained with the specified apparatus.

To avoid injury to the experimenter a preliminary screening test is necessary to establish safe conditions for the performance of the three tests and so ascertain if the prescribed sensitivity tests should be performed with special precautions. For the screening test very small samples (circa 10 mg) of the substance or preparation should be subjected to heating without confinement in a gas flame, to impact in any convenient form of apparatus and to friction by the use of a mallet against an anvil or any form of friction machine.

The reader should refer to the full test method for details on apparatus and reference substance specifications in addition to the requirements for test conditions, test performance, result reporting and evaluation.

[1] Bretherick, L. 1979. Handbook of Reactive Chemical Hazards. Butterworths, pp. 60 to 63.

Appendix C:

C2 Assessment of Hazard H2: Oxidising

C2.1 Definition of Oxidising

Annex III of the rWFD defines H2 "Oxidising" as:

"*substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances*"

C2.2 Risk Phrases

A waste may exhibit the hazard "oxidising" (H2) if it contains a substance assigned one of the following risk phrases:

R7 *May cause fire*

Organic peroxides which have flammable properties even when not in contact with other combustible material.

This risk phrase is most commonly attributed to organic peroxides. These have flammable properties even when not in contact with other combustible material, due to the chemical structure of the compound, which combines a flammable hydrocarbon functional group with a peroxide functional group.

R8 *Contact with combustible material may cause fire*

Other oxidising substances and preparations, including inorganic peroxides, which may cause fire or enhance the risk of fire when in contact with combustible material.

R9 *Explosive when mixed with combustible material*

Other substances and preparations, including inorganic peroxides which become explosive when mixed with combustible materials, e.g. certain chlorates.

Substances which are oxidising can be distinguished from substances which are flammable: oxidising substances can initiate combustion in the absence of air.

The risk phrase R16, *Explosive when mixed with oxidising materia*l, is clearly included within the broad definition of H2. The only substance in table 3.2 of the CLP classified as R16 is red phosphorus. Red phosporus is, however, also listed as R11, highly flammable, and is therefore adequately described and classified by H3A (third indent). R16 should not be considered to apply to Hazard H2 specifically, but should be considered under H15 (see Section C15.2).

C2.3 Limiting Concentrations

There is no single limiting concentration applicable to substances that exhibit Hazard H2. This is because the potency of the substance as an oxidiser is dependent upon, among other criteria:

- the chemical structure of the substance;
- the percentage of oxygen available for reaction.

The hierarchy for deciding on threshold limiting concentrations should be as follows:

- substances listed in table 3.2 of the CLP with specific concentration limits;
- organic peroxides, for which concentration limits may be calculated;
- inorganic and other oxidisers, for which testing is the only option.

C2.4 Organic Peroxides

Organic peroxides[2] combine the properties of an oxidiser and a combustible substance in one molecule, and have the following generic limiting concentrations attributed to them. Any waste containing organic peroxides will be classified as hazardous by H2 if the waste contains:

(i) more than 5% by weight of organic peroxides;

(ii) more than 0.5% available oxygen from the organic peroxides, when containing more than 5% hydrogen peroxide.

The method for calculating the amount of available oxygen from the organic peroxide is set out below:

The available oxygen content, O_i (%) of an organic peroxide *i*, is given by:

$$O_i\ (\%) = 16 \times (n_i \times c_i / m_i)$$

Where 16 = gram molecular mass of the available oxygen of the peroxide functional group -O-O-.

n_i = number of peroxide groups per molecule of organic peroxide *i*.

c_i = concentration (mass %) of organic peroxide *i* in the waste.

m_i = gram molecular mass of organic peroxide *i*.

Given point (ii) above, it is possible to identify the concentration of organic peroxides that would make a waste hazardous when in the presence of more than 5% hydrogen peroxide by rearranging the above formula as follows:

$$c_i = (O_i \times m_i) / (16 \times n_i)$$

An example calculation is in Box C2.1.

Box C2.1: Calculating concentration of organic peroxide required to make a waste hazardous

Example calculation for methyl ethyl peroxide

Methyl ethyl peroxide has the chemical formula C_2H_5-O-O-CH_3 and molecular mass 76 g.
There is one peroxide functional group present, therefore, n_i =1.

The limiting concentration for organic peroxides is one which would give rise to an available oxygen concentration of 0.5%, therefore, O_i = 0.5. The concentration c_i which would give rise to this is:

$$c_i = (O_i \cdot m_i) / (16 \cdot n_i)$$

$$c_i = (0.5 \cdot 76) / (16 \cdot 1)$$

$$c_i = 2.4$$

Therefore a waste would be hazardous by H2 if:

- the methyl ethyl peroxide concentration exceeded 5%; or
- the methyl ethyl peroxide concentration exceeded 2.4% in the presence of >5% hydrogen peroxide.

[2] Generic formula R-OO-R, e.g. methyl ethyl peroxide C_2H_5-O-O-CH_3.

C2.5 Other R7, R8 and R9 Oxidisers

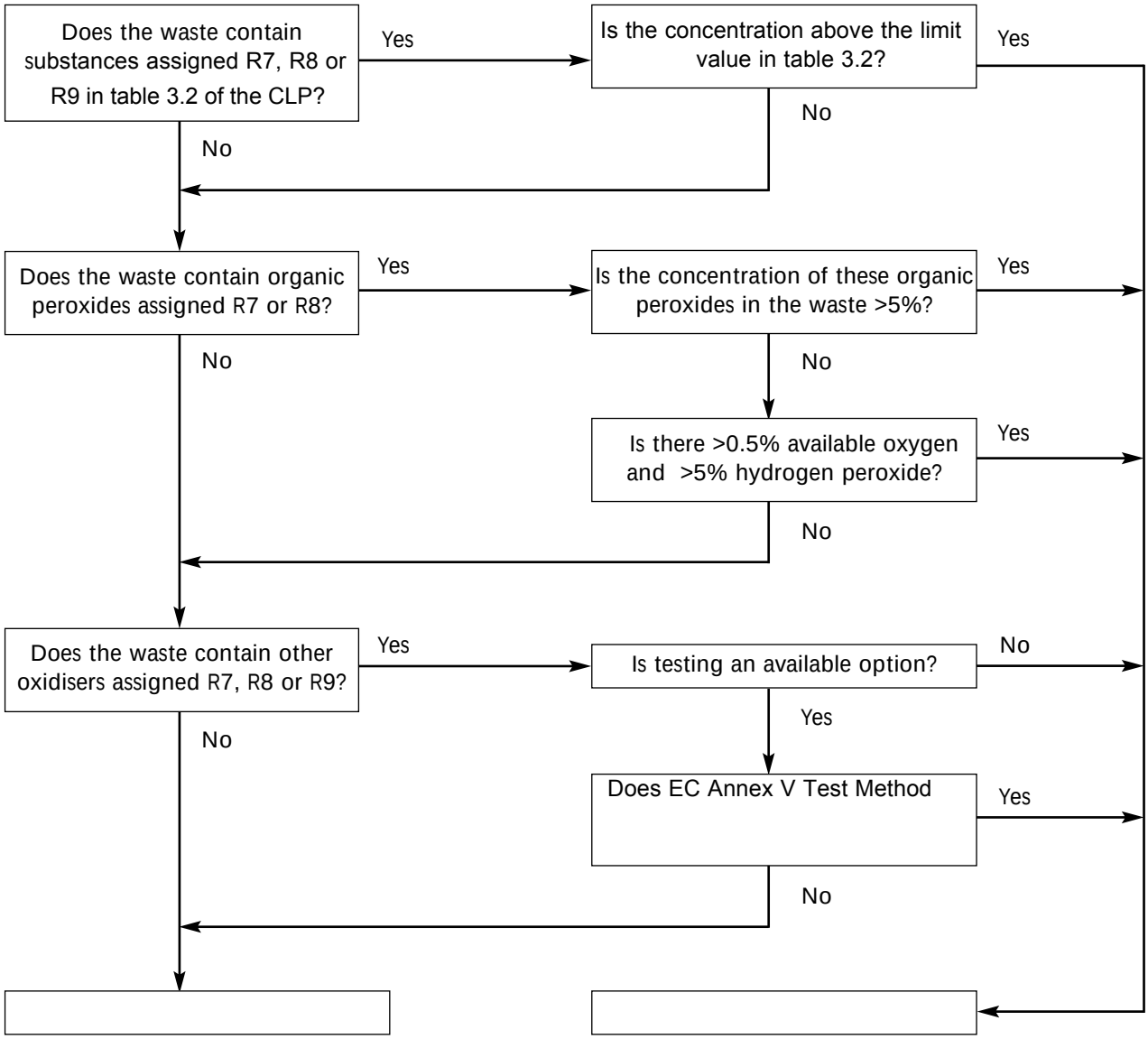
Limiting concentrations for the bulk of the substances classified by these risk phrases remain undetermined or are commercially confidential. The reactivity and free oxygen cannot be determined from the structure, and therefore calculating limiting concentrations is not possible. In the case of inorganic oxidisers testing is required.

Primary producers generally chemically degrade inorganic oxidisers in a controlled manner, before disposal. The majority of oxidiser waste is created by secondary users, and, if not destroyed, all inorganic oxidants are considered dangerously reactive. In particular perchlorates and bromates can react explosively when mixed with combustible materials (R9).

C2.6 Decision Tree

Figure C2.1 sets out the assessment process for the Hazard H2.

Figure C2.1: Decision Tree for the Assessment of Hazard H2



C2.7 Test Methods

The approved test methods are shown in Table C2.1.

Table C2.1: Hazard H2, associated risk phrases and relevant test methods

Hazard	Phase	Risk phrase	Test
H2	Solid (not explosive, highly flammable, organic peroxides or combustible	R7, R8	Directive 92/69/EEC, Test Method A17
	Organic peroxides	R7, R8, R9	Use calculation method as no test available
	Liquids and oxidising materials not covered by the classes listed above	R7, R8, R9	No test available

The EC approved Annex V test method A17, described below, and the test in HSE L88, are not applicable to the following:

- liquids or gases
- explosive or highly flammable substances
- organic peroxides
- combustible solids liable to melt under the conditions of the test.

Although there is no test applicable to organic peroxides, there is a generic threshold limit, and the approved calculation method for determining when they are oxidising is described in Section 3.5. There is no currently recommended or agreed standard test for liquid oxidisers. Advice for specific testing of liquid oxidisers should be sought from the Health and Safety Executive Health Directorate, Industrial Chemicals Unit, Magdalen House, Stanley Precinct, Bootle, Merseyside L20 3QZ (0151 951 4000).

Waste materials exhibit considerable variability in composition and the approved test method is not applicable to all oxidising materials. In addition, there are significant safety hazards involved in carrying out the test on oxidising substances. For these reasons, testing for hazard H2 should only be considered in exceptional circumstances, e.g. where non-test decisions have failed to correctly identify the waste as hazardous or not.

C2.7.1 EC Test Method A17: Oxidising Properties (solid)

The test method which corresponds best to the definition of the hazard is test method A17 from EC Directive 92/69/EEC. This test method is not applicable to liquids and gases, explosive or highly flammable substances, organic peroxides or to combustible solids liable to melt under the conditions of the test.

Introduction

It is useful to have preliminary information on potentially explosive properties and toxicity of the substance before performing this test. This test is irrelevant when examination of the structural formula establishes beyond reasonable doubt that the substance or preparation is not capable of reacting exothermically with a combustible material.

Principle of Method

In order to ascertain if the test should be performed with special precautions, a preliminary test should be performed. A preliminary test establishes an oxidisation hazard if the test substance reacts vigorously. When this is not the case, the substance or preparation should then be subject to a full test as summarised below.

The full test method involves the burning of a range of mixtures formed from the test substance and a defined combustible substance. Each mixture from the range is then formed into a pile and ignited at one end. The maximum burning rate determined is compared with the maximum burning rate of the reference mixture cellulose and barium nitrate. The substance is considered to be oxidising when the maximum burning rate of the mixtures to be tested is higher than or equal to the maximum burning rate of the reference mixture.

The full method provides explicit details of preparation of the test substance and the barium nitrate and cellulose utilised as reference substances. The method presents clear guidelines on apparatus, test performance, quality criteria, reporting and evaluation of the results.

C2.7.2 Alternative Methods

Similar tests are used for classification under the Transport of Dangerous Goods Regulations; details and guidance on the tests can be obtained from the Health and Safety Executive.

Appendix C:

C3 Assessment of Hazard H3: Flammable

C3.1 Definition

Hazard H3 is divided into two sections

- highly flammable (H3A)
- flammable (H3B).

H3A is further divided into five sub-sections with these sub-sections referred to as H3A (first–fifth indents) or H3A(i–v).

Annex III of the rWFD defines H3A "Highly flammable" as:

(i) *liquid substances and preparations having a flash point below 21°C (including extremely flammable liquids), or*

(ii) *substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without application of energy, or*

(iii) *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 the removal of the ignition source, or*

(iv) *gaseous substances and preparations which are flammable in air at normal pressure, or*

(v) *substances or preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.*

Annex III of the rWFD defines H3B "Flammable" as:

"Liquid substances and preparations having a flash point equal to or greater than 21°C and less than or equal to 55°C".

C3.2 Risk Phrases

A waste possessing H3A(i–v) or H3B is likely to contain a substance with one or more of the following risk phrases.

R10 *Flammable*

For liquid substances and preparations having a flashpoint equal to or greater than 21°C, and less than or equal to 55°C.

R11 *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; or

Liquid substances having a flashpoint below 21°C but which are not extremely flammable.

R12 *Extremely Flammable*

Liquid substances and preparations which have a flashpoint lower than 0°C and a boiling point (or in case of a boiling range the initial boiling point) lower than or equal to 35°C; or

Gaseous substances and preparations which are flammable in contact with air at ambient temperature and pressure.

R15 *Contact with water liberates extremely flammable gases*

Substances and preparations, which, in contact with water or damp air, evolve extremely flammable gases in dangerous quantities, at a minimum rate of 1 litre per kg per hour.

R17 *Spontaneously flammable in air*

Substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any input of energy.

Flammability may not be the only hazard possessed by a waste, but it is important, and should always be recorded. Classification as flammable may be necessary to meet the legal requirements for carriage of the waste.

C3.3 Related Risk Phrases

The following are related risk phrases:

R14 *Reacts violently with water*

R18 *In use may form flammable/explosive vapour–air mixture*

R30 *Can become highly flammable in use*

These risk phrases are only associated with waste exhibiting other hazards, and will not constitute hazardous waste in isolation. Wastes containing these risk phrases will be candidates for hazard H15 (see Appendix C15).

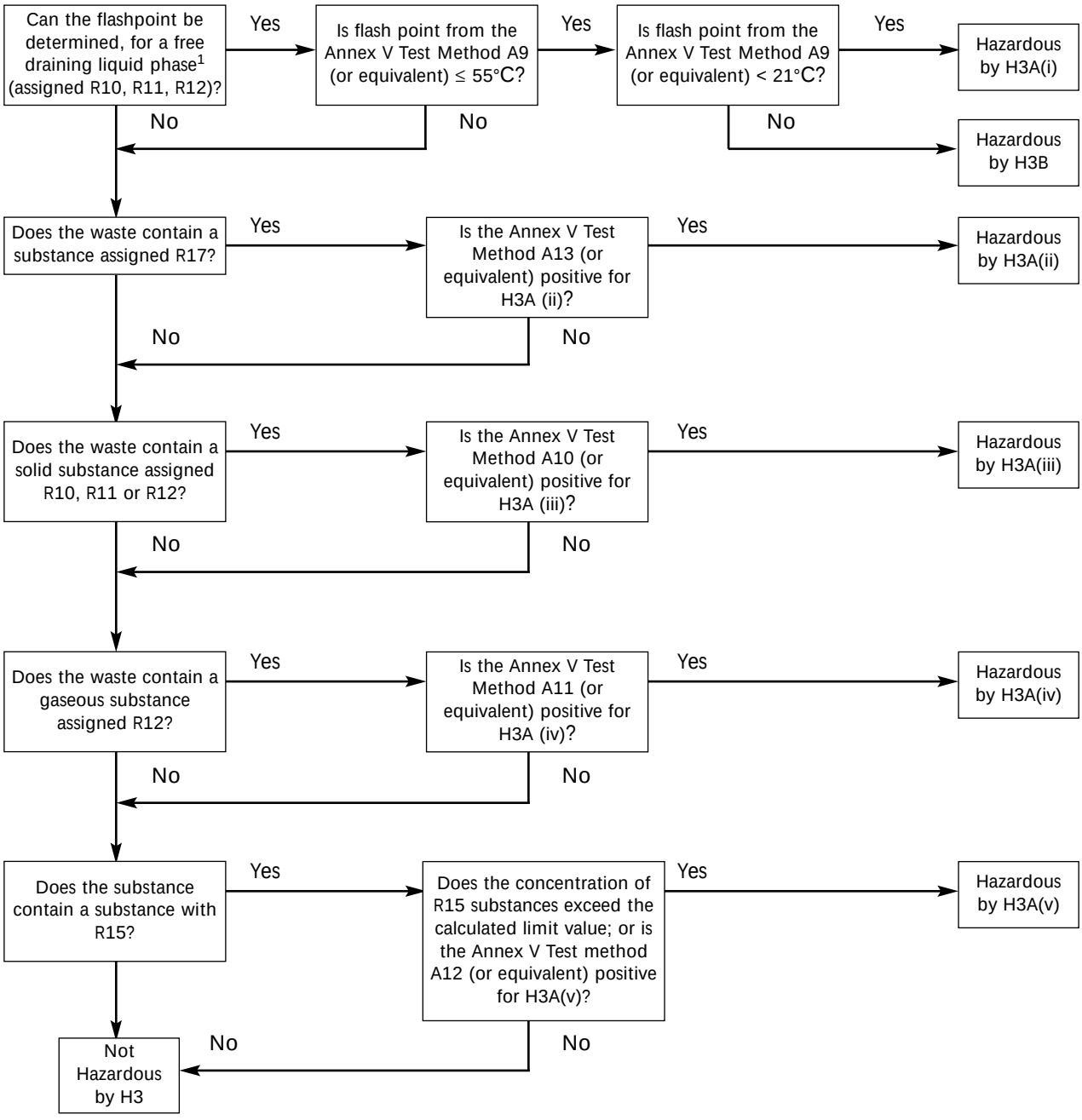
C3.4 Combined Risk Phrases

Any combination of risk phrases including R10, R11, R12, R15 or R17 indicates the potential to exhibit hazard H3. Related risk phrases must be in combination with the above to indicate the potential for hazard H3.

C3.5 Decision Tree

If substances are present in the waste which have any of the risk phrases R10, R11, R12, R15 or R17, the waste will generally require testing to determine whether it exhibits the particular hazard, with the exception of H3A(v) which should be determined using a calculation method (see Section C3.5.1). Figure C3.1 sets out the assessment process for the Hazard H3.

Figure C3.1: Decision Tree for the Assessment of Hazard H3



Note:

[1] A free draining liquid phase is a liquid that can be poured or decanted from a waste.

Note also that:

Many solid substances classified R17, which have the potential for hazard H3A(ii), are also R15 (particularly in powder form), which makes them candidates for H3A(v) as well.

Dilution of low flashpoint liquids in a solid or liquid matrix will raise the flashpoint until, at some stage, the dilution effect will render the waste non-hazardous by H3. Unless otherwise known, testing must be carried out on:

- the mixture;
- the separate phases in the case of two-phase solid/freely draining liquid mixtures, e.g. toluene impregnated soils; or
- the liquid extracted from absorbents/rags by physical or mechanical means.

C3.5.1 Calculation Method for Hazard H3A(v)

This hazard can be determined by calculation or by testing. If information on the composition of the waste is available the calculation method should be used; otherwise EC standard test method A12 or equivalent should be used (see Section C3.6).

The first step in the calculation method is to determine whether the waste contains any of the substances which are classified by the following risk (or combined risk) phrases:

R15 *Contact with water liberates extremely flammable gas*

R14/15 *Reacts violently with water, liberating extremely flammable gas*

R15/29 *Contact with water liberates toxic, extremely flammable gas*

To show this hazardous property, the waste should be capable of releasing a highly flammable gas at a rate in excess of 1 m^3 gas per tonne of waste per hour (or at an equivalent rate). It should be assumed that if a substance is classified by any of the above risk phrases, or could be classified by any of these risk phrases, this criterion has already been met.

The extremely flammable gases which substances classified in table 3.2 of the CLP with these risk phrases could release by chemical reaction with water appears to be limited to the following:

hydrogen	H_2	by R15 and R14/15
ethane	C_2H_6	by R14/15
ethyne (acetylene)	C_2H_2	by R15
phosphine	PH_3	by R15/29

The waste producer should also consider what other solid substances in his waste could break down to give off extremely flammable gases, and carry out the assessment set out in Box H3.1.

Box H3.1: Calculation Method for Hazard H3A(v)

1. Write a balanced equation for the reaction that produces the gas. The general form of this equation should be as follows:

   aA + bB = cC + gG

   where: A, B, C and G are the products and reactants; and

   a, b, c and g are the stoichiometric ratios between the products and reactants.

2. Attribute molecular weights and stoichiometric ratios to the substances in the equation.

3. Divide (a x molar weight of A) by (g x 22.4 [the volume of 1 mol of gas at 25°C and 1 atmosphere pressure (STP)]). This gives the mass of reactant A that will evolve 1 litre of gas G.

4. The limiting concentration for the substance in the waste with the potential to show hazard H3A(v) is this amount (in grams) divided by 1,000 (to convert to kg) and multiplied by 100 (to give % by weight). The same calculation can be used to determine hazard H12.

   Example Calculation – The main constituents which may make aluminium drosses and slags hazardous, covered by "*mirror entry*" 10 08 10*, are aluminium, aluminium nitride, aluminium carbide. Aluminium powder is classified F: R15 and R10, with aluminium carbide assigned R15. Applying this calculation method to the aluminium drosses and slags gives the following threshold limits. (Note: other constituents may make the aluminium drosses and slags hazardous by H12, see Appendix C12.)

   Aluminium powder (R15) giving rise to hazard H3A(v)

$2Al$	+	$3H_2O$	→	Al_2O_3	+	$3H_2$
aluminium		water		aluminium oxide		hydrogen
27 g		18 g		102 g		2 g
2 mol		3 mol		1 mol		3 mol

   Limiting concentration of aluminium powder in waste

   = [(2 x 27) / (3x22.4)] / 1,000 x 100 = 0.08% [a] 0.1%

   Aluminium carbide (R15) giving rise to hazard H3A(v)

Al_4C_3	+	$6H_2O$	→	$2Al_2O_3$	+	$3CH_4$
aluminium carbide		water		aluminium oxide		methane
144 g		18 g		102 g		16 g
1 mol		6 mol		2 mol		3 mol

   Limiting concentration of aluminium carbide in waste

   = [144 / (3x22.4)] / 1,000 x 100 = 0.21% ≈ 0.2%

Threshold limits for certain substances listed in table 3.2 of the CLP, for Hazard H3A(v), have been derived using the assessment methodology and are set out in Table C3.1. It should also be noted that a substance exhibiting R15/29 also has the potential to exhibit hazard H12, and the threshold limit for that hazard will be the same as that established for H3A(v).

Table C3.1: Examples of substances which may cause a waste to exhibit hazard H3A(v) (Classification by risk phrases R15, R14/15 and R15/29)

Substance name	Risk phrases	Equation	Threshold Conc. %
Lithium	R14/15	$2Li + 2H_2O \rightarrow 2LiOH + H_2$	0.06
Sodium	R14/15	$2Na + 2H_20 \rightarrow 2NaOH + H_2$	0.2
Magnesium powder (pyrophoric)	R15–17	$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$	0.1
Aluminium powder (pyrophoric)	R15–17	$2Al + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2$	0.08
Aluminium powder (stabilised)	R15		
Potassium	R14/15	$2K + 2H_2O \rightarrow 2KOH + H_2$	0.4
Calcium	R15	$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$	0.2
Zinc powder/ zinc dust (pyrophoric)	R15–17	$Zn + 2H_2O \rightarrow Zn(OH)_2 + H_2$	0.3
Zirconium powder (pyrophoric)	R15–17	$Zr + 4H_2O \rightarrow Zr(OH)_4 + 2H_2$	0.2
Zirconium powder (non pyrophoric)	R15		
Aluminium lithium hydride	R15	$LiAlH_4 + H_2O \rightarrow LiAl(OH)_a + 4H_2$	0.04
Sodium hydride	R15	$NaH + H_2O \rightarrow NaOH + H_2$	0.1
Calcium hydride	R15	$CaH_2 + 2H_20 \rightarrow Ca(OH)_2 + 2H_2$	0.1
Calcium carbide	R15	$CaC_2 + H_2O \rightarrow Ca(OH)_2 + C2H_2$	0.3
Calcium phosphide	R15/29	$Ca_3P_2 + 6H_2O \rightarrow 2PH_3 + 3Ca(OH)_2$	0.4
Aluminium phosphide	R15/29	$AlP + 3H_2O \rightarrow PH_3 + Al(OH)_3$	0.3
Magnesium phosphide	R15/29	$Mg_3P_2 + 6H_2O \rightarrow 2PH_3 + 3Mg(OH)_2$	0.3
Trizinc diphosphide	R15/29	$Zn_3P_2 + 6H_2O \rightarrow 2PH_3 + 3Zn(OH)_2$	0.6
Trichlorosilane	R14–17	$Cl_3HSi + H_2O \rightarrow Cl_3(OH)Si + H_2$	0.6
Diethyl (ethyldimethyl-silanolato) aluminium	R14/15, 17	$(C_2H_5)_2Si(CH_3)_2C_2H_5Al + 2H_2O \rightarrow 2C_2H_6 + Al(OH)_2Si(CH_3)_2C_2H_5$	0.4

Notes:

R15 Contact with water liberates extremely flammable gases

R14/15 Reacts violently with water, liberating extremely flammable gas

R15/29 Contact with water liberates toxic, extremely flammable gas (may also exhibit hazard H12)

R17 Spontaneously flammable in air

C3.6 Test Methods

Unless otherwise known, test procedures for flammability are recommended for all except for hazard H3A(v) which should be assessed using the calculation method in Section 3.5.1. The approved test methods for the determination of flammable properties are set out in Table C3.2. The appropriate hazard may be identified following the outcome of the test.

Table C3.2: Hazard H3 with associated risk phrases and relevant approved test methods

Hazard	Phase	Risk phrase	Test and Reference
H3A(i)	liquid	R11 and some R10	Directive 92/69/EEC, Test Method A9
	liquid	R12	Directive 92/69/EEC, Test Method A11
H3A(ii)	solid or liquid	R17	Directive 92/69/EEC, Test Method A13.
H3A(iii)	solid	R11	Directive 92/69/EEC, Test Method A10.
H3A(iv)	gas	R12	1. Directive 92/69/EEC, Test Method A11. 2. Directive 92/69/EEC, Test Method A15 is a useful adjunct to test A11.
H3A(v)	solid/liquid	R15	Directive 92/69/EEC, Test Method A12.
H3B	liquid	R10 and some R11	Directive 92/69/EEC, Test Method A9.

Similar tests are used for classification under the Transport of Dangerous Goods Regulations; details and guidance on the tests can be obtained from the Health and Safety Executive.

C3.6.1 EC Test Method A9 (flashpoint) for Hazard H3A (first indent) and H3B

Introduction

This test is for flashpoint. It is useful to have preliminary information on the flammability of the substance to perform this test. The test procedure is only applicable to liquid substances, whose vapours can be ignited by ignition sources. The test methods described in this text are only reliable for flashpoint ranges which are specified in the individual methods.

The flashpoint is the lowest temperature, corrected to a pressure of 101 325 kPa (1 atmosphere) at which a liquid evolves vapours, under the conditions defined in the test method, in such an amount that a flammable vapour/air mixture is produced in the test vessel.

Principle of the method

The substance is placed in a test vessel which is progressively heated or cooled to the test temperature according to the procedure described in the individual test method. Ignition trials are carried out in order to ascertain whether or not the sample flashed at that temperature. Reference substances should be used to calibrate the method from time to time and to offer a chance to compare results when another method is applied.

Sensitivity and reproducibility vary according to the test method used. The specificity of some test methods is limited to certain flashpoint ranges and subject to substance-related data (e.g. high viscosity).

For full details on the performance of the test refer to the following methods.

Equilibrium method: see the following ISO standards.

- ISO 1516
- ISO 3680
- ISO 1523
- ISO 3679.

Non-equilibrium method: refer to the following methods.

- Abel apparatus: BS 2000 part 170, NF M07-011, NF T66-009
- Abel-Pensky apparatus: (EN 57), DIN 51755 part 1 (5 - 65°C), and part 2 (<5°C), NF M07-036
- Tag apparatus: ASTM D 56
- Pensky-Martens apparatus: ISO 2719, EN 11, DIN 51758, ASTM D 93, BS 2000-34, NF M07-019
- For viscous liquids (paints, gums and similar) containing solvents, only apparatus and test methods suitable for determining the flashpoint of viscous liquids may be used: see ISO 3679, ISO 3680, ISO 1523, DIN 53213 part 1.

C3.6.2 Summary of EC Test Method A13 (Pyrophoric Properties of Solids and Liquids) for Hazard H3A (second indent)

Introduction

It is useful to have preliminary information on the auto-flammability of a substance. The test procedure is only applicable to solid and liquid substances which in small amounts will ignite spontaneously a short time after coming into contact with air at room temperature (circa 20°C).[3]

Substances not covered by this test method are those which need hours or days at room temperature before self-ignition occurs, or those which need to be exposed to considerably higher temperature before self-ignition occurs.

The auto-flammability of liquids may also need to be tested following the result of EC Test Method A15 Auto-ignition temperature (liquids and gases) for hazard H3A (fourth indent) (see Section C3.6.4 below.)

Principle of the method

The substance, whether solid or liquid, is added to an inert carrier and brought into contact with air at ambient temperature for a period of five minutes. If liquid substances do not ignite they are absorbed onto filter paper and exposed to air at ambient temperature (circa 20°C) for five minutes. If the substance ignites within five minutes when added to an inert carrier and exposed to air, or a liquid substance chars or ignites a filter paper within five minutes when added and exposed to air, it is considered to be pyrophoric and therefore highly flammable.

[3] NF T 20-039 (SEPT 85). Chemical products for industrial use. Determination of the spontaneous flammability of solids and liquids.

Testing can be discontinued as soon as a positive result occurs in any of the tests: because safety is at stake, a single positive result is sufficient for the substance to be considered highly flammable.

The full test method should be referred to for complete details on test performance.

C3.6.3 EC Test Method A10 (Flammability (solids)) for Hazard H3A (third indent)

Introduction

It is useful to have preliminary information on any potentially explosive properties of the substance before performing this test. This test should only be applied to powder, granular and paste-like substances.[4]

In order to include only those substances which burn rapidly or those whose burning behaviour is in any way especially dangerous, only substances whose burning velocity exceeds a certain limiting value are considered to be highly flammable.

It can be especially dangerous if incandescence propagates through a metal powder because of the difficulties in extinguishing the fire. Metal powders should be considered highly flammable if they support spread of incandescence throughout the mass within a specified time.

Principle of the method

The substance is formed into an unbroken strip or powder train of specified length and a preliminary screening test performed to determine if, on ignition by a gas flame, propagation by burning with flame or smouldering occurs. If the propagation over a specified proportion of the train occurs within a specified time the full test programme to determine the burning rate is carried out.

Powdery, granular or pasty substances are to be considered as highly flammable when in one of the test runs they give a burning time as less than 45 seconds. Powders of metals or metal alloys are considered to be highly flammable when they can be ignited and the flame or the zone of reaction spreads over the whole sample in 10 minutes or less.

The full test method should be referred for complete details on test apparatus, test performance and results evaluation.

C3.6.4 EC Test Method A15 (Auto-ignition Temperature (liquids and gases)) for Hazard H3A (fourth indent)

Introduction

It is useful to have preliminary information on the auto-flammability of a substance. Explosive substances and substances which ignite spontaneously in contact with air at ambient temperature should not be submitted to this test. The test procedure is applicable to gases and volatile liquid substances whose vapours can be ignited by a hot surface in the presence of air, by a hot surface.

Auto-ignitability is expressed in terms of auto-ignition temperature, which is the lowest temperature at which the test substance will ignite when mixed with air under the conditions defined in the test method.

Principle of the method

The method determines the minimum temperature of the inner surface of an enclosure that will result in ignition of a gas, vapour or liquid injected into the enclosure. For performance of the test refer to the following methods: IEC 79-4, DIN 51794, ASTM-E 659-78, BS 4056, NF T 20-037. Reference substances are cited and should primarily serve to check the performance of the method from time to time and allow comparison with results from other methods. The reproducibility varies according to the range of self-ignition temperatures and the test method used. The sensitivity and specificity will also vary with the chosen test method.

[4] NF T 20-042 (SEPT 85). Chemical products for industrial use. Determination of the flammability of solids.

C3.6.5 EC Test Method A11 (Flammability (gases)) for Hazard H3A (fourth indent)

Introduction

This method allows a determination of whether gases mixed with air at room temperature and atmospheric pressure are flammable, and if so over what range of concentrations. Mixtures of increasing concentrations of the test gas with air are exposed to an electrical spark and it is observed whether ignition occurs.

Principle of method

The range of flammability is the range of concentration between the lower and upper explosive limits (LEL and UEL). The LEL and UEL are those limits of concentration of the flammable gas in admixture with air at which propagation of a flame does not occur. The occurrence of flame propagation is the only relevant information data for the determination of this property.[5]

The test vessel is an upright glass cylinder fitted with a pressure-release opening. Ignition electrodes send a spark generated from a high voltage transformer. The apparatus is shielded to restrict any explosion damage. Using proportioning pumps, a known concentration of gas in air is introduced into the glass cylinder and the spark is passed through the mixture. It is observed whether or not a flame detaches itself from the ignition source and propagates independently.

Refer to the full method in the Directive for specification of test apparatus, test conditions and performance.

C3.6.6 EC Test Method A12 (Flammability (contact with water)) for Hazard H3A (fifth indent)

Introduction

This test method can be used to determine whether the reaction of a substance with water or damp air evolves gas or gases that are highly flammable.[6] The method can be applied to both solid and liquid substances; however, it is not applicable to substances which spontaneously ignite when in contact with air.

Principle of the method

The substance is tested according to the step by step sequence outlined below. The initial steps in the method are to establish whether the substance reacts violently with water; if it is known that it does not then performance of these parts of the method not required. The substance is considered hazardous if spontaneous ignition occurs in any step of the test procedure, or evolution of flammable gas evolves at a rate greater than 1 litre/kg of substance per hour.

Step 1. The test substance is placed in a trough containing distilled water at room temperature and it is noted whether or not the evolved gas ignites.

Step 2. The test substance is placed on a filter paper floating on the surface of a dish containing distilled water at room temperature and it is noted whether or not the evolved gas ignites. The filter paper is merely to keep the substance in one place to increase the chances of ignition.

Step 3. The test substance is made into a small pile and a few drops of water are added to the pile and it is noted whether or not the evolved gas ignites.

Step 4. The test substance is mixed with distilled water at 20°C and the rate of evolution of gas is measured over a period of seven hours at one-hour intervals. If the rate of evolution is erratic, or is increasing, after seven hours, the measuring time should be extended to a maximum time of five days. The test may be stopped if the rate at any time exceeds 1 litre per kg per hour.

For the details and specifications of test apparatus and performance the full method should be referred to.

Alternative Methods

Similar tests are used for classification under the Transport of Dangerous Goods Regulations; details and guidance on the tests can be obtained from the Health and Safety Executive.

[5] NF T 20-041 (SEPT 85). Chemical products for industrial use. Determination of the spontaneous flammability of gases.

[6] NF T 20-040 (SEPT 85). Chemical products for industrial use. Determination of the spontaneous flammability of gases formed by the hydrolysis of solids and liquids.

Appendix C:

C4 Assessment of Hazards H4/H8: Irritant and Corrosive

C4.1 Definition

"Irritant" (H4) and "Corrosive" (H8) hazards are linked because they both refer to the potential for harm or damage to tissue.

Annex III of the rWFD defines H4, "Irritant" as:

> *"Non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation"*

Annex III of the rWFD defines H8, "Corrosive" as:

> *"substances and preparations which may destroy living tissue on contact."*

Preparations containing corrosive substances can exhibit either corrosive or irritant properties dependant upon concentration. However, substances classified as irritants can not become corrosive.

Mechanical irritation produced by some substances, for example mineral wool, is not included within this definition.

C4.2 Risk Phrases

In the following list of the risk phrases associated with the hazards irritant and corrosive, R34 and R35 are risk phrases associated with corrosive, the others relate to irritant:

R35 *Causes severe burns*

This risk phrase is assigned to substances which, when applied to healthy intact animal skin, cause full thickness destruction of skin tissue in up to three minutes exposure or to substances where this result can be predicted.

R34 *Causes burns*

This risk phrase is assigned to substances which, when applied to healthy intact animal skin, cause full thickness destruction of skin tissue in up to four hours exposure; or to substances where this result can be predicted. Organic hydroperoxides are assigned this risk phrase unless there is evidence to the contrary.

R36 *Irritant to eyes*

This risk phrase is assigned to substances if, when applied to the eye of an animal, significant ocular lesions occur within 72 hours after exposure and persist for at least 24 hours. Organic peroxides are assigned this risk phrase unless there is evidence to the contrary.

R37 *Irritant to respiratory system*

This risk phrase is assigned to substances and preparations which cause serious irritation to the respiratory system; the conclusion is normally based on:

a) practical observations in humans;

b) positive results from appropriate animal tests.

R38 *Irritant to skin*

This risk phrase is assigned to substances which cause significant inflammation of the skin which persists for at least 24 hours after an exposure period of up to four hours (based on the rabbit cutaneous irritation test method in Annex V of Directive 67/548/EEC). Organic peroxides are assigned this risk phrase unless there is evidence to the contrary.

R41 *Risk of serious damage to eyes.*

This risk phrase is assigned to substances which, when applied to the eye of an animal, cause severe ocular lesions within 72 hours after exposure if the lesions are present 24 hours or more after the instillation of the test material.

C4.3 Combined Risk Phrases

The risk phrases R36, R37 and R38 can be combined when substances are irritants by more than one route. This results in the following combined risk phrases:

R36/37 *Irritant to eyes and respiratory system*

R36/37/38 *Irritant to eyes, respiratory system and skin*

R36/38 *Irritant to eyes and skin*

R37/38 *Irritant to respiratory system and skin*

The purpose of these risk phrases is to reduce the quantity of information required on the labels needed for the CHIP3 Regulations: they mean that a substance possesses each of the individual risk phrases. For example a classification of R36/37/38 is equivalent to R36, R37 and R38.

C4.4 Limiting Concentrations

"Corrosive" and "Irritant" have specified concentration limits set out in the EWC, above which a waste would be hazardous:

- one or more corrosive substances classified as R35 at a total concentration ≥ 1%;
- one or more corrosive substances classified as R34 at a total concentration ≥ 5%;
- one or more irritant substances classified as R41 at a total concentration ≥ 10%; or
- one or more irritant substances classified as R36, R37, R38 at a total concentration ≥ 20%.

C4.5 Procedure for Assessment of Hazards H4 and H8

First, determine whether the waste contains any substances classified with the risk phrases R34, R35, R36, R37, R38, R41 or the related combined risk phrases. If it does, and the concentrations within the waste equal or exceed the relevant thresholds, the waste will be hazardous.

If the waste comprises a complex mixture of substances whose composition is not determined, there are two options:

- use pH to determine if the waste is hazardous and thus avoid testing; or
- use an appropriate test method to determine the corrosivity or irritancy of the waste.

Using pH

If the waste is believed to contain "*dangerous substances*" with a high or low pH and can be leached to produce a leachate that has a pH of 2 or less or a pH of 11.5 or greater it should be assumed to be corrosive and thus be hazardous waste by H8. If pH is being used as the basis of the classification, the acid/alkali reserve[7] can be taken into consideration. The acid/alkali reserve provides a measure of the capability of an acid or alkali to maintain its pH and combined with pH provides a good indication of corrosivity. If the acid/alkali reserve suggests that a waste may not be corrosive, this must be confirmed by further testing. If the pH is within the range 2 to 11.5 the waste is not corrosive on the basis of pH; but it may still be irritant (see Section C4.6) or corrosive if the presence of, for example, organic hydroperoxides is suspected.

[7] Young, J.R., How, M.J., Walker, A.P. and Worth, W.H.M. 1988. "Classification as corrosive or irritant to skin of preparations containing acidic or alkaline substances, without testing on animals", Toxic In Vitro 2(1): 19-26.

Using testing

Testing should be limited to cases where the hazards cannot be determined from the composition of the waste (i.e. using risk phrases) or by using pH (see above). However, some of the Annex V Test Methods B4 and B5, which correspond best to hazard H4 and H8, rely on animal testing and should not be performed. Details of the approved test methods for hazards H4 and H8 can be found in Section C4.8.

C4.6 Assignment of Appropriate Hazard

After determining whether a waste is hazardous waste, the appropriate hazard should be assigned to the waste so that it can be correctly identified for Duty of Care purposes. The hazards irritant and corrosive are linked because they both refer to the potential for harm or damage to tissue. Corrosive substances exhibit irritant properties at low concentrations.

Threshold concentrations (listed in Article 2 of EWC for R34 or R35 substances) are the concentrations at which the presence of such substances in a waste would classify it as hazardous. However, at these concentrations the appropriate hazardous property would be H4 (Irritant). Table C4.1 shows the thresholds at which wastes become hazardous (H4 or H8) and the limits for assigning the appropriate hazard.

Regardless of the hazard assigned, wastes with a total concentration of substances classified R35 greater than or equal to 1%, or a total concentration of substances classified R34 greater than or equal to 5%, will be hazardous wastes.

Table C4.1: Limits for Assigning Hazards to Irritant and Corrosive

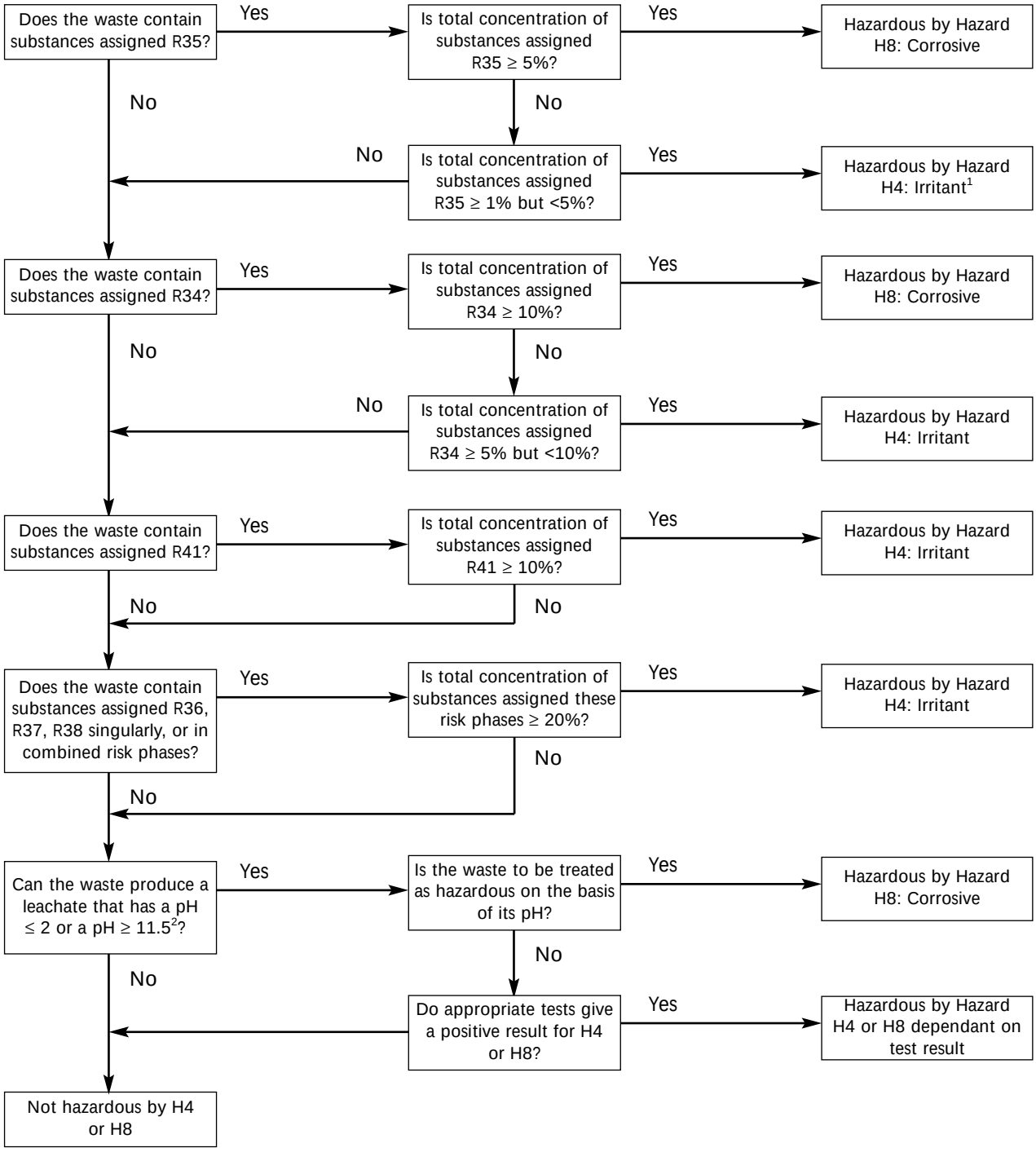
Risk Phrases	Thresholds for classification as hazardous waste	Limits for assigning hazard	
		H4: Irritant	H8: Corrosive
Total concentration of substances classified as R35	≥ **1%**	1% ≤ total conc. <5%	conc. ≥5%
Total concentration of substances classified as R34	≥ **5%**	5% ≤ total conc. <10%	conc. ≥ 10%
Total concentration of substances classified as R41	≥ **10%**	conc. ≥ 10%	n/a
Total concentration of any substances classified as R36, R37 or R38	≥ **20%**	conc. ≥ 20%	n/a

n/a not applicable

C4.7 Decision Tree

Figure C4.1 sets out the assessment process for Hazards H4 and H8.

Figure C4.1: Decision Tree for the Assessment of Hazards H4 and H8



Notes

[1] *If the waste also contains substances assigned R34 and the total concentration of those substances is ≥ 10% , the waste is hazardous by hazard H8: Corrosive.*

[2] *Including consideration of acid/alkali reserve, if appropriate.*

C4.8 Test Methods

The test methods which correspond best to the definitions of the hazards H4 and H8 are set out in Table C4.2. The test methods B4 and B5 provided by EC Directive 92/69/EEC for the hazards are not appropriate: as they rely on animal testing and therefore are not considered further.

Table C4.2: Test Methods for Hazards H4 and H8

Hazard(s)	Test Method	Reference	Acceptability
H4 and H8	B4: Acute toxicity (skin irritation)	EC Directive 92/69/EEC	1
H4 and H8	B5: Acute toxicity (eye irritation)	EC Directive 92/69/EEC	1
H8	B40: Skin Corrosion (in vitro) Rat Skin TER Assay Human Skin Model Assay	EC Directive 2000/32/EC	1 ✓
H4 and H8	pH, including the acid/alkali reserve[8]		✓
H4	Neutral Red Assay	Babich H and	✓
H4	Neutral Red Release	Borenfreund E (1990)	✓
H8	Dermal Biobarrier	In Vitro International	✓

Note:

[1] *The Agencies do not endorse destructive animal testing. Their view is that wherever there is any doubt about the corrosive/irritant nature of a waste, the precautionary principle should apply.*

The pH is a basic physico-chemical property which assists in establishing whether a waste exhibits H4 or H8 hazards. While pH can be a direct and immediate measurement from liquid waste, assessment of solid waste requires leaching and testing of the leachate. A summary of the draft CEN leaching test and references to other established leaching tests are given in Table C4.3.

Several cytotoxicity tests and biochemical methods give a reasonable correlation with *in vivo* methods for hazards H4 and H8. Other tests are at an early stage of validation and considerable work remains to be done before they can be recommended as alternatives.

[8] Young, J.R., How, M.J., Walker, A.P. and Worth, W.H.M. 1988. "Classification as corrosive or irritant to skin of preparations containing acidic or alkaline substances, without testing on animals", Toxic In Vitro 2(1): 19-26.

Table C4.3: Some Leaching Tests for Solid Materials

Source	Title	Reference
CEN	Characterisation of waste – Leaching	• BS EN 12457-1: 2002 • BS EN 12457-2: 2002 • BS EN 12457-3: 2002 • BS EN 12457-4: 2002
DIN	Standard Methods for the Examination of Water, Wastewater and Sludge. Sludges and sediments (Group 5). Determination of leachability by water.	DIN 38414 part 4 October 1984
NRA	Leaching Tests for Assessment of Contaminated Land Interim NRA Guidance	NRA R&D Note 301, 1994
NEN	Leaching characteristics of building materials and solid waste material. Leaching tests. Determination of the leaching of inorganic constituents from powder and granular building materials and waste materials	NEN 7343, 1992
AEA	Review of leaching test protocols with a view to developing an accelerated anaerobic leaching test	S.M. Wallis, P.E. Scott and S. Waring. Environment Safety Centre. AEA-EE-0392. 1992
Environment Canada	Compendium of waste leaching test	Environment Canada, 1990. Environmental Protection series. Report EPS 3/HA/7
AFNOR	Waste, Leaching of waste	AFNOR x-31-210. 1992

C4.8.1 CEN Leaching Test

The European/UK Standard is designed to be used as a compliance test to provide information on the leaching behaviour of key constituents from granular waste materials and sludges. The test procedure produces eluates, which can subsequently be characterised physically and chemically according to existing standards methods.

The procedures in the Standard are not applicable to monolithic wastes with a cross-section larger than 40 mm (e.g. solidified, encapsulated and vitrified waste). Leaching from monolithic materials is addressed in a separate standard to be developed by CEN.

Special care must be taken when testing waste materials that are not thermodynamically stable under ambient conditions (e.g. materials with reducing or oxidising properties).

Four test procedures are presented in the standard based on different liquid to solid (L/S) ratios because this parameter among others plays an important role in the leaching process. The choice of procedure depends on the degree and type of information needed for compliance.

The sample material, reduced to a particle size of less than 4 mm diameter, is brought into contact with demineralised water under defined conditions according to one of the procedures selected. The standard is based on the assumption that equilibrium or near equilibrium is achieved between the liquid and solid phases during the test period. The solid residue is separated by filtration. The properties of the eluate(s) are measured using methods developed for water analysis and adapted to meet criteria for analysis of eluates.

After the test the leaching conditions in terms of pH, conductivity and redox potential dictated by the waste are recorded: these parameters are important in the interpretation of data since they largely control the leaching behaviour of wastes.

The standard should be referred to for the full experimental procedures covering apparatus, sampling and sample preparation, test conditions and data handling.

C4.8.2 pH Measurement for Hazards H4 and H8

EC Annex V test methods for hazards H4 and H8 specify that further testing need not be carried out if the pH value of the waste is less than 2 or greater than 11.5. If the pH exceeds these limits then the waste should be regarded as hazardous by hazard H8.

When the pH indicates the waste is hazardous, but specific information to indicate whether the waste is hazardous by hazard H4 or H8 is not available, the assessors should assume the waste is corrosive and assign the waste hazard H8. pH measurements can be successfully carried out on moist solid waste and a pH test carried out on a dry solid moistened with a little water can give an indication of a pH which exceeds the above stated limits. Where pH measurements cannot be successfully carried out on solid wastes, an appropriate leaching test should be selected and a determination on the leachate carried out.

If pH is being used as the basis of the classification, the acid/alkali reserve[9] can be taken into consideration. The acid/alkali reserve provides a measure of the capability of an acid or alkali to maintain its pH, combined with pH it provides a good indication of corrosivity.

The acid/alkali reserve is determined by titration and is expressed as the grams of sodium hydroxide (equivalent) per 100 g of substance required to adjust the pH to the appropriate value. A waste should be considered as corrosive if:

- pH + 1/12 alkali reserve $\geq$ 14.5; or
- pH - 1/12 acid reserve $\leq$ -0.5.

If a waste is not classified as corrosive on this basis, it may be classified as irritant if

- pH + 1/6 alkali reserve $\geq$ 13; or
- pH - 1/6 acid reserve $\leq$ 1.

C4.8.3 Neutral Red Uptake Assay for Hazard H4

The neutral red assay detects irritant effects of complex mixtures. This is a simple and fairly rapid test with an objective endpoint. It may be used in micro-titre systems, which are valuable because they utilise very little space, increase the number of replicates and are usually easily automated. This results in a substantial saving in time and manpower.

The method of measuring inhibition of cell growth utilises the uptake of certain dyes, known as vital dyes, by living cells. The method was developed primarily by Babich and Borenfreund (1990)[10] and is based on the uptake of neutral red which is thought to enter living cells by non-ionic diffusion and then accumulates in lysosomes. The dye is excluded from dead cells.

The cells are grown in tissue culture flasks until nearly confluent, harvested and aliquots grown in 24-well micro-titre or tissue culture plates for 24 hours, after which the test solution is removed and inhibition of cell growth measured. As sensitivity is a significant factor when testing complex mixtures the exposure time may be increased to 72 hours.

[9] Young, J.R., How, M.J., Walker, A.P. and Worth, W.H.M. 1988. "Classification as corrosive or irritant to skin of preparations containing acidic or alkaline substances, without testing on animals", Toxic In Vitro 2(1): 19-26.

[10] Babich, H. and Borenfreund, E. 1990. "Applications of the Neural Red Cytotoxicity Assay to in vitro toxicology", Alternatives to Animal Experiments, No 18.

C4.8.4 EC Test Method B40 (Skin Corrosion) for Hazard H8

Introduction

Test Method B40 contains two *in vitro* tests for skin corrosivity:

- a rat skin transcutaneous electrical resistance (TER) assay; and
- a test employing a human skin model.

The Rat Skin TER Assay involves destructive animal testing and is therefore not appropriate.

The human skin model assay enables the correct distinction between degrees of corrosive effect (i.e. severe skin corrosives (R35) and other skin corrosives (R34)).

Principle of the Test Method - Human Skin Model Assay

The test material is applied topically for up to 4 hours to a three-dimensional human skin model, comprising a reconstructed epidermis with a functional stratum corneum. Corrosive materials are identified by their ability to produce a decrease in cell viability (as determined, for example, by using the MTT reduction assay) below defined threshold levels at specified exposure periods. The principle of the assay is in accordance with the hypothesis that chemicals which are corrosive are those which are able to penetrate the stratum corneum (by diffusion or erosion) and are sufficiently cytotoxic to cause cell death in the underlying cell layers.

C4.8.5 Neutral Red Release Test for Hazard H4

An alternative method for irritancy testing, also recommended for use, is a recent modification to the neutral red uptake method – the neutral red release method. This method is based on the release of dye (neutral red) from pre-loaded cells exposed to irritant compounds. The test uses a similar technique to the neutral red uptake test but has been claimed to be more reliable than uptake techniques. Tests in the USA looked at 12 *in vitro* methods: the cytological test "neutral red release" gave the best correlation to standard Draize irritancy tests on rabbits.

C4.8.6 Dermal Biobarrier Test for Hazard H8

A test to determine corrosivity has been developed consisting of two compartments:

- a dermal biobarrier of target macromolecules;
- a chemical detection system (CDS).

The test kit is available ready formulated from In Vitro International.

The biobarrier is prepared by coating a support with a mixture of diluent and solubilised proteins. The macromolecules are gelled onto a cellulose support within a circular disc deliverable system. The biobarrier is then sealed and stored at 4°C. The CDS consists of multiple chemical detectors.

Test substances either solid or liquid are applied directly to the dermal biobarrier. When the chemical destroys the biobarrier it is detected by the CDS which produces a simple colour change. The colour change is detected by eye and the amount of time for the colour change to occur is related to the corrosivity of the substances. If no colour change occurs then the substance is non-corrosive.

This test has produced reliable results in validation exercises with *in vitro* effects and also reproducibility tests. It should also be remembered that pH testing is also appropriate for the identification of this hazard.

Appendix C:

C5 Assessment of Hazards H5/H6: Harmful and Toxic

C5.1 Definition

"Harmful" (H5) and "Toxic" (H6) hazards are linked.

Annex III of the rWFD defines H5 "Harmful" as:

> "*substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks*".

Annex III of the rWFD defines H6 "Toxic" as:

> "*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*".

C5.2 Risk Phrases

The risk phrases associated with the hazards harmful and toxic are:

R20 *Harmful by inhalation*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LC_{50} inhalation, rat for aerosols or particulates: $1 < LC_{50} \leq 5$ mg/litre/4 hours; or
- LC_{50} inhalation, rat for gases or vapours: $2 < LC_{50} \leq 20$ mg/litre/4 hours.

R21 *Harmful in contact with skin*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LD_{50} dermal, rat or rabbit: $400 < LD_{50} \leq 2{,}000$ mg/kg.

R22 *Harmful if swallowed*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LD_{50} oral, rat: $200 < LD_{50} \leq 2{,}000$ mg/kg; or
- discriminating dose, oral, rat, 50 mg/kg: 100% survival but evident toxicity, or
- less than 100% survival at 500 mg/kg oral, rat by the fixed dose procedure; or
- high mortality in the dose range > 200 to ≤ 2,000 mg/kg oral, rat, by the acute toxic class method.

R23 *Toxic by inhalation*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LC_{50} inhalation, rat for aerosols or particulates: $0.25 < LC_{50} \leq 1$ mg/litre/4 hours; or
- LC_{50} inhalation, rat for gases or vapours: $0.5 < LC_{50} \leq 2$ mg/litre/4 hours.

R24 *Toxic in contact with skin*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LD_{50} dermal, rat or rabbit: $50 < LD_{50} \leq 400$ mg/kg.

R25 *Toxic if swallowed*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LD_{50} oral, rat: $25 < LD_{50} \leq 200$ mg/kg, or
- discriminating dose, oral, rat, 5 mg/kg: 100% survival but evident toxicity; or
- high mortality in the dose range > 25 to ≤ 200 mg/kg oral, rat, by the acute toxic class method.

R26 *Very toxic by inhalation*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LC_{50} inhalation, rat for aerosols or particulates: ≤ 0.25 mg/litre/4 hours, or
- LC_{50} inhalation, rat for gases or vapours: ≤ 0.5 mg/litre/4 hours.

R27 *Very toxic in contact with skin*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LD_{50} dermal, rat or rabbit: ≤ 50 mg/kg.

R28 *Very toxic if swallowed*

This risk phrase is assigned to substances and preparations if the results of acute toxicity tests are:

- LD_{50} oral, rat: ≤ 25 mg/kg; or
- less than 100% survival at 5 mg/kg oral, rat by the fixed dose procedure; or
- high mortality in the dose range ≤ 25 mg/kg oral, rat, by the acute toxic class method.

R39 *Danger of very serious irreversible effects*

This risk phrase is assigned if there is strong evidence that irreversible damage is likely to be caused by a single exposure by an appropriate route. In order to indicate the route, R39 is combined with R23 to R28 or the combined risk phrases detailed below (Section C5.3) related to toxic and very toxic. The doses related to the single exposure are those related to the risk phrases R23 to R28 detailed above.

R48 *Danger of serious damage to health by prolonged exposure*

This risk phrase is assigned if serious damage is likely to be caused by repeated or prolonged exposure by an appropriate route. It is only associated with toxic and harmful and is combined with R20 to R25 or the combined risk phrases, related to R20 to R25, detailed below related to toxic and harmful, to indicate the route. However, the doses are as follows:

"*Toxic with R48*"

- oral, rat: ≤ 5 mg/kg (bodyweight)/day
- dermal, rat or rabbit: ≤ 10 mg/kg (bodyweight)/day
- inhalation, rat: ≤ 0.025 mg/litre, 6 hrs/day

"*Harmful with R48*"

- oral, rat: ≤ 50 mg/kg (bodyweight)/day
- dermal, rat or rabbit: ≤ 100 mg/kg (bodyweight)/day
- inhalation, rat: ≤ 0.25 mg/litre, 6 hrs/day.

R65 *Harmful, may cause lung damage if swallowed*

This risk phrase is assigned to liquid substances and preparations presenting an aspiration hazard in humans because of their low viscosity.

R68 *Possible risk of irreversible effects*

This risk phrase is assigned if there is strong evidence that irreversible damage is likely to be caused by a single exposure by an appropriate route. In order to indicate the route, R68 is combined with R20 to R22 or the combined risk phrases detailed below related to harmful. The dose related to the single exposure are those related to the risk phrases R20 to R22.

C5.3 Combined Risk Phrases

The above risk phrases can be combined when a substance is harmful, toxic or very toxic by more than one route. This results in the following combined risk phrases:

R20/21 *Harmful by inhalation and in contact with skin*

R20/21/22 *Harmful by inhalation, in contact with skin and if swallowed*

R20/22 *Harmful by inhalation and if swallowed*

R21/22 *Harmful in contact with skin and if swallowed*

R23/24 *Toxic by inhalation and in contact with skin*

R23/24/25 *Toxic by inhalation, in contact with skin and if swallowed*

R23/25 *Toxic by inhalation and if swallowed*

R24/25 *Toxic in contact with skin and if swallowed*

R26/27 *Very toxic by inhalation and in contact with skin*

R26/27/28 *Very toxic by inhalation, in contact with skin and if swallowed*

R26/28 *Very toxic by inhalation and if swallowed*

R27/28 *Very toxic in contact with skin and if swallowed*

In addition, these risk phrases can be combined with R39, R48 and R68 (when used with a substance classified as Xn Harmful) in order to identify the appropriate routes and risks of exposure.

The purpose of these combined risk phrases is to reduce the quantity of information required on the labels needed for the CHIP Regulations. They mean that a substance possesses each of the individual risk phrases.

C5.4 Limiting Concentrations

"Harmful" and "Toxic" have specified concentration limits set out in the EWC, above which a waste would be hazardous:

- one or more substances classified as very toxic at a total concentration ≥ 0.1%;
- one or more substances classified as toxic at a total concentration ≥ 3%; or
- one or more substances classified as harmful at a total concentration ≥ 25%.

C5.5 Procedure for Assessment of Hazards H5 and H6

First, determine whether the waste contains any substances classified with the risk phrases R20 to R28, R39, R48, R65, Xn R68 or the combined risk phrases. If it does and the concentrations within the waste equal or exceed the relevant thresholds the waste will be hazardous.

It must be remembered that:

- the concentrations of very toxic substances can only be added to the concentrations of other very toxic substances;

- the concentrations of toxic substances can only be added to the concentrations of other toxic substances;
- the concentrations of harmful substances can only be added to the concentrations of other harmful substances.

This means that the concentrations of very toxic substances cannot be added to the concentrations of toxic or harmful substances. Toxic substances cannot be added to the concentrations of very toxic or harmful substances. Harmful substances cannot be added to very toxic or toxic substances.

For R65, the classification is harmful and therefore the concentrations of R65 substances can be added to the concentrations of other harmful substances.

R68 substances can only be considered for H5 if the substance is classified as harmful. If a substance is classified as Mutagenic Category 3; R68 it should be assessed under Hazard H11 "mutagenic" (see Appendix C11). Substances classified as Mutagenic Category 3; R68 have a much lower threshold limit than substances classified Harmful; R68 (1% compared to 25%).

C5.6 Assignment of Appropriate Hazard

After determining whether a waste is hazardous waste, the appropriate hazard should be assigned to the waste so that it can be correctly identified on the consignment note. As stated in Section C5.1, there is a link between the hazards harmful, toxic and very toxic, with toxic or very toxic substances exhibiting harmful properties at low concentration.

The threshold values given in Article 2 of EWC, for toxic and very toxic substances, are the concentrations at which the presence of such substances in a waste would classify it as hazardous. However, at these concentrations the appropriate hazard for a waste would be H5 (Harmful). Only at higher concentrations will the substances classified as toxic or very toxic be assigned the hazard H6 (Toxic). Table C5.2 shows the thresholds at which wastes become hazardous (by H5 or H6) and limits for assigning the appropriate hazard. This follows from the CHIP3 Regulations.

Regardless of the hazard assigned, wastes will be hazardous if:

- the total concentration of substances classified as very toxic is equal to or greater than 0.1%; or
- the total concentration of substances classified as toxic is equal to or greater than 3%; or
- the total concentration of substances classified as harmful is equal to or greater than 25%.

Table C5.1: Limits for Assigning Hazards to Harmful and Toxic

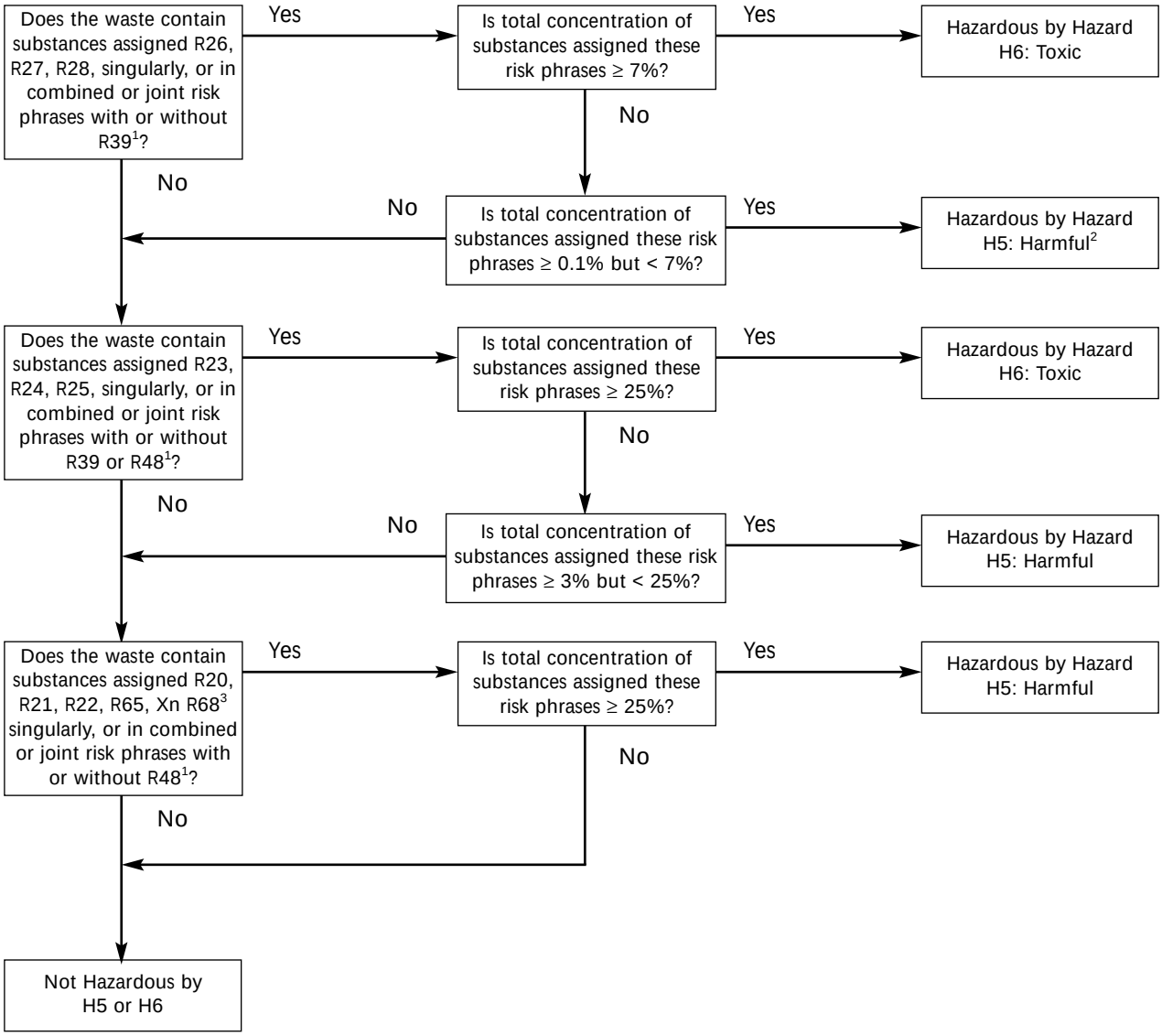
Classification	Risk Phrases	Thresholds for classification as hazardous waste	Limits for assigning hazard	
			H5: Harmful	H6: Toxic
Very Toxic	R26, R27, R28, and combined risk phrases with or without R39	≥ 0.1%	0.1% ≤ total conc.<7%	≥ 7%
Toxic	R23, R24, R25, and combined risk phrases with or without R39 or R48	≥ 3%	3% ≤ total conc. <25%	≥ 25%
Harmful	R20, R21, R22, R65, Xn R68 and combined risk phrases with or without R48	≥ 25%	≥ 25%	n/a

n/a not applicable

C5.7 Decision Tree

Figure C5.1 sets out the assessment process for the Hazards H5 and H6.

Figure C5.1: Decision Tree for the Assessment of Hazards H5 and H6



Notes

[1] *There are no substances with the classification R39 or R48 alone. In order to indicate the route these are combined with R20 to R28 or the combined risk phrases.*

[2] *If the waste also contains substances classified as toxic and the total concentration of those substances is ≥ 25%, the waste is hazardous by Hazard H6: Toxic.*

[3] *R68 can only be considered for H5 if the substance is classified Xn harmful. If a substance is classified as Mutagenic Category 3, it must be assessed under H11. In order to indicate the route R68 can be combined with R20 to R22 or the combined risk phrases relating to harmful.*

C5.8 Test Methods

The test methods which correspond best to the definitions of the hazards H4 and H8 are set out in Table C5.2.

Table C5.2: Test methods for hazards H5 and H6

Hazard	Test Method	Source	Acceptability
H5 and H6	B1	EC Directive 92/69/EEC	[1]
H5 and H6	B1.bis	EC Directive 92/69/EEC	[1]
H5 and H6	B1.trs	EC Directive 96/54/EC	[1]
H5 and H6	B2	EC Directive 92/69/EEC	[1]
H5 and H6	B3	EC Directive 92/69/EEC	[1]
H6	B7	EC Directive 92/69/EEC	[1]
H6	B8	EC Directive 92/69/EEC	[1]
H6	B9	EC Directive 92/69/EEC	[1]
H5 and H6	B26	EC Directive 2000/59/EC	[1]
H5 and H6	B27	EC Directive 2000/59/EC	[1]
H5, H6 and H14	Bacterial bio-luminescence assay	Liu, D. and Dutke, B.J. 1984	✓[2]
H5, H6 and H14	Enhanced chemi-luminescence assay	Hayes, E. and Smith, M. 1996	✓[2]

Notes:

[1] *The Agencies do not endorse destructive animal testing. Wherever there is any doubt about the toxicity of a waste, the precautionary principle should apply.*

[2] *While these are predominantly applicable to H14, they will also serve as indicators for H5 and H6.*

None of the EC Annex V tests is approved by the Agencies for use, because of their reliance on animal testing.

There are many alternative toxicity tests available but it is important to select those that are suitable for assessing the toxicity of complex substances. Two commercially available screening tests can be used to identify hazards H5 and H6 (and is also applicable to H14, see Appendix C14) in a wide range of substances. These are:

- the bacterial bioluminescence assay test;
- the enhanced chemiluminescence assay test.

These tests are well established, but do not differentiate between toxicity (to man) and ecotoxicity. There are no appropriate rapid screening tests available that are solely hazard H5 and/or H6 specific.

C5.9 Screening Tests for Hazards H5 and H6

C5.9.1 Bacterial Bioluminescence Assay Test

These assays using *Vibrio fischeri* (formerly known as *Phytobacterium phosphoreum*) have been validated specifically for assessing toxicity of hazardous wastes and show good correlation with higher organisms (Bulich, A.A. in Liu and Dutke 1984).[11] The use of freeze dried or lyophilised bacteria allows tests to be conducted without extensive preparation or pre-planning. The test is available as a standardised commercial package from the Microbics Corporation.

The test is simple and rapid, and provides an indication of toxicity after a 5–30 minute exposure period. The test measures light output from the bioluminescent bacterium which is inhibited in the presence of pollutants. This is in contrast to other acute toxicity tests of comparable sensitivity, which typically requires exposure periods of between 24 and 96 hours. The constant test capability can therefore be achieved with minimum laboratory space.

The *Vibrio fischeri* bioluminescence test is generally less sensitive to aquatic contaminants than higher organism tests. Low level toxicity, which may render a waste hazardous, may not always be detected by bacterial bioluminescence.

The test is sensitive to the toxicity of sewage effluents, petroleum effluents and industrial effluents but not those containing high levels of urea, cyanide or ammonia. Bioluminescence in *Vibrio fischeri* is not as sensitive as other acute tests to insecticides, herbicides, textile effluents, highly lipophilic contaminants or to wastes with a high inorganic content.

Procedures for using *Vibrio fischeri* bioluminescence assays are detailed in the manuals published by the Microbics Corporation. The Environment Agency's SCA (Standing Committee of Analysts) "Blue Book" contains a method for acute toxicity to bioluminescent bacteria. The test is also recognised by ASTM, DIN and other bodies.

C5.9.2 Enhanced Chemiluminescent Assay Test

These assays involve a free radical reaction based upon the oxidation of luminol in the presence of the enzyme horseradish peroxidase. Horseradish peroxidase is used as the conjugate because of its stability and commercial availability. The reaction emits light at a relatively constant rate. If free radical scavengers such as anti-oxidants are added to the reaction, light emission is stopped or delayed. Any substance capable of inhibiting the enzyme will also cause a reduction, or complete inhibition of light output.

The technique is commercially available and full guidance[12] on the methodology is provided in the form of user manuals with the required hardware and reagents from the manufacturers.

[11] Liu, D. and Dutke, B.J. 1984. Toxicity Screening Procedures Using Bacterial Systems. Marcel Dekker Inc.

[12] Hayes, E. and Smith, M. 1996 " Eclox: A Rapid Screening Toxicity Test." Toxic Impacts of Waste on the Aquatic Environment, Tapp, J.F. et al. (Eds) Royal Society of Chemistry, pp. 94-103.

Appendix C:

C6 Assessment of Hazard H6: Toxic

Assessment of Hazard H6, Toxic, is carried out alongside the assessment of Hazard H5, Harmful, in Appendix C5.

Appendix C:

C7 Assessment of Hazard H7: Carcinogenic

C7.1 Definition

Annex III of the rWFD defines H7 "Carcinogenic" as:

> "*substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence*".

C7.2 Risk Phrases

For the purposes of classification and labelling, carcinogens are divided into three categories:

Category 1:

> *Substances known to be carcinogenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer.*

Category 2:

> *Substances which should be regarded as if they are carcinogenic to man. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer, generally on the basis of:*

(a) appropriate long-term animal studies

(b) other relevant information.

Category 3:

> *Substances which cause concern for man owing to possible carcinogenic effects but in respect of which the available information is not adequate for making a satisfactory assessment. There is some evidence from appropriate animal studies, but this is insufficient to place the substance in Category 2*.

The following risk phrases apply:

Categories 1 and 2:

R45 *May cause cancer*

R49 *May cause cancer by inhalation*

Category 3:

R40 *Limited evidence of a carcinogenic effect*

C7.3 Limiting Concentration

"Carcinogenic" has specified concentration limits set out in the EWC, above which a waste would be hazardous:

- one substance known to be carcinogenic of category 1 or 2 at a concentration ≥ 0.1%; and
- one substance known to be carcinogenic of category 3 at a concentration ≥ 1%.

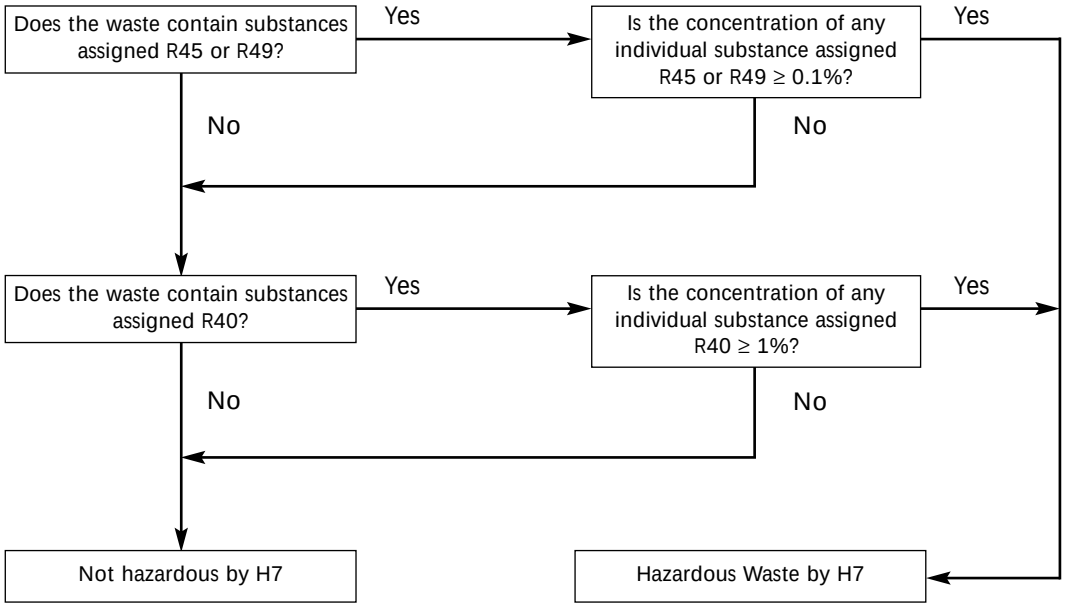
Wastes containing category 1 or 2 carcinogens (i.e. substances with risk phrases R45 or R49) will be hazardous if the concentration of any one of those substances is ≥ 0.1% w/w in the waste. It should be noted that this is a change from the classification under the Special Waste Regulations 1996, under which the concentrations of category 1 and 2 carcinogens were additive. The new criterion means that an individual category 1 or 2 carcinogen must be present at a concentration ≥ 0.1%.

Wastes containing category 3 carcinogens (i.e. substances with risk phrases R40) will be hazardous if the concentration of any one of those carcinogens is ≥ 1% w/w in the waste. This is a change from classification under the Special Waste Regulations 1996, as category 3 carcinogens were not included in the assessment criteria.

C7.4 Decision Tree

Figure C7.1 sets out the assessment process for the Hazard H7.

Figure C7.1: Decision Tree for the Assessment of Hazard H7



C7.5 Test Methods

None of the EC test methods published corresponds to the definition of the hazard carcinogenic.

Simple *in vitro* tests are unable to identify those compounds which are carcinogenic. Even utilising *in vivo* tests for carcinogenicity would be unsuitable for the classification of wastes as the testing requires several months to complete. The genotoxicity tests are the only *in vitro* techniques that are enshrined in regulatory toxicology. Detailed guidance is provided on test protocols and interpretation by the UK Environmental Mutagen Society (UKEMS).

Tests are available to give some indication of carcinogenic potential, by studying the mutagenic effects of compounds. However, these tests will not give a definitive result for hazard H7. The recommended non-mammalian tests for H11, mutagenicity, are found in Section C11, and some of these tests (e.g. Test Method B10) can be used to screen for possible mammalian carcinogens.

C7.6 Application of H7 to Waste Oils and Wastes Containing Oil

C7.6.1: Absolute Entries

Waste Oils are included in the EWC in Chapter 13 - Oil Wastes and Wastes of Liquid Fuels (except edible oils; and those in chapter 05, 12 and 19). They are all marked as hazardous without a general or specific reference to dangerous substances. There are further entries for waste oils in Chapters 05, 08, 12, 19 and 20.

All waste oils, with the exception of edible oil, are considered hazardous wastes regardless of their composition, biodegradability, synthetic nature, or otherwise.

There is no threshold to apply to these wastes.

The entries for edible oil are non-hazardous.

C7.6.2: Mirror Entries - Classification of wastes containing oil

Specific reference:

The EWC contains a number of references to wastes specifically containing oil; or where oil may be a contaminant, e.g.

16 07 wastes from transport tank, storage tank and barrel cleaning (except 05 and 13)

16 07 08* wastes containing oil

16 07 99 wastes not otherwise specified

The determination of whether the waste is hazardous or not , and of the appropriate EWC code, is made on the basis of the oil contamination alone. If the oil is present below the threshold concentration, the waste is not hazardous.

General reference:

There are a number of references in the EWC to dangerous substances in general.

17 05 soil (including excavated soil from contaminated sites), stones and dredging spoil

17 05 03* soil and stones containing dangerous substances

17 05 04 soil and stones other than those mentioned in 17 05 03

The determination of whether the waste is hazardous or not , and of the appropriate EWC code, is made on the basis of assessment of all dangerous substances present. If oil is present in the waste below the threshold concentration, the oil alone will not render the waste hazardous.

Appendix C:

C8 Assessment of Hazard H8: Corrosive

Assessment of Hazard H8, Corrosive, is carried out alongside the assessment of Hazard H4, Irritant, in Appendix C4.

Appendix C:
C9 Assessment of Hazard H9: Infectious

C9.1 Definition

Annex III of the rWFD defines H9 "Infectious" as :

"substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms".

C9.2 Background

The definition of H9 includes the terms:

- "*micro-organisms"* - a microbiological entity, cellular or non-cellular, capable of replication or of transferring genetic material (includes algae, bacteria, fungi, parasites, plasmids, prions, viruses, rickettsia, and genetically modified variants thereof)
- "viable" - Micro-organisms that have been killed are not considered infectious. Viability relates solely to the state of the organism at the point and time of the production of the waste.
- "*or their toxins"* - Toxins produced by micro-organisms render the waste 'infectious' even if the producing organism is no longer present.
- "*cause disease "* - This includes any disease regardless of severity.
- "*man or other living organisms"* - This includes Animals, but not plants. The European Waste Catalogue provides sub-chapters for human and animal healthcare only.

Note that the CHIP Regulations apply to chemical hazards and as such do not include any risk phrases related to the hazardous property 'Infectious'.

C9.3 Principle for Assessing Hazard H9

It should be recognised that many waste streams may contain pathogens. However a waste would not be hazardous by H9 where:-

For Non-healthcare wastes –

- where there is a low probability that infectious substances are present, **or**
- the concentration is at a level naturally encountered in a healthy individual or environment,

For healthcare wastes –

- where the waste is not clinical waste **and**
- where there is no requirement to treat the waste to render it microbiologically safe, **and**
- where the infectious fraction has been removed by specific segregation at source.

The following procedures are used to assess H9 .

C9.4 Assessment Procedure

Due to the unique nature of H9, the assessment procedure has been divided into three sections:

- waste arising from human or animal healthcare (i.e. those under EWC Chapter 18); and
- potentially infectious wastes from other sources (Chapters 1-17 19 and 20).
- microbial toxins

C9.4.1 Chapter 18: Wastes From Human or Animal Healthcare

The key entries under Chapter 18 are:

18 01	**wastes from natal care, diagnosis, treatment or prevention of disease in humans**
18 01 03*	wastes whose collection and disposal is subject to special requirements in order to prevent infection
18 02	**wastes from research, diagnosis, treatment or prevention of disease involving animals**
18 02 02*	wastes whose collection and disposal is subject to special requirements in order to prevent infection

Both of these entries (18 01 03 and 18 02 02) are absolute entries, without threshold concentrations, that refer to "*special requirements."*

Figure C9.1 provides the assessment method to determine whether a waste is covered by "*special requirements* " and Table C9.1 provides examples of the application of the assessment methodology.

"Special requirements" (and H9) apply to healthcare wastes where any of the following apply.

(i) the source person, or animal is known or suspected to have a disease/infection caused by a micro-organism or its toxin **and** the waste is likely to contain the viable infectious agent or toxin.

(ii) the waste is, or is contaminated with, a culture or an enrichment of a micro-organism or its toxin that may cause disease in man or other living animals.

(iii) The healthcare waste "*may cause infection to any person* (or other living organism) *coming into contact with it"*. (note this step refers to the definition of a clinical waste)

This should be determined by clinical assessment of each item and source patient, as follows:-

- Clinical assessment should be carried out by a healthcare professional who is familiar with type of waste generated, the current medical condition and, where feasible, the past medical history of the patient.
- It is unlikely that it will always be practical or possible to identify specific pathogens or toxins within the waste when a patient first presents symptoms as definitive laboratory identification requires time to undertake. The procedure for determining whether a waste is considered hazardous by H9 must therefore, where this is the case, assume that the disease causing agent has not been confirmed and should be based on clinical assessment of whether an unidentified infection of any type is suspected or known. Laboratory identification is not required to assess the waste for H9.
- All pathogens and microbial toxins should be included in the assessment. H9 does not consider the severity of the disease.
- Note that any underlying or secondary infections, previously diagnosed by a healthcare worker, may also generate waste that is subject to assessment for special requirements.

The following indicates how the general principles (C9.3) are applied to healthcare waste. "*Special requirements* " do not apply where

- Clinical assessment of the specific waste item, and where applicable the source patient, indicates that the waste does not meet the criteria for " *special requirements"* **and**
- the waste is segregated from waste that is subject to "*special requirements."*

Assessment is item and patient specific. General premises or waste stream based assessment is not included in the assessment methodology for "*special requirements* ".

Note: Waste Segregation

The "infectious" fraction of healthcare waste should be identified and segregated on the basis of "special requirements."

Healthcare waste streams that contain the " infectious" fraction in any quantity are hazardous waste.

Where the healthcare waste has not been clinically assessed for H9 on an item and /or patient specific basis, then the infectious fraction has not been identified and segregated, and the waste should be regarded as subject to special requirements.

C9.4.2 Potentially Infectious Wastes that do not arise from Human or Animal Healthcare and/ or Related Research .

Where there is a low probability that infectious substances are present, or where the concentration is at a level naturally encountered, the waste should not be classified as hazardous by H9.

The term "a level naturally encountered" is difficult to define, but can be taken to accept the presence of pathogens in wastes arising from a generally healthy population or environment. For example this may include the majority of foodstuffs, soil, construction and demolition waste, wastes treated to eliminate pathogens and domestic refuse.

Risk assessment, analysis or knowledge should be used to determine :

- if the waste is likely to contain a microbial toxin above a level naturally encountered. (Where the presence of elevated levels of toxin is indicated the waste should be assessed as indicated in C9.4.3).
- if the waste is likely to contain a human/animal pathogen above naturally encountered levels.
- if the waste a culture or enrichment of a micro-organism reliably believed to cause disease in man or other living animal.

C9.4.3 : Microbial Toxins

Toxins from micro-organisms are assessed in the same manner as chemical toxins.

Microbial toxins are assessed using the procedure provided in Figure C9.2 with reference to Appendix C5 "Assessment of Hazards H5/H6: Harmful and Toxic" .

These substances are unlikely to be described with chemical risk phrases. The assessment will therefore require the use of appropriate data sources (see Appendix D) .

Only those microbial toxins which are "very toxic" , "toxic" or "harmful" are potentially hazardous by H9. Threshold concentrations are provided in Appendix C5.

Where these toxins are present at or above the threshold concentration the appropriate hazards are H9, **and** either H5 or H6.

Examples of microbes that produce toxins include:

- *Clostridium botulinum* and *C. perfringens,*
- Toxigenic *Vibrio sp* . and verocytotoxin or enterotoxin producing E.coli
- *Cyanobacteria* - blue green algae ,
- *Dinophyceae* - (Paralytic/Diarrhetic Shellfish Poisoning, Fish Kills)

C9.5 Decision Tree

Figures C9.1 and C9.2 set out the assessment process for the Hazard H9

Figure C9.1: Healthcare Wastes in Chapter 18

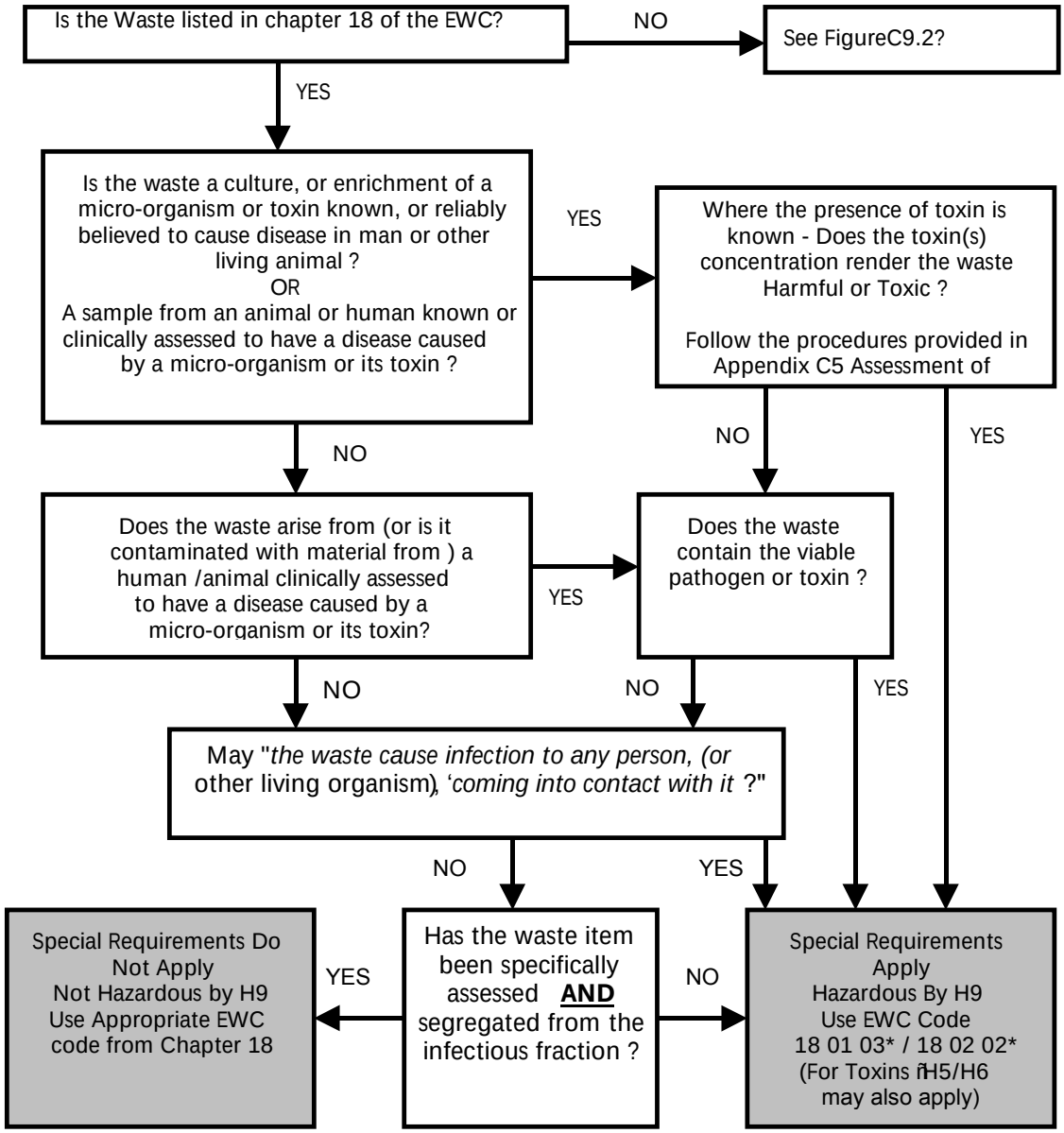
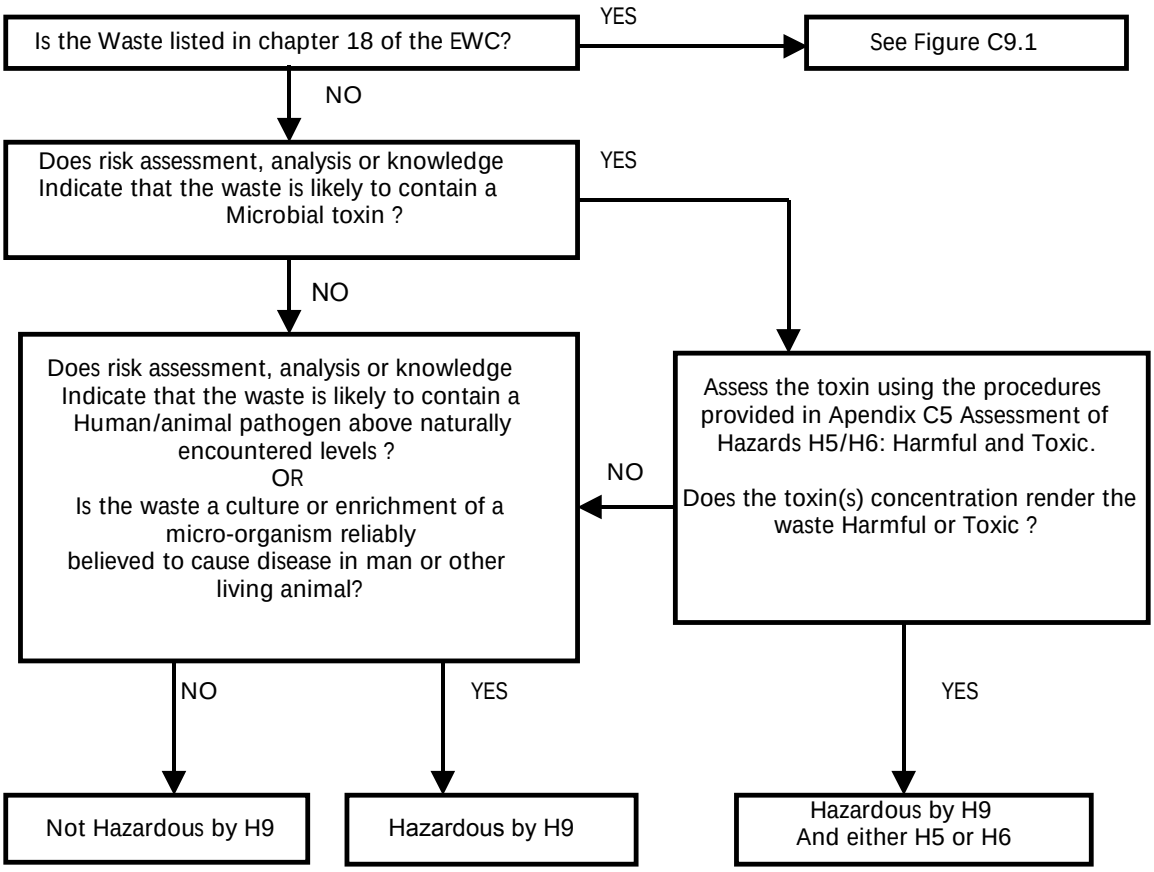


Figure C9.2: **Potentially infectious wastes from other sources (Chapters 17, 19 and 20)**



C9.6 Test Methods

The potential hazards posed by different types of wastes are not fully documented and tests to quantitatively define all hazards associated with wastes do not exist.

Micro-organisms may not be distributed homogenously throughout a waste stream. Sampling must therefore be representative of, and appropriate to, the waste stream. Additionally, any analysis should only be carried out at a suitably accredited laboratory, using relevant and appropriate analytical methods.

Table C9.1: **Examples From Chapter 18 of the EWC ñHealthcare Wastes (see Figure C9.1 for assessment procedure)**
(Note: This is not an inclusive list)

Source	Special Requirements Apply (Hazardous by H9)	Special Requirements DO NOT apply
General Principles	**Clinical (or animal healthcare) Waste which has not been subject to specific assessment and segregation protocols to remove waste subject to special requirements.** The specifically segregated "special requirements" fraction.	• Non-clinical Healthcare waste where the "special requirements" fraction has been removed following item and/or patient specific assessment and segregation .
Healthcare premises, (Hospital, Veterinary practice, dentist, veterinary practice, Nursing home)	Clinical (or animal healthcare) waste arising from a patient clinically assessed or known to have a disease caused by a micro-organism or its toxin. **Where the causal pathogen or toxin is present in the waste**. For exampleÖ • Waste from infectious disease cases. • Waste from wound infections and other hospital acquired infections. • hygiene products from patients in with UTI infections. • Waste from patients with diarrhoea and vomiting caused by infectious agents or toxins. For example Norwalk and *Clostridium difficile* . • Blood contaminated dressings from a patient with HIV, Hepatitis B, rubella, measles, mumps, influenza or other infection that may be present in the blood. • Respiratory materials from patients with Pulmonary Tuberculosis, Influenza, RSV or other respiratory infections. • Contaminated waste from provision of general healthcare care to patients with known or suspected underlying or secondary microbial diseases. **Healthcare waste that may cause infection to any person (or other living organism) coming into contact with it.**	• Non-clinical Healthcare waste where the "special requirements" fraction has been removed following item and/or patient specific assessment and segregation .

Table C9.1: **Examples From Chapter 18 of the EWC of Healthcare Wastes (see Figure C9.1 for assessment procedure)**
(Note: This is not an inclusive list)

Source	Special Requirements Apply (Hazardous by H9)	Special Requirements DO NOT apply
Community	Clinical (or animal healthcare) waste arising from a patient with a disease caused by a micro-organism or is toxin . • A contaminated dressing from a leg ulcer with a bacterial infection arising from provision of healthcare in the home • Contaminated clinical waste hygiene products from patients in Residential homes with UTI infections. **Healthcare waste that may cause infection to any person (or other living organism) coming into contact with it.**	• Non-clinical Healthcare waste where the "special requirements" fraction has been removed following item and /or patient specific assessment and segregation . • See also Municipal Waste examples .
	Human/animal hygiene waste that a healthcare worker has identified as healthcare waste is subject to assessment. • Dog faeces from a boarding kennels with an outbreak of gastrointestinal disease diagnosed by a veterinarian • A childcare nursery with an outbreak of gastrointestinal disease diagnosed by a healthcare worker.	Non-clinical Human/animal hygiene waste that is classified under chapter 20 of the EWC is not subject to assessment for H9 . • Dog faeces from community collection bins • Feminine hygiene waste from public toilets This waste would only be subject to assessment if a considered to be healthcare waste (classified under chapter 18 of the EWC)
Laboratory waste (including microbiological waste from colleges, environmental and food analysis)	Cultures of human and animal pathogens, or solutions of their toxins (above threshold concentration) Clinical samples from source individuals known or clinically assessed to have a microbial disease, which contain the causal pathogen or toxin Healthcare waste that may cause infection to any person (or other living organism) coming into contact with it	Clinical samples from source individuals not known or clinically assessed to have a microbial disease, **and** that do not fall within the 'may cause infection to any person (or other living organism) coming into contact with it' definition
Medicines		Medicines are hazardous only where they are considered to be Cytotoxic and Cytostatic

Table C9.2: **Examples From Chapters 1 to 17, 19 and 20 of the EWC of Non-Healthcare Wastes (see Figure C9.2 for assessment procedure)**
(Note: This is not an inclusive list)

Source	Infectious - Hazardous by H9	Not Hazardous by H9
Construction and demolitions wastes	Canal dredgings, or surface skimmings, from a site where a cyanobacterial bloom has occurred AND where risk assessment or analysis indicates a toxin above the appropriate threshold concentration. Sludges from an industrial effluent plant where industrial or commercial activity has increased the numbers or ranges of pathogens normally present.	Canal dredgings where risk assessment identified no evidence that a cyanobacterial bloom has occurred. Sludges from waste water treatment for a generally healthy population.
Municipal Waste		Mixed municipal waste (black bag), 20 03 01, is non-hazardous. Clinical waste classified in chapter 20 of the EWC2002 (that does not arise from Human or Animal Healthcare and/or related research.) and is therefore not subject to assessment • Sharps litter from substance abuse (20 01 99) • Sharps waste from cosmetic body piercing and application of tattoos. (20 01 99) This waste is still subject to a requirement to be rendered safe . (This does not include community healthcare waste, for example diabetic sharps, which should be classified under chapter 18 and are subject to assessment .)

Appendix C:

C10 Assessment of Hazard H10: Toxic for Reproduction

C10.1 Definition

In the rWFD the term for H10 is "teratogenic". In Directive 92/32/EEC amending for the seventh time Dangerous Substance Directive 67/548/EEC the term "toxic for reproduction" was introduced and replaced the term "teratogenic". The two definitions are set out below and highlights slight differences between the definitions, with "teratogenic" making no references to effects on fertility.

Annex III of the rWFD defines H10 "Teratogenic" as:

> "*substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce non-hereditary congenital malformations or increase their incidence*".

Dangerous Substance Directive defines "Toxic to reproduction" as:

> "*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*".

However, the EWC, states that the term "toxic for reproduction" is considered to be in line with hazard H10 in Annex III to rWFD. Therefore the assessment of Hazard H10 is based on the definition of "toxic for reproduction" and the associated risk phrases, with the term "teratogenic" replaced by the term "toxic for reproduction".

C10.2 Risk Phrases

For the purposes of classification and labelling, substances which are "toxic to reproduction" are divided into three categories:

Category 1:

(a) Substances known to impair fertility in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility.

(b) Substances known to cause developmental toxicity in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and subsequent development toxic effects in the progeny.

Category 2:

(a) Substances which should be regarded as if they impair fertility in humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in impaired fertility on the basis of:

(i) clear evidence in animal studies of impaired fertility in the absence of toxic effects, or evidence of impaired fertility occurring at around the same dose levels as other toxic effects but which is not a secondary non-specific consequence of the other toxic effects;

(ii) other relevant information.

(b) Substances which should be regarded as if they cause developmental toxicity to humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in developmental toxicity, generally on the basis of:

(i) clear results in appropriate animal studies where effects have been observed in the absence of signs of marked material toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of the other toxic effects;

(ii) other relevant information.

Category 3:

(a) Substances which cause concern for human fertility, generally on the basis of:

(i) results in appropriate animal studies which provide sufficient evidence to cause a strong suspicion of impaired fertility in the absence of toxic effects, or evidence of impaired fertility occurring at around the same dose levels as other toxic effects, but which is not a secondary non-specific consequence of the other toxic effects, but where the evidence is insufficient to place the substance in Category 2;

(ii) other relevant information.

(b) Substances which cause concern for humans owing to possible developmental toxic effects, generally on the basis of:

(i) results in appropriate animal studies which provide sufficient evidence to cause a strong suspicion of developmental toxicity in the absence of signs of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of the other toxic effects, but where the evidence is insufficient to place the substance in Category 2;

(ii) other relevant information.

The risk phrases applicable to substances toxic for reproduction Category 1 and 2 are:

R60 *May impair fertility*

R61 *May cause harm to the unborn child*

Those which apply to substances toxic for reproduction Category 3 are:

R62 *Possible risk of impaired fertility*

R63 *Possible risk of harm to the unborn child*

C10.3 Limiting Concentrations

"Toxic for reproduction" has specified concentration limits, set out in Article 2 of EWC, above which a waste would be hazardous:

- one substance toxic for reproduction of category 1 or 2 classified as R60, R61 at a concentration ≥ 0.5%; and
- one substance toxic for reproduction of category 3 classified as R62, R63 at a concentration ≥ 5%.

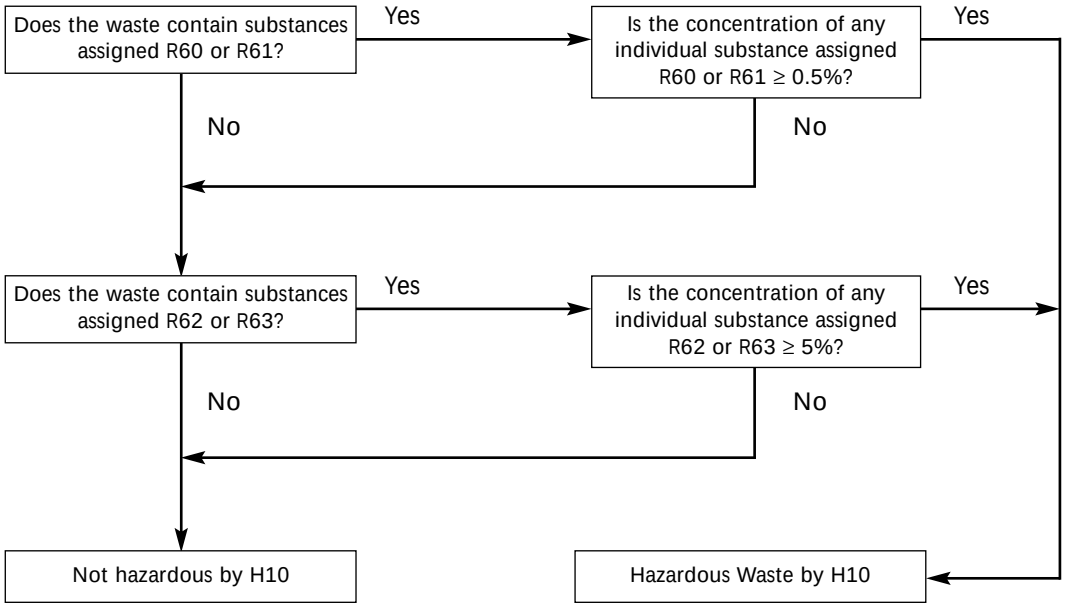
Wastes containing substances classified as toxic for reproduction Category 1 or 2 (i.e. substances with risk phrases R60 or R61) will be hazardous if the concentration of any one of those substances is ≥ 0.5% w/w in the waste. It should be noted that this is a change from the classification under the Special Waste Regulations 1996, under which only substances assigned R61 were classified as special waste because effects on fertility were not considered.

Wastes containing substances classified as toxic for reproduction Category 3 (i.e. substances with risk phrases R62 or R63) will be hazardous if the concentration of any one of those substances is ≥ 5% w/w in the waste. It should be noted that this is a change from the classification under the Special Waste Regulations 1996, under which only substances assigned R63 were classified as special waste because effects on fertility were not considered.

C10.4 Decision Tree

Figure C10.1 sets out the assessment process for the Hazard H10.

Figure C10.1: Decision Tree for the Assessment of Hazard H10



C10.5 Test Methods

None of the EC Annex V test methods corresponds to the definition of "toxic for reproduction".

Some of the alternative tests, such as the Hydra assay and the X-gal assay, have performed well in predicting *in vivo* teratogenic effects. The Hydra assay and X-gal assay tests are summarised below.

C10.5.1 The Hydra Assay

The Hydra assay is a rapid early screening tool for the investigation of the teratogenic potential of compounds and mixtures. The steps for the regeneration of *Hydra attenuata* cell aggregates are performed in three phases with three artificial hydra embryos or three adult hydra placed in each test vessel.

In phase I, the toxicity of the waste is determined by exposing adult hydra to a range of concentrations (log intervals, maximum concentrations 5 mg/ml) and observing at 4, 20, 28, 44, 68, and 92 hours post exposure. Toxicity is assessed by microscopic examination with reference to a standard scoring system. The toxic endpoint is considered to be the "tulip" stage for adults and disintegration for artificial hydra embryos. A concentration resulting in an early toxic endpoint is selected for further study.

In phase II, the minimum effective concentrations in both adult hydra (MECA) and developing embryos (MECD) are determined using a restricted concentration range, based around the concentration obtained from phase I.

The phase II results are subsequently confirmed in phase III by incubating the adult hydra and embryos at the appropriate MEC and two higher or lower concentrations. In phase III the concentrations should be tested in triplicate.

The data are presented in tabular form, and the stage of each hydra/embryo is reported at every observation for each treatment group. The MECs are expressed as an A/D ratio (MEC adult/MEC developing embryo), and a positive result is indicated if this is shown to be significantly less than one on any of the phase III test concentrations. Results obtained using this *in vitro* test have shown good correlations with known teratogens tested *in vivo*.

C10.5.2 The X-Gal Assay

An alternative test uses *Drosophila melanogaster* embryonic cells. The embryonic cells exposed to teratogens dramatically increase their levels of low-molecular weight heat shock proteins (hsp). The test is known as an X-gal assay and has been adapted to be used as teratogen screen for environmental pollutants. Details of the procedure are available in Bournais-Viardiabasis *et al* (1983)[13].

[13] Bournais-Viardiabasis, N., Teplitz, R.R., Chenoff, G.P. and Seecof, R.L. 1983. Detection of teratogens in the Drosphila in vitro test: Assay of 100 chemicals. Teratology 28:109-122.

Appendix C:

C11 Assessment of Hazard H11: Mutagenic

C11.1 Definition

Annex III of the rWFD defines H11 "Mutagenic" as:

"*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*".

C11.2 Risk Phrases

For the purposes of classification and labelling, mutagens are divided into three categories:

Category 1

Substances known to be mutagenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage.

Category 2

Substances which should be regarded as if they are mutagenic to man. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in the development of heritable genetic damage, generally on the basis of:

(a) appropriate animal studies,

(b) other relevant information.

Category 3

Substances which cause concern for man owing to possible mutagenic effects. There is evidence from appropriate mutagenicity studies, but this is insufficient to place the substance in Category 2.

The risk phrase applicable to category 1 and 2 mutagenic substances is:

R46 *May cause heritable genetic damage*

The risk phrase applicable to category 3 mutagenic substances[14] is:

R68 *Possible risk of irreversible effects*

C11.3 Limiting Concentrations

"Mutagenic" has specified concentration limits set out in Article 2 of EWC, above which a waste would be hazardous:

- one mutagenic substance of category 1 or 2 classified as R46 at a concentration ≥ 0.1%; and
- one mutagenic substance of category 3 classified as R68[15] at a concentration ≥ 1%.

[14] R40 for Category 3 mutagens was replaced by R68 by Commission Directive 2001/60/EC.

[15] Article 2 of EWC 2002 specifies the threshold for Category 3 mutagens by referring to substances classified as R40. However, R40 for Category 3 mutagens was replaced by R68 by Commission Directive 2001/60/EC.

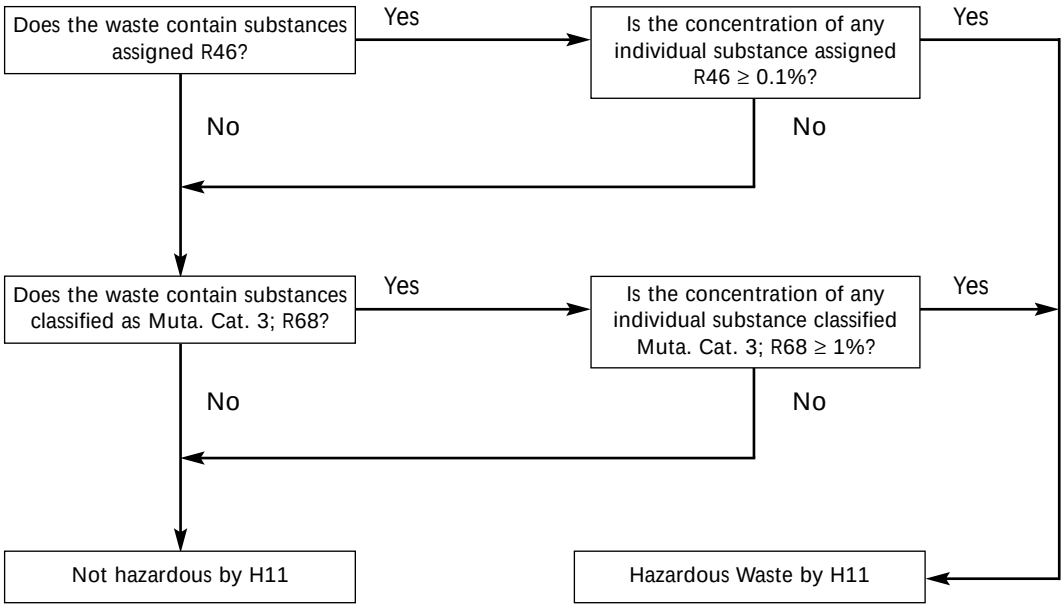
Wastes containing category 1 or 2 mutagens, that is substances with risk phrase R46, will be hazardous if the concentration of any of those mutagens is ≥ 0.1%.

Wastes containing category 3 mutagens, that is substances with risk phrases R68, will be hazardous if the concentration of any of those mutagens is ≥ 1%. It should be noted that R68 can also be assigned to substance classified as Harmful (H5).

C11.4 Decision Tree

Figure 11.1 sets out the assessment process for the Hazard H11.

Figure C11.1: Decision Tree for the Assessment of Hazard H11



C11.5 Test Methods

The test methods published by the EC that correspond best to the definition of the mutagenic are set out in Table C11.1.

Table C11.1: Test methods for hazard H11

Test Method		Source	Acceptability
B10:	*In vitro* mammalian chromosome aberration test	EC Directive 2000/32/EC	✓
B11:	*In vivo* mammalian bone marrow chromosome aberration test	EC Directive 2000/32/EC	[1]
B12:	*In vivo* mammalian erythrocyte micronucleus test	EC Directive 2000/32/EC	[1]
B13/14:	Reverse mutation test using bacteria	EC Directive 2000/32/EC	✓
B17:	*In vitro* mammalian cell gene mutation test	EC Directive 92/69/EEC	✓
Ames Assay		see below	✓
Mutant *Vibrio fischeri* Test		see below	✓

Notes:

The Agencies do not endorse destructive animal testing. Wherever there is any doubt about the mutagenic nature of a waste, the precautionary principle should apply.

Tests B10, B13/14 and B17 are in vitro tests and are therefore acceptable to the Agencies as non-mammalian test methods to determine hazard H11. Tests B11 and B12 are not considered appropriate because of their reliance on animal testing.

The Ames Assay and the Mutant *Vibrio fischeri* Test are two alternative tests for the hazard H11 providing only a broad classification of potential mutagenic effects. The Ames plate tests use two different strains with and without metabolic activation to detect point mutations in genetically engineered strains of *Salmonella typhimurium*. A clear positive result will give a positive classification. The Ames plate test does not identify the mutagenic potential of metals. A new test has been developed using a dark mutant of *Vibrio fischeri* that exhibits light production when grown in the presence of sublethal concentrations of genotoxic agents. These tests are summarised at the end of this chapter.

C11.5.1 EC Test Method B10 (*In vitro* mammalian chromosome aberration test)

Introduction

Tests on the production of chromosomal aberrations in mammalian cells can provide a preliminary assessment of the mutagenic potential of a substance.

Principle of the test method

The *in vitro* cytogenetic test is a short-term mutagenicity test for the detection of structural chromosomal aberrations in cultured mammalian cells. Cultures of established cell lines as well as primary cell cultures may be used. After exposure to test chemicals with and without an appropriate metabolic activation system, cell cultures are treated with spindle inhibitors such as colchicine to accumulate cells in a metaphase-like stage of mitosis (c-metaphase). Cells are harvested at appropriate times and chromosome preparations are made. Preparations are stained and metaphase cells are analysed for chromosomal abnormalities.

Established cell lines or cultures of primary cells are used, e.g. Chinese hamster cells and human lymphocytes. Test chemicals are prepared in culture medium or dissolved in appropriate vehicles prior to treatment of the cells.

The full test method identifies experimental procedure including details on experimental conditions and controls, culture preparation and conditions, metabolic activation systems, and data evaluation and reporting.

C11.5.2 EC Test Methods B13/14 (Reverse mutation test using bacteria)

Introduction

For the preliminary assessment of mutagenic potential of a substance this method tests the production of gene (point) mutations in microbe cells.

Principles of the test method

The reverse mutation microbial assay measures the base changes in the genome of the organisms by the chemicals it is exposed to. The base change measured for *Escherichia coli* is the tryptophan (trp^- - trp^+) reversion and for *Salmonella typhimurium* the histidine base (his^- - his^+).

Bacteria are exposed to test chemicals with and without metabolic activation. After a suitable period of incubation on minimal medium, revertant colonies are counted and compared to the number of spontaneous revertants in an untreated and/or solvent control culture.

The full test method identifies the preferred bacterial strains for the two species and requires recognised methods of stock culture preparation and storage to be used. In addition the full experimental procedure includes details on bacterial preparation, metabolic activation systems, experimental conditions and controls, and data evaluation and reporting.

C11.5.3 EC Test Methods B17 (*In vitro* mammalian cell gene mutation test)

Introduction

This test can be used to detect gene mutations induced by chemical substances.

Principles of the test method

Mutant frequency is determined by seeding known numbers of cells in medium containing the selective agent to detect mutant cells and in medium without selective agent to determine the cloning efficiency (viability). After a suitable incubation time, colonies are counted. The mutant frequency is derived from the number of mutant colonies in selective medium and the number of colonies in non-selective medium.

The full test method identifies the preferred bacterial strains for the two species and requires recognised methods of stock culture preparations and storage to be used. In addition the full experimental procedure includes details on bacterial preparation, metabolic activation systems, experimental conditions and controls, and data evaluation and reporting.

C11.5.4 The Ames Plate test

The Ames reverse mutation assay has an extensive database, and is a standard test system for mutagenicity. OECD test guidelines are available[16], and the test is included in the Classification, Packaging and Labelling Regulations[17].

This test can be carried out on agar plates or in a liquid medium, which also incorporates a step to simulate the effects of liver enzymes, which may activate some compounds or deactivate others. Waste samples or their extracts should be tested to the limit of toxicity up to a maximum of 5 mg/ml overlay agar. Toxicity is indicated by a clearing of the background lawn, a reduction in the number of spontaneous revertants, or by degree of survival of treated cultures. At least five different amounts of the water sample should be tested, with half-log intervals between plates. The number of revertant colonies per plate is reported for both control and treated series. Individual plate counts, the mean number of revertant colonies per plate and standard deviation should be presented for the tested sample and the controls. The mean data should be summarised graphically.

A positive result in the Ames test does not necessarily demonstrate a hazard, and a negative result on its own does not necessarily give complete confidence that the waste was not mutagenic since it may be important to optimise the test conditions for particular compounds. In general, if at least one of the test series shows a response, leading to at least a doubling of the number of revertants in the control plates, the waste sample or extract may be regarded as mutagenic. Therefore, for the purpose of classification of special waste the test is best used in conjunction with the other screening tests.

The testing of complex mixtures presents a problem: one component may be toxic, but not mutagenic, to the test organisms at such a dose as to prevent the expression of other mutagenic components. Testing of 33 industrial effluents showed that only one sample had sufficient cytotoxic effects to mask mutagenicity. The wide range of effluents tested provides some guidance as to what may be considered to be “high” or “low” Ames responses.

C11.5.5 The Mutant *Vibrio fischeri* Test

This is a test using a dark mutant of *Vibrio fischeri*[18] that produces light when grown in the presence of sublethal concentrations of genotoxic agents.

The mutant bacteria of *Vibrio fischeri* are provided in lyophilised form: they must be rehydrated with double deionised water. Serially diluted samples are then added to each 1 ml of rehydrated bacteria medium for testing. A photometer is used for bioluminescence determination. Prepared samples are measured for light intensity for a continuous 24 hour period at 1 hour intervals. If the luminescence value reached at any time is higher than three times that of a negative control, the test is designated a positive. Duplicate or triplicate samples are run in each test to ensure reliability of results.

The dark mutation bacterium test has some advantages over the Ames test in that it is not affected by the presence of amino acids or other nutrients. Limited validation at this stage suggests that this test should be used in conjunction with the Ames test until further validation has been carried out.

[16] OECD Paris 1984

[17] OJ No. 196 16/8/1967 as amended by Commission Directive 92/69/EEC (OJ No L383 29/12/192).

[18] Carlsbad, C.A. 1993 Mutatox test data for Prechemicals. Department of Microbics Inc. Wang, W.D., Sun, T.S.C. and Stahr, H.M. 1998 “Continued Elevation and Application of a Bioluminescent Bacterial Genotoxicity Test” in “Advances in Animal Alternatives for Safety and Efficacy Testing” Salem, H. and Katz, S.A. (Eds), Taylor and Francis, USA.

Appendix C:

C12 Assessment of Hazard H12: Produces Toxic Gases in Contact with Water, Air or Acid

C12.1 Definition

Annex III of the rWFD defines H12 as:

> "Waste which releases toxic or very toxic gases in contact with water, air or and acid"

C12.2 Risk Phrases

One of these risk phrases has to be identified for a substance or preparation in the waste if the waste is to have the potential to exhibit Hazard H12:

R29 *Contact with water liberates toxic gas*

Substances and preparations which in contact with water or damp air evolve very toxic/toxic gases in potentially dangerous amounts. Examples of such substances includes aluminium phosphide and phosphorous pentasulphide.

R31 *Contact with acids liberates toxic gas*

Substances or preparations which react with acid to evolve toxic gases in dangerous amounts. Examples of such substances includes sodium hypochlorite and barium polysulphide.

R32 *Contact with acids liberates very toxic gas*

Substances or preparations which react with acid to evolve very toxic gases in dangerous amounts. Examples of such substances includes salts of hydrogen cyanide, sodium azide.

Any combined risk phrase including R29, R31 or R32 with other risk phrases indicates the potential to exhibit Hazard H12. A special case is the combined risk phrase:

R15/29 *Contact with water liberates toxic, extremely flammable gas*

This risk phrase indicates that Hazard H3A (fifth indent) also applies. The assessment methodology is similar, and the threshold for H3A(v) will be the same as that for H12.

C12.3 Limiting Concentrations

To show Hazard H12, a waste should be capable of releasing a toxic gas at a rate in excess of 1 litre/kg substance/hour. This equates to 1 m^3 gas per tonne waste in one hour. It should be assumed that if a substance listed in table 3.2 of the CLP is classified by any of the risk phrases R29, R31 or R32, or could be classified by any of these risk phrases, this criterion will have been met. However, as there are no thresholds for concentrations of R29, R31 or R32 in a waste to make that waste hazardous by H12 , it is the waste itself which requires testing, although presence of such substances would indicate the likelihood of the waste possessing H12.

From the listing of substances in table 3.2 of the CLP which exhibit this hazard property, the toxic or very toxic gases which could be released by chemical reaction with water, air or an acid appear to be limite at present to those set out in Table C12.1.

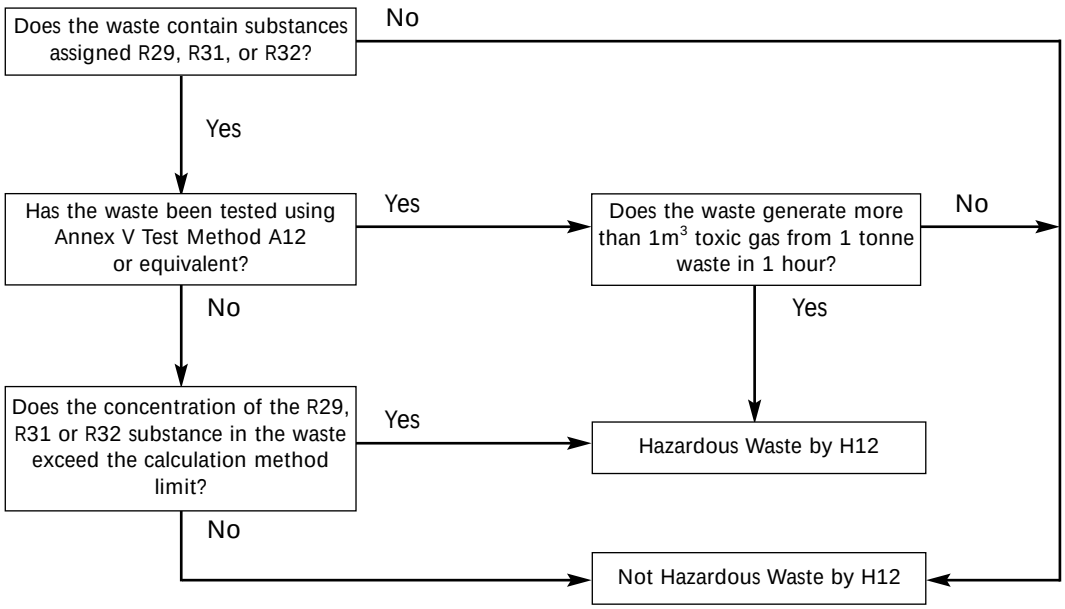
Table C12.1: Some toxic gaseous substances released by H12 waste

Substance	Chemical Formula	By Risk Phrase(s) R29	R31	R32
Hydrogen sulphide	H_2S	✓	✓	✓
Hydrofluoric acid / hydrogen fluoride	HF	✓		✓
Carbon disulphide	CS_2		✓	
Sulphur dioxide	SO_2		✓	
Chlorine	Cl_2		✓	
Nitrogen dioxide	NO_2			✓
Ammonia	NH_3		✓	
Hydrogen cyanide	HCN			✓

C12.4 Decision Tree

Figure C12.1 sets out the assessment process for the Hazard H12.

Figure C12.1: Decision Tree for the Assessment of Hazard H12



C12.4.1 Calculation Method for Hazard H12

This hazard can be determined by calculation or by testing. If information on the composition of the waste is available the calculation method should be used, otherwise EC standard test method A12 or equivalent should be used (see Section C3.6). The threshold concentration is not fixed, but is calculated on the basis of the reaction observed.

The first step in the calculation method is to determine whether the waste contains any of the substances which are classified by the following risk (or combined risk i.e. R15/29) phrases:

R29 *Contact with water liberates toxic gas*

R31 *Contact with acids liberates toxic gas*

R32 *Contact with acids liberates very toxic gas*

The waste producer should also consider what other solid substances in his waste could break down to give off a toxic gas, and carry out the assessment set out in Box H12.1.

Box H12.1: Calculation Method for Hazard H12

1. Write a balanced equation for the reaction that produces the gas. The general form of this equation should be as follows:

   aA + bB = cC + gG

   where: A, B, and C are the products and reactants with G being a toxic gas; and

   a, b, c and g are the stoichiometric ratios between the products and reactants.

2. Attribute molecular weights and stoichiometric ratios to the substances in the equation.

3. Divide (a x molar weight of A) by (g x 22.4 (the volume of 1 mol of gas at standard temperature and pressure (STP 25°C and 1 atmosphere pressure). This gives the mass of reactant A that will evolve 1 litre of gas G.

4. The limiting concentration for the substance in the waste with the potential to show hazard H12 is this amount (in grams) divided by 1,000 (to convert to kg) and multiplied by 100 (to give % by weight).

Example Calculation – The main constituents which may make aluminium drosses and slags hazardous are aluminium, aluminium nitride, aluminium carbide. Aluminium nitride is an R29 substance which may make the waste hazardous by H12. The aluminium nitride content may be 0-1% (slag) or 0-10% (dross). Applying this calculation method to the aluminium drosses and slags gives the following threshold limit for H12 (Note: other constituents may make the aluminium drosses and slags hazardous by H3A(v), See Appendix C3).

Aluminium nitride (R29) giving rise to hazard H12

AlN	+	$3H_2O$	→	$Al(OH)_3$	+	NH_3
aluminium nitride		water		aluminium hydroxide		ammonia
41 g		18 g		78 g		17 g
1 mol		3 mol		1 mol		1 mol

Limiting concentration of aluminium nitride in waste

$=[(1 \times 41) / (1 \times 22.4) / 1{,}000] \times 100 = 0.18\% \approx 0.2\%$

Listed reactions, where known, and threshold concentrations for certain substances listed in table 3.2 of the CLP with the potential to exhibit for Hazard H12, have been derived using the assessment methodology and are set out in Table C12.2. A substance exhibiting R15/29 also has the potential to exhibit hazard H3A(v), and the threshold limit for that hazard will be the same as that established for H12.

Table C12.2: Examples of substances which may cause a waste to exhibit hazard H12 (Classification by risk phrases R29, R31, R32 and R15/29)

Substance name	Risk phrases	Equation	Threshold Conc. %[1]
Phosphorus pentasulphide	R29	$P_2S_5 + 8H_2O \rightarrow 5H_2S + 2H_3PO_4$	0.1
3,5-dichloro-2,4-difluoro-benzoyl fluoride (DCDFBF)	R29	DCDFBF + $H_2O \rightarrow$ HF + Prod.	1.0
Metam-sodium	R31	$CH_3NHCSSNa + H^+ \rightarrow CH_3NH_2 + CS_2 + Na^+$	0.5
Barium sulphide	R31	$BaS + 2H^+ \rightarrow H_2S + Ba^{2+}$	0.8
Barium polysulphides	R31	$BaS_n + 2H^+ \rightarrow H_2S + Ba^{2+} + S_{n-1}$	0.8
Calcium sulphide	R31	$CaS + 2H^+ \rightarrow H_2S + Ca^{2+}$	0.3
Calcium polysulphides	R31	$CaS_n + 2H^+ \rightarrow H_2S + Ca^{2+} + S_{n-1}$	0.3
Potassium sulphide	R31	$K_2S + 2H^+ \rightarrow H_2S + 2K^+$	0.5
Ammonium polysulphides	R31	$(NH_4)_2S_n + 2H^+ \rightarrow H_2S + 2NH_4^+ + S_{n-1}$	0.3
Sodium sulphide	R31	$Na_2S + 2H^+ \rightarrow H_2S + 2Na^+$	0.4
Sodium polysulphides	R31	$Na_2S_n + 2H^+ \rightarrow H_2S + 2Na^+ + S_{n-1}$	0.4
Sodium dithionite	R31	$Na_2O_6S_2 + 2H^+ \rightarrow 2Na^+ + SO_2 + H_2SO_4$	0.9
Sodium hypochlorite, solution % Cl active[2]	R31	$2NaOCl + 2H^+ \rightarrow Cl_2 + 2Na^+ + H_20$	2.9
Calcium hypochlorite % Cl active[2]	R31	$Ca(OCl)_2 + 2H^+ \rightarrow Cl_2 + Ca^{2+} + H_2O$	0.6
Dichloroisocyanuric acid	R31	$C_3HCl_2N_3O_3 + 2H^+ \rightarrow C_3H_3N_3O_3 + Cl_2$	0.9
Dichloroisocyanuric acid, sodium salt of	R31	$C_3Cl_2N_3O_3Na + 3H^+ \rightarrow C_3H_3N_3O_3 + Cl_2 + Na^+$	1.0
Sodium dichloroisocyanurate, dihydrate	R31	$C_3Cl_2N_3O_3Na + 3H^+ \ 2H_2O \rightarrow C_3H_3N_3O_3 + Cl_2 + Na^+ + 2H_2O$	1.1
Trichloroisocyanuric acid	R31	$2C_3Cl_3N_3O_3 + 6H^+ \rightarrow 2C_3H_3N_3O_3 + 3Cl_2$	0.7
Hydrogen cyanide, salts of (with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide)	R32	$NaCN + H^+ \rightarrow HCN + Na^+$	0.2

Substance name	Risk phrases	Equation	Threshold Conc. %[1]
Sodium fluoride	R32	$NaF + H^+ \rightarrow HF + Na^+$	0.2
Sodium azide	R32	$NaN_3 + H^+ + H_2O$ Æ $NO_2 + NH_3 + Na^+$	0.3
Aluminium phosphide	R32	$AlP + 3H^+ \rightarrow PH_3 + Al^{3+}$	0.3
Trizinc diphosphide	R32	$Zn_3P_2 + 6H^+ \rightarrow 2PH_3 + 3Zn^{2+}$	0.6
Calcium cyanide	R32	$Ca(CN)_2 + 2H^+ \rightarrow 2HCN + Ca^{2+}$	0.2
Cadmium cyanide	R32	$Cd(CN)_2 + 2H^+ \rightarrow 2HCN + Cd^{2+}$	0.4
Calcium phosphide	R15/29[3]	$Ca_3P_2 + 6H_2O \rightarrow 2PH_3 + 3Ca(OH)_2$	0.4
Aluminium phosphide	R15/29[3]	$AlP + 3H_2O \rightarrow PH_3 + Al(OH)_3$	0.3
Magnesium phosphide	R15/29[3]	$Mg_3P_2 + 6H_2O \rightarrow 2PH_3 + 3Mg(OH)_2$	0.3
Trizinc diphosphide	R15/29[3]	$Zn_3P_2 + 6H_2O \rightarrow 2PH_3 + 3Zn(OH)_2$	0.6

Notes:

[1] *Rounded to one decimal place*

[2] *Based on 29.3 g (NaOCl)/100ml (max solubility)*

[3] *Contact with water liberates toxic, extremely flammable gas (also exhibit hazards H3A(v))*

The hazard is not limited to substances listed in table 3.2 of the CLP. These and other gases could also be produced from non-listed substances. The waste producer should consider what substances in the waste could react with water, air or an acid to give off toxic gases, and carry out the assessment.

If there is any doubt as to the potential of a waste to liberate a toxic or very toxic gas, a test can be performed as described in Section C12.5.

C12.5 Test methods

The approved methods for determining Hazard H12 properties are set out in Table C12.3 with details of the test methods provided in Section C3.6.

Table C12.3: Hazard H12 with associated risk phrases and summary of relevant test methods

Phase	Risk Phase	Test
Liquid/solid	R29	1. Directive 92/62/EEC, Test Method A12 (a similar test is used for classification under the Transport of Dangerous Goods legislation; details and guidance on the tests can be obtained from the Health and Safety Executive
	R31	1. Modification of Directive 92/62/EEC Test Method A12 Replace water with an acid which will not cause a displacement reaction to occur. 2. Method for measuring SO_2 evolved when a waste is in contact with an acid, see text box below.
	R32	Modification of Directive 92/62/EEC Test Method A12. Replace water with an acid which will not cause a displacement reaction to occur.

Annex 1 ñ Outline of method developed for measurement of SO^2 evolved when a waste is in contact with an acid.

- A known weight of the sample, approximately 10g, is placed in the reaction vessel.
- 250mls of 3% hydrogen peroxide in 0.1 molar sodium hydroxide are placed in an absorbing flask.
- The apparatus was connected together and nitrogen passed through the system.
- 50mls of approximately 5 molar hydrochloric acid is introduced via a dropping funnel.
- After one hour the contents of the absorbing flask is made up to 500mls.
- A portion of this is then removed, acidified, placed in an ultrasonic bath to displace oxygen, made up to a known volume and analysed by ICP/OES against a sulphate standard.

The method gives a concentration of SO^2 evolved in mg/l. The result is calculated to obtain a volume of gas liberated by a litre of the waste. When looking at a reaction with acids, the toxic gas evolved could be quite small. This method has been devised specifically to determine; firstly, whether the waste releases toxic or very toxic gas (H12) and secondly, the actual concentration of sulphur dioxide evolved.

For liquid wastes the reaction is going to be rapid. Where sufficient gas is obtained in one hour to make it hazardous, the initial rate of gas production would be expected to be very high.

Appendix C:

C13 Assessment of Hazard H13: Sensitizing

C13.1 Definition

Annex III of the rWFD defines H13* as:

"*substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction of hypersensitization such that on further exposure to the substance or preparation, characteristic adverse effects are produced.*"

C13.2 Risk Phrases

A waste may exhibit the hazard "sensitizing" (H13) if it contains a substance or substances assigned any of the following risk phrases:

R42 *May cause sensitisation by inhalation*

R43 *May cause sensitisation by skin contact*

Combined risk phrases are possible:

R42/43 *May cause sensitisation by inhalation and skin contact*.

Substances assigned R42/43 are considered to exhibit both R42 and R43.

C13.3 Limiting concentrations

Limiting concentrations are not given in the EWC, however they are given in CHIP.

There are 4 steps in deciding if a waste is hazardous by H13

Step 1 – identify whether the waste contains a substance or substances given the risk phrases R42, R43 (or R42/R43) in Annex VI, Table 3.2 to the CLP or, if not listed in the CLP, from other data sources.

Step 2 – identify whether the substances are given substance specific concentration limits in Annex VI, Table 3.2 to the CLP, and, if so, whether that substance is at or above that specific concentration limit.

Step 3 – if not, identify whether any individual substance is at or above the limiting concentration given in CHIP. This limit is 0.2% for gaseous substances and 1% for other substances.

Step 4 – identify whether there are any substances in the waste at or above the limits in Step 2 and 3. If there are that waste is hazardous by H13. If not the waste is not hazardous by H13.

* The revised Waste Framework Directive includes a footnote for H13 – "As far as testing methods are available". The criteria for R42 and R43 are complex and are not fully supported by test methods. In addition test methods use animal testing and are constrained by legislative controls on such testing. For those reasons the availability of test methods is limited.

Example: a waste contains 0.15% methylenediphenyl diisocyanate and 0.8% 1,5-naphthylene diisocyanate.

Step 1 – methylenediphenyl diisocyanate is classified R42/43 and 1,5-naphthylene diisocyanate as R42 in CLP.

Step 2 – 1,5-naphthylene diisocyanate does not have limit set in Table 3.2 to CLP but methylenediphenyl diisocyanate has a substance specific concentration limit set at 0.1%. The concentration of methylenediphenyl diisocyanate in the waste is at or above this.

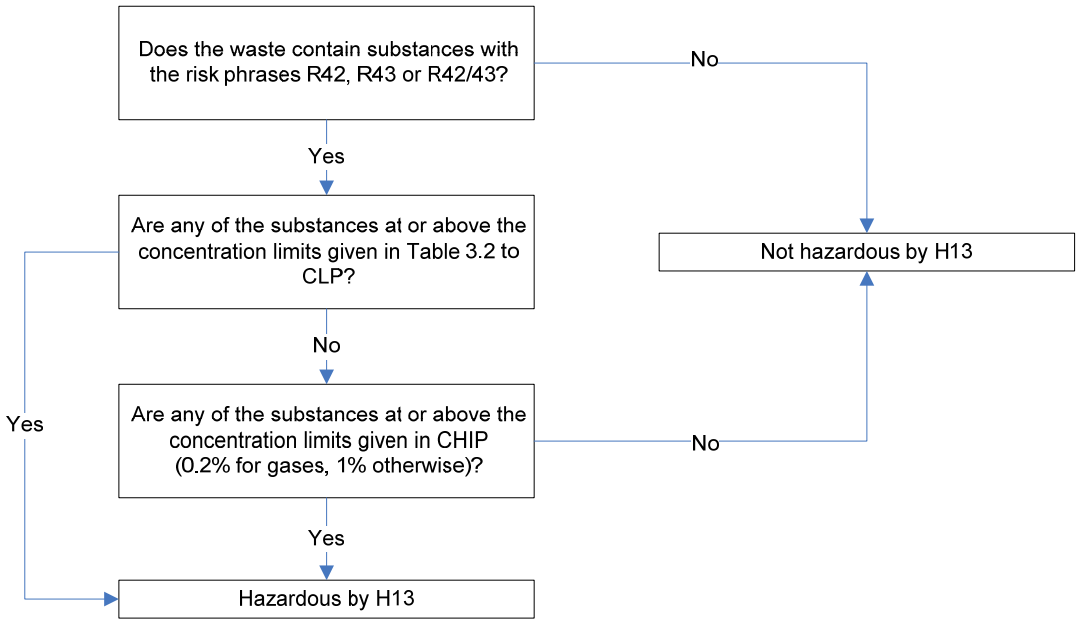
Step 3 – the limiting concentration for 1,5-naphthylene diisocyanate set in CHIP is 1% for non-gaseous substances. The concentration of 1,5-naphthylene diisocyanate in the waste (0.8%) is below this.

Step 4 – as the limit in Step 2 is exceeded the waste is hazardous by H13 sensitizing.

C13.4 Decision Tree

Figure C13.1 sets out the assessment process for the Hazard H13.

Figure | Decision Tree for the Assessment of Hazard H13



C13.5 Test Methods

The test methods that correspond to the definition of sensitizing are given in Council Regulation 440/2008.

- B.6 : Skin Sensitisation
- B.42 : Skin Sensitisation: Local Lymph Node Assay

These test methods rely on destructive animal testing subject to the Animals (Scientific Procedures) Act 1986. Regulated procedures can only be authorised and performed if there are no scientifically suitable alternatives that:

- replace animal use;
- reduce the number of animals needed; or
- refine the procedures used to cause suffering.

In addition the likely benefits (to humans, other animals or the environment) must be weighed

against the likely welfare costs to the animal involved.

Furthermore, the criteria in the Approved Classification and Labelling Guide (ACLG) for assigning R42 and R43 are only partially supported by test methods. Testing alone may not be sufficient to demonstrate that a waste is not hazardous.

As a result of the limited availability of test methods H13 sensitizing will normally be determined by the conventional (or calculation) method provided here as a scientifically suitable alternative. If a waste contains substances with a sensitizing risk phrase above relevant thresholds it will be H13 sensitizing. If it does not, it is not H13 and no further testing is required.

Note: Isocyanates are normally regarded as R42 sensitising unless assessment in accordance with the ACLG demonstrates otherwise.

Appendix C:
C14 Assessment of Hazard H14: Ecotoxicity

C14.1 Definition

Annex II of the rWFD defines H14 "Ecotoxic" as:

> *"waste which presents or may present immediate or delayed risks for one or more sectors of the environment."*

C14.2 Principle for Assessing Hazard H14

The assessment of hazard H14 Ecotoxic has been developed from the calculation method (or Conventional Method) in the Chemicals (Hazard Information and Packaging for Supply) Regulations. These regulations and their supporting guidance base the determination of Ecotoxicity primarily on risk phrases and substance concentrations, and therefore provide only a very limited scope for direct ecotoxicity testing of wastes.

The risk phrases associated with ecotoxic are broken down into hazards to the aquatic environment and hazards to the non-aquatic environment:

Aquatic Environment

R50 *Very toxic to aquatic organisms*

R51 *Toxic to aquatic organisms*

R52 *Harmful to aquatic organisms*

R53 *May cause long-term effects in the aquatic environment*

Combined or joint risk phrases are common for substances that are dangerous to the aquatic environment; the six possible classification combinations are set out in Section C14.3 along with the classification criteria.

Where combined or joint risk phrases apply, for example R50 and R53, the convention is to express them using a hyphen, for example R50-53. The hyphen equates to an 'and'. The use of '/' or ',' in R50/53 or R50,53 has the same meaning.

Non-Aquatic Environment (see C14.4.2)

R54 *Toxic to flora*

R55 *Toxic to fauna*

R56 *Toxic to soil organisms*

R57 *Toxic to bees*

R58 *May cause long-term adverse effects in the environment*

Substances which on the basis of the available evidence concerning their properties, persistence, potential to accumulate and predicted or observed environmental fate and behaviour may present a danger, immediate or long-term and/or delayed, to the structure and/or functioning of natural ecosystems other than those covered above.

Detailed criteria are still to be determined by the Commission for R54 to R58. Therefore these risk phrases cannot be applied to the assessment of H14.

R59 *Dangerous for the ozone layer*

Substances which on the basis of the available evidence concerning their properties and their predicted or observed environmental fate and behaviour may present a danger to the structure and/or functioning of the stratospheric ozone layer. This includes the substances which are listed in Annex I to Council Regulation (EC) No 2037/2000 on substances that deplete the ozone layer and its subsequent amendments.

C14.3 Classification for the Aquatic Environment

There are six possible substance classifications that consist of either a single risk phrase or a pair of combined risk phrases:

N, R50 *Very toxic to aquatic organisms*

Acute toxicity: 96 hr LC50 (for fish): ≤1 mg/l; **or**
48 hr EC50 (for daphnia): ≤1 mg/l; **or**
72 hr IC50 (for algae): ≤1 mg/l

N, R50-53 *Very toxic to aquatic organisms and may cause long-term effects in the aquatic environment*

Acute toxicity: 96 hr LC50 (for fish): ≤1 mg/l; **or**
48 hr EC50 (for daphnia): ≤1 mg/l; **or**
72 hr IC50 (for algae): ≤1 mg/l
and
the substance is not readily degradable **or**
the log Pow (log octanol/water partition coefficient) ≥3.0 (unless the experimentally determined bioconcentration factor (BCF) ≤100).

N, R51-53 *Toxic to aquatic organisms and may cause long-term effects in the aquatic environment*

Acute toxicity: 96 hr LC50 (for fish): 1 mg/l < LC50 ≤10 mg/l; **or**
48 hr EC50 (for daphnia): 1 mg/l < EC50 ≤10 mg/l; **or**
72 hr IC50 (for algae): 1 mg/l < IC50 ≤10 mg/l
and
the substance is not readily degradable **or**
the log Pow ≥3.0 (unless the experimentally determined BCF ≤ 100).

R52-53 *Harmful to aquatic organisms and may cause long-term effects in the aquatic environment*

Acute toxicity: 96 hr LC50 (for fish): 10 mg/l < LC50 ≤100 mg/l; **or**
48 hr EC50 (for daphnia): 10 mg/l < EC50 ≤100 mg/l; **or**
72 hr IC50 (for algae): 10 mg/l < IC50 ≤100 mg/l
and
the substance is not readily degradable.

R52 *Harmful to aquatic organisms*

Substances **not** falling under the criteria listed above, but which on the basis of the available evidence concerning their toxicity may nevertheless present a danger to the structure and/or functioning of aquatic ecosystems.

R53 *May cause long-term effects in the aquatic environment*

Substances **not** falling under the criteria listed above, but which on the basis of the available evidence concerning their persistence, potential to accumulate, and predicted or observed environmental fate and behaviour may nevertheless present a long-term and/or delayed danger to the structure and/or functioning of aquatic ecosystems.

For example, poorly water soluble substances, i.e. substances with a solubility of less that 1 mg/l, will be covered by these criteria if:

the substance is not readily degradable; **or**

the log Pow ≥3.0 (unless the experimentally determined BCF ≤100).

C14.4: Background to the Assessment Procedure

C14.4.1: Criteria for classifying a waste as Ecotoxic on the basis of aquatic toxicity

The Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP) have specified concentration limits for individual substances and combinations of substances with risk phrases that relate to the aquatic environment.

The calculations provided in CHIP contain 8 equations that consider the additive properties of two or more dangerous substance and serve two purposes
(i) To determine if a preparation is dangerous for the environment, and
(ii) To determine the severity of this and assign the appropriate risk phrase(s).

Hazardous waste assessment only requires determination of whether a waste is Ecotoxic (Dangerous for the environment), without determination of the specific risk phrases that might be assigned to that waste. Therefore four of the equations, presented in CHIP for the purpose of assigning risk phrases, have been removed to simplify the assessment.

C14.4.2: Criteria for classifying a waste as Ecotoxic on the basis of terrestrial toxicity

No criteria are provided here for classifying a waste as Ecotoxic on the basis of terrestrial toxicity.

C14.4.3: Criteria for classifying a waste as Ecotoxic on the basis of danger to the ozone layer.

The Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP) have specified concentration limits for individual substances that are a danger to the ozone layer.

C14.4.4: Specific Concentration Limits for Highly Ecotoxic Substances

Substances which are very toxic to the aquatic organisms (R50 or R50-53) may be assigned specific concentration limits by CHIP. These are incorporated into the assessment methodology.

C14.4.5: Metal Alloys

Pure metal alloys that are not contaminated with dangerous substances are excluded from the classification process.

C14.4.6: Metal Compounds and Table 3.2 of the CLP, Note 1.

This assessment procedure is based on CHIP and uses the concentration limits from table 3.2 of the CLP. Certain metal compounds are assessed on the basis of the metallic element (cation), rather than compound, concentrations. Table 3.2 of the CLP identifies these by assigning 'Note 1' to the concentration limits.

'Note 1 - *The concentration stated is the percentage by weight of the metallic element calculated with reference to the total weight of the preparation*.'

This applies, for example, to the 'general' compound entries for Antimony, Arsenic, Cadmium, Inorganic Mercury, Organic Mercury, Lead and a number of specific compound entries for Cadmium, Cobalt, and particularly Lead. Note that the 'general' compound entries should only be used where the specific compounds are not listed separately and the scope of the entries permit their use.

Where the metal compound, or worst case compound, identified in the waste is assigned Note 1 (in the concentration field of its entry in table 3.2 of the CLP) then the cation concentration of the metal can be used for this assessment.

C14.5: Procedure for Assessment of Hazardous Property H14

The assessment procedure is presented in the decision tree, Figure C14.1, and supported by the explanatory text below.

C14.5.1: Step 1: Is the composition of the waste known or can it be determined?

The calculation method presented in the following steps (C14.5.2 to C14.5.10) should be used for the determination of the hazardous property H14 Ecotoxic. Where possible, the compound speciation should be determined using chemical analysis, knowledge of the process or activity that produced the waste, information/literature available concerning similar wastes/processes, and where applicable information from material safety data sheets. Where this is not possible then the worst-case compound speciation in terms of ecotoxic properties must be determined, considering and relevant information, for the waste in question.

See 14.4.6 for the assessment of wastes containing metal compounds. In some cases table 3.2 of the CLP indicates that the metal concentration, rather than compound concentration, should be used.

Ecotoxicity testing is not normally appropriate, apart from in exceptional circumstances where there is no other alternative. The methodologies used must conform to the quality criteria normally applied for substance testing. Further information is provided in C14.7.

C14.5.2: Step 2: Does the waste contain dangerous substances with Ecotoxic Risk Phrases ?

The following assessment considers dangerous substances with the following risk phrases

R50	*Very toxic to aquatic organisms*
R50-53	*Very toxic to aquatic organisms and may cause long-term effects in the aquatic environment*
R51-53	*Toxic to aquatic organisms and may cause long-term effects in the aquatic environment*
R52-53	*Harmful to aquatic organisms and may cause long-term effects in the aquatic environment*
R52	*Harmful to aquatic organisms*
R53	*May cause long-term effects in the aquatic environment*
R59	*Dangerous for the ozone layer*

If none of the dangerous substances in waste possess any of these risk phrases the waste will not possess the hazardous property H14 Ecotoxic using the calculation method, and the assessment ends here (steps 3 to 10 are not considered).

If the waste contains dangerous substances with Ecotoxic risk phrases proceed to step 3.

C14.5.3: Step 3: Does the waste contain an individual substance classified as Ecotoxic at a concentration at or above the generic threshold limits ?

This step determines whether the waste is Ecotoxic due to the presence of an individual dangerous substances that is classified with the risk phrases listed in C14.5.2

Table C14.5.3 lists the generic threshold limits for individual dangerous substances.

If the concentration of an individual dangerous substance is at or above that listed in Table C14.5.3. then the waste is assigned the hazardous property H14 Ecotoxic (H14) and the assessment procedure ends here (steps 4 to 10 are not considered)

If no individual dangerous substance is present at a concentration at or above that listed in Table C14.5.3 then proceed to step 4.

Table C14.5.3 Generic Threshold Limits (adapted from CHIP)

Classification of the substance	Generic Threshold Concentration for an Individual Substance
R59	≥ 0.1%
R50-53	≥ 0.25%
R51-53	≥ 2.5%
R50 or R52 or R53 or R52-53	≥ 25%

C14.5.4: Step 4: Does the waste contain an individual substance classified as Ecotoxic at a concentration at or above its substance specific threshold limits?

Table 3.2 of the CLP provides substance specific thresholds for a small number of listed, and predominantly organic, chemicals. These thresholds indicate the concentration at which Ecotoxic risk phrases apply, and determine which specific risk phrase is allocated. An example is presented below. Where an individual dangerous substance has been assigned a substance specific threshold concentration for any Ecotoxic risk phrase, which is lower than the generic threshold concentration in C14.5.3 above, then the lowest substance specific threshold must be considered.

The waste will possesses the hazardous property H14 where the concentration of an individual dangerous substance is at or above its substance specific threshold for any Ecotoxic risk phrase.

If the concentration of an individual dangerous substance is at or above its substance specific threshold then the waste is assigned the hazardous property H14 Ecotoxic (H14) and the assessment procedure ends here (steps 5 to 10 are not considered)

If the none of the substances present in the waste have lower substance specific thresholds, or the individual substance(s) within the waste are not present a concentration at or above these substance specific thresholds then proceed to step 5.

For example table 3.2 of the CLP classifies Mevinphos as:

Classn T+: R27/28 N: R50, 53

However it also provides specific concentration thresholds for this classification.

'Concentration Limits'

N; R50-53: C >= 0.0025%
N; R51-53: 0.00025% =< C <0.0025%
R52-53: 0.000025% =< C <0.00025%

From this it can be seen that a material containing Mevinphos would be assigned Ecotoxic risk phrases when the concentration of Chemical was at or above 0.000025% or greater.

So, 0.000025% is the substance specific threshold for Mevinphos.

Where the concentration of Mevinphos is at or above 0.000025% the waste will possess the hazardous property H14 Ecotoxic.

C14.5.5: Step 5: Remove dangerous substances below the trace impurity thresholds concentrations from further consideration.

Where an individual dangerous substance is present at a very low concentration it can be excluded from further consideration. This simplifies the subsequent calculations.

The concentration criteria are based on compounds, and are not normally applicable to anion or cation concentrations (see 14.4.6). The concentration of worst case scenario compounds, must be determined for anions and cations before applying this step.

Individual Dangerous substances can be excluded from consideration in the steps 6 to 10 where the concentration of the individual dangerous substance is lower than that provided in the table below for the risk phrase(s) assigned to that substance.

Category of Danger of the Substance	Classification (Risk phrases)	Concentration to take into consideration (%w/w)
Dangerous for the environment N	R50-53, R51-53, R50	≥ 0.1
Dangerous for the environment	R52-53, R52 R53	≥ 1.0

(Note: substance specific thresholds are not considered in step 5 because they have already been considered in step 4)

C14.5.6: Step 6: Does the waste contain two or more substances that are classified as dangerous for the environment with aquatic risk phrases?

The additive equations are only used where two or more ecotoxic substances are present.

This step, and the following steps (7, 8, 9 and 10), consider wastes that contain two or more dangerous substances that are

- classified as dangerous for the environment, and
- Present in concentrations at or above the trace impurity thresholds (C14.4.5).

If, at this stage of the assessment, the waste does not contain two or more Ecotoxic substances (at or above trace impurity threshold levels) then the waste will not be hazardous, and the assessment ends here (steps 7 to 10 are not considered).

If the waste does contains two or more substances (at or above the trave impurity threshold levels) then proceed to step 7.

For the purposes of this step only those substances with risk phrases related to the aquatic environment are considered. (R50, R50-53, R51-53, R52, R52-53, R53).

Those substances classified as dangerous for the environment by R59 have been assessed in steps 3 and 4. The R59 risk phrase is therefore excluded from step 6 onwards.

C14.5.7: Step 7: Is the waste classified as Dangerous for the Environment as a result of Equation 1?

If the waste does not contain more than one dangerous substance classified as R50-53, R51-53 or R52-53 then go to step 8.

This equation considers whether the waste is dangerous for the environment due to the additive properties of two or more dangerous substances that cause the waste to be both *'harmful to aquatic organisms'* and to potentially cause *'long-term effects in the aquatic environment'.*

Equation 1: A waste is dangerous for the environment (H14 Ecotoxic) if:-

$$\Sigma \left(\frac{P_{N.\ R50\text{-}53}}{0.25} + \frac{P_{N.\ R51\text{-}53}}{2.5} + \frac{P_{N.\ R52\text{-}53}}{25} \right) \geq 1$$

Where:-

- Σ is the sum total of the (……)
- $P_{N.\ R50\text{-}53}$ is the total concentration of dangerous substances classified as R50-53
- $P_{N.\ R51\text{-}53}$ is the total concentration of dangerous substances classified as R51-53
- $P_{N.\ R52\text{-}53}$ is the total concentration of the dangerous substances classified as R52-53
- Concentrations are expressed as w/w percent.

If the result of Equation 1 indicates that the waste is Ecotoxic the assessment ends here, and steps 8 to 10 are not considered. Otherwise proceed to step 8.

C14.5.8: Step 8: Is the waste classified as Dangerous for the Environment as a result of Equation 2?

If the waste does not contain more than one dangerous substance classified as R50 or R50-53 then go to step 9.

This equation considers whether the waste is dangerous for the environment due to the additive properties of two or more dangerous substances that are '*Very toxic to aquatic organisms* '.

Equation 2 : A waste is dangerous for the environment (H14 Ecotoxic if:-

$$\Sigma \left(P_{N.\ R50} + P_{N.\ R50\text{-}53}\right) \geq 25\%$$

Where

- Σ is the sum total of the (……)
- $P_{N.\ R50}$ is the total concentration of dangerous substances classified as R50
- $P_{N.\ R50\text{-}53}$ is the total concentration of dangerous substances classified as R50-53
- Concentrations are expressed as w/w percent.

If the result of Equation 2 indicates that the waste is Ecotoxic the assessment ends here, and steps 9 and 10 are not considered. Otherwise proceed to step 9.

C14.5.9: Step 9: Is the waste classified as Dangerous for the Environment as a result of Equation 3?

If the waste does not contain more than one dangerous substance classified as R52 then go to step 10.

This equation considers whether the waste is dangerous for the environment due to the additive properties of two or more dangerous substances that are '*Harmful to aquatic organisms* '.

Equation 3: A waste is dangerous for the environment if:-

$$\Sigma \left(P_{N.\ R52}\right) \geq 25\%$$

Where

- Σ is the sum total of the (……)
- $P_{N.\ R50}$ is the total concentration of the dangerous substances classified as R52
- Concentrations are expressed as w/w percent.

If the result of Equation 3 indicates that the waste is Ecotoxic the assessment ends here, and step 10 is not considered. Otherwise proceed to step 10.

C14.5.10: Step 10: Is the waste classified as Dangerous for the Environment as a result of Equation 4?

Equation 4 considers whether the waste is dangerous for the environment due to the additive properties of two of more dangerous substances in the waste that *'may cause long-term effects in the aquatic environment'.*

Equation 4 A waste is dangerous for the environment if:-

$$\Sigma \left(P_{N.\ R53} + P_{N.\ R50\text{-}53} + P_{N.\ R51\text{-}53} + P_{N.\ R52\text{-}53} \right) \geq 25\%$$

Where

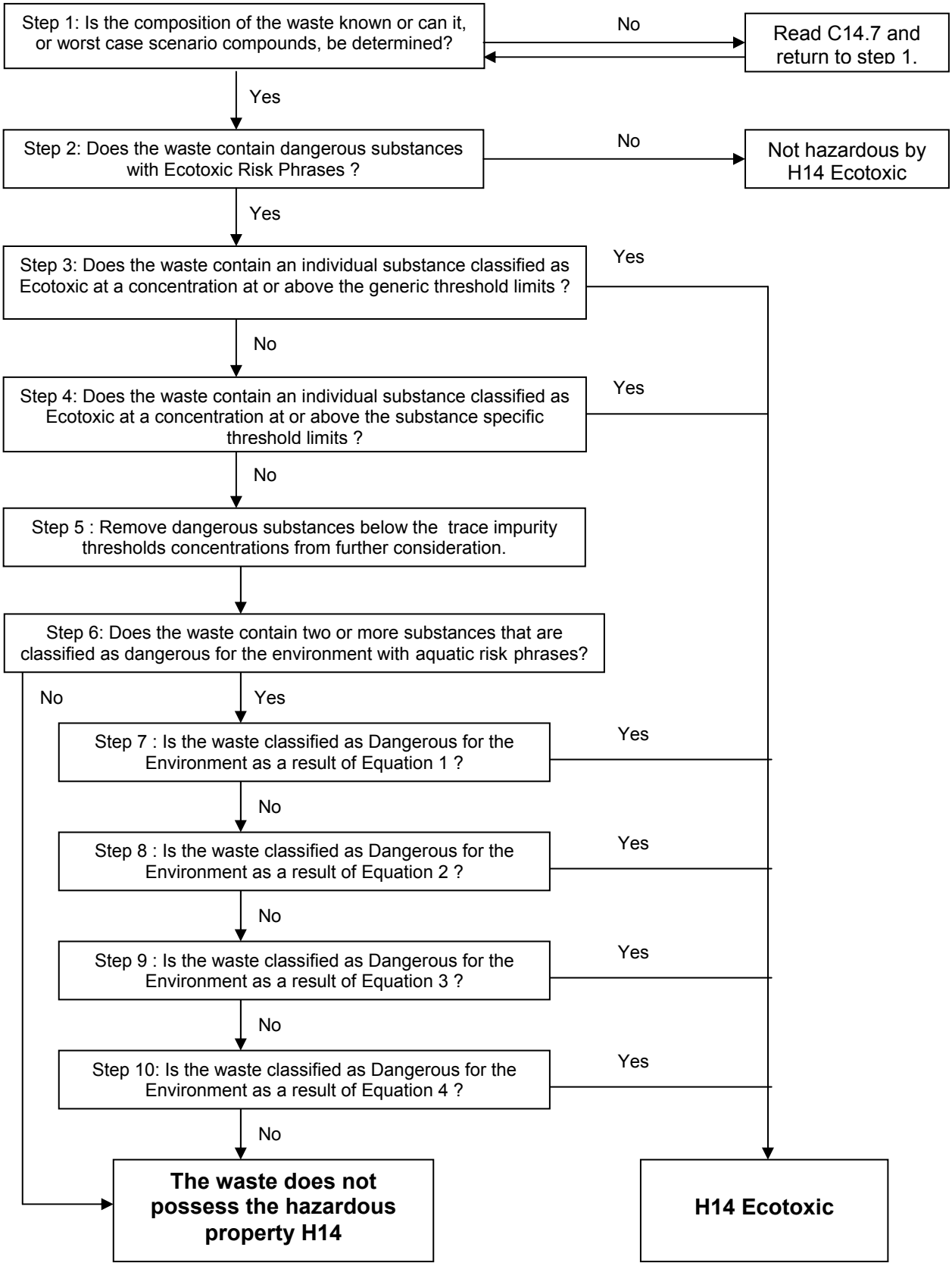
- Σ is the sum total of the (……)
- $P_{N.\ R53}$ is the total concentration of the dangerous substances classified as R53
- $P_{N.\ R50\text{-}53}$ is the total concentration of the dangerous substances classified as R50-53
- $P_{N.\ R51\text{-}53}$ is the total concentration of the dangerous substances classified as R51-53
- $P_{N.\ R52\text{-}53}$ is the total concentration of the dangerous substances classified as R52-53
- Concentrations are expressed as w/w percent.

If the result of Equation 4 indicates that the waste is Ecotoxic the assessment ends here.

If the result of Equation 4 indicates that the waste is not Ecotoxic the assessment ends here.

C14.6 Decision Tree - Ecotoxic

Figure C14.1 sets out the assessment process for Hazard H14 and should only be used in conjunction with the explanatory text in C14.5.



C14.7 Aquatic Toxicity Testing

The scope for using animal testing to assess a waste for the hazardous property H14 Ecotoxic is very limited. We would discourage its use. This is because;

1. testing for the evaluation of the ecotoxicity **must** be carried out on all three species (algae, daphnia, fish), in compliance with the criteria of Annex VI to Directive 67/548/EEC. A waste can only be determined to be non-hazardous by Ecotoxic if all three species have been tested. A positive (Ecotoxic) test result for a single species would however negate the need for testing on the other two

.

2. These test methods may have limitations when applied to partially soluble or insoluble wastes that could require fundamental alterations to test methodology. This will reduce the value of the results obtained.

3. Testing on fish is a 'regulated procedure' that uses a 'protected animal' and falls within the scope of the Animals (Scientific Procedures) Act 1986. Regulated procedures can only be authorised and performed if there are no scientifically suitable alternatives that
    - replace animal use,
    - reduce the number of animals needed, or
    - refine the procedures used to cause suffering.

    In addition the likely benefits (to humans, other animals or the environment) must be weighed against the likely welfare costs to the animal involved.

So, testing a waste to identify whether it possesses H14 can only be considered where it can be demonstrated that there is no other alternative to animal testing.

The calculation method, published in the guidance, for hazardous waste assessment of H14 provides a suitable alternative to such testing. We consider that the use of worst case scenario compounds is appropriate to support this. We would also indicate that further or more specialist chemical analysis, for example X-Ray Diffraction (XRD), may be used to determine speciation in support of the calculation method. The assessment criteria presented here also enable the direct use of metal cation concentrations (C14.4.6) in certain circumstances.

So, testing for H14 is not provided as part of the assessment methodology presented here.

In exceptional circumstances, where it can be clearly demonstrated that :

- current analytical techniques would be unable to determine the composition of a waste to a level sufficient to inform the use of worst case scenario compounds, or
- the risk phrases that are applicable to the components (including worst case scenario compounds) of the waste are not adequately known such that the above calculation approach cannot be used. (This would not apply where applying the calculation approach to those components where the risk phrases are known is sufficient to identify that the waste is Ecotoxic),

then further advice should be sought from the Agencies.

We would recommend in these circumstances that a precautionary approach of classifying the waste as hazardous should be considered as a possible alternative to conducting animal testing.

Where testing is considered appropriate, the test methods used must be EC Test methods C1, C2 and C3. Where a Water Accommodated Fraction is used, the results must be related to the measured equilibrium mass in solution (e.g. dissolved) to which the organisms are exposed during the test period. The 'loading rate' used to prepare the W.A.F. must not be used.

Appendix C:

C15 Assessment of Hazard H15: Can the Substance Produce Another Hazardous Substance after Disposal?

C15.1 **Definition**

Annex III of the rWFD defines H15 as:

"Waste capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above"

i.e. that could produce another substance which would exhibit one or more of the hazards H1 to H15.

C15.2 **Risk Phrases**

The hazard applies if the waste contains substances that degrade to form; (or react with) other wastes or substances to produce; (or produce on combustion) other substances with any of the properties H1 to H14, at or above the appropriate threshold concentrations.

H15 may arise from reaction with a substance which is already allocated a risk phrase, or a substance may be produced which may be allocated a risk phrase. Most risk phrases are assigned to hazards already, so the likelihood of a hazard H15 arising by this route is small. However, there are a number of unassigned or associated risk phrases which may cause hazard H15 to arise.
The most likely are:

R1 *Explosive when dry*

R4 *Forms very sensitive explosive metal compounds*

R5 *Heating may cause explosion*

R6 *Explosive with or without contact with air*

R16 *Explosive when mixed with oxidising material*

R18 *In use may form flammable/explosive vapour-air mixture*

R19 *May form explosive peroxides*

R44 *Risk of explosion if heated under confinement*

C15.3 Typical Substances

Some examples of wastes and treatment routes which could give rise to H15 are:

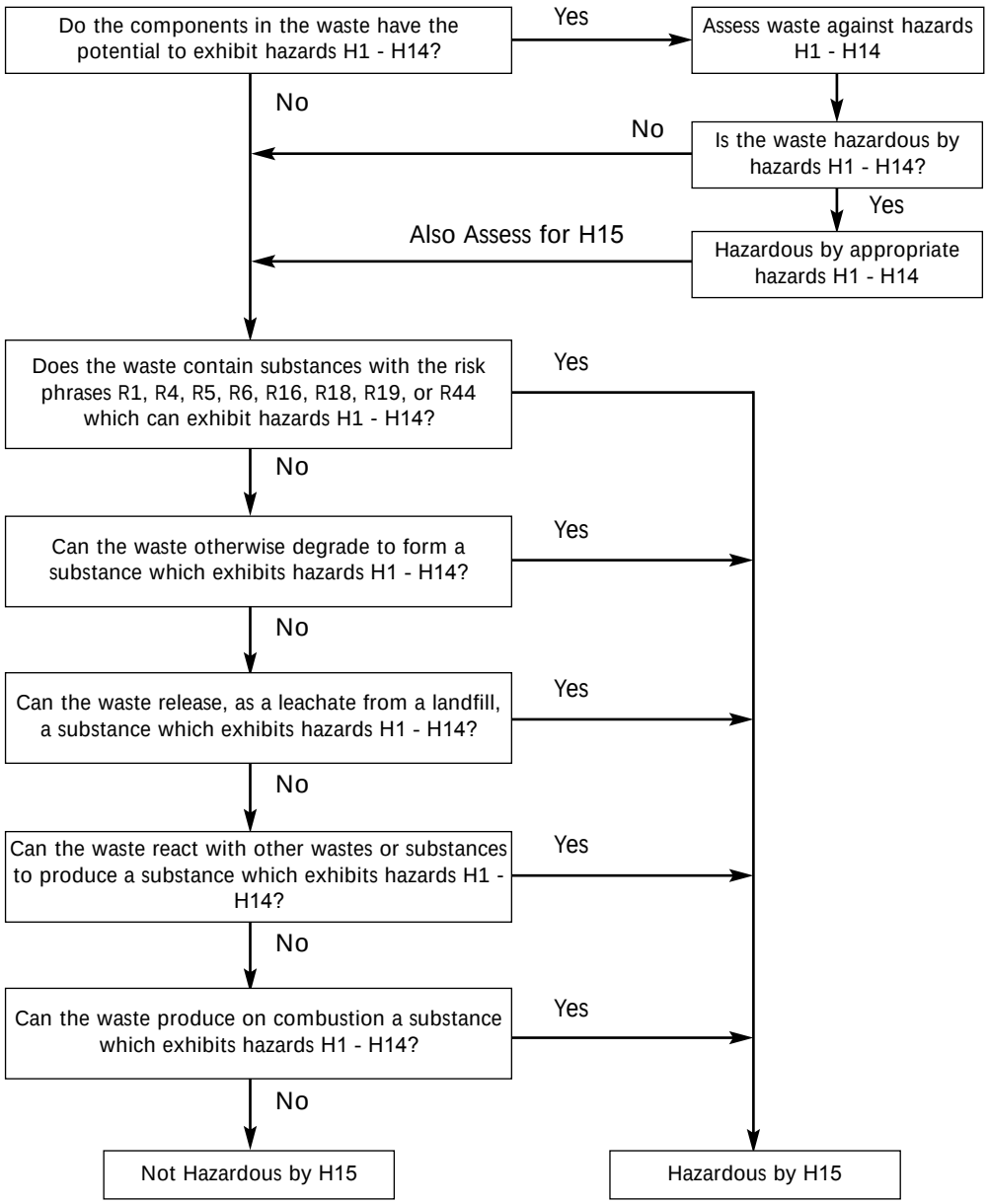
- Storage. This may apply to substances with the risk phrases listed above. However, most explosive substances and preparations are not directive or controlled waste, and the assessment process should take into account whether the term "explosive" is used in the strict sense (the definition of the 1875 Act) or more loosely (e.g. R19, where peroxides are oxidising substances and the term explosive relates to the extreme rate of reaction).

- Incineration. This may apply, for example, to organic wastes containing chlorine that in uncontrolled combustion liberate hazardous amounts of dioxins (very toxic, hazard H6) or hydrochloric acid (corrosive, hazard H8).
- Accidental mixing of incompatible materials during chemical treatment. This may apply, for example, to aluminium wastes treated with alkali metal hydroxide solutions, when hydrogen gas is produced (flammable, hazard H3).
- Landfill, anaerobic digestion or composting. The chemical composition of leachates/digestates produced by these disposal routes is normally below threshold levels for other hazards.

C15.4 Decision Tree

Figure C15.1 sets out the assessment process for the Hazard H15.

Figure C15.1: Decision Tree for the Assessment of Hazard H15



C15.5 Test Methods and Limiting Concentrations

The test methods and limiting concentrations for hazards H1–H14 are set out in Appendices C1–C14.

For certain substances and preparations the limiting concentrations for hazard H15, may be calculated from the expected reaction and the likely concentration or production rate of new substance that will be produced. This can then be assessed against the available limits for hazards H1 to H14.

In the case of waste combustion, the likely products may be evaluated and concentrations estimated. The combustion product of the waste can be assessed for hazards H1 to H14.

Appendix D:

Data Sources

Appendix D:

D1 Data Sources

This appendix provides guidance on where users of the Technical Guidance may find data not contained in Table 3.2 of CLP.
The appendix:

- identifies the types of alternative reputable data sources available;
- documents the scope of the information available from these sources;
- provides a brief outline of the origin and content of a number of these sources.

D1.1 Using Further Data Sources

The Hazardous Waste Assessment Framework requires identification of hazardous properties/ risk phrases and threshold concentrations for any waste, that is a "*mirror entry*" on the EWC, in order to determine if the waste is hazardous. Table 3.2 of the CLP is the primary source for classification of dangerous substances: where a substance within the waste is identified in table 3.2 , the classification given must be used. Although table 3.2 will supply classifications for some hazardous materials, there will be occasions when wastes cannot be classified by this data source.

Further data sources will need to be accessed for the assessment of "*mirror entry*" wastes when table 3.2 data are not available.

Given a mixture of substances some can be found in table 3.2 but not for others. The waste holder should first identify the classification of the listed substances. It is a requirement under Duty of Care[2] to identify all hazards pertinent to the waste, even if the waste is an absolute hazardous entry on the EWC. The waste holder must try to classify the substances which are not listed in table 3.2 of the CLP. Further data sources will need to be examined.

Some general points:

- Not all the potential sources are listed here. Many sources could be consulted for the necessary information.
- The data sources included here are not ranked in order of importance. The appropriateness of the data source will vary depending on the substance of concern.
- Many of the sources (particularly the Internet sources) refer back to primary databases for their information. The primary database (i.e. the sourced reference(s) for the data) is the preferred source of information from a data quality perspective, and where possible should be accessed.
- Data quality is important. The information used is from a peer-reviewed authoritative source. The source of any information should be recorded as part of a data audit trail.
- Check that the most recent data are being used.

2 Section 34, Environmental Protection Act 1990

- Particular care should be exercised when using information from the world wide web. The home page and specific site URL (uniform resource locator, i.e. Internet address) should be referenced in addition to the date the information was accessed. For example, if using the USEPA IRIS (Integrated Risk Information System) database the home page URL is http://www.epa.gov and the site specific URL is http://www.epa.gov/iris. Be aware that URLs may change.
- A number of the data sources referred to in this guidance contain information in different formats or with different slants, for different users' perspectives and needs. Some data sources include information on risk phrases and physical hazards, e.g. ICSC (International Chemical Safety Cards), whereas others are simply toxicological databases, e.g. IRIS.
- Some data sources may be available in both electronic and published hard copy formats. In terms of legal standing, the hard copy format will usually take precedence (particularly if there are found to be differences between the data from the same data provider in different formats). However, online or CD-ROM-based databases often provide the quickest way of securing a lot of information.

In order to agree an assessment with the regulator, the data should therefore be:

- referenced to a reputable source;
- of known data quality; and
- of good data quality.

D1.2 Technical Data Sources

D1.2.1 Types of data sources

The types of data source which may be used to supplement table 3.2 of the CLP are listed in Table D1.1 below.

Table D1.1: Types of Data Sources

Type	Cost	Advantages	Disadvantages
Books/hard copy	Fixed	Reliability Easy to reference	Not usually updateable unless replaced
Safety Data Sheets (SDSs)	Usually free	Reliability Easy to reference May be updated UK sourced SDSs should be used where practicable as the classifications should be in accordance with CHIP.	US sourced SDSs may not be consistent with CHIP. Therefore US sourced SDSs should be used to obtain chemical/physical properties and toxicological information to assess against the criteria in the Approved Guide. Risk phrase information should not be taken from US SDSs.
CD-ROM (may also include $3^1/_2$" disks) and downloadable databases	Usually requires a subscription fee	Reliability - usually updated on a regular basis as part of the subscription fee May contain information from a number of databases	Cost
Internet sources	Some are free to access online. Others require registration and payment for online access	Easily accessible Generally updated regularly	Not all are reliable, as data sources are not always available May be difficult to check on the reliability

D1.2.2 Hard copy sources

These are the original reference texts. Table D1.2 gives titles and bibliographic details of some of the most useful sources of data and information that may be of help to waste assessors in their classification of wastes. These texts are likely to be found in the libraries of larger companies, and in the reference section of public and university libraries, learned societies, trade associations, or in the British Library.

Environmental Health Criteria Documents (EHCs) and Health and Safety Guides prepared under the International Programme on Chemical Safety provide detailed information on a number of chemicals.

Safety Data Sheets (SDSs) on substances and preparations are available from the manufacturers and/or suppliers. Schedule 4 of the CHIP Regulations provides a list of 16 obligatory headings under which information is to be provided in SDSs for chemical substances supplied within Europe.[3] CHIP obliges any person who supplies a dangerous chemical for use at work to also provide a SDS. These include hazard identification, risk phrases, handling and toxicological information, ecological information and disposal considerations. An example of a UK SDS supplied by a manufacturer is provided in Figure D2.1. US sourced Material Safety Data Sheets (MSDS) may not be consistent with CHIP. Therefore US sourced SDSs should be used to obtain chemical/physical properties and toxicological information to assess against the criteria in the Approved Guide. Risk phrase information should not be taken from US SDSs. Table D1.3 provides an example of a US MSDS for perchloroethylene downloaded from the Internet. Figure D1.2 provides an example (calcium hydroxide) of how a web-based SDS may appear; however, the source of web-based SDSs needs to be considered.

The main drawback to hard copy sources is that they can get out of date, particularly their toxicological information.

[3] US SDSs normally are in a different format with fewer headings

Table D1.2: | Some hard copy sources of data

Title	Publisher and ISBN No
Agrochemicals Handbook and updates	Royal Society of Chemistry (Cambridge) ISBN 0 85186 416 3
BDH-Hazard Data Sheets (1990) + Addendum	Merck Ltd, Broome Road, Poole, BH12 4NN, BDH Product No. 57053 1 S and 5703 2T
Chemical Safety Data Sheets	Royal Society of Chemistry (Cambridge)
Vol. 1. Solvents (1989)	ISBN 0 85186 903 3
Vol. 2. Main Group of Metals and Compounds (1990).	ISBN 0 85186 913 0
Vol. 3. Corrosives and Irritants.	ISBN 0 85186 923 8
Vol. 4A. Toxic Chemicals (A-L) (1991).	ISBN 0 85186 311 6
Vol. 4B. Toxic Chemicals (M-Z) (1992).	ISBN 0 85186 321 3
Vol. 5. Flammable Chemicals (1992).	ISBN 0 85186 411 2
Compendium of Safety Data Sheets for Research and Industrial Chemicals (Vols. I-III).	L H Keith and D B Walters. ISBN 0 89573 313 7
Dictionary of Substances and their Effects (DOSE)	Royal Society of Chemistry, Information Services, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 4WF
Environmental Hazard Assessment: A review of the distribution, fate and effects of particular chemicals on the environment	Building Research Establishment (BRE), BRE Bookshop, Garston, Watford
Fire Protection Guide to Hazardous Chemical Substances (1991)	US National Fire Protection Association. ISBN 0 87765 366 6
Handbook of Chemistry and Physics (1993/4)	D R Lide (Ed.). ISBN 0 8493 0474 1
Handbook of Reactive Chemical Hazards	L Bretherick, Butterworths (London). ISBN 0 408 013887 5
International Programme on Chemical Safety (IPCS).	World Health Organisation (WHO)
Merck Index - An Encyclopaedia of Chemicals, Drugs and Biologicals.	Merck & Co., Inc., Rahway, NJ, USA
Register of Toxic Effects of Chemical Substances (RTECS).	NIOSH, Microinfo Ltd., PO Box 3, Omega Park, Hants GU34 2PG
Sax's Dangerous Properties of Industrial Materials (1992) 3 volumes.	R J Lewis Snr. (Ed.), Van Nostrand Reinhold (London). ISBN 0 442 01132 6

Figure D1.1: Example of a UK manufacturer supplied SDS

SAFETY DATA SHEET

Print Date 24.10.2000 Version 2 Revision Date 18.07.2000

1 Identification of substance:

· **Product details:**

· **Trade name:** MICROETCH SF

· **Product Code:** 9639

· **Manufacturer/Supplier:**

MANUFACTURER/SUPPLIER'S ADDRESS & CONTACT DETAILS

· **Information department:**
Quality, Health, Safety and Environment Department
· **Emergency information:**
Out of hours transport emergency 01865 407333
CEAS NCEC CULHAM

Atotech Hazard Code:R2

2 Composition/Data on components:

· **Chemical characterization**
· **Description:**

Mixture of the substances listed below with non-hazardous additions.
Dangerous components:

7775-27-1 sodium persulphate < 90 %
Xn, O; R 8-22-36-37-38-42-43

7681-38-1 sodium bisulphate < 30 %
Xi; R 41

* **3 Hazards identification**

· **Hazard description:**

Xn Harmful
O Oxidizing

· **Information pertaining to particular dangers for man and environment**
R 8 Contact with combustible material may cause fire.
R 22 Harmful if swallowed.
R 37/38 Irritating to respiratory system and skin.
R 41 Risk of serious damage to eyes.
R 42/43 May cause sensitization by inhalation and skin contact.
· **Classification system**
The classification was made according to the latest editions of the Chemicals (Hazard Information and Packaging for Supply) Regulations and expanded upon from company and literature data.

* **4 First aid measures**

· **General information**
Immediately remove any clothing soiled by the product.
· **After inhalation**
Supply fresh air and to be sure call for a doctor.
In case of unconsciousness place patient in the recovery position and obtain immediate medical attention.

(Contd. on page 2)

(Contd. of page 1)

· **After skin contact**
Immediately wash with water and soap and rinse thoroughly.
If skin irritation continues, consult a doctor.
· **After eye contact**
Irrigate opened eye for 10 minutes minimum (timed) under running water.
Obtain immediate medical attention.
· **After swallowing**
Rinse out mouth and then drink plenty of water.
Call for a doctor immediately.

5 Fire fighting measures

· **Suitable extinguishing agents**
CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **Special hazards caused by the material, its products of combustion or resulting gases:**
Formation of toxic gases is possible during heating or in case of fire.
· **Protective equipment:**
Firefighters should wear self contained breathing apparatus and full personal protective clothing.

*

6 Accidental release measures

· **Person-related safety precautions:**
Wear protective equipment. Keep unprotected persons away.
· **Measures for environmental protection:**
Do not allow to enter sewers/ surface or ground water.
· **Measures for cleaning/collecting:**
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

*

7 Handling and storage

· **Handling**
· **Information for safe handling:**
Ensure good local exhaust ventilation at the workplace.
Open and handle receptacle with care.
Always wear the recommended PPE.
Prevent formation of dust.
Thorough dedusting.
· **Information about protection against explosions and fires:**
No special measures required.

· **Storage**
· **Requirements to be met by storerooms and receptacles:**
Store only in original receptacles.
· **Information about storage in one common storage facility:**
Do not store with alkalis (caustic solutions).
Store away from foodstuffs.
Do not store with combustible / organic materials.
· **Further information about storage conditions:**
Keep container tightly sealed.
· **Storage class**
· **Class according to regulation on flammable liquids:** Void

*

8 Exposure controls and personal protection

· **Additional information about design of technical systems:**
No further data; see item 7.

Components with limit values that require monitoring at the workplace:

(Contd. on page 3)

(Contd. of page 2)

7775-27-1 sodium persulphate
OEL: 1 (as S2O8) mg/m³

7681-38-1 sodium bisulphate
OES - DUST: 8hr:10 mg/m3, total inhalable; 4 mg/m3, respirable

· **Additional information:**
The information is based on data valid at the time of compilation.

· **Personal protective equipment**
· **General protective and hygienic measures**
Keep away from foodstuffs, beverages and animal feedstuff.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
Use suitable respiratory protective device in case of insufficient ventilation.
· **Protection of hands:** Protective gloves.
· **Eye protection:** Safety glasses or goggles to BS 2092C
· **Body protection:** Protective work clothing.

* **9 Physical and chemical properties:**

· **Form:** Powder
· **Colour:** White
· **Odour:** Characteristic

	Value/Range	Unit	Method
· **Change in condition**			
· **Melting point/Melting range:**	undetermined		
· **Boiling point/Boiling range:**	undetermined		
· **Flash point:**	Not applicable		
· **Flammability (solid, gaseous)** Contact with combustible material may cause fire.			
· **Self igniting:**	Product is not self-igniting.		
· **Danger of explosion:** Product does not present an explosion hazard.			
· **Density:**	Not determined		
· **Solubility in / Miscibility with** · **Water:**	Soluble		

* **10 Stability and reactivity**

· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **Dangerous reactions**
Reacts with alkali (lyes)
Acts as an oxidizing agent on organic materials such as wood, paper and fats.
· **Dangerous products of decomposition:**
No dangerous decomposition products known

Trade name: MICROETCH SF

* **11 Toxicological information**

· **Acute toxicity:**
LD/LC50 values that are relevant for classification:
7775-27-1 sodium persulphate
Oral: LD50: 920 mg/kg (RAT)
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:**
Sensitization possible through inhalation.
Sensitisation possible through skin contact.
· **Additional toxicological information:**
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version:
Harmful
Irritant

* **12 Ecological information:**

· **General notes:**
Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water.
Do not allow undiluted product or diluted product to reach ground water, water course or sewage system.

13 Disposal considerations

· **Product:**
· **Recommendation**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.
Flush spillage to effluent treatment plant with copious amounts of water.

· **Uncleaned packagings:**
· **Recommendation:**
Disposal must be made according to official regulations.
· **Recommended cleansing agent:** Water, if necessary with cleansing agents.

* **14 Transport information**

· **Land transport ADR/RID (cross-border)**
· **ADR/RID class:** 5.1
· **Item:** 31c
· **Danger code (Kemler):** 58
· **UN-Number:** 3085
· **Label** 5.1+8
· **Description of goods:** Oxidizing solid, corrosive, n.o.s. (sodium persulphate, sodium bisulphate)

· **Maritime transport IMDG:**
· **IMDG Class:** 5.1
· **Page:** 5164
· **UN Number:** 3085
· **Packaging group:** III
· **EMS Number:** 5.1-05
· **MFAG:** 760
· **Marine pollutant:** No
· **Proper shipping name:** Oxidizing solid, corrosive, n.o.s. (sodium

(Contd. on page 5)

(Contd. of page 4)

persulphate, sodium bisulphate)

· **Air transport ICAO-TI and IATA-DGR:**
· **ICAO/IATA Class:** 5.1
· **UN/ID Number:** 3085
· **Packaging group:** III
· **Proper shipping name:** Oxidizing solid, corrosive, n.o.s. (sodium persulphate, sodium bisulphate)

* **15 Regulations**

· **Markings according to EU guidelines:**
The product has been classified and marked in accordance with EU Directives / Ordinance on Hazardous Materials

· **Code letter and hazard designation of product:**

Xn Harmful
O Oxidizing

· **Hazard-determining components of labelling:** sodium persulphate

· **Risk phrases:**
8 Contact with combustible material may cause fire.
22 Harmful if swallowed.
37/38 Irritating to respiratory system and skin.
41 Risk of serious damage to eyes.
42/43 May cause sensitization by inhalation and skin contact.

· **Safety phrases:**
17 Keep away from combustible material.
22 Do not breathe dust.
24 Avoid contact with skin.
26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
37/39 Wear suitable gloves and eye/face protection.

· **National regulations**

· **Water hazard class:**
Water hazard class 1 (Self-assessment): slightly hazardous for water.

16 Other information:

IMPORTANT NOTE TO BE READ BY ALL CONCERNED
The data given here is based on current knowledge and experience. The purpose of this MSDS is to describe the product in terms of its safety requirements. The data does not signify any warranty with regard to the product's properties. The product is used singly or as one of a number of products used in combination in industrial surface treatment processes. For assessment of the PROCESS hazards, evaluation of all of the product MSDS'S required for the process will be necessary.
Product use is described in the relevant Process Technical Data Sheet.
Sections of this MSDS which have been modified since the last Version are indicated by an asterisk (*).

· **Department issuing MSDS:**
Quality, Health, Safety and Environment Department

(Contd. on page 6)

Table D1.3: An example MSDS for perchloroethylene (Direct Reproduction of US MSDS)

1. Product Identification	**Synonyms:** ethylene tetrachloride; tetrachloroethene; perchloroethylene; carbon bichloride; carbon dichloride **CAS No.: 127-18-4** **Molecular Weight: 165.83** **Chemical Formula: Cl2C:CCl2** **Product Codes:** J.T. Baker: 9218, 9360, 9453, 9465, 9469 Mallinckrodt: 1933, 8058
2. Hazard Identification	Emergency Overview
	WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure. **J.T. Baker SAF-T-DATA$^{(tm)}$** Ratings (Provided here for your convenience)
	Health Rating: 3 - Severe (Cancer Causing) Flammability Rating: 0 - None Reactivity Rating: 1 - Slight Contact Rating: 2 - Moderate Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES Storage Colour Code: Blue (Health)
	Potential Health Effects **Inhalation:** Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes. **Ingestion:** Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhoea, headache, and dizziness. **Skin Contact:** Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects. **Eye Contact:** Causes irritation, redness, and pain. **Chronic Exposure:** May cause liver, kidney or central nervous system damage after repeated or prolonged exposures. Suspected cancer risk from animal studies. **Aggravation of Pre-existing Conditions:** Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

3. Ecological Information	**Environmental Fate:** When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. **Environmental Toxicity:** The LC_{50}/96-hour values for fish are between 1 and 10 mg/l. The LC_{50}/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be toxic to aquatic life.
4. Toxicological Information	Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 34.2 g/m3/8H; investigated as a tumorigen, mutagen, reproductive effector. \Cancer Lists\ NTP Carcinogen Ingredient — Known — Anticipated — IARC Category Tetrachloroethylene (127-18-4) — No — Yes — 2A
5. Disposal Information	Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.
6. Handling and Storage	Store in a cool, dry, ventilated area away from sources of heat or ignition. Isolate from flammable materials. Protect from direct sunlight. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapours, liquid); observe all warnings and precautions listed for the product.
7. Exposure	**Airborne Exposure Limits:** -OSHA Permissible Exposure Limit (PEL): 100 ppm (TWA), 200 ppm (ceiling), 300 ppm/5min/3-hour (max) -ACGIH Threshold Limit Value (TLV): 25 ppm (TWA), 100 ppm (STEL); listed as A3, animal carcinogen

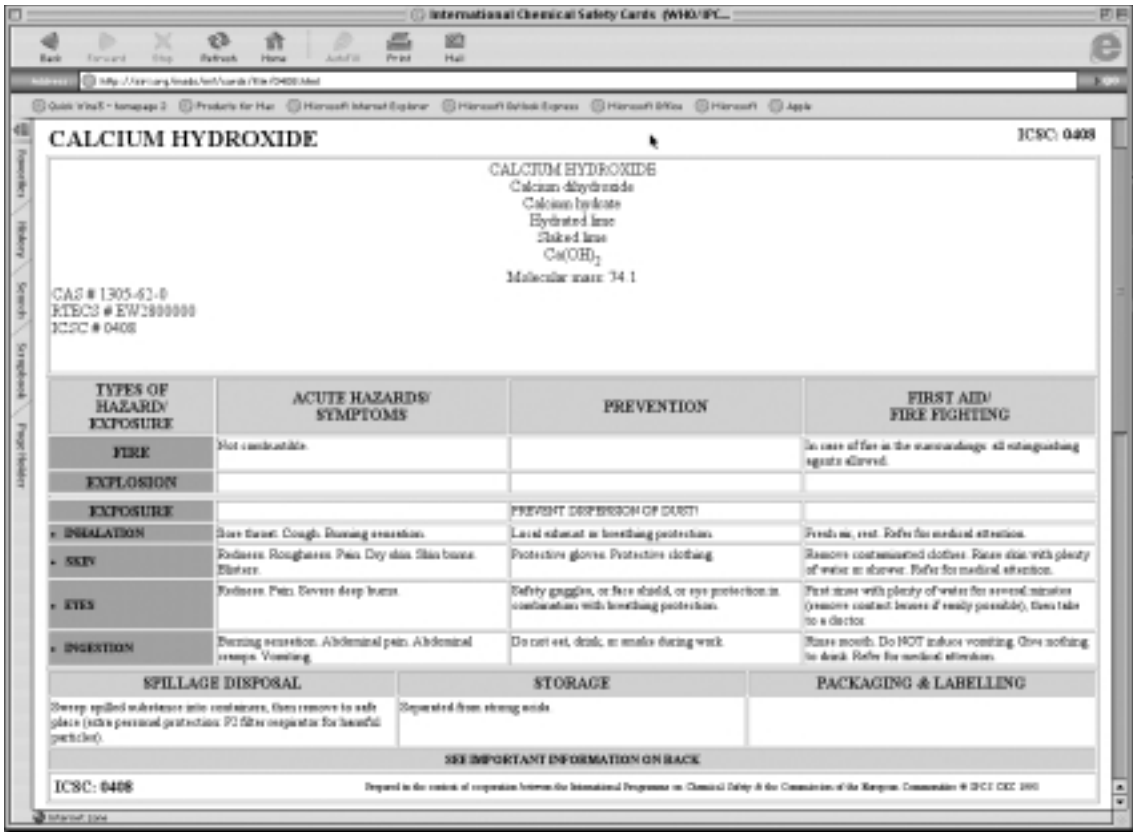
8. Personal Safety	**Ventilation System:** A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details. **Personal Respirators (NIOSH Approved):** If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. **Skin Protection:** Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. **Eye Protection:** Use chemical safety goggles and/or full-face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.
9. Chemical and Physical Properties	**Appearance:** Clear, colourless liquid. **Odour:** Ethereal odour. **Solubility:** 0.015 g in 100 g of water. **Specific Gravity:** 1.62 @ 20C/4C **pH:** No information found. **% Volatilise by volume @ 21C (70F):** 100 **Boiling Point:** 121C (250F) **Melting Point:** -19C (-2F) **Vapour Density (Air=1):** 5.7 **Vapour Pressure (mm Hg):** 18 @ 25C (77F) **Evaporation Rate (BuAc=1):** 0.33 (trichloroethylene = 1)
10. Stability and Reactivity	**Stability:** Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates. **Hazardous Decomposition Products:** Carbon dioxide and carbon monoxide may form when heated to decomposition. Hydrogen chloride gas and phosgene gas may be formed upon heating. Decomposes with moisture to yield trichloroacetic acid and hydrochloric acid. **Hazardous Polymerisation:** Will not occur. **Incompatibilities:** Strong acids, strong oxidisers, strong alkalis, especially NaOH, KOH; finely divided metals, especially zinc, barium, lithium. Slowly corrodes aluminium, iron and zinc.

	Conditions to Avoid: Moisture, light, heat and incompatibles.
11. Transport Information	**Domestic (Land, D.O.T.)** Proper Shipping Name: TETRACHLOROETHYLENE **Hazard Class:** 6.1 **UN/NA:** UN1897 Packing Group: III **Information reported for product/size:** 20L **International (Water, I.M.O.)** **Proper Shipping Name:** TETRACHLOROETHYLENE **Hazard Class:** 6.1 **UN/NA:** UN1897 Packing Group: III **Information reported for product/size:** 20L **International (Air, I.C.A.O.)** **Proper Shipping Name:** TETRACHLOROETHYLENE **Hazard Class:** 6.1 **UN/NA:** UN1897 Packing Group: III **Information reported for product/size:** 20L
12. Regulatory Information	Chemical Inventory Status - Part 1 Ingredient TSCA EC Japan Australia Tetrachloroethylene (127-18-4) Yes Yes Yes Yes Chemical Inventory Status - Part 2 Canada Ingredient Korea DSL NDSL Phil. Tetrachloroethylene (127-18-4) Yes Yes No Yes Federal, State & International Regulations - Part 1 -SARA 302- -SARA 313- Ingredient RQ TPQ List Chemical Catg. Tetrachloroethylene (127-18-4) No No Yes No Federal, State & International Regulations - Part 2 -RCRA- -TSCA- Ingredient CERCLA 261.33 8(d) Tetrachloroethylene (127-18-4) 100 U210 No Chemical Weapons Convention: No TSCA 12(b): No CDTA: No SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No Reactivity: No (Pure / Liquid) **WARNING:** THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER. **Australian Hazchem Code:** 2[Z] **Poison Schedule:** No information found. **WHMIS:** This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

13. Fire Fighting Measures	**Fire:** Not considered to be a fire hazard but becomes hazardous in a fire situation because of vapour generation and possible degradation to phosgene (highly toxic) and hydrogen chloride (corrosive). Vapours are heavier than air and collect in low-lying areas. **Explosion:** Not considered to be an explosion hazard. Containers may explode when involved in a fire. **Fire Extinguishing Media:** Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire-exposed containers cool. **Special Information:** In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

Source: http://www.jtbaker.com/msds/t0767.htm

Figure D1.2. Web screenshot examples of an SDS for calcium hydroxide



CALCIUM HYDROXIDE

ICSC: 0408

CALCIUM HYDROXIDE
Calcium dihydroxide
Calcium hydrate
Hydrated lime
Slaked lime
$Ca(OH)_2$
Molecular mass: 74.1

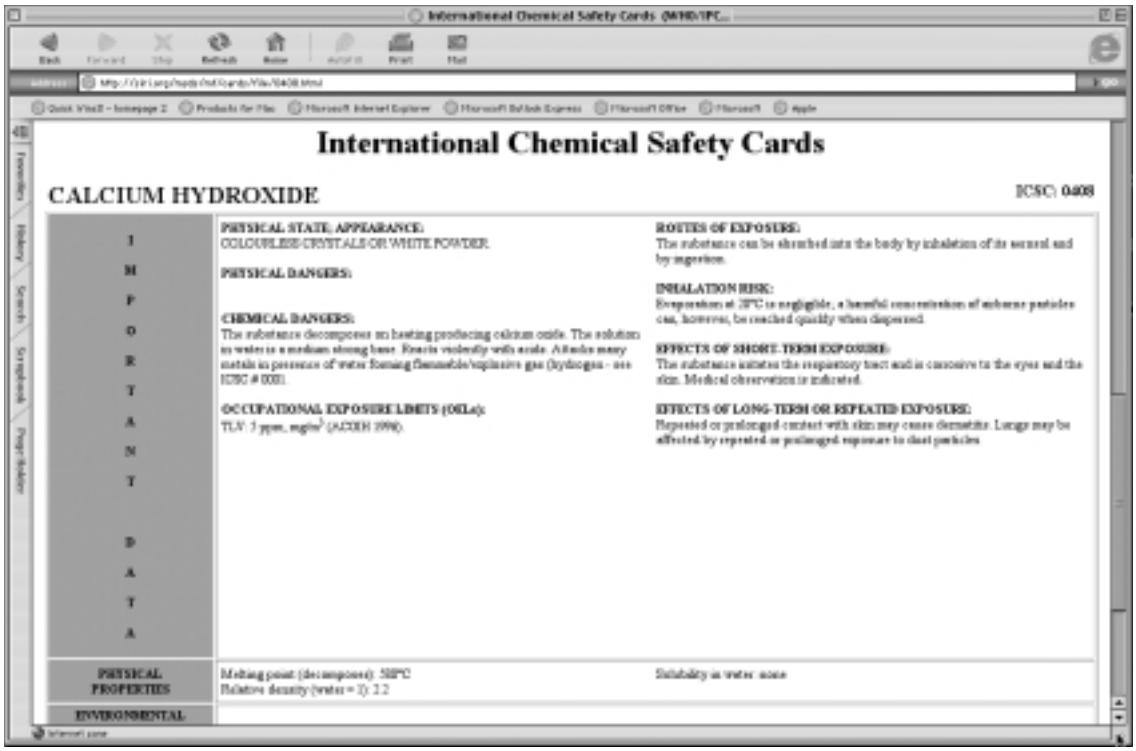
CAS # 1305-62-0
RTECS # EW2800000
ICSC # 0408

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
• INHALATION	Sore throat. Cough. Burning sensation.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• SKIN	Redness. Roughness. Pain. Dry skin. Skin burns. Blisters.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
• EYES	Redness. Pain. Severe deep burns.	Safety goggles, or face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Burning sensation. Abdominal pain. Abdominal cramps. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give nothing to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; then remove to safe place (with personal protection: P1 filter respirator for harmful particles).	Separated from strong acids.	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0408



International Chemical Safety Cards

CALCIUM HYDROXIDE

ICSC: 0408

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** COLOURLESS CRYSTALS OR WHITE POWDER. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** The substance decomposes on heating producing calcium oxide. The solution in water is a medium strong base. Reacts violently with acids. Attacks many metals in presence of water forming flammable/explosive gas (hydrogen - see ICSC # 0001). **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV: 5 ppm, mg/m³ (ACGIH 1998). **ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible, a harmful concentration of airborne particles can, however, be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance irritates the respiratory tract and is corrosive to the eyes and the skin. Medical observation is indicated. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** Repeated or prolonged contact with skin may cause dermatitis. Lungs may be affected by repeated or prolonged exposure to dust particles.
PHYSICAL PROPERTIES	Melting point (decomposes): 580°C Relative density (water = 1): 2.2 Solubility in water: none.
ENVIRONMENTAL	

Source: http://siri.org/msds/mf/cards/file/0408.html

D1.2.3 Databases

Table D1.4 shows a matrix of common databases and database providers which are available over the Internet or by CD-ROM. Table D1.5 expands on Table D1.4 with details of:

- who provides the database;
- whether it is free or by subscription;
- the web address;
- the type of information which the database provides;
- how easy it is to find relevant information; and
- the reliability of the data.

CD-ROM databases

The main advantage of CD-ROMs is that many original databases can be found on one or two CDs, and the information is regularly updated. The main disadvantage is their ongoing subscription cost. Table D1.5 shows some sources of CD-ROM-based information.

Internet database sources

Internet sources are becoming more widely used due mainly to the ease of accessibility and the comprehensive range of information available. The main disadvantages are that data quality needs consideration every time and a number of sites may need to be visited. Table D1.5 shows a number of Internet sources. It should be noted that Internet sources of information may change without warning. Some database hosts may change the URLs or, worse, may no longer support the database. New or additional sites may support these databases also. The listing in Table D1.5 cannot therefore be guaranteed to be complete or accurate. If a particular database or URL cannot be located, a search for the specific database using an Internet search engine may relocate the new host/URL.

Table D1.4: Matrix of Common Databases and Free (F) or Subscription (S) Data Providers

Databases	Database Providers																		
	ATSDR	Cambridgesoft	US Coastguard	ERG 2000	Knovel	International Labour Organisation	WHO	European Chemicals Bureau	Merck	National Chemical Emergency Centre	NISC (CIS)	NIOSH	Van Nostran Reinhold	Silver Platter (Chembank)	Safety Information Resources and Material Safety	Chemical Abstracts Service	USEPA	US National Library of Medicine
ATSDR	F																	
CSELite										F								
CSE										S								
CHEMFINDER	F	F																
CHEMID *plus*																		F
CHRIS2000			F								S			S				
DOSE					S													
EINECS								F						S				
ERG2000				F										S				
HSDB											S			S				F
ICSC						F												
IPCS INCHEM							F											
IRIS											S			S			F	F
IUCLID								S										
Merck Index		S							S									
OHMTADS														S			F	
RTECS											S	S		S				
SIRI MSDS	F														F			
Sax's			S										S					
STN																S		
TOXNET																		F
TSCA														S			F	

Table D1.5: Some available databases and their relevance

Database	Data Provider	Subscription / Free	Web / CD-ROM	Notes
ATSDR	Agency for Toxic Substances and Disease Registry	Free web access Free CD-ROM	www.atsdr.cdc.gov http://www.atsdr.cdc.gov/hazdat.html and CD-ROM	ATSDR's HazDat database provides access to ATSDR toxicology profiles, and ToxFaq sheets. HazDat also contains data from the USEPA's CERCLIS database. ATSDR contains 250 published toxicological profiles. All profiles have been peer reviewed. Relevant subject areas: chemical and physical information; environmental fate; human health effects. ToxFAQs ™ are a two-page summary about hazardous substances developed by ATSDR. Links to more external safety and chemistry information such as Chemfinder, National Fire Protection Association (NFPA) and the Vermont SIRI Material Safety Data Sheet (MSDS) Archive.
CHEM-FINDER (pseudo database)	Cambridgesoft	Limited free web access to individuals Subscription access to institutions CD-ROM is not free	www.cambridgesoft.com CD-ROM (ChemFinderUltra 6.0) Includes additional features and databases	Contains index to >75,000 substances from over 350 sites. Chemfinder is a chemical database which searches the world wide web for references to the hazardous substances of concern. The searches will bring up a range of web pages which contain information on the substance in question. Relevant subject areas: health; miscellaneous; SDS; pesticides/herbicides; physical properties. A disadvantage of Chemfinder is that it can be time consuming searching the sources of information.
CSE and CSELite	National Chemical Emergency Centre (NCEC)	CSE Lite is a free but incomplete database CSE is a complete database but is not free	www.the-ncec.com/index.html www.the-ncec.com/cselite/	These databases are downloadable for use on individual computers. Relevant subject areas: Carriage Labels, Supply Labels, Exposure Limit Information. Contains chemical classification data and applicable risk phrases. There are two databases, CSE and CSE Lite. CSE Lite is free but is not a complete database, whereas CSE is a complete database but is not free.

Database	Data Provider	Subscription / Free	Web / CD-ROM	Notes
CHEM-BANK (pseudo database)	Silver Platter	Subscription based	www.silverplatter.com/index.html and CD-ROM	Silver Platter provide a collection of databases of reference material in electronic form. Chembank includes the following databases: CHRIS, EINECS, ERG, HSDB, IRIS, OHMTADS, RTECS and TSCA.
CHEMID *plus*	US National Library of Medicine	Free web access	http://chem.sis.nlm.nih.gov/chemidplus/	ChemIDplus is a free web-based search system that provides access to numerous chemical synonyms, structures, regulatory list information and links to other databases containing information about the chemicals.
Chemical Hazard Response Information System (CHRIS 2000)	US Coastguard	Free web access	http://www.chrismanual.com/Default.htm http://www.chrismanual.com/findform.htm	Contains 1,150 chemicals. Designed for use in spill situations. The database provides no indication of data quality. Relevant subject areas: physico-chemical properties; toxicity; threshold values for BOD and food chain, and concentration for aquatic toxicity and irritancy.
	CIS	Subscription-based web access	http://www.nisc.com/cis/cisfacts.html	
	Silver Platter	Subscription-based	www.silverplatter.com/index.html and CD-ROM	
Chemical Information System (CIS) (pseudo database)	NISC	Subscription-based web access	http://www.nisc.com/cis/cisfacts.htm	CIS covers >500,000 different chemicals from 30 different databases including AQUIRE, BIODEG, BIOLOG, BRS, CCRIS, CERCLIS, **CHRIS**, DATALOG, DOCKET, ENVIROFATE, FINDS, GENE-TOX, GIABS, **HSDB**, **IRIS**, ISHOW, MALLIN, MEDLINE Toxicology subset, NIOSHTIC®(subset, PHYTOTOX, RCRIS, **RTECS®**, SANSS, TERRETOX, TRI, TSCAINV, TSCAPP and TSCATS. Further databases (e.g. DERMAL, **OHMTADS**) will be added. Those of relevance are highlighted in **BOLD**

Database	Data Provider	Subscription / Free	Web / CD-ROM	Notes
Dictionary of Substances and their Effects (DOSE)	Royal Society of Chemistry via Knovel	Subscription-based web access	http://www.knovel.com/knovel2/	The database combines environmental impact and toxicological data on over 4,000 chemicals. Relevant subject areas: identifiers and basic chemistry; physical properties; mammalian and avian toxicity- carcinogenicity, mutagenicity, teratogenicity, irritancy, acute effects, genotoxicity; environmental fate - inhibition effects, degradation, absorption, removal, anaerobic fate; occupational exposure - risk and safety phrases, limit values, supply and conveyance, classification; ecotoxicity - fish, invertebrate, bioaccuamlation; legislation and references. It also contains the risk phrases and safety phrases assigned to each substance.
European Inventory of Chemicals on European Inventory of Existing Chemicals (EINECS)	European Chemicals Bureau (ECB)	Free web access, limited information	http://ecb.jrc.it/existing-chemicals/	EINECS-Plus includes: the European List of Notified Chemical Substances (ELINCS 5th edition), which contains over 100,000 records; the list of Dangerous Substances whose classification and labelling is prescribed by EC legislation; the European Customs Inventory of Chemical Substances; the European Cosmetics Inventory; the EINECS corrections list from the EC; and a summary of EC Legislation on Dangerous Substances.
	Silver Platter	Subscription-based web access	www.silverplatter.com/index.html and CD-ROM	
Emergency Response Guide 2000 (ERG 2000)	Developed jointly by Transport Canada, the Secretariat of Communications and Transportation of Mexico and the US Department of Transportation	Free web access	http://www.tc.gc.ca/canutec/erg_gmu/erg2000_menu.htm	ERG has been designed for use by emergency services personnel at incidents involving dangerous goods. It provides information on the following: potential hazards with regards to human health effects and fire and explosion issues; public safety such as protective clothing: emergency response measures.
	Silver Platter	Subscription based	www.silverplatter.com/index.html and CD-ROM	

Database	Data Provider	Subscription / Free	Web / CD-ROM	Notes
Hazardous Substances Data Bank (HSDB)	US National Library of Medicine	Free web access	http://www.nlm.nih.gov/	Contains over 4,500 chemicals. The information is referenced and peer reviewed. Relevant subject areas: substance identification; manufacturing information; environmental fate/exposure potential; chemical and physical properties; exposure standards and regulations; safety and handling; toxicity. A large amount of detailed information is available and covers all areas necessary for hazard classification.
	Silver Platter (part of Chembank suite)	Subscription based	www.silverplatter.com/index and CD-ROM	
	NISC (part of CIS) online access	Subscription based	http://www.nisc.com/cis/cisfacts.htm	
International Programme on Chemical Safety (IPCS INCHEM)	World Health Organisation (WHO)	Free web access	http://www.inchem.org/	Environmental Health Criteria (EHC) monographs are comprehensive data from scientific sources for the establishment of safety standards and regulations. The EHCs review and examine the literature and evaluate risks for human health and the effects on the environment. The information is peer reviewed.
Integrated Risk Information System (IRIS)	USEPA toxicology database covering exposure and health effects	Free web access	http://www.epa.gov/ http://www.epa.gov/iris	IRIS contains risk assessment data giving both values and details of studies carried out, with information covering the following key subject areas: substance identification; oral exposure; inhalation exposure; drinking water exposure; health risk assessment; Regulations and Acts. The quality of the data provided can be assessed from the study data, but the information provided is specialised and is concerned only with exposure and health effects.
	NISC	Subscription-based online access	http://www.nisc.com/cis/cisfacts.htm	
	Silver Platter	Subscription-based online access	http://www.silverplatter.com/index.html	

Database	Data Provider	Subscription / Free	Web / CD-ROM	Notes
International Uniform Chemical Information Database (IUCLID)	European Chemicals Bureau (ECB)	Available from the Office for Official Publications of the European Communities, L-2985 Luxembourg, through 80 sales agents worldwide.	http://ecb.jrc.it to order CD-ROM latest CD is IUCLID 2000.	The IUCLID CD-ROM is the tool to make the data collected under the Council Regulation (EEC) 793/93 on the "Evaluation and Control of the Risks of Existing Substances" available. It gives access to the documents and data sets in pdf format documents. It allows the waste assessor to find data sets via substance identifiers, e.g. CAS or EINECS numbers and also via the manufacturing companies or the given R-phrases. It contains legislative information such as the Existing Substances Regulation, the Risk Assessment Regulation, the Priority Lists and the English version of EINECS.
Merck Index (12th edition)	Merck and Co.Inc. (USA)	Subscription based	http://chemfinder.cambridgesoft.com/reference/TheMerckIndex.asp and CD-ROM	This database contains information on > 10,000 substances. It covers drugs, biological and natural products, agricultural compounds, commercial and laboratory chemicals and environmentally significant compounds. Complex searches on physico-chemical properties can be carried out, so it is more flexible than a simple direct search. The information available is the same as that found in the book version.
Oil and Hazardous Materials, Technical Assistance Data Systems (OHMTADS)	USEPA	Free web access	http://www.epa.gov/	Contains 1,400 oily or hazardous materials, using data from published literature. It covers the following key subject areas: identification of substances and trade names; containers, storage, handling, producers and transport; physical properties including: flammability, corrosiveness, explosivity, solubility and vapour information; environmental characteristics including: persistency, BOD and bioaccumulation; toxicity and exposure limits for aquatic systems, animals, and plants. The database contains a basic indication of data quality for each compound.
	Silver Platter	Subscription (part of Chembank suite)	http://www.silverplatter.com/catalog/cmbk.htm and CD-ROM	

Database	Data Provider	Subscription / Free	Web / CD-ROM	Notes
Registry of Toxic Effects of Chemical Substances (RTECS)	NIOSH	NIOSH last updated RTECS in 2001 and has now sold the distribution rights to a number of database vendors. A full list of vendors is given at the web address	http://www.cdc.gov/niosh/rtecs.html	Contains over 120,000 chemicals. Relevant subject areas: class of compound and health effects: irritation, mutagenic, reproductive or tumorigenic effects; toxicology/cancer references; acute toxicity. The database is mainly concerned with health effects, and is therefore unlikely to provide much information on physico-chemical hazard properties.
Safety Information Resources and Material Safety Data Sheets (SIRI MSDS)	Safety Information Resources and Material Safety	Free web access	http://siri.org/msds/index.php (Florida site) http://siri.uvm.edu/msds/ (Vermont Site) http://www.vetmed.ucdavis.edu/msds/ (California Site)	The information included in each product reference was extracted from information published by the US Government. The site provides access to current information on chemical products. It contains archives of SDSs, which are kept up to date by manufacturers providing information. There are three "mirror sites" should one website be down, and an inquiry on a particular substance will give a number of SDSs on different websites.
Sax's Dangerous Properties of Industrial Materials	Van Nostrand Reinhold of New York	CD-ROM only	N/A	Contains entries identifying the hazardous properties of chemicals used in industry, published in both printed and CD-ROM form. Key subject areas are: identification of chemical names, synonyms and foreign languages names; physical properties; safety profile; listings of toxicities for a wide range of test species via a number of exposure routes.
STN on the web	Chemical Abstracts Service (CAS)	Subscription-based web access	http://stnweb.cas.org/	STN International is an online scientific and technical information service. STN provides a collection of databases in science and technology to give quick, direct links to the literature, patents, and chemical catalogues. STN databases cover a wide range of scientific and technical topics such as toxicology and health and safety.

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TOXNET (pseudo database)	US National Library of Medicine	Free web access	http://toxnet.nlm.nih.gov/	This is an amalgamation of a number of free databases on toxicology, hazardous chemicals and related areas. Examples of the available databases are HSDB, IRIS, GENE-TOX, TOXLINE and ChemID*plus*.
Toxic Substances Control Act (TSCA)	Publicly available inventory produced under the legislation	Free web access	http://www.epa.gov/opptintr/newchems/invntory.htm	TSCA lists public information on more than 63,000 chemicals manufactured in or imported into the US for commercial purposes. Searchable by topic, chemical substance, molecular formula etc.
	Silver Platter	Subscription (part of Chembank suite)	http://www.silverplatter.com/catalog/cmbk.htm and CD-ROM	

Glossary of terms

absolute entries	hazardous waste regardless of any threshold concentrations
acid/alkali reserve	a measure of the capability of an acid or alkali to maintain its pH
Act	primary legislation produced by Parliament
Agencies	Waste Regulation Authorities comprising the Environment Agency (for England and Wales), the Scottish Environment Protection Agency, and the Environment and Heritage Service for Northern Ireland
anaerobic fate	microbial degradation of substances in the absence of oxygen
Approved Classification and Labelling Guide	Approved Guide to the Classification and Labelling of Dangerous Substances and Dangerous Preparations (5th edition)
bioaccumulation	a process by which chemicals are taken up by organisms from exposure through various routes including contact with contaminated water, sediment, soil and food
bioconcentration	a process by which there is a net accumulation of a chemical within an organism resulting from simultaneous uptake and elimination
biological oxygen demand	the degree of oxygen consumption by microbially mediated oxidation of the contaminant in water (BOD)
boiling point	the temperature at which a liquid substance turns into a gas
carcinogenic	substances or preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence
chemical	a common term for substances and preparations
classification	identification of the hazard of a chemical by assigning a category of danger and a risk phrase using set criteria
clinical waste	clinical waste as defined in the Controlled Waste Regulations 1992, as amended
corrosive	substances or preparations which may destroy living tissue on contact
Cytotoxic and Cytostatic Medicines	Any medicinal product that possesses one or more of the hazardous properties Toxic (H6), Carcinogenic (H7), Toxic for Reproduction (H10), Mutagenic (H11). This may include drugs from a number of medicinal classes, for example Antineoplastic agents, antivirals, immunosuppressants, a range of hormonal drugs, and others.
dangerous substances	substances classified as dangerous in Directive 67/548/EEC and its subsequent amendments
degradation	breakdown of complex/large components of a substance to simpler/smaller units by physical, chemical and/or biological processes
directive waste	waste as defined in Article 1(a) of Council Directive 75/442/EEC on waste
disease	unhealthy condition of the body or mind, or part thereof, of a type which requires healthcare intervention
EC Directive	The major form of European legislation

EC Regulation	another form of European Statute
EC_{50}	the effective concentration is an endpoint used in short-term toxicity tests determining concentrations associated with sublethal responses (e.g. immobility) in the test population. The EC_{50} is the concentration at which a 50% response is detected
ecotoxic	substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment
explosive	substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene
exposure limits	time-weighted values limiting the exposure to substances for health and safety reasons
flammable	substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or 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** gaseous substances and preparations which are flammable in air at normal pressure, or substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities **or** liquid substances and preparations having a flashpoint equal to or greater than 21°C and less than or equal to 55°C
flashpoint	the temperature of a heated substance at which the vapour/air mixture at its surface ignites on exposure to a flame
harmful	substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks
hazard	the inherently dangerous properties of a chemical
IC_{50}	an endpoint in toxicity testing marking the median inhibitory concentration of a substance on a test population
infectious	substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms
in viro	in the living organism
in vitro	a biological process or reaction made to occur outside the body of the organism in an artificial environment is said to be *in vitro* (as against *in viro*)
irritant	non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membranes, can cause inflammation
LD_{50} / LC_{50}	LD_{50} marks the endpoint of a toxicity test, and is an empirical measure of the dose associated with a 50% lethal response in the test population; LC_{50} is a concentration in a medium leading to a 50% lethal response
limit value	see 'threshold concentration'
man or other living organisms	Kingdom Animalia (Vertebrates - mammals, reptiles, fish, amphibians, birds; Invertebrates - arthropods, molluscs etc.). Excludes Kingdoms Plantae, Fungi, Protista, Prokaryotae
melting point	the temperature at which a solid turns into a liquid

micro-organism	a microbiological entity, cellular or non-cellular, capable of replication or of transferring genetic material (includes algae, bacteria, fungi, parasites, plasmid, prions, viruses, rickettsia, and genetically modified variants thereof)
mirror entries	hazardous waste only if dangerous substances are present above threshold concentrations
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
occupational exposure	exposure due to nature or location of employment
oxidising	substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances
pathogen	micro-organisms known or reliably believed to cause disease in man or other living organisms
pH	a measure of acidity or alkalinity described by the negative log of the hydrogen ion concentration in water
physico-chemical properties	the physical and chemical characteristics of a substance
preparation	a mixture of substances
risk	the likelihood of the hazardous properties of a chemical causing harm (to people or to the environment)
risk phrase	a standard phrase giving simple information about the hazards of a chemical in normal use
Safety Data Sheet (SDS)	information sheets supplied by producers or suppliers of chemicals or preparations containing chemicals, which list all relevant risk and safety phrases
safety phrase	a standard phrase giving advice on safety precautions which may be appropriate when using the chemical
substance	a chemical element or one of its compounds, including any impurities
teratogens	substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce non-hereditary congenital malformations or increase their incidence
threshold concentration	concentration of a substance in a waste above which the waste may be classified as hazardous waste
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
toxins	microbial substances able to induce host damage
tumorigenic	substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may cause tumour growths or increase their incidence
viable	alive, able to reproduce