ENVIRONMENTAL RTDI PROGRAMME (2000-2006)

Procedure for the Identification of the Hazardous Components of Waste

(2000-DS-3-M1)

Main Report

NATIONAL DEVELOPMENT PLAN

Your Plan - Your Future

Cork Institute of Technology
Melbourne Business Park
Model Farm Road
Cork

15th May 2001

Procedure for the Identification of the Hazardous Components of Waste (2000-DS-3-M1)

Authors
Noel Duffy (Project leader)
Dermot Cunningham
Jean Finn
Eileen O'Leary

Clean Technology Centre
Cork Institute of Technology
Melbourne Business Park
Model Farm Road
Cork

ACKNOWLEDGEMENTS

This report has been prepared as part of the Environmental Research, Technological Development and Innovation Programme under the Productive Sector Operational Programme 2000-2006. The programme was financed by the Irish Government under the National Development Plan. The programme is administered on behalf of the Department of Environment and Local Government by the Environmental Protection Agency which has the statutory function of co-ordinating and promoting environmental research.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

According to the Waste Management Act, 1996, waste categorised as hazardous waste must be handled in accordance with certain procedures. In many instances, however, there can be considerable confusion when attempting to determine whether or not a waste is to be categorised as hazardous waste. Holders of waste may apply to have a waste categorised as non-hazardous waste – even though the waste may be on the hazardous waste list – if it does not exhibit the properties of a hazardous waste. The Waste Management Act, 1996, implements appropriate European Union (EU) legislation, in particular, the Hazardous Waste Directive from 1991 and the associated EU Decisions implementing the European Waste Catalogue (EWC) and the Hazardous Waste List (HWL). Further reference is required to the Dangerous Substances Directive and associated test methods. The procedures for determining if a waste is hazardous waste are often complex and difficult to follow.

There is a requirement, therefore, for a definitive methodology, backed by all pertinent information, which would guide a holder of waste through the categorisation of its waste, and which could also be used by regulators in making a determination. Irish and EU legislation are decisive, but practice in other countries may be informative. Various international and national regulatory frameworks and practices were reviewed. All the relevant legislation was gathered and the properties and test methods of the Dangerous Substances Directive and its amendments were distilled into a usable format.

The only effective approach to this project, ultimately, was the production of a paper-based tool and a prototype computer-based package, which can guide the user through the procedures. Both tools direct the user to current Irish legislation and also address changes to the legislation which are due to be implemented on 1 January 2002. The paper-based tool is in the form of a workbook with associated worksheet. Five worked examples are provided to illustrate the use of the paper-based tool. This paper-based tool is available from the Environmental Protection Agency.

A new waste list (Decision 2000/532/EC as amended by Decision 2001/118/EC and Decision 2001/119/EC) will be introduced on 1 January 2002. This legislation will address a number of the uncertainties of the original hazardous waste list (Decision 94/904/EC), nonetheless, some difficulties remain and are identified. The legislative framework is neither entirely comprehensive nor sufficiently specific to address all cases. Hence the tools may not be universal. These tools interpret current Irish and EU legislation. However their validity is dependent on their being maintained. The tools must be regularly updated to reflect any legislative advances. This refers not only to the waste legislation, but also to the associated test methods and the classification of substances. Guidance has been provided on a mechanism to maintain the validity of these tools.

In examining practice in other EU Member States, it was apparent that there is a common desire among regulatory authorities to address the difficulties, which are shared. Consequently, there is a need for additional co-operation between EU Member States to share experiences and harmonise practices, particularly at the level of those responsible for actual classification of wastes.

If there is any doubt regarding classification, reference must be made to the appropriate regulatory authority. This is particularly necessary if a suspect waste is to be classified as non-hazardous waste.

CHAPTER ONE: INTRODUCTION

1.1 Background

Section 4(2) of the Waste Management Act, 1996, defines hazardous waste. In many instances, however, there can be considerable confusion when attempting to determine whether or not a waste is to be categorised as hazardous waste in accordance with this definition.

The procedures for determining if a waste is hazardous waste are often complex and difficult to follow. The Waste Management Act, 1996, implements appropriate European Union (EU) legislation, in particular, the Hazardous Waste Directive from 1991 and the associated EU Decisions implementing the European Waste Catalogue (EWC) and the Hazardous Waste List (HWL).

The definition of hazardous waste was clarified as a result of the 1991 Directive. The three Annexes to the 1991 Directive are the source of the Second Schedule to the Waste Management Act, 1996, defining the categories and properties of hazardous waste. However, determination of these properties refers further to the Dangerous Substances Directive. In summary there is a trail: Waste Management Act - European Waste Catalogue/Hazardous Waste List - Dangerous Substances Directive which must be followed.

At the moment, such analysis is complex and difficult. Furthermore there needs to be considerable cross-referencing. For example, not only are definitions of properties such as 'Toxic' cumbersome to apply in themselves, but various estimation methods, such as those given in the Dangerous Substances Directive, are not specifically for wastes. As a consequence, there is a need for further information on how to apply the categorisation techniques to a waste.

Holders of waste may apply to have a waste categorised as non-hazardous waste – even though the waste may be on the hazardous waste list, or be a Category I or Category II waste. However, at the moment there is no easy way for regulators to assess the claim, nor indeed for the holders of waste to validate their claim. There is a requirement, therefore, for a definitive methodology, backed by all pertinent information, which would guide a holder of waste through the categorisation of its waste, and which could also be used by regulators in making a determination. Irish and EU legislation are decisive, but practice in other countries may be informative.

1.2 Scope of this desk study

The specified outputs from this project were:

1. A brief review of the definition of hazardous waste.

   This is presented in Chapter 2.

2. A review of existing relevant EU, Irish and international legislation relating to standards and parameters for the assessment of the properties of hazardous waste.

   This is discussed in Chapter 2 and 3. It is also considered in Section 4.2.

3. A procedure for examination and identification of a waste, its nature, properties and constituents.

   The only effective solution, ultimately, was the production of a paper-based tool and a prototype computer-based package, which can guide the user through the procedures. Both tools contain current legislation and also address changes to the legislation which is due to be implemented on 1 January 2002.

4. A set of standards or other guidance values or benchmarks for the assessment of those properties.

   This is incorporated into the tools and is addressed in Section 4.2. The properties and test methods of the Dangerous Substances Directive and its amendments were distilled into a usable format, which aids holders of waste and regulators in assessing the properties of waste. The Dangerous Substances Directive is a very complex and unwieldy document, and previously its effective use was likely to be beyond the capabilities of the majority of waste generators.

5. A mechanism to ensure that the proposed identification procedure is kept up to date.

   This is proposed in Section 4.3.

CHAPTER TWO: LEGISLATIVE BACKGROUND

This chapter is essentially a two tiered assessment of hazardous waste classification schemes. It commences with an international perspective in terms of the OECD (Organisation for Economic Co-operation and Development) and the Basel Convention. It then looks at the general European legislation regarding hazardous waste classification.

2.1 INTERNATIONAL LEGISLATION

The most important international developments in the definition and classification of hazardous waste have been driven by the (Organisation for Economic Co-operation and Development (OECD) and the United Nations Environmental Programme (UNEP) through the Basel Convention. The policies and measures developed by the OECD have to a large part provided the stimulus for the initiation of the Basel Convention by UNEP.

2.1.1 OECD

The OECD recognised the need to control the movement and management of hazardous wastes and its international trade as early as 1974. Concern arose particularly out of the fact that significant quantities of hazardous waste were being exported to non-OECD developing countries which had neither the technology nor the expertise to deal with them (Ministry of the Environment New Zealand, 1999).

Between 1982-1992, the OECD's Waste Management Policy Group developed a series of policies and measures for controlling the transfrontier movement of hazardous waste. This work led to the development of a classification system for hazardous waste, the International Waste Identification Code, and ultimately to the formation of the Basel Convention (see Section 2.1.2), an international agreement that regulates the import and export of hazardous waste between OECD and non-OECD countries.

As part of developing a control framework for the control of the transfrontier movement of hazardous waste, the OECD developed a designation and classification system for hazardous waste. This system is based on a core list of hazardous wastes that require to be controlled, the so-called Y-List.

The Y-List of hazardous wastes comprises 17 generic waste types (Y1-Y17) and 27 waste constituents (Y18-Y44). These waste types and constituents are typically known to be hazardous and have the potential for adverse environmental effects when handled or disposed of inappropriately. The International Waste Identification Code (IWIC) forms the basis for the classification of hazardous waste for monitoring and reporting purposes under OECD controls. The IWIC comprises six waste codes referred to as Tables 1 – 6. These include the wastes listed in the Y-List, and a range of other codes for characterising hazardous waste, as follows:

Table 1	This table lists a series of reasons why materials are intended for disposal (Q-List).
Table 2	This table lists different disposal operations, including activities which do not lead to the possibility of resource recovery, recycling, reclamation, direct re-use or alternative use (D-List) or those activities which do (R-List).
Table 3	This table lists generic hazardous waste types in either liquid (L), solid (S) or gaseous (G) form (based on the Y-List) [Generic waste list].
Table 4	This table lists 51 specific contaminants (extracted from the Y-List) that are deemed to be particularly hazardous [Contaminant list].
Table 5	This is a list of hazardous characteristics which may be displayed by hazardous wastes (H-List) [Hazardous characteristics list].
Table 6	This table lists activities that generate potentially hazardous waste based on a standard industry classification code.

Tables 1 - 6 of the IWIC are used to provide a complete characterisation of a hazardous waste for control and monitoring purposes.

For the purpose of designating hazardous wastes, all wastes (other than radioactive materials) on the Y-List that are intended for disposal are hazardous waste, unless they do not possess any of the hazardous characteristics outlined in Table 5 (H-List) of the IWIC. A waste is also deemed to be hazardous waste if it is legally defined as such in domestic legislation of Member Countries.

In 1992, the OECD adopted a decision (OECD, 1992) instituting a three-tier approach to classifying and controlling wastes for recovery and recycling activities. The decision divided wastes into three tiers, green, amber and red, according to the need to control these wastes in terms of the risks they presented for transport and recovery/recycling. Green wastes were defined as those wastes that do not meet the hazardous waste characteristics of Table 5 of the IWIC or of the Basel Convention and were therefore deemed to be non-hazardous waste. Red and amber wastes were deemed to be hazardous waste and their movement for recovery or recycling purposes therefore needed to be controlled.

2.1.2 Basel Convention

The international Basel Convention on the Control of Transboundary Movements of Wastes and their Disposal was adopted in 1989 and came into force on 5 May 1992. The Convention was initiated by UNEP following earlier OECD decisions on hazardous waste controls.

The aim of the Basel Convention is to bring together countries both within and outside of the OECD involved in the import and export of hazardous waste, and to work out an appropriate mechanism to control the transboundary transport of hazardous waste.

Under the Basel Convention, the designation and classification of hazardous waste is based on a simplified version of the IWIC and is attached as Annexes to the Convention. These Annexes include:

Annex I Categories of wastes to be controlled – based on the OECD Y-List and comprising 18 waste streams (Y1-Y18) and 27 waste constituents (Y19-Y45).

Annex II Categories of wastes requiring special consideration – incorporating only two wastes (Y46 and Y47, namely household waste and residues arising from the combustion of household wastes).

Annex III List of hazardous characteristics – based on the OECD H-List describing hazardous waste characteristics.

Annex IV List of disposal operations, including operations which do or do not lead to the possibility of resource recovery, recycling, reclamation, direct re-use or alternative uses (OECD R-List and D-List).

Under the Basel Convention, wastes are designated as hazardous waste and therefore subject to the controls of the Convention if:

a) They belong to any category contained in Annex I, unless they do not exhibit any of the hazardous characteristics contained in Annex III.

b) They are wastes not covered under (a) but are designated as hazardous waste by the domestic legislation of the party of export, import or transit.

c) Wastes that belong to any category contained in Annex II (household hazardous waste and residues arising from the incineration of household hazardous waste) that require special consideration under the Convention.

The following wastes are excluded from the scope of the Basel Convention:

a) Wastes which, as a result of being radioactive, are subject to other international control systems, including international instruments applying specifically to radioactive materials.

b) Wastes which derive from the normal operations of a ship, which is a discharge covered by another international instrument.

2.2 EUROPEAN LEGISLATION

The overall structure for the EU framework for waste management is set out in a series of Directives on waste and hazardous waste. The European legislation concerning the classification of hazardous wastes is constantly evolving. In order to classify a waste, a number of different Directives and Decisions must be consulted concerning:

- European definition of hazardous waste
- European waste catalogue/hazardous waste list
- Classification, packaging and labelling of dangerous substances

Table 1 outlines the major pieces of EU legislation concerning the definition and classification of hazardous waste.

Legal Instrument	Description
Council Directive of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances (67/548/EEC) *(OJ L 196, 16.8.1967, p. 1)*	This Directive along with subsequent amendments is referenced in hazardous waste legislation.
Council Directive of 15 July 1975 on waste (75/442/EEC) *(OJ L 194, 25.7.1975, p. 39)*	Known as the "Waste Framework Directive", it constitutes the legal framework for all wastes.
Council Directive of 20 March 1978 on toxic and dangerous waste (78/319/EEC). (*OJ L 84, 31.3.1978, p. 43)*	This Directive provides a definition of 'toxic and dangerous waste'. This Directive is now revoked.
Council Directive of 18 March 1991 amending Directive 74/442/EEC on waste (91/156/EC) *(OJ L 78, 18.3.1991, p. 32)*	This amends the Waste Framework Directive.
Council Directive of 12 December 1991 on hazardous waste (91/689/EEC) *(OJ L 377, 31.12.1991, p. 20)*	This replaced Directive 78/319/EEC. It provides: • A definition of hazardous waste • A procedure for the establishment of a Hazardous Waste List (HWL)
Commission Decision of 20 December 1993 establishing a list of waste pursuant to Article 1(a) of Council Directive 75/442/EEC on waste (94/03/EC) *(OJ L 5, 7.1.1994, p. 15)*	This Decision established the European Waste Catalogue (EWC) as directed by Article 1 of 75/442/EEC.
Council Decision of 22 December 1994 establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (94/904/EC) *(OJ L 356, 31.12.1994, p. 14)*	This established the Hazardous Waste List (HWL). It also set thresholds for a number of hazardous properties.
Commission Decision of 3 May 2000 replacing 94/03/EC establishing a list of waste pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (2000/532/EC) *(OJ L 226, 6.9.2000, p. 3)*	Decision 94/3/EC and Decision 94/904/EC will be replaced by this Decision on 1st January 2002. This Decision effectively amalgamated the EWC and the HWL into a single list by indicating on the EWC if a waste was hazardous waste. Additional property thresholds were also provided with this Decision. This Decision has been amended by Decision 2001/118/EC and Decision 2001/119/EC and should be read in conjunction with these amendments.
Commission Decision of 16 January 2001 amending Decision 2000/532/EC as regards the list of wastes (2001/118/EC) *(OJ L 47, 16.2.2001, p. 3)*	This amends Decision 2000/532/EC. It further modifies the wastes identified as hazardous waste on the EWC as a result of notifications from Member States.
Commission Decision of 22 January 2001 amending Decision 2000/532/EC replacing decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste (2001/119/EC) *(OJ L 47, 16.2.2001, p. 32)*	This amends Decision 2000/532/EC regarding 'end-of-life vehicles'. It further modifies the wastes identified as hazardous waste on the EWC as a result of notifications from Member States.

Table 1: EU Legislation related to definition and classification of hazardous waste

2.2.1 Development of Hazardous Waste Legislation

2.2.1.1 General Definition of Waste

The 1975 Framework Directive on Waste (CEC, 1975) and its 1991 amendment (CEC, 1991) provide the legal framework for the avoidance, environmentally sound management and disposal of waste. Directive 75/442/EEC laid down broad controls for all wastes and defined wastes as "*any substance or object which the holder disposes of or is required to dispose of pursuant to the provisions of national law in force*". Disposal, in turn, is defined by reference to a list of "*disposal operations such as they occur in practice*". This list is similar to the OECD D-List.

This framework establishes a common terminology and definition of waste according to the work carried out by the OECD and the Basel Convention. The definition of waste included those wastes that are destined for recovery operations.

Wastes which are excluded from the scope of the Framework Directive on waste are:

- Gaseous effluents emitted into the atmosphere
- Wastes that are already covered by other legislation:
    - Radioactive waste
    - Waste resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries
    - Animal carcasses and the following agricultural waste: faecal matters and other natural, non-dangerous substances used in farming
    - Waste waters, with the exception of waste in liquid form
    - Decommissioned explosives

Also provided for by this Directive was the establishment of a list of wastes. A waste was defined as such if it belonged to any of the 16 categories of waste as outlined in Annex I of the Directive.

2.2.1.2 Generic Definition of Hazardous Waste

The first attempt at defining hazardous waste was in Directive 78/319/EEC. This Directive defined hazardous wastes or 'toxic and dangerous wastes' as "*any wastes containing or contaminated by, the substances or materials listed in the Annex to this Directive of such a nature, in such quantities or in such concentrations as to constitute a risk to health or the environment*". The Annex listed 27 substances.

Council Directive on hazardous waste (91/689/EEC) repealed Directive 78/319/EEC. Directive 91/689/EEC recognised the need to improve the management of hazardous wastes in the countries of the European Union. It defines hazardous waste to be:

- wastes featuring on a list to be drawn-up on the basis of Annex I and II to this Directive
- any other waste which is considered by Member States to display any of the properties listed in Annex III of the Directive. The Member State is obliged to notify the Commission of such cases.

The Annexes to this Directive are as follows:

- Annex I - Categories or generic types of hazardous waste listed according to their nature or the activity which generated them. There are two sections: Annex I.A and Annex I.B.
- Annex II - This is a list of waste constituents which render the wastes listed in Annex I.B hazardous waste when they have the properties described in Annex III.
- Annex III - This contains a list of the properties of wastes which render them hazardous wastes. There are fourteen properties listed in total (H1-H14):

H1	Explosive
H2	Oxidising
H3A	Highly Flammable
H3B	Flammable
H4	Irritant
H5	Harmful
H6	Toxic
H7	Carcinogenic
H8	Corrosive
H9	Infectious
H10	Teratogenic/Toxic for reproduction
H11	Mutagenic
H12	Substances and preparations which release toxic or very toxic gases in contact with water, air or an acid
H13	Substances and preparations capable by any means, after disposal, of yielding another substance, e.g. leachate, which possesses any of the characteristics listed above
H14	Ecotoxic

2.2.2 European Waste Catalogue and Hazardous Waste List

2.2.2.1 European Waste Catalogue

Directive 91/156/EC, which amended the Framework Directive on Waste, required the preparation of a waste list, the so-called European Waste Catalogue (EWC). The EWC was established in Decision 94/3/EC.

The EWC is a harmonised non-exhaustive list of waste (to be periodically reviewed). The EWC is applied to all waste types, irrespective of whether they are destined for disposal or recovery (including re-use and recycling). The EWC is a reference nomenclature providing a common terminology throughout the EU with the purpose of improving the efficiency of waste management activities.

The EWC comprises three levels:

- The highest level with 20 entries describes the source and the branch generating the waste (2-digit codes)
- Each of the 20 main groups has several subgroups which describe the process generating the waste (4-digit codes)
- Each subgroup has several waste codes describing the substances in the waste (6-digit codes)

The six-digit number employed by the EWC enables any waste to be categorised according to main industry and process categories, as well as specific wastes within these. This system allows the addition of new waste types at any time. The creation of the EWC represents the most significant move to date towards harmonising information on waste production and management in Europe and the development of a common European-wide waste classification system for hazardous and non-hazardous waste.

2.2.2.2 Hazardous waste list and characteristics

The hazardous waste list was introduced under Decision 94/904/EC. The hazardous waste list contains those wastes that are known to be hazardous wastes because they exhibit one or more of the hazardous characteristics listed in Annex III of Directive 91/689/EEC. Decision 94/904/EC also provides thresholds for the hazardous characteristics H3-H8 (flammable, toxic, harmful, corrosive, irritant and carcinogenic characteristics).

2.2.2.3 Joining of the EWC and the HWL

Council Decision 2000/532/EC replaces Decision 94/3/EC and Decision 94/904/EC from 1 January 2002. This Decision effectively provides for the amalgamation of the EWC and the HWL into a single list by indicating on the EWC if a waste is hazardous waste. The list of hazardous wastes was also expanded to take into account notifications made to the Commission by Member States regarding wastes which had one or more properties listed in Annex III of Directive 91/689/EEC. Further hazardous characteristic thresholds are also included in Decision 2000/532/EC. Step-by-step instructions on how to use the classification scheme are provided in an attempt to clarify the application of the EWC.

The rapidly changing situation regarding hazardous waste classification is illustrated by Decision 2001/118/EC and Decision 2001/119/EC which have already amended Decision

2000/532/EC. These decisions further modify the wastes on the EWC identified as hazardous wastes to take into account additional notifications from Member States.

2.2.3 Dangerous Substances Directive

Directive 67/548/EEC outlines the procedures for the classification, packaging and labelling of dangerous substances. Although directed towards substances that are placed on the market, it is referenced by the waste legislation. The property test methods and general classification requirements outlined in the European waste legislation refer to Directive 67/548/EEC and its subsequent amendments. The annexes to this Directive are:

Annex	Description
Annex I	Provides a list of dangerous substances
Annex II	Symbols and Indications of Danger
Annex III	Risk phrases - nature of special risks
Annex IV	Safety phrases
Annex V	Provides test methods for determination of physicochemical, toxicological and ecotoxicological properties.
Annex VI	General classification and labelling requirements for dangerous substances and preparations
Annex VII	Information required under Article 7(1) for the technical dossier
Annex VIII	Additional tests and information required under Article 7(2)
Annex IX	Provisions relating to child proof fastenings and tactile warning devices

Annex I, Annex V and Annex VI are of primary concern when classifying waste, although reference is often made to the other annexes.

CHAPTER THREE: CLASSIFICATION SCHEMES IN SELECTED COUNTRIES

This chapter briefly reviews the standards relating to the definition of hazardous waste and classification schemes in a number of European countries and in other countries throughout the world.

3.1 EUROPEAN COUNTRIES

All EU Member States are obliged to bring into law the EU legislation concerning the definition and classification of hazardous waste. An EU Commission report published in 2000 (CEC, 2000) examined the Member States implementation of the Hazardous Waste Directive 91/689/EEC for the period 1995-1997. According to the report, in order for Member States to have correctly transposed the EU definition of hazardous waste into national legislation the following legislation was to be adopted:

- The definition of hazardous waste as outlined by Article 1(4) of Directive 91/689/EEC.
- The hazardous waste list as implemented by Decision 94/904/EC.
- Annexes I, II and III of Directive 91/689/EEC.

Table 2 shows the degree of adherence by individual Member States up to 1997 to the EU definition of hazardous waste.

Countries	Definition of hazardous waste	Transposition of hazardous waste list	Transposition of Annexes to Directive 91/689/EEC		
			Annex I	Annex II	Annex III
Austria		×	×	×	×
Belgium (Brussels Region)	✓	✓	✓	✓	✓
Belgium (Flemish Region)	✓	✓	×	×	✓
Belgium (Walloon Region)	✓	✓	✓	✓	✓
Denmark	✓	✓	×	×	✓
Finland	✓	✓	✓	✓	✓
France	×	✓	×	×	×
Germany	×	✓	×	×	×
Greece	✓	✓	✓	✓	✓
Ireland	✓	×[1]	✓	✓	✓
Luxembourg	✓	✓	✓	✓	✓
Netherlands	×				
Portugal	✓	✓	×	×	✓
Spain	✓	✓	✓	✓	✓
Sweden	✓	✓	×	×	✓
United Kingdom			×	×	

Table 2: Degree of adherence up to 1997 to the EU definition of hazardous waste

Key:	× Not implemented	✓ Implemented	Unsure if implemented or not

In the section to follow, Ireland along with four other European Countries namely, Austria, Germany, Finland and the United Kingdom will be briefly reviewed in terms of their national legislation concerning hazardous waste along with their classification methodologies.

3.1.1 Ireland

3.1.1.1 National Legislation

In Ireland, the Waste Management Act, 1996 (S.I. No. 10 of 1996) gives effect to a number of European Directives including:

- Council Directive 75/442/EEC of 15 July 1975 on waste

[1] Note: this Commission report does not appear to take account of the Waste Management Act, 1996.

- Council Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on waste
- Council Directive 91/689/EEC of 12 December 1991 on hazardous waste

3.1.1.2 Classification methodology

In the Waste Management Act, 1996 'hazardous waste' means -

(i) hazardous waste for the time being mentioned in the list prepared [the hazardous waste list] *pursuant to Article 1 (4) of Council Directive 91/689/EEC of 12th December 1991* [the Hazardous Waste Directive] *being either –*

> *(I) Category I waste that has any of the properties specified in Part III of the Second Schedule, or*
>
> *(II) Category II waste that –*
>
> > *(A) contains any of the constituents specified in Part II of the Second Schedule, and*
> >
> > *(B) has any of the properties specified in Part III of the Second Schedule,*

(*ii) such other waste, having any of the properties specified in Part III of the Second Schedule, as may be prescribed for the purposes of this definition.*

The Second Schedule to the Act is divided into three parts:

Part	Title/Description	Implements
I	Categories or generic types of hazardous waste (Category I Waste and Category II Waste)	Annex I of Directive 91/689/EEC
II	Constituents of Category II waste which render it hazardous when it has the properties specified in Part III	Annex II of Directive 91/689/EEC
III	Properties of waste which render it hazardous	Annex III of Directive 91/689/EEC

The European Waste Catalogue (EWC) and the Hazardous Waste List (HWL) apply directly to Ireland and are legally binding. The revised EWC and HWL established in Decision 2000/532/EC and amended by Decision 2001/118/EC and Decision 2001/119/EC will have effect from 1 January 2002.

The European Communities (Classification, Packaging, Labelling and Notification of Dangerous Substances) Regulations, 2000 (S.I. No. 393 of 2000) gives effect to the Dangerous Substances Directive.

3.1.2 Austria

3.1.2.1 National Legislation

The main pieces of Austrian legislation regarding the definition and classification of hazardous waste are (ISWA, 2000):

- Ordinance on the Definition of Hazardous Waste - 4/12/1997
- Ordinance on the Definition of Hazardous Waste - 15/2/1991
- Ordinance on the Identification of Hazardous Substances - 1/1/1991
- Austrian Standard (S2101) on hazardous substances necessary to be controlled - 1/12/1983

Austrian legislation provides that "*dangerous substances are wastes, the treatment of which requires specific prudence and particular measures in view of the public interest, and the normal treatment of which requires supplementary measures or greater prudence than those required for the treatment of domestic waste*" (CEC, 2000).

3.1.2.2 Classification methodology

The Federal Minister of the Environment stipulates by decree, which waste substances have to be regarded as hazardous waste. These wastes are then compiled in the Austrian Waste Catalogue according to the Austrian Standard ONORM 2100 - 1990, indicating the waste types, waste codes and origin (ISWA, 2000).

EU Council Decision 94/904/EC was incorporated into the 1997 Waste Determination Ordinance. An immediate implementation of the EWC/HWL on the basis of this Ordinance was not considered appropriate because of the substantial structural differences that exist between the ONORM standards and the EWC. A correlation programme is ongoing however, which is translating waste codes according to the Austrian Waste Catalogue (ONORM 2100, 1990) to the EWC.

The Austrian Waste Catalogue has a substance-oriented background and consists of 668 different waste types of which 322 are hazardous waste. De-classification from the category of hazardous waste is only possible on the basis of comprehensive and standardised examinations and expert opinions. De-classified quantities must be reported to the authority. For this reason Annex 2 of the 1997 Ordinance contains a detailed explanation of the hazardous criteria, in terms of the classification and or declassification of waste within the category of hazardous waste (EEA, 2000).

3.1.3 Finland

3.1.3.1 National Legislation

According to the Waste Act (1072/1993), '*hazardous waste shall mean any waste which may cause particular hazard or harm to health or the environment because of its chemical or some other property*'.

The Waste Decree (1390/1993) classifies hazardous wastes as the following:

'Wastes belonging to the categories referred to in Annex 2 and 3 to this Decree and other wastes are classified as hazardous waste in accordance with section 3, paragraph 1, subparagraph 2 of the Waste Act if they are referred to as hazardous waste in the list of the most common wastes and of hazardous wastes referred to in section 75, subparagraph 1, of the waste Act'.

The Annexes of the Waste Decree are:

- Annex 2: Categories or generic types of hazardous waste listed according to their nature or the activity which generated them
- Annex 3: Constituents of the wastes in Annex 2 B which render them hazardous when they have the properties described in Annex 4
- Annex 4: Properties of wastes which render them as hazardous waste.

According to the Waste Decree *'in individual cases the regional environment centre can decide:*

a) that a waste referred to as hazardous waste is not hazardous waste, if the waste holder can reliably demonstrate that the waste in question does not have any of the properties listed in Appendix 4; and

b) that other waste is also hazardous waste if it has any of the properties listed in Annex 4 and it is necessary to classify this waste as hazardous waste in order to prevent or combat a hazard or harm caused by this waste.'

The European Waste Catalogue is implemented by the Finnish Ministry of the Environment Decision on the List of the Most Common Wastes and of Hazardous Waste (867/1996).

3.1.3.2 Classification methodology

The assessment of the hazardous properties of a waste is based on Finnish chemical legislation.

The Ministry of the Environment in Finland is in general responsible for overseeing the classification of hazardous waste. The regional environment centres supervise the compliance with the provisions and regulations set by the Waste Act.

3.1.4 Germany

3.1.4.1 National Legislation

The German Waste Law (Kreislaufwirtschafts-und Abfallgesetz) and the Waste Management Law constitutes the legal basis of waste management in Germany. The ordinances that implement this law which are relevant to the classification of hazardous waste are (ISWA, 2000):

- Ordinance to introduce the European Waste Catalogue
- Ordinance to define types of waste which require special monitoring

The German Waste Law regulates waste disposal and recovery. Due to the higher risk, potential hazardous waste data have to be reported to the authorities.

Since the 1st of January 1999 the use of EWC/HWL codes is obligatory for waste producers, collectors and treaters (EEA, 2000).

3.1.4.2 Classification methodology

Classification of hazardous waste for monitoring and reporting purposes requires a range of information to be recorded, including the EWC code of the hazardous waste and a description of the physical form, odour and colour. If a hazardous waste is destined for disposal, analytical details have to be provided that are relevant both in terms of the nature of the waste concerned and the proposed route of disposal.

It is also important to note that German legislation departs from Community terminology ("hazardous wastes") by referring to "wastes for special supervision" (CEC, 2000).

Up until December 1998 Germany applied the LAGA-classification system (Abfallartenkatalog der Landerarbeitsgemeinschaft Abfall). In this catalogue 584 different waste types are listed, of which 332 are stated as hazardous waste. The German LAGA-catalogue and the Austrian ONORM-catalogue are rather similar.

The relation between LAGA-classification and the HWL codes has been evaluated in general for translation purposes for Germany and in detail for the province of North Rhine-Westphalia. The transcription from the LAGA nomenclature to EWC is considered problematic in Germany because there is little relation between both catalogues (EEA, 2000).

3.1.5 United Kingdom

3.1.5.1 National Legislation

The EU Directives on Hazardous Waste are implemented in England, Scotland and Wales through the Special Waste Regulations 1996 (under section 62 of the Environment Protection Act 1990). In Northern Ireland, equivalent regulations were made under section 30 of the Waste and Contaminated Land Order 1997.

The hazardous waste list (HWL) is reproduced as Schedule 2 Part 1 to the Special Waste Regulations (SWR). Annex III of the Hazardous Waste Directive (91/689/EEC) is reproduced in the SWR as Schedule 2 Part II.

In UK legislation hazardous waste is referred to as "Special Waste". It is defined in the SWR as any controlled waste, other than household waste:

- which is on the HWL and displays any of the hazardous properties of Annex III to the Hazardous Waste Directive.
- which displays the property H3A, H4, H5, H6, H7 or H8 of Annex III to Directive 91/689/EC.
- which is a medicinal product.

Controlled waste means household, commercial and industrial waste. It includes office waste and waste from a house, shop, factory or other business premises. A substance is controlled waste whether it is solid or liquid and even if it is not hazardous or toxic (UK Environment Agency, 1999).

3.1.5.2 Classification methodology

The preferred methodology of the UK Environment Agency to determine whether a waste is special or not is shown in Figure 1. The Agency's methodology is considered to be a practical one but any methodology can be used provided that a proper assessment is carried out.

The SWR indicates that there are three methods for assessing a waste for a hazardous property:

- *The Approved Supply List (ASL).* The ASL and its supplement describe hazard information and classifications for many common chemicals. If a substance is listed within the ASL, the classification given must be used.
- *The Approved Classification Guide*. The Approved Classification Guide sets out the general principles of classification and tells suppliers how to correctly classify and label chemicals.
- *The Approved Code of Practice on Test Methods*. The Approved Code of Practice on Test Methods refers to the latest amendment of Annex V to Directive 67/548/EEC.

The SWR is closely tied in with European Classification, Packaging and Labelling Directives, which link through to UK Health and Safety Legislation (the CHIP Regulations). However, there are limitations in the use of the CHIP Regulations to support the SWR. This is because the methods used to determine hazards in the SWR are different to those in CHIP.

Responsibility for all aspects of the Special Waste Regulation (SWR) functions rests with the Environment Agency (in Scotland with the Scottish Environmental Protection Agency). The Agencies are responsible for supervising the persons and activities subject to any provision of the SWR.

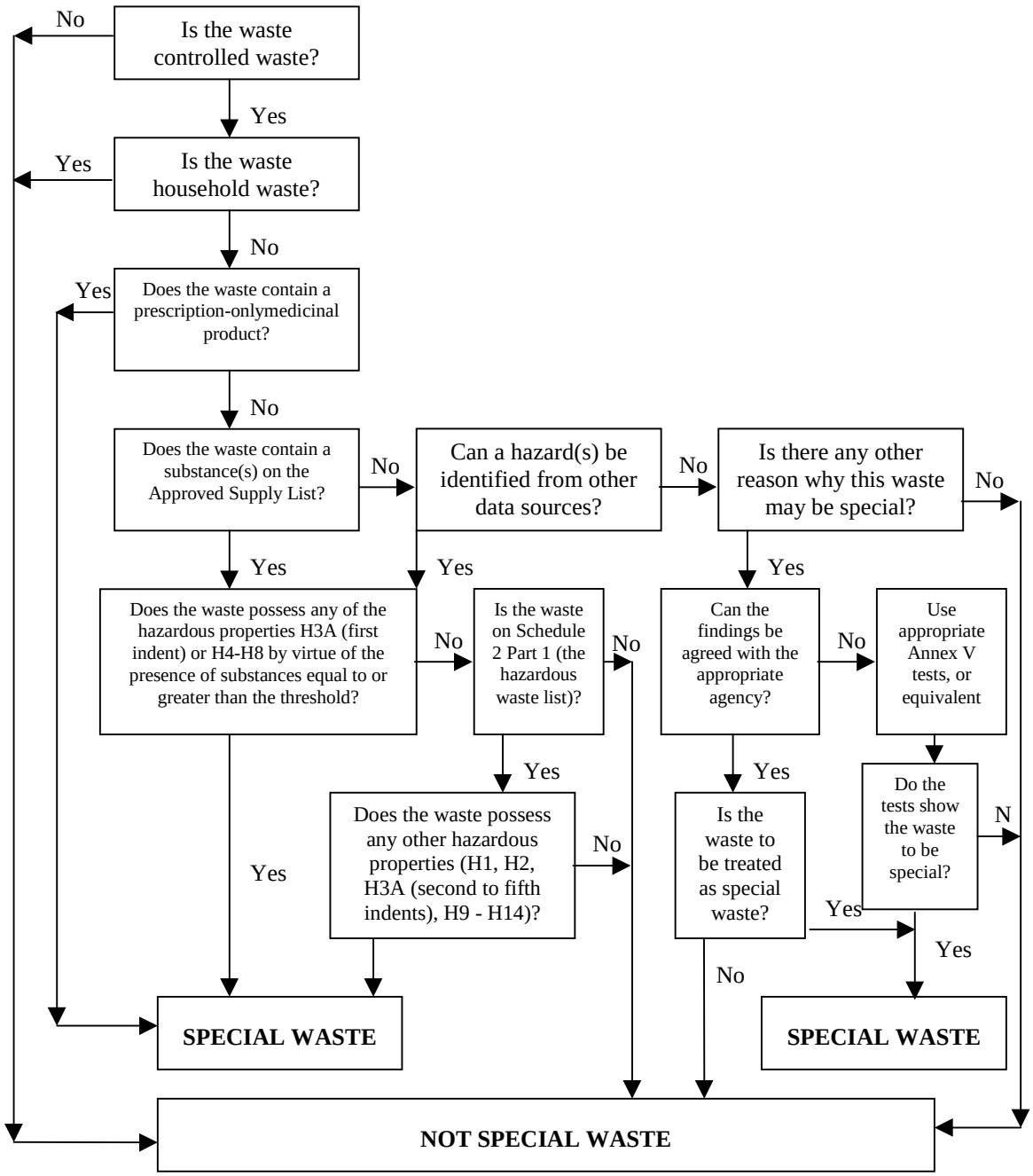


Figure 1 UK Assessment Methodology

3.2 OTHER COUNTRIES

3.2.1 U.S.A.

The Resource Conservation and Recovery Act (RCRA) is the framework for the federal hazardous waste management programme in the USA. It establishes a cradle-to-grave management system for hazardous waste from the time it is generated until its ultimate disposal. In particular, it provides for the proper management of hazardous waste at active and properly closed facilities (Ministry of the Environment New Zealand, 1999).

RCRA Section 1004(5) defines hazardous waste as:

A solid waste, or combination of solid waste, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may

a) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or

b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

As can be seen from this definition, RCRA deals primarily with solid hazardous wastes. Liquid or gaseous wastes that are discharged to the environment are not regulated directly under RCRA.

Exclusions apply to wastes that do not present a significant health or environmental hazard or are managed under other programmes, specifically:

- household wastes
- wastes from municipal resource recovery operations
- agricultural wastes
- waste from mining overburden that is returned to the mine site
- domestic sewage
- special nuclear or by-product material as defined by the Atomic Energy Act (AEA)
- certain recycled materials.

3.2.1.1 Listed and characteristic hazardous wastes

The broad statutory definition provided above offers a general indication of which wastes are hazardous wastes, but it obviously does not provide the clear distinctions

necessary for industrial waste handlers to determine whether their wastes are hazardous wastes or not.

The USEPA developed more specific criteria for defining hazardous waste. The regulatory definition identifies precisely which wastes are subject to RCRA waste management regulations and defines hazardous waste using two different mechanisms:

1. by listing certain specific wastes as hazardous wastes and

2. by identifying characteristics which, when present in a waste, make it a hazardous waste.

Listed hazardous wastes are classified according to their source into:

- non-specific source wastes, which are generic waste types produced by manufacturing or industrial processes such as treatment sludges (F-wastes).

- specific source wastes, which are wastes generated by specifically identified industries such as wood preserving or petroleum refining (K-wastes).

- discarded commercial chemical products, which consist of acute hazardous waste (P-wastes) and toxic hazardous waste (U-wastes), for example arsenic acid or xylene.

Characteristic hazardous wastes are commonly called D-wastes. A waste is deemed to be hazardous waste if it exceeds the thresholds for the main four hazard characteristics groups of ignitability, corrosivity, reactivity or toxicity.

3.2.2 Canada

In Canada there are currently two main federal regulations which form the basis of the Canadian definitions and criteria for hazardous wastes/recyclable materials:

- The Transportation and Dangerous Goods Regulation 1985 (TDGR).

- The Export and Import of Hazardous Waste Regulation 1992 (EIHWR), which sets out the controls on transboundary movement of hazardous wastes including hazardous recyclable materials based on the Basel Convention.

3.2.2.1 Hazardous waste designation

The definition of hazardous waste under the TDGR includes:

Any product, substance or organism that is a dangerous good which is no longer used for its original purpose and which is a recyclable material or intended for treatment or disposal, including storage prior to treatment or disposal, but does not include a product, substance or organism that is:

- *household in origin*
- *returned directly to a manufacturer or supplier of the product or material*
- *included in UN Classes 1 or 7 (explosives and radioactive materials - covered by other regulations).*

3.2.2.2 Hazardous waste classification

The system for classifying hazardous wastes in Canada is based on both lists and hazardous characteristic thresholds. This system is based on:

- A list of fully specified hazardous materials and waste lists in the TDGR. This list comprises hazardous materials and hazardous wastes for disposal and recovery purposes, including more than 3,000 chemicals and 100 waste streams. The hazardous materials are listed with the following information: a unique identifier, hazardous substance/waste name, UN number and classification, packaging provisions and reportable quantities.
- Hazardous characteristics and thresholds based on the United Nations Recommendations on the Transport of Dangerous Goods (UN, 1997) (except for Classes 9.2 and 9.3, which are based on criteria separately developed in Canada)
- additional waste streams listed as required in other provincial or federal regulations.

The classification of waste dangerous goods mixtures and solutions that are not fully specified is based on:

- hazard characteristics and thresholds of the TDGR (This contains safety requirements for classification, including classification of dangerous goods and specification of hazardous characteristics and thresholds).
- tests and criteria for Classes 2-8 based on the United Nations Recommendations on the Transport of Dangerous Goods
- tests and thresholds for leachable toxic waste.

3.2.3 Australia and New Zealand

In 1994, the Australia and New Zealand Environment and Conservation Council (ANZECC) published a hazardous waste classification system under the national guidelines for the management of wastes (ANZECC, 1994). These guidelines recommended a national manifest format and waste classification system to track the movement of wastes within and between Australian states for treatment and disposal purposes.

The system for hazardous waste tracking developed by ANZECC comprises a designation and classification system for hazardous waste, a multiple waste transport certificate and a procedure for prior notification of interstate movements.

3.2.3.1 Hazardous waste classification system

The ANZECC classification system consists of six lists, as follows (Ministry of the Environment New Zealand, 1999):

List 1 **Generic Waste Code.** This list comprises a wide range of hazardous waste types and constituents which include the Y-List wastes of the IWIC and the Basel Convention. Wastes are grouped into a series of broad categories and specific waste types that are coded with a letter and a three-digit number. Where applicable, waste codes are linked to those of the Basel Convention.

List 2 **Contaminant Code.** This list contains 54 priority contaminant types based on Table 4 of the IWIC. Up to four contaminants may be assigned to each waste, in descending order of hazard.

List 3 **Industry Origin Code**. This list contains the Australia New Zealand Standard Industry Classification (ANZSIC) codes. It enables wastes to be assigned to different industry types.

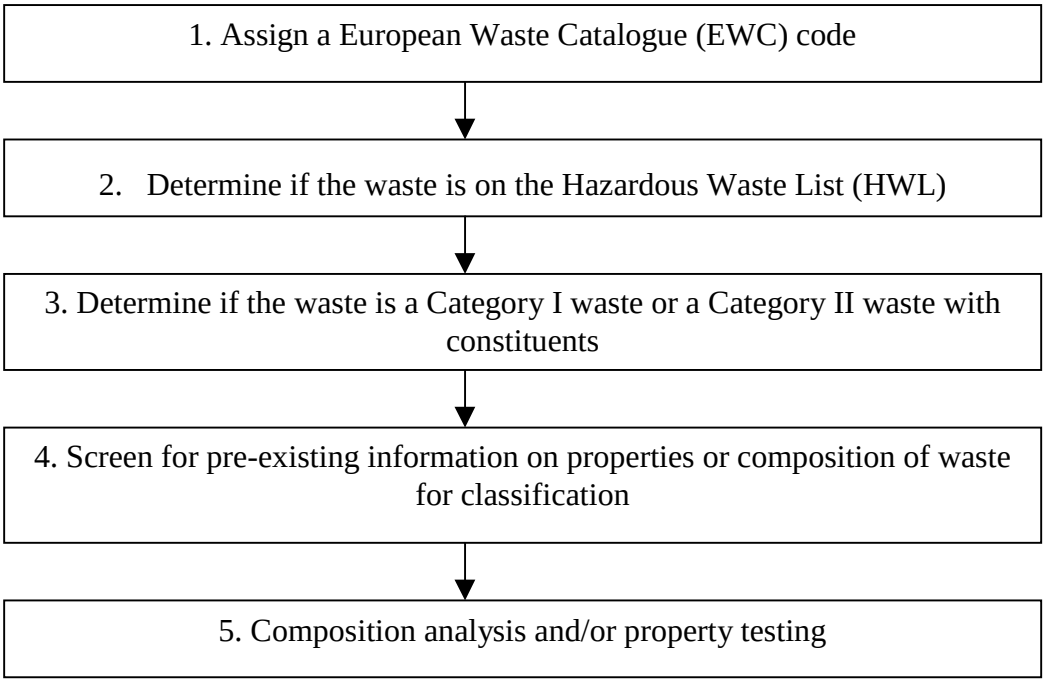
List 4 **Disposal/Recovery Code**. This table reflects D- and R- Lists of the IWIC/Basel Convention.

List 5 **United Nations (UN) number and hazardous goods classification**. For the purpose of transporting hazardous wastes, they need to be coded/labelled according to the United Nations Recommendations for the Transportation of Hazardous Goods.

List 6 **Hazardous characteristics.** Equivalent to the H-Lists of the IWIC/Basel Convention. If no UN Class can be assigned to a hazardous waste, then a hazardous characteristic is selected from this list.

CHAPTER FOUR: PAPER-BASED TOOL AND PROTOTYPE COMPUTER-BASED TOOL

The paper-based tool and prototype computer-based tools were developed in order to guide waste generators and regulators through the relevant waste classification process. The waste classification process is broadly divided into five tasks:



These steps can be seen in greater detail in the flowchart provided in Figure 2.

The first step in classifying a waste involves establishing an EWC code for the waste. The next step is to establish whether the waste is listed on the HWL. If the waste is not listed on the HWL then it is a non-hazardous waste. If the waste is listed on the HWL, then it is to be handled as a hazardous waste.

However, a key clause in the introductory remarks to the HWL (Decision 2000/532/EC) states that "*Member States may decide, in exceptional cases, on the basis of documentary evidence provided in an appropriate way by the holder, that a specific waste indicated in the list does not display any of the properties listed in Annex III to Directive 91/689/EEC*". The existing Decision 94/904/EC contains a similar provision.

In essence, it states that if a holder of a specific hazardous waste can demonstrate that a waste does not display any of the properties of hazardous waste, then the appropriate regulatory authority, to whom the appeal is made, may decide that the specific waste may be handled as a non-hazardous waste. It is under this clause that the tool becomes widely useful.

In order to gather the necessary documentary evidence, the composition and/or properties of the waste must be determined. The tools were developed to allow the waste generator to utilise the information available to them to classify their waste. Composition data can be used to determine the waste classification. Alternatively, property test methods are identified in the tool with reference to the most recent amendments to Annex V of the Dangerous Substances Directive. In addition, the most recent amendments to the general classification requirements (Annex VI of the Dangerous Substances Directive) of the waste are also provided.

Ultimately, once a decision has been reached and the documentary evidence gathered to demonstrate that the waste is on the HWL but does not display the properties listed in Directive 91/689/EEC then the waste generator must submit the data to the appropriate regulatory authority for a final classification.

A flowchart of the decision tree is presented overleaf. The paper-based tool is available from the Environmental Protection Agency.

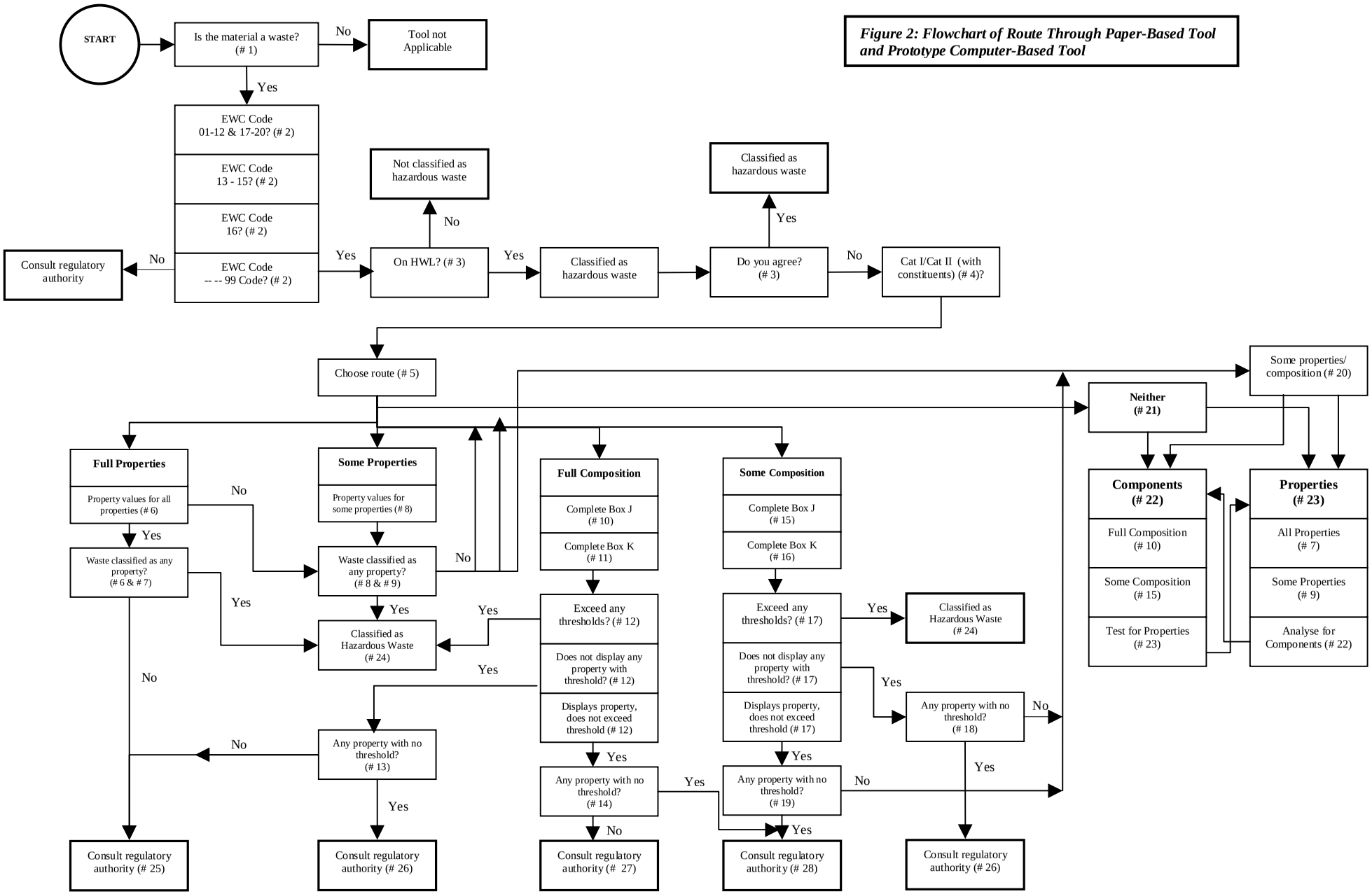


Figure 2: Flowchart of Route Through Paper-Based Tool and Prototype Computer-Based Tool

4.1 WORKED EXAMPLES

The following simple, introductory examples are provided to demonstrate the use of the paper-based tool. Five materials were chosen which are illustrative of:

1. Non-hazardous waste stream (cardboard packaging) - assign EWC code

2. Hazardous waste stream (fluorescent tubes) - assign HWL code

3. Classification of waste based on partial composition (organic solvents)

4. Classification of waste when a generator is unsure if substance contains dangerous substances or not (contaminated soil)

5. Classification of waste when a generator is unsure if substance contains dangerous substances or not (filter materials).

The current date is assumed to be 15 May 2002. Therefore, the paper-based tool effective from 1 January 2002 was used to classify the wastes.

4.1.1 Cardboard Packaging

1. The material is a waste according to the First Schedule of the Waste Management Act, 1996 'products for which the holder has no further use' (Tab No. 1).

2. At Tab No. 2, the waste is assigned the EWC code of 15 01 01 (paper and cardboard packaging).

3. The waste, which was identified in Tab No. 2, does not have an asterisk next to it. Therefore, based on the answers supplied, the waste is not classified as hazardous waste (Tab No. 3).

4.1.2 Fluorescent Tubes

1. The material is a waste according to the First Schedule of the Waste Management Act, 1996 'substances which no longer perform satisfactorily' (Tab No. 1).

2. At Tab No. 2, the waste is assigned the EWC code of 20 01 21* (fluorescent tubes and other mercury containing waste).

3. The waste, which was identified in Tab No. 2, does have an asterisk next to it. Therefore, at this point the waste is classified as hazardous waste. This decision is accepted and the waste is classified as hazardous waste (Tab No. 3).

4.1.3 Organic Solvents (from manufacture, formulation, supply and use of pharmaceuticals)

1. The material is a waste according to the First Schedule of the Waste Management Act, 1996 'products for which the holder has no further use' (Tab No. 1).

2. At Tab No. 2, the waste is assigned the EWC code of 07 05 04* (other organic solvents, washing liquids and mother liquors).

3. The waste, which was identified in Tab No. 2, does have an asterisk next to it. Therefore, at this point the waste is classified as hazardous waste. This decision is challenged by the waste holder and further consideration is undertaken to determine if the waste should be so-classified (Tab No. 3).

4. The material is classified as a Category I waste 'residue from substances employed as solvents' (Tab No. 4).

5. At Tab No. 5, the partial composition of the waste is known to be 35% acetone and 15% toluene.

6. At Tab No. 15 and 16, Box J and K were completed according to Annex I of 67/548/EEC.

    - Acetone was classified as F, R11; Xi, R36, R66 and R67 (flash point of -18ºC) and

    - Toluene was classified as F, R11 and Xn, R20 (flash point of 4ºC).

7. At Tab No. 17, the sum of the components were compared with the waste thresholds. The waste exceeded the thresholds for the following properties:

    - 50% of the waste had a flash point of $\leq$ 4ºC (threshold of $\leq$ 55ºC). Therefore assume substance is flammable.

    - 35% of the waste was classified as irritant with the risk phrase R36 (threshold of $\geq$ 20%).

8. At Tab No. 24, the waste is classified as hazardous waste. Hence, after consideration the waste holder has failed to demonstrate that this waste is not hazardous waste.

4.1.4 Soil contaminated with simazine (from construction and demolition)

1. The material is a waste according to the First Schedule of the Waste Management Act, 1996 'materials spilled, lost or which have undergone any other mishap (including any materials contaminated as a result of any such mishap)' (Tab No. 1).

2. At Tab No. 2, the waste generator is unsure as to which EWC code applies: 17 05 03* (soil and stones containing dangerous substances) or 17 05 04 (soil and stones other than those mentioned in 17 05 03).

3. The waste, which was identified in Tab No. 2, may have an asterisk next to it. Therefore, at this point the waste is classified as hazardous waste. This decision is challenged by the waste holder and further consideration is undertaken to determine if the waste should be so-classified (Tab No. 3).

4. The material is classified as a Category II waste 'soil, sand or clay (including dredging spoils)'. The constituents of the Category II waste are 'biocides or phyto-pharmaceutical substances (including pesticides)' (Tab No. 4).

5. At Tab No. 5, the partial properties and composition of the waste are known. Acute toxicity tests were conducted on the waste (LD_{50} oral rat 230 mg/kg). Simazine is classified according to Annex I of 67/548/EEC as Harmful (Xn) and R40 (Possible risks of irreversible effects) [Carcinogen Category 3].

6. At Tab No. 9, the acute toxicity results were compared to Annex VI of Directive 67/548/EEC. The waste was classified as harmful, assigned the symbol 'Xn' and the indication of danger 'harmful' and the risk phrase 'R22 Harmful if swallowed' (classified as harmful when $200 \leq LD_{50} < 2000$ mg/kg).

7. At Tab No. 24, the waste is classified as hazardous waste. The EWC code with the asterisk for 'containing dangerous substances' applies to the waste.

4.1.5 Filter materials

1. The material is a waste according to the First Schedule of the Waste Management Act, 1996 'materials contaminated or soiled as a result of planned actions' (Tab No. 1).

2. At Tab No. 2, the waste generator is unsure as to which EWC code applies: 15 02 02* (absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances) or 15 02 03 (absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02).

3. The waste, which was identified in Tab No. 2, may have an asterisk next to it. Therefore, at this point the waste is classified as hazardous waste. This decision is challenged by the waste holder and further consideration is undertaken to determine if the waste should be so-classified (Tab No. 3).

4. The material is classified as a Category I waste 'residues from substances employed as solvents' (Tab No. 4).

5. At Tab No. 5, the full composition of the waste is known to contain 10% 1,1,2-Trichloroethane.

6. At Tab No. 10 and 11, Box J and K were completed.

    - 1,1,2-Trichloroethane was classified according to Annex I of 67/548/EEC as Harmful (Xn), harmful by inhalation (R20), harmful in contact with skin (R21) and harmful if swallowed (R22).

7. At Tab No. 12, the sum of the components was compared with the waste thresholds. The waste did not exceed the threshold for harmful of $\geq$ 25%. In addition, at Tab No. 14, the waste did not display a property without a threshold.

8. At Tab No. 27, the waste has a property which renders it hazardous which does have a threshold, but the waste is below such threshold(s). Since the waste is listed on the HWL as containing dangerous substances, the waste is classified as hazardous waste until documentary evidence is submitted to the regulatory authority in order to determine if the waste may be handled as a non-hazardous waste.

4.2 KEY POINTS REGARDING CLASSIFICATION

The paper-based and prototype computer-based tools were developed in order to interpret Irish and European legislation and to make the task of waste classification more straightforward. However, there are a number of fundamental issues with regard to the existing legislation that can still make the task of waste classification difficult.

4.2.1 General

- To prove a waste is non-hazardous waste is more difficult than proving it is hazardous waste. If a material possesses just one of the properties that render it hazardous, it must be classified as hazardous waste. To be considered as non-hazardous waste, it must possess none of the properties. The burden of proof is greater.

- A new waste list (Decision 2000/532/EC as amended by Decision 2001/118/EC and Decision 2001/119/EC) will be introduced on 1 January 2002. This legislation will address a number of the uncertainties of the original hazardous waste list (Decision 94/904/EC), including:

    - A number of wastes have 'mirror entries' in Decision 2000/532/EC as amended by Decision 2001/118/EC and Decision 2001/119/EC. 'Mirror entries' apply when a particular waste that contains a dangerous substance(s) is given one code and classified as a hazardous waste, while the same waste that does not contain any dangerous substances is given another code and not classified as a hazardous waste. For example: ‘soil and stones containing dangerous substances’ is given the code 17 05 03*,where the asterisk indicates it is on the hazardous waste list. However, ‘soil and stones other than those mentioned in 17 05 03’ is given the code 17 05 04, and is not on the hazardous waste list.

    - No wastes in chapter 15 00 00 (Packaging, absorbents, wiping cloths, filter materials and protective clothing not otherwise specified) were listed as hazardous wastes in Decision 94/904/EC. Therefore, contaminated packaging, absorbents, filter materials, wiping cloths and protective clothing were classified as non-hazardous waste. Decision 2001/118/EC includes '15 01 10* packaging containing residues of or contaminated by dangerous substances' and '15 02 02* absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances'. Therefore, nominally empty solvent drums and solvent wipes, which were previously classified as non-hazardous waste, may be classified as hazardous waste from 1 January 2002 if they contain or are contaminated with dangerous substances.

- These revisions clarify the classification of containers to an extent, but there is still uncertainty. The threshold that applies to toxic substance composition may be used to consider if the containers are "clean" or "uncontaminated", but if the material of the container has absorbed some of the dangerous substance there might be a potential for leaching.

- Classification of waste is independent of the fate of the waste, i.e. it refers to the intrinsic properties of the waste.

- The dilution or mixing of hazardous waste to bring it below the threshold is prohibited under the Hazardous Waste Directive.

- From time to time, new properties may be introduced under the dangerous substances legislation. However, these properties do not apply to waste until the waste legislation has been modified. For example, "sensitisation" is listed as a property under Directive 67/548/EEC but is not yet incorporated into waste legislation.

- Composition analysis may be simpler in certain circumstances than property testing. The composition may, however, only be used to infer properties. It may be necessary nevertheless to conduct property testing if properties such as flammability are suspected.

4.2.2 Waste thresholds

The hazardous waste list specifies thresholds for a number (not all) of the properties of a waste. There are a number of issues that arise with regard to this system:

- The waste legislation is such that if a waste displays a property above the specified threshold it is deemed to be hazardous waste and below the threshold as non-hazardous waste. Therefore, a waste may contain a dangerous substance but be below the threshold to classify the waste as hazardous waste. For example if a component of a waste is determined to be harmful but at a concentration less than the specified threshold of 25% than the waste is classified as non-hazardous waste.

- Thresholds for a number of properties (for example, explosive, oxidising, ecotoxic and residuary hazardous property) have not been specified in EU legislation. Classification of waste based on these properties is more difficult and the relevant regulatory authority must ultimately determine the waste classification. But, guidance may be obtained for residuary hazardous property by reference to Austrian legislation (Festsetzungsverordnung gefährliche Abfälle idF. BGBI. II Nr. 178/2000), a translation of which is provided in Appendix 1. Guidance on ecotoxicity is being developed by international working groups.

4.2.3 Property test methods

Property test methods may be required in order to classify waste. Application and interpretation of these can present problems:

- Property test methods and the general classification of the waste must be conducted in accordance with Directive 67/548/EEC (and its subsequent amendments). It is important to ensure that where scientific literature and/or Material Safety Data Sheets (MSDSs) are consulted the information provided is in accordance with EU legislation. If data is available from non-EU sources it may be difficult to interpret its significance. Errors with waste classification may arise when properties are classified according to legislation in a non-EU Member State or by a different classification system to the one used in the EU. For example, for

the property carcinogenic, many classification systems are used internationally including IARC (International Agency for Research on Cancer) and NTP (U.S. Department of Health and Human Services Public Health Service National Toxicology Program).

- Expert assistance may be required to interpret the test method results. In some cases thresholds or pass/fail criteria are provided, but in others consideration must be given to current evidence and state of knowledge or to a combination of effect mechanisms.

- The property 'infectious' does not have any property tests listed in Annex V or general classification requirements listed in Annex VI of Directive 67/548/EEC.

4.2.4 Difficulty in obtaining information

- Many substances are not yet classified in EU legislation under Annex I of Directive 67/548/EEC. Hence it is even more difficult to consider products containing mixtures of substances. Therefore, property testing may be required for these substances.

- Legislation with regard to the classification, packaging and labelling of dangerous substances is updated regularly (approx. twice yearly). Therefore, it is difficult to obtain MSDSs which are current. Many EU MSDSs in circulation do not provide the current R-phrases and labelling. This information is essential to correctly classify a waste.

- Surprisingly, one of the key problems in classifying a waste is the difficulty in obtaining legislation. This is particularly the case with regard to Directive 67/548/EEC and its subsequent amendments. The Eur-lex database did not list all the relevant amendments. In addition, a number of the annexes were not published in the Official Journal of the European Communities (these had to be subsequently ordered through the European Commission by special request). This legislation is applicable to a wide range of industrial activities and should be readily available.

Considering the above difficulties, and if there is any doubt, reference must be made to the appropriate regulatory authority. This is particularly necessary if a suspect waste is to be classified as non-hazardous waste.

4.3 MECHANISM TO ENSURE THE TOOLS ARE KEPT UP TO DATE

The paper-based and prototype computer-based tools developed by the Clean Technology Centre will need to be periodically revised to incorporate future legislation. The updating mechanism can be sub-divided into three tasks:

1. Identify new legislation

2. Identify relevant areas of the paper-based tool, prototype computer-based tool and worksheet that need to be updated

3. Ensure all relevant information is updated

4.3.1 Step One: Identify New Legislation

New legislation can be identified from a number of sources:

The EUR-Lex web site contains European legislation (Directives, Decisions and Regulations). Official Journals (OJ) are available free of charge (for a period of 45 days in Adobe Acrobat® format) at http://europa.eu.int/eur-lex/en/oj/index.html. In addition, older legislation related to the European Waste Catalogue/Hazardous Waste List, property test methods and general classification requirements (Annex V and VI respectively of Directive 67/548/EEC and its subsequent amendments) are also available at this site at http://europa.eu.int/eur-lex/en/lif/index.html. It should be noted that these files are not in Adobe Acrobat® format and do not contain figures or tables.

The Health and Safety Authority (HSA) can be contacted for recent amendments to the classification, packaging and labelling of dangerous substances legislation (Directive 67/548/EEC and its subsequent amendments). It should be noted that this legislation is updated approximately twice a year.

The Waste Management Section of the Department of the Environment can be contacted for amendments to the Waste Management Act or by browsing the 'Press Releases' pages of the Department of Environment web site at http://www.environ.ie/pressindex.html.

4.3.2 Step Two: Identify Relevant Areas of the Paper-Based Tool, Prototype Computer-Based Tool and Worksheet

The paper-based tool, prototype computer-based tool and the hazardous waste classification worksheet can be updated when the following legislation is revised or amended:

- European Waste Catalogue/Hazardous Waste List (inc. thresholds)

- First and Second Schedule of Waste Management Act

- Annex V and VI of Directive 67/548/EEC

The relevant tabs in the paper-based tool, the relevant files in the prototype computer-based tool and the relevant boxes of the hazardous waste classification worksheet which need to be amended for each of these circumstances is provided below:

NEW EWC/HWL		
Relevant Boxes (Worksheet)	**Relevant Tabs (Paper Tool)**	**Relevant Files (Prototype Computer Tool)**
European Waste Catalogue		
B	2	Files/New Folder/EWC & HWL/Cat 1-20.doc
C	3	Files/New Folder/EWC & HWL/Is waste on HWL.doc
C1	24	Files/New Folder/Results/Above threshold.doc
D	25	Files/New Folder/Results/No property.doc
D1	26	Files/New Folder/Results/No threshold.doc
L	27	Files/New Folder/Results/Below threshold.doc
M	28	Files/New Folder/Results/Below & no threshold.doc
Hazardous Waste List		
E	3	Files/New Folder/EWC & HWL/Is waste on HWL.doc
Waste Thresholds		
J K	10	Files/New Folder/Properties or Composition/Composition/Full composition1.doc
	12	Files/New Folder/Properties or Composition/Composition/Full composition3.doc
	15	Files/New Folder/Properties or Composition/Composition/Some composition1.doc
	17	Files/New Folder/Properties or Composition/Composition/Some composition3.doc
	22	Files/New Folder/Properties or Composition /Analysing for components.doc

WASTE MANAGEMENT ACT		
Relevant Boxes (Worksheet)	**Relevant Tabs (Paper Tool)**	**Relevant Files (Prototype Computer Tool)**
First Schedule		
N/A	1	Files/Is the material a waste.doc
Second Schedule Part I: Category I Waste and Category II Waste		
F G	4	Files/New Folder/Category I & II/Category I&II waste.doc
Second Schedule Part II: Constituents of Category II waste which render it hazardous when it has the properties specified in Part III		
H	4	Files/New Folder/Category I & II/Category I&II waste.doc
Second Schedule Part III: Properties of waste which render it hazardous		
I J K	5	Files/New Folder/Properties or Composition/What info do you have.doc
	6	Files/New Folder/Properties or Composition/Properties/Full properties.doc
	7	Files/New Folder/Properties or Composition/Properties/Test methods full.doc
	8	Files/New Folder/Properties or Composition/Properties/Some properties.doc
	9	Files/New Folder/Properties or Composition/Properties/Test methods some.doc
	12	Files/New Folder/Properties or Composition/Composition/Full composition3.doc
	13	Files/New Folder/Properties or Composition/Composition/Full composition4.doc
	14	Files/New Folder/Properties or Composition/Composition/Full composition5.doc
	17	Files/New Folder/Properties or Composition/Composition/Some composition3.doc
	18	Files/New Folder/Properties or Composition/Composition/Some composition4.doc
	19	Files/New Folder/Properties or Composition/Composition/Some composition5.doc
	23	Files/New Folder/Properties or Composition/Testing for properties.doc

DANGEROUS SUBSTANCES DIRECTIVE		
Relevant Boxes (Worksheet)	**Relevant Tabs (Paper Tool)**	**Relevant Files (Prototype Computer Tool)**
Annex V of 67/548/EEC: Property Test Methods[2]		
I	29	Files/New Folder/Properties or Composition/Annex V/Annex V tests.doc
Annex V of 67/548/EEC: General Classification Requirements[3]		
I	30	Files/New Folder/Properties or Composition/Annex VI/Annex VI classification.doc

In order to allow the paper-based tool and prototype computer-based tool to be updated more efficiently this table links the paper-based tool tabs to the computer-based tool files. If changes are made to the paper-based tool they should also be made to the prototype computer-based tool and vice versa.

Paper Tool Tab No.	Prototype Computer Tool File	Paper Tool Tab No.	Prototype Computer Tool File
Tab No. 1	Is the material a waste.doc	Tab No. 16	Some Composition2.doc
Tab No. 2	Cat 1-20 doc	Tab No. 17	Some Composition3.doc
Tab No. 3	Is waste on HWL.doc	Tab No. 18	Some Composition4.doc
Tab No. 4	Category I&II Waste.doc	Tab No. 19	Some Composition5.doc
Tab No. 5	What info do you have.doc	Tab No. 20	Some prop or comp.doc
Tab No. 6	Full properties.doc	Tab No. 21	No prop or comp.doc
Tab No. 7	Test methods full.doc	Tab No. 22	Analysing for components.doc
Tab No. 8	Some properties.doc	Tab No. 23	Testing for properties.doc
Tab No. 9	Test methods some.doc	Tab No. 24	Above threshold.doc
Tab No. 10	Full Composition1.doc	Tab No. 25	No property.doc
Tab No. 11	Full Composition2.doc	Tab No. 26	No threshold.doc
Tab No. 12	Full Composition3.doc	Tab No. 27	Below threshold.doc
Tab No. 13	Full Composition4.doc	Tab No. 28	Below & no threshold.doc
Tab No. 14	Full Composition5.doc	Tab No. 29	Annex V Tests.doc
Tab No. 15	Some Composition1.doc	Tab No. 30	Annex VI Tests.doc

2 Annex V has been amended several times and the most recent legislation is indicated in Section 4.3.3.3
3 Annex VI has been amended several times and the most recent legislation is indicated in Section 4.3.3.3

4.3.3 Step Three: Ensure All Relevant Information is Updated

The final step involves updating the relevant areas with the new legislation. This is achieved differently in the paper-based tool and the prototype computer-based tool.

4.3.3.1 Paper-Based Tool

Remove the obsolete tabs from the folder and replace with the revised tabs. Destroy old tabs.

4.3.3.2 Prototype Computer-Based Tool

1. Open up 'Files' folder in the prototype computer-based tool.
2. **Copy** the most recent folder (for example, choose 'After 1 Jan 02' rather than 'Before 31 Dec 01')
3. **Paste** the folder into a new location (for example on the desktop) and rename the folder with a new folder name
4. **Cut** the new folder (from the desktop, for example) and **paste** into the 'Files' folder.
5. Change the relevant files in the prototype computer-based tool as identified above.
6. Change the dates and hyperlinks in the file 'Date.doc' so that the updated information is incorporated into the tool. (All other existing links will be retained).

4.3.3.3 Annex V and Annex VI of Directive 67/548/EEC

Annex V has been amended several times and the most recent tests (as of 30 April 2001) are indicated in the following tables. The table relates the tests to the properties in order that the paper-based and prototype computer-based tool may be updated more efficiently.

PART A

METHODS FOR THE DETERMINATION OF PHYSICO-CHEMICAL PROPERTIES

CODE	TITLE	LEGISLATION	PROPERTY
A. 1.	Melting/Freezing Temperature	Directive 92/69/EEC	Not related to individual property
A. 2.	Boiling Temperature	Directive 92/69/EEC	Flammable
A. 3.	Relative Density	Directive 92/69/EEC	Not related to individual property
A. 4.	Vapour Pressure	Directive 92/69/EEC	Not related to individual property
A. 5.	Surface Tension	Directive 92/69/EEC	Not related to individual property
A. 6.	Water Solubility	Directive 92/69/EEC	Not related to individual property
A. 8.	Partition Coefficient	Directive 92/69/EEC	Ecotoxic
A. 9.	Flash Point	Directive 92/69/EEC	Flammable
A. 10.	Flammability (Solids)	Directive 92/69/EEC	Flammable
A. 11.	Flammability (Gases)	Directive 92/69/EEC	Flammable
A. 12.	Flammability (Contact with Water)	Directive 92/69/EEC	Residuary hazardous property (a)
A. 13.	Pyrophoric properties of solids and liquids	Directive 92/69/EEC	Residuary hazardous property (a)
A. 14.	Explosive Properties	Directive 92/69/EEC	Explosive
A. 15.	Auto-ignition temperature (liquids and gases)	Directive 92/69/EEC	Flammable
A. 16.	Relative self-ignition temperature for solids	Directive 92/69/EEC	Flammable
A. 17.	Oxidising Properties (solids)	Directive 92/69/EEC	Oxidising
A.18.	Number-Average Molecular Weight And Molecular Weight Distribution Of Polymers	Directive 98/73/EC	Not related to individual property
A.19	Low Molecular Weight Content Of Polymers	Directive 98/73/EC	Not related to individual property
A.20.	Solution/Extraction Behaviour Of Polymers In Water	Directive 98/73/EC	Residuary hazardous property (b)

PART B **METHODS FOR THE DETERMINATION OF TOXICITY AND OTHER HEALTH EFFECTS**			
CODE	**TITLE**	**LEGISLATION**	
	General Introduction: Part B	Directive 84/449/EEC Directive 92/69/EEC, Directive 96/54/EC	Introduction to property with tests table
B. 1.	Acute toxicity (oral)	Directive 92/69/EEC	Harmful & Toxic
B. 1bis	Acute toxicity (oral) Fixed Dose Method	Directive 92/69/EEC	Harmful & Toxic
B. 1tris	Acute Toxicity (Oral) - Acute Toxic Class Method	Directive 96/54/EC	Harmful & Toxic
B. 2.	Acute Toxicity (Inhalation)	Directive 92/69/EEC & Directive 93/21/EC	Harmful & Toxic
B. 3.	Acute Toxicity (Dermal)	Directive 92/69/EEC	Harmful & Toxic
B. 4.	Acute Toxicity (Skin Irritation)	Directive 92/69/EEC	Irritant Harmful & Toxic Corrosive
B. 5.	Acute Toxicity (Eye Irritation)	Directive 92/69/EEC	Irritant Harmful & Toxic
B. 6.	Skin Sensitisation	Directive 96/54/EC	Not related to individual property
B. 7.	Repeated Dose (28 Days) Toxicity (Oral)	Directive 96/54/EC	Harmful & Toxic
B. 8.	Repeated Dose (28 Days) Toxicity (inhalation)	Directive 92/69/EEC	Harmful & Toxic
B. 9.	Repeated Dose (28 Days) Toxicity (dermal)	Directive 92/69/EEC	Harmful & Toxic
B. 10.	Mutagenicity - in Vitro Mammalian Chromosome Aberration Test	Directive 2000/32/EC	Mutagenic
B. 11.	Mutagenicity - in Vivo Mammalian Bone Marrow Chromosome Aberration Test	Directive 2000/32/EC	Mutagenic
B. 12.	Mutagenicity - in vivo mammalian erythrocyte Micronucleus Test	Directive 2000/32/EC	Mutagenic
B. 13/14	Mutagenicity - Reverse Mutation Test Bacteria	Directive 2000/32/EC	Mutagenic
B.15.	Gene mutation-*Saccharomyces cerevisiae*	Directive 87/302/EEC	Mutagenic
B.16.	Mitotic recombination-*Saccharomyces cerevisiae*	Directive 87/302/EEC	Mutagenic
B. 17.	Mutagenicity - In Vitro Mammalian Cell Gene Mutation Test	Directive 2000/32/EC	Mutagenic

B.18.	DNA damage and repair-unscheduled DNA synthesis-mammalian cells in vitro	Directive 87/302/EEC	Mutagenic
B.19.	Sister chromatid exchange assay in vitro	Directive 87/302/EEC	Mutagenic
B.20.	Sex-linked recessive lethal test in *Drosophila melanogaster*	Directive 87/302/EEC	Mutagenic
B.21.	In vitro mammalian cell transformation tests	Directive 87/302/EEC	Mutagenic
B.22.	Rodent dominant lethal test	Directive 87/302/EEC	Mutagenic
B. 23.	Mammalian Spermatogonial Chromosome Aberration Test	Directive 2000/32/EC	Mutagenic
B.24.	Mouse spot test	Directive 87/302/EEC	Mutagenic
B.25.	Mouse heritable translocation	Directive 87/302/EEC	Mutagenic
B.26.	Sub-chronic oral toxicity test: 90-day repeated oral dose using rodent species	Directive 87/302/EEC	Harmful & Toxic
B.27.	Sub-chronic oral toxicity test: 90-day repeated oral dose using non-rodent species	Directive 87/302/EEC	Harmful & Toxic
B.28.	Sub-chronic dermal toxicity study: 90-day repeated dermal dose study using rodent species	Directive 87/302/EEC	Harmful & Toxic
B.29.	Sub-chronic inhalation toxicity study: 90-day repeated inhalation dose study using rodent species	Directive 87/302/EEC	Harmful & Toxic
B.30.	Chronic toxicity test	Directive 87/302/EEC	Harmful & Toxic
B.31.	Teratogenicity test - rodent and non-rodent	Directive 87/302/EEC	Toxic for Reproduction
B.32.	Carcinogenicity test	Directive 87/302/EEC	Carcinogenic
B.33.	Combined chronic toxicity/carcinogenicity test	Directive 87/302/EEC	Harmful & Toxic Carcinogenic
B.34.	One-generation reproduction toxicity test	Directive 87/302/EEC	Toxic for Reproduction
B.35.	Two-generation reproduction toxicity test	Directive 87/302/EEC	Toxic for Reproduction
B.36.	Toxicokinetics	Directive 87/302/EEC	Not related to individual property
B.37.	Delayed Neurotoxicity Of Organophosphorus Substances Following Acute Exposure	Directive 96/54/EC	Harmful & Toxic
B.38.	Delayed Neurotoxicity Of Organophosphorus Substances 28-Day Repeated Dose Study	Directive 96/54/EC	Harmful & Toxic
B. 39.	Unscheduled DNA Synthesis (UDS) Test With Mammalian Liver Cells In Vivo	Directive 2000/32/EC	Mutagenic
B. 40.	Skin Corrosion	Directive 2000/33/EC	Corrosive

B. 41.	Phototoxicity - In Vitro 3T3 NRU Phototoxicity Test	Directive 2000/33/EC	Harmful & Toxic

PART C **METHODS FOR THE DETERMINATION OF ECOTOXICITY**			
CODE	**TITLE**	**LEGISLATION**	
	General introduction	Directive 87/302/EEC, Directive 92/69/EEC & Directive 2000/32/EC	Introduction to property with tests table
C. 1.	Acute Toxicity For Fish	Directive 92/69/EEC	Ecotoxic
C. 2.	Acute Toxicity For Daphnia	Directive 92/69/EEC	Ecotoxic
C. 3.	Algal Inhibition Test	Directive 92/69/EEC	Ecotoxic
C. 4.	Determination of 'ready' biodegradability C.4-A: Dissolved organic carbon (DOC) die-away test C.4-B: Modified OECD screening test C.4-C: Carbon dioxide (CO2) evolution test C.4-D: Manometric respirometry test C.4-E: Closed bottle test C.4-F: MITI (Ministry of International Trade & Industry-Japan) test	Directive 92/69/EEC	Ecotoxic
C. 5.	Degradation biochemical oxygen demand	Directive 92/69/EEC	Ecotoxic
C. 6.	Degradation chemical oxygen demand	Directive 92/69/EEC	Ecotoxic
C. 7.	Degradation abiotic degradation: hydrolysis as a function of pH	Directive 92/69/EEC	Ecotoxic
C. 8.	Toxicity for earthworms: artificial soil test	Directive 87/302/EEC	Ecotoxic
C. 9.	Biodegradation - Zahn -Wellens test	Directive 87/302/EEC	Ecotoxic
C. 10.	Biodegradation - activated sludge simulation tests	Directive 87/302/EEC	Ecotoxic
C. 11.	Biodegradation - activated sludge respiration inhibition test	Directive 87/302/EEC	Ecotoxic
C. 12.	Biodegradation - modified SCAS test	Directive 87/302/EEC	Ecotoxic
C. 13.	Bioconcentration: Flow-Through Fish Test	Directive 98/73/EC	Ecotoxic

Annex VI has been amended several times and the most recent legislation (as of 30 April 2001) is indicated in the following table.

	SECTIONS	LEGISLATION
1	General Introduction	Directive 93/21/EEC amended by Directive 98/98/EC
2	Classification on the Basis of Physico-Chemical Properties	Directive 93/21/EEC amended by Directive 98/98/EC
3	Classification on the Basis of Toxicological Properties	Directive 93/21/EEC amended by Directive 98/98/EC
4	Classification on the Basis of Specific Effects on Human Health	Directive 93/21/EEC amended by Directive 98/98/EC
5	Classification on the Basis of Environmental Effects	Directive 93/21/EEC amended by Directive 98/98/EC
6	Choice of Safety Advice Phrases	Directive 93/21/EEC amended by Directive 98/98/EC
7	Labelling Proposal	Directive 93/21/EEC amended by Directive 98/98/EC
8	Special Cases (Substances)	Directive 93/21/EEC amended by Directive 96/54/EC and Directive 98/98/EC
9	Special Cases (Preparations)	Directive 93/21/EEC amended by Directive 96/54/EC

4.3.3.4 Final Check

Please ensure that each of the following areas have been adequately addressed and updated (if applicable):

- Paper-based tool, prototype computer-based tool and 'Hazardous Waste Classification Worksheet' (as identified in Section 4.3.2) have been revised.
- The tables provided in Section 4.3.3.3 regarding Annex V of 67/548/EECand Annex VI of 67/548/EEC are updated.
- Guide to the use of the paper-based and prototype computer-based tool accurately reflects which legislation is required.

CHAPTER FIVE: RECOMMENDATIONS AND CONCLUSIONS

Conclusions

1. The paper-based and prototype computer-based tools have been developed to interpret and facilitate the classification of hazardous waste in accordance with current and anticipated Irish and EU legislation. A worksheet has been provided to record the decision path and substantiate any conclusion. In the course of development, these tools have been tested by their successful application to 30 non-trivial "real wastes". Each of these wastes, at first sight, might have been considered as hazardous waste and required detailed consideration to arrive at a valid conclusion.

2. An extensive range of applicable legislation has been compiled for this project. This was surprisingly difficult, and would not be convenient for the average waste generator.

3. The legislative framework is neither entirely comprehensive nor sufficiently specific to address all cases. Hence the tools may not be universal. A number of issues (discussed in Section 4.2) remain. These could be important for a specific waste.

4. Guidance has been provided in Section 4.3 on a mechanism to maintain the validity of these tools.

5. If there is any doubt regarding classification, reference must be made to the appropriate regulatory authority. This is particularly necessary if a suspect waste is to be classified as non-hazardous waste.

Recommendations

1. The paper-based tool interprets current Irish and EU legislation, however its validity is dependent on its being maintained. This tool must be regularly updated to reflect any legislative advances (particularly those addressing the key points discussed in Section 4.2). This refers to the waste legislation, but also the associated test methods and the classification of substances.

2. In examining practice in other EU Member States, it was apparent that there is a common desire among regulatory authorities to address the difficulties, which are shared. Consequently there is a need for additional co-operation between EU Member States to share experiences and harmonise practices, particularly at the level of those responsible for actual classification of wastes.

Additional Information

In addition to this main report detailing the project, a brief Synthesis Report is available from the Environmental Protection Agency. The paper-based tool is also available from the Agency.

REFERENCES

Australia and New Zealand Environment and Conservation Council (ANZECC) 1994. *National guidelines for the management of wastes – national manifest and classification system.*

Commission of the European Communities, 10.01.2000. *Report From The Commission To The Council And The European Parliament On The Implementation Of Community Waste Legislation: Directive 75/442/EEC On Waste, Directive 91/689/EEC On Hazardous Waste, Directive 75/439/EEC On Waste Oils And Directive 86/278/EEC On Sewage Sludge For The Period 1995 - 1997*. COM(1999) 752 Final. Commission of the European Communities, Brussels.

Council of the European Communities, 1991. *Council Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on waste*. Official Journal of the European Communities No L 78/32.

Council of the European Communities, 1975. *Council Directive 75/442/EEC of 15 July 1975 on waste*. Official Journal of the European Communities No L 194/39.

Council of the European Communities, 1967. *Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.* Official Journal of the European Communities No L 196/1.

Environment Agency, January 1999. *Special Wastes: A technical guidance note on their definition and classification.* Environment Agency, United Kingdom.

European Environment Agency, 2000. *Hazardous waste generation in selected European countries - Comparability of classification systems and quantities.* Topic report No. 14/1999. Office for Official Publications of the European Communities, Luxembourg.

International Solid Waste Association, 2000. *National Hazardous Waste Management Profiles from ISWA Member Countries.* ISWA Working Group report no. 2/2000. ISWA Working Group on Hazardous Waste, Denmark.

Ministry for the Environment, New Zealand and Environment Business Group, 1999. *Towards a New Zealand Definition of Hazardous Waste - Issues and Options*. http://www.mfe.govt.nz/issues/waste/issues_options.pdf.

Organisation for Economic Co-operation and Development, 1992. *Decision concerning the control of transfrontier movements of wastes destined for recovery operations.* C(92)39/FINAL

Organisation for Economic Co-operation and Development, 1988. *Decision on transfrontier movements of hazardous waste*. Council Decision C(88) 90/FINAL.

United Nations, 1997. *United Nations Recommendations for the Transport of Dangerous Goods (UNRTDG), 10th Edition.* United Nations, Geneva.

Verordnung des Bundesministers für Umwelt, Jugend und Familie über die Festsetzung von gefährlichen Abfällen und Problemstoffen (Festsetzungsverordnung gefährliche Abfälle idF. BGBI. II Nr. 178/2000)

BIBLIOGRAPHY

Booz-Allen & Hamilton Inc., 2000. *RCRA, Superfund & EPCRA Hotline Training Module Introduction to Hazardous Waste Identification (40 CFR Part 261)*, USEPA, Washington DC http://www.epa.gov/epaoswer/hotline/training/hwid.txt

Carpenter, R.A. and R.R. Cirillo, 1990. *From Grave To Cradle: Trends In Hazardous Waste Management An edited compilation of papers from the 1990 Pacific Basin Conference on Hazardous Waste of the Pacific Basin Consortium for Hazardous Waste Research, Honolulu, Hawaii*. Pacific Basin Consortium for Hazardous Waste Research, Hawaii

Commission Of The European Communities, 2000. *Report From The Commission To The Council And The European Parliament On The Implementation Of Community Waste Legislation: Directive 75/442/EEC On Waste, Directive 91/689/EEC On Hazardous Waste, Directive 75/439/EEC On Waste Oils And Directive 86/278/EEC On Sewage Sludge For The Period 1995 - 1997. Com(1999) 752 Final* Commission Of The European Communities, Brussels.

Commission Of The European Communities, 1992. *European Community Environment Legislation - Volume 6*. Office for Official Publications of the European Communities, Luxembourg.

Environmental Protection Agency Ireland, 1996. *Waste Catalogue and Hazardous Waste List*, EPA, Ardcavan.

European Environment Agency, 2000. *Hazardous Waste Generation in Selected European Countries: Comparability of Classification Systems and Quantities*, European Environment Agency, Copenhagen.

Institute of Engineers of Ireland, 1994. *Conference: Toxic Waste Management held at Ballsbridge on November 10 1994*.

International Solid Waste Association, 1999. *International Perspectives in Hazardous Waste Management : 1999 edition - ISWA Working Group report no. 2/1999.* ISWA, Denmark.

LaGrega, M.D. et al, 1994. *Hazardous Waste Management*, McGraw Hill Inc.

Ministry for the Environment, New Zealand and Environment and Business Group, 1999. *Definition for Hazardous Waste: Issues and Options* http://www.mfe.govt.nz/issues/waste/issues_options.pdf

Ministry of Housing, Spatial Planning and the Environment, 1997. *Multi-Year Plan for Hazardous Waste II (MJP-GA II)*. Ministry of Housing, Spatial Planning and the Environment, The Hague.

UNEP, 1999. *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Adopted by the Conference of the Plenipotentiaries on 22 March 1989*.

USEPA, 1986. *Solving the Hazardous Waste Problem: EPA's RCRA Program*, Office of Solid Waste Washington DC

Wagner, T.P., 1991. *The Complete Guide to the Hazardous Waste Regulations: A Comprehensive Step-by-Step Guide to the Regulation of Hazardous Wastes under RCRA, TSCA, HMTA, OSHA and Superfund*, 2nd Edition, Van Nostrand Reinhold, New York.

Wentz, C.A., 1989. *Hazardous Waste Management*, McGraw Hill Inc., Singapore

WEB-SITES

CAREX *(International Information System on Occupational Exposure to Carcinogens)* http://www.occuphealth.fi/list/data/CAREX

CEFIC, *Responsible Care -Health, Safety and Environmental Reporting Guidelines* http://www.cefic.org/activities/hse/rc/guide/06.htm

Chemexper, Chemical Directory http://www.chemexper.com/

Chemfinder, Database and Internet Searching http://www.chemfinder.com/

Connecticut Department of Environmental Protection, *Environmental Program Fact Sheet Hazardous Waste Determinations/Knowledge of Process* http://www.dep.state.ct.us/wst/proddisp/hwd.htm

CREST, *Hazardous Waste and RCRA* http://www.crest.org/environment/gotwh/general/hazwaste-RCRA/html/whats-hw.html

Department of Environmental Health and Safety Indiana University, *Hazardous Waste Management Guide* http://www.ehs.indiana.edu/em/hazwasne.html#WHATIS

Department of the Environment, Transport and the Regions. *Waste Strategy 2000 for England and Wales Part 1 & 2*
http://www.environment.detr.gov.uk/waste/strategy/cm4693/13.htm

Department of the Environment, Transport and the Regions. *Register of English Regulatory Requirements for Government Departments (England)*
http://www.environment.detr.gov.uk/greening/register/02.htm

Department of Public Enterprise Ireland, *Legislation* http://www.gov.ie/tec/legislation

ENFO http://www.enfo.ie

Environmental Health and Safety at Iowa State University, *Hazardous Waste Manual*
http://www.ehs.iastate.edu/publications/manuals/wastemanual.htm#definition

Environmental Protection Agency http://www.epa.ie

EU Delegation of the European Commission to the United States, *Chemical Legislation in the EU* http://www.eurunion.org/legislat/chemical.htm

EU Legislation on Waste http://kola.dcu.ie/~environ/waste.htm

European Commission DG XI, Environment, Nuclear Safety and Civil Protection. *Waste legislation: Commission moves against Germany, Italy, the UK and Spain*
http://www.waternunc.com/gb/dg11en13.htm

Health and Safety Authority Ireland, *Dangerous Substances Acts, 1972 and 1979*
http://www.hsa.ie/osh/dsa7279.htm

International Solid Waste Association ISWA http://www.iswa.dk/

National Chemical Emergency Centre http://www.the-ncec.com/

National Occupational Health and Safety Commission, Australia. *Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1999)]* http://www.worksafe.gov.au/publications/fulltext/standards/nohsc1008_44.htm

OECD, Detailed Review Document on Classification Systems for Reproductive Toxicity in OECD Member Countries http://www.oecd.org/ehs/test/mono15.pdf

Office of Land Quality Indiana Dept. of Environmental Management, *Hazardous Waste* http://www.state.in.us/idem/olq/special_topics/hazardous_waste/index.html

PRO-ACT, *Hazardous Waste Identification and Sampling* http://www.afcee.brooks.af.mil/pro_act/fact/nov97a.htm

Southern Illinois University (SIU), *III. Hazardous Chemical Waste Definition* http://www.cehs.siu.edu/Chemical/CWMG/CWMG-3.HTM

The National Park Service, *Hazardous Waste Management* http://www2.nature.nps.gov/nps77/wastmgmt.new.html

UC Santa Cruz - EHS *Hazardous Waste Determination and Classification Guide* http://ehs.ucsc.edu/hw/guide/

UNEP *Basel Convention Ratifications (9 October 2000)* http://www.basel.int/ratif/ratif.html

USEPA, *Part 261-Identification And Listing of Hazardous Waste* http://www.access.gpo.gov/nara/cfr/waisidx_99/40cfr261_99.html

USEPA, *Subchapter I (1995-1999) - Solid Wastes* http://www.epa.gov/docs/epacfr40/chapt-I.info/subch-I/

Warner Norcross and Judd, *Dealing with Hazardous Solid and Liquid Industrial Waste* http://www.wnj.com/environmental/hazover.htm#Hazardous

APPENDIX 1: TRANSLATION OF AUSTRIAN LEGISLATION

A translation of Austrian legislation relating to thresholds for property H12 and H13 is provided below. While great effort has been made to ensure that the information contained herein is accurate, the Clean Technology Centre assumes no responsibility and disclaims all liability for any injury or damage resulting from the use or effect of any product or information specified in the publication. Anyone using this information assumes all liability arising from such use. The original Austrian text is definitive and must be consulted.

Anlage 2 Gefahrenrelevante Eigenschaften *'Verordnung des Bundesministers für Umwelt, Jugend und Familie über die Festsetzung von gefährlichen Abfällen und Problemstoffen (Festsetzungsverordnung gefährliche Abfälle idF. BGBI. II Nr. 178/2000)*'

H12

The criterion H12 is related to:
Discharged wastes, (at pH 4) which contains sulphides and cyanides and exceeds the following limits:
S^{2-} discharge 10,000 mg/kg TM
CN^- discharge 1,000 mg/kg TM

H13

The criterion H13 is related to:
Waste, which contain pollutants, which exceed the following limits:
1. Inorganic Contents

Mercury	20 mg/kg TM and 3,000 mg/kg TM (applied to compressed wastes with hard solvable sulphuric compounds)
Arsenic [4,5]	5,000 mg/kg TM
Lead [6,7]	10,000 mg/kg TM
Cadmium [8,9]	5,000 mg/kg TM

2. Organic Content

PAK	100 mg/kg TM
PCB	100 mg/kg TM
PCDD/PCDF	10,000 mg/kg TM[10]
POX	1,000 mg/kg TM
Sum of hydrocarbons (Mineral oil)	20,000 mg/kg TM[11]
BTXs	500 mg/kg TM
Phenol (free)	10,000 mg/kg TM

[4] Not applied to glazed waste
[5] Not applied to stable alloys
[6] Not applied to glazed waste
[7] Not applied to stable alloys
[8] Not applied to glazed waste
[9] Not applied to stable alloys
[10] According to the regulation for vessel plants
[11] Without asphalt and bitumen

- Waste, where the eluate exceeds the following limit values according to IIIA as well as
- Concentrated liquids, which exceeds the following limit values according to IIIB

Parameter	**IIIA Eluate Value (mg/kg TM)**	**IIIB Total Content (mg/l)**
Remaining after evaporation	100,000	30,000
pH	6 - 13	2 -11.5
Antimony	50	5
Arsenic	50	5
Barium	500	50
Beryllium	5	0.5
Boron	1,000	100
Lead	100	10
Cadmium	5	0.5
Chromium (Total)	300	30
Chromium VI	20	2
Cobalt	100	10
Copper	100	10
Nickel	500	50
Mercury	0.5	0.05
Selenium and Tellerium (sum of)	50	5
Silver	50	5
Thallium	20	2
Vanadium	200	20
Zinc	1,000	100
Tin	1,000	100
Cyanide (total)	200	20
Cyanide (easily leachable)	20	2
S^{2-}	200	20
F^{-}	500	50
NH_4^{+}	10,000	1,000
NO_2^{-}	1,000	100
Sum of hydrocarbons	1,000[12,13] and 50 [14,15]	100
PAK	0.5[16]	0.05
AOX	100	10
Phenol	1,000	100

[12] For waste of SN 31423,31424,54503 and 54504, 50 mg/kg TM is applied
[13] Centrifuged eluate/not filtered
[14] For waste of SN 31423,31424,54503 and 54504, 50 mg/kg TM is applied
[15] Centrifuged eluate/not filtered
[16] Centrifuged eluate/not filtered

APPENDIX 2: GUIDANCE FOR CHOOSING PROPERTIES TO BE TESTED

When classifying waste, it may be difficult to determine which property test methods should be conducted. As can be seen from Section 4.3.3.3, over 75 property test methods exist in Directive 67/548/EEC and its subsequent amendments, many of them for the same property.

In order to address this problem for the classification of dangerous substances, Annex VII[17] and Annex VIII[18] of Directive 67/548/EEC and its subsequent amendments specifies the information which must be presented to the relevant regulatory authority when notifying a substance. Potentially, a similar approach may be applied to hazardous waste, i.e. considering it as a hypothetical marketable substance and using the testing priorities expressed in dangerous substance legislation as a guideline. These annexes provide details of information required for:

1. Reduced Notification (for substances placed on the market in quantities of less than one tonne per annum per manufacturer)

    - Annex VII.C details information which is required when the quantity of a substance placed on the market is below 100 kg per year per manufacturer

    - Annex VII.B details information which is required when the quantity of a substance placed on the market reaches 100 kg per year per manufacturer or before the total quantity placed on the market reaches 500 kg per manufacturer

2. Full Notification (for substances placed on the market in quantities greater than one tonne per annum per manufacturer)

    - Annex VII.A details the basic information which must be provided to satisfy the full notification requirements.

    - Annex VIII (Level 1) details additional information which may be required when the quantity of a substance placed on the market reaches 10 tonnes per year per manufacturer or when the total quantity placed on the market reaches 50 tonnes per manufacturer. Annex VIII (Level 1) also details further information which is required when the quantity of a substance placed on the market reaches 100 tonnes per year per manufacturer or when the total quantity placed on the market reaches 500 tonnes per manufacturer

    - Annex VIII (Level 2) details information supplementary to Level 1 which is required when the quantity of a substance placed on the market reaches 1000 tonnes per year per manufacturer or when the total quantity placed on the market reaches 5000 tonnes per manufacturer.

[17] Directive 92/32/EEC and Directive 93/105/EEC (provisions for polymers only)
[18] Directive 92/32/EEC

Each of these annexes is broadly divided into:

0. Identity of manufacturer and the notifier if these are not the same
1. Identity of the substance
2. Information on the substance
3. Physico-chemical properties of the substance
4. Toxicological studies
5. Ecotoxicological studies
6. Possibility of rendering the substance harmless

Conclusion

The testing requirements referred to in the annexes relating to the reduced notification requirements are quite short. Therefore the tests outlined in the full notification annexes may be more useful. The full notification annex may be a good starting point to identify tests to be conducted on the waste. Full notification (Level 1) tests may then follow. Full notification (Level 2) tests may be applied subsequently if required. These tests are listed below.

This hierarchy of testing is specified in the dangerous substances legislation. However, it is not specified in the waste legislation and is intended only as a guide to identify which tests could be conducted on the waste. Tests which are thought not to be relevant have been scored through.

FULL NOTIFICATION

FULL NOTIFICATION
3. PHYSICO-CHEMICAL PROPERTIES OF THE SUBSTANCE

~~3.0. State of the substance at 20 °C and 101,3 kPA~~
~~3.1. Melting point~~
~~3.2. Boiling point~~
~~3.3. Relative density~~
~~3.4. Vapour pressure~~
~~3.5. Surface tension~~
~~3.6. Water solubility~~
~~3.8. Partition coefficient n/octanol/water~~
3.9. Flash-point
3.10. Flammability
3.11. Explosive properties
3.12. Self-ignition temperature
3.13. Oxidizing properties
3~~.15. Granulometry:~~
~~For those substances which may be marketed in a form which gives rise to the danger of exposure by the inhalatory route, a test should be conducted to determine the particle size distribution of the substance as it will be marketed.~~

FULL NOTIFICATION
5. ECOTOXICOLOGICAL STUDIES

5.1. Effects on organisms
5.1.1. Acute toxicity for fish
5.1.2. Acute toxicity for daphnia
5.1.3. Growth-inhibitor test on algae
5.1.6. Bacterial inhibition
in those cases where biodegradation may be affected by the inhibitory effect of a substance on the bacteria, a test for bacterial inhibition should be carried out prior to undertaking the biodegradation.
5.2. Degradation
- biotic
- antibiotic:
If the substance is not readily biodegradable then consideration should be given to the need to carry out the following test?: hydrolysis as a function of pH.
5.3. Absorption/desorption screening test

FULL NOTIFICATION
4. TOXICOLOGICAL STUDIES

4.1. Acute toxicity
For tests 4.1.1 to 4.1.3, substances other than gases shall be administered via at least two routes, one of which should be the oral route. The choice of the second route will depend on the nature of the substance and the likely route of human exposure. Gases and volatile liquids should be administered by the inhalation route.
4.1.1. Administered orally
4.1.2. Administered by inhalation
4.1.3. Administered cutaneously
4.1.5. Skin irritation
4.1.6. Eye irritation
4.1.7. Skin sensitisation
4.2. Repeated dose
The route of administration should be the most appropriate having regard to the likely route of human exposure, the acute toxicity and the nature of the substance. In the absence of contra-indications the oral route is usually the preferred one.
4.2.1. Repeated dose toxicity (28 days)
4.3. Other effects
4.3.1. Mutagenicity
The substance shall be examined in two tests. One shall be a bacteriological (reverse mutation) test, with and without metabolic activation. The second shall be a non-bacteriological test to detect chromosome aberrations or damage. In the absence of contra-indications, this test should normally be conducted in vitro, both with and without metabolic activation. In the event of a positive result in either test, further testing according to the strategy described in Annex VII should be carried out.
4.3.2. Screening for toxicity related to reproduction (for the record)
4.3.3. Assessment of the toxicokinetic behaviour of a substance to the extent that can be derived from base set data and other relevant information

FULL NOTIFICATION (LEVEL I)

FULL NOTIFICATION (LEVEL I)
3. PHYSICO-CHEMICAL PROPERTIES OF THE SUBSTANCE

Further studies on physico-chemical properties dependent upon the results of the studies laid down in Annex VII. Such further studies could include for example the development of analytical methods which make it possible to observe and detect a substance or its transformation products and studies on thermal decomposition products.

FULL NOTIFICATION (LEVEL I)
5. ECOTOXICOLOGICAL STUDIES

- prolonged toxicity study with daphnia magna (21 days)
- test on higher plants
- test on earthworms
- further toxicity studies with fish
- tests for species accumulation; one species, preferably fish
- supplementary degradation study(ies), if sufficient degradation has not been proved by the studies laid down in Annex VII
- further studies on absorption/desorption dependent upon the results of the investigations laid down in Annex VII.

FULL NOTIFICATION (LEVEL I)
4. TOXICOLOGICAL STUDIES

Fertility study (one species, one generation, male and female, most appropriate route of administration).
If there are equivocal findings in the first generation, study of a second generation is required.
Depending upon the dosing schedule it may be possible in this study to obtain an indication of teratogenicity. A positive indication should be examined in a formal teratology study.
- teratology study (one species, most appropriate route of administration)
this study is required if teratogenicity has not been examined in the fertility study.
- sub-chronic and/or chronic toxicity study, including special studies (one species, male and female, most appropriate route of administration) shall be required if the results of the repeated-dose study in Annex VII or other relevant information demonstrate the need for further appropriate investigation.
The effects which would indicate the need for such a study could include for example:
(a) serious or irreversible lesions;
(b) a very low or absence of a "no effect" level;
(c) a clear relationship in chemical structure between the substance being studied and other substances which have been proved dangerous.
- additional mutagenesis studies and/or screening study(ies) for carcinogenesis as prescribed in the testing strategy described in Annex VII.
When both tests in the base set are negative, further tests shall be conducted according to the specific properties and the purposed use of the substance.
When a test or both tests were positive in the base set, a supplementary study should include the same or different end points in other in vivo test methods.
- basic toxicokinetic information.

FULL NOTIFICATION (LEVEL II)

FULL NOTIFICATION (LEVEL II)
5. ECOTOXICOLOGICAL STUDIES

- additional tests for accumulation, degradation, mobility and absorption/desorption
- further toxicity studies with fish
- toxicity studies with birds
- additional toxicity studies with other organisms.

FULL NOTIFICATION (LEVEL II)
4. TOXICOLOGICAL STUDIES

The test programme shall cover the following aspects unless there are strong reasons to the contrary, supported by evidence, that it should not be followed:
- chronic toxicity study
- carcinogenicity study
- fertility study (e.g. Three-generation study); only if an effect on fertility has been established at level 1
- developmental toxicity study on peri- and postnatal effects
- teratology study (species not employed in the respective level 1)
- additional toxicokinetic studies which cover biotransformation, pharmacokinetics
- additional tests to investigate organ or system toxicity.