

*ISWA Working Group report no. 2, 1999*

**International Perspectives in Hazardous  
Waste Management: 1999 edition**



**ISWA**

# International Perspectives in Hazardous Waste Management: 1999 Edition

1<sup>st</sup> Edition

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International Perspectives in Hazardous Waste Management  
1999 Edition

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and  
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On behalf of the  
ISWA Working Group on Hazardous Waste

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# **1 INTRODUCTION**

## **1.1 BACKGROUND AND PURPOSE OF REPORT**

It is now more than ten years since the International Solid Waste Association (ISWA)'s Working Group on Hazardous Waste published its first major output, *International Perspectives on Hazardous Waste Management* (Academic Press, 1987). This book comprised a series of 12 country reports prepared by members of the Working Group, together with a comparative analysis, *Summary And Analysis of Hazardous Waste Management in ISWA Countries*, compiled on behalf of the Working Group by the UK member, Dr David Wilson.

The original 1987 report was very useful for countries in the process of developing their own hazardous waste management system, as a starting point for deciding on the most appropriate system in their particular circumstances, building on the 'best of the rest' from around the world, rather than simply trying to transplant a (probably inappropriate) system from one particular country. Much has happened in hazardous waste management over the last twelve years, so that an update and expansion of the original report is both overdue and, it is hoped, something that will make a considerable contribution to the continued development of hazardous waste management around the world.

The original comparative analysis was based on a series of tables, comparing and contrasting the features of the regulatory control systems for hazardous waste management in the 12 countries. These tables have now been updated and expanded to cover 18 countries or territories.

This report is largely based around those updated tables with two major new tables added. The purpose of the report is twofold:

- to present an overview of the common elements in national regulatory management systems for hazardous waste control in a number of countries and territories around the world; and
- to provide comparative information on exactly how some of those elements have been implemented in practice in the different countries.

## **1.2 APPLICATION OF THE REPORT - ACKNOWLEDGEMENT OF SUPPORT**

As noted in *Section 1.1*, the information in this report has considerable potential for use by countries which are in the process of developing their own individual systems for hazardous waste management. The interest of one particular country in using the information has made the compilation of this report possible.

The ISWA Working Group on Hazardous Wastes relies largely on the voluntary support of its members. Even with the full support of the members to complete the questionnaires and update the tables, it is very difficult to rely on voluntary effort for the considerable time and effort required to compile and collate the tables, to carry out the comparative analysis and to write the text. In 1987, sponsorship of the Working Group by the US Environmental Protection Agency enabled financial support to be given to Dr Wilson to carry out this work. Such resources are no longer available to the Working Group.

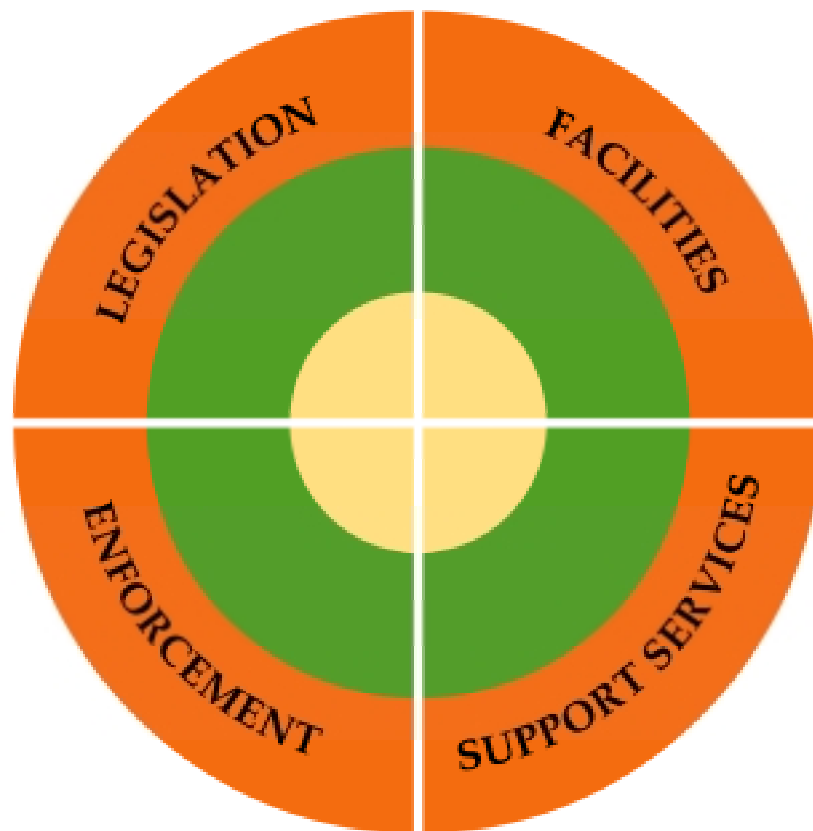
Preparation of this report has been made possible by cooperation with the State Committee of Environmental Protection (SCEP) of the Russian Federation. Dr Wilson is currently participating in a World Bank supported project for the *Development and Demonstration of a Regulatory Management System for Hazardous Waste Control at the Regional Level* in Sverdlovsk Oblast in Russia. The work of Dr Wilson and his staff at ERM to compile and collate this report on behalf of the Working Group also formed part of this project, in which it served as a starting point for the selection of those elements of international practice which best fits the specific local circumstances. ERM's report to their client acknowledges the contribution of the members of the ISWA Working Group on Hazardous Waste as suppliers of the information. Similarly, the Working Group acknowledges the support of the SCEP.

**2.1****OVERVIEW**

*Figure 2.1* illustrates the four vital components that should be provided for if a national or regional system for hazardous waste management is to be successful.

- A legal framework is an absolute requirement, but the proper infrastructure and resources for enforcement and control are even more important.
- It is not possible to implement and enforce legislation which tells waste generators, for example, that certain types of facilities need to be used for specified types of hazardous wastes, unless those facilities exist and are accessible. A national system must therefore include measures to ensure that adequate facilities are planned and developed as necessary, and subsequently used. A proactive system to encourage compliance is, in industrial as well as in environmentally developing countries, particularly important when company managers are usually focused on meeting production and profit targets.

**Figure 2.1** *Components of a Hazardous Waste Management System*



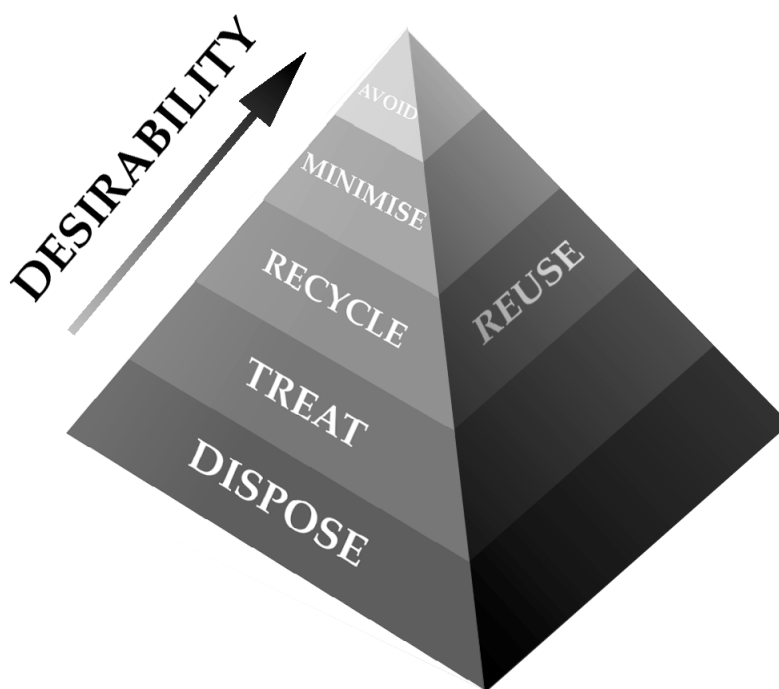
Source: ERM

- Many types of technology are available for hazardous waste management; for simplicity these can be classified into a number of categories. There is general agreement on a hierarchy of options for waste management (*Figure 2.2*).
  - The preferred option is to avoid generation of the waste in the first place.
  - If the generation of waste cannot be avoided, both the quantity and the degree of hazard should be minimised.
  - For those quantities of waste which must be generated, the preferred option is recycling, recovery or reuse.
  - For wastes which must be generated and cannot be recycled, treatment should be considered to remove the hazard (eg by incineration, neutralisation), to reduce the volume (eg by precipitation of heavy metals) or to render the waste into a less mobile form (eg by solidification).
  - Only when all of the other options have been fully explored, should consideration be given to final disposal methods such as landfill.
- The fourth component is the support services and technical infrastructure which are needed within the country or region to underpin the development of a hazardous waste management system. Examples here include the availability of laboratory facilities, technical information, consultancy services and training schemes to provide the skilled personnel required in each part of the system.

This report begins in this Section by providing an overview of a number of the important elements which are commonly included in a legislative/regulatory control framework for hazardous waste management. *Section 3* focuses on different national approaches to implementing a system, which examines the interface between legislation/regulations/enforcement and the encouragement of waste generators to manage their waste properly through the use of waste prevention or the proper facilities for recycling, treatment and/or disposal. This interface can loosely be described as the development of an appropriate *compliance strategy*. Subsequent sections look at some of the elements in more detail, including *Definitions and Information Systems* in *Section 4* and *Transport* in *Section 5*.

*Table 2.1* provides an initial summary of the elements that may be covered within a regulatory control system for hazardous waste management. *Table 2.2* provides a simplified comparison of how some of these elements have been approached in 18 countries around the world, each being discussed in the sub-sections which follow. *Definitions* are discussed later in *Section 4* and *Responsibilities Placed on the Waste Generator* in *Section 3.2*.

**Figure 2.2**     **The Waste Management Hierarchy**



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## **2.2**     **REGISTRATION OR LICENSING OF OPERATORS**

A possible element in the regulatory control system is a registration or licensing system for waste collectors and transporters, and/or waste treatment and disposal contractors. This is separate from control over transport *operations* or over treatment and disposal *facilities* (see below).

Registration is a relatively simple procedure, whereby contractors are required to register with the authorities. No endorsement of their competence is required on the part of the authorities, although in some countries any contravention of legal requirements may result in the company being removed from the register.

Licensing is a more complex procedure, requiring the authorities to examine matters such as the professional, technical and financial competence of the contractor to carry out the duties for which he requires a license.

As shown in *Table 2.2*, licensing of operators is more common than registration, although one or other is now generally in place ( a significant increase since 1987). Arguments against licensing include the additional burden on controlling authorities for administration, and also the duplication of effort, given that the credentials of the operator will generally be one of the criteria used in assessing applications for permits to run treatment and disposal facilities. Licensing or registration is thus of more critical importance as applied to collection/transport operators.

Hazardous wastes often have to be transported long distances to a treatment or disposal facility. It follows that there could be a strong financial incentive for an unscrupulous operator to dump the waste illegally, either at a local landfill site not licensed to receive hazardous waste or even by the roadside, or to mix the hazardous waste with other wastes prior to local landfill or incineration.

In order to prevent such abuses, most countries have or will soon implement a system for cradle-to-grave control, through some kind of manifest or trip-ticket system. Again, this has often been added at a second or subsequent stage of developing the control system. The individual systems in different countries differ in the detail of their operation and are discussed more fully in *Section 5*.

*Table 2.1* lists a number of other common elements in a regulatory control system, concerned with the transport of hazardous materials. These include standards for design and construction of vehicles and containers, labelling, packaging and contingency planning for and emergency response to spills and accidents. These aspects are not covered in *Table 2.2*, because in most countries they do not form part of specific hazardous waste management legislation. Rather, the general approach has been to adapt and extend legislation controlling hazardous materials (dangerous goods) in transit to cover also hazardous wastes. For example, the international codes regulating the transport of dangerous goods (in Europe ADR for road transport and RID for rail transport) drawn up under the auspices of the United Nations have been amended to explicitly include hazardous wastes (for example, adding a new category 9.3 *Hazardous Wastes (Not Otherwise Specified)* to the list of dangerous goods).

A further element of control over transport identified in both *Tables 2.1* and *2.2* and is control over export and import of hazardous wastes. Attention was originally drawn to this aspect in the early 1980s, both by a number of well publicised incidents where hazardous wastes have been exported from industrialised countries and dumped in low-income countries, and also by a specific incident in Europe, where 41 drums of dioxin waste, from the accident at Seveso in Italy, went missing, and were eventually discovered some time later in a warehouse in France.

To address this problem, the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* was agreed under the auspices of the United Nations Environment Programme (UNEP) in 1989. More than 100 countries around the world have now signed and ratified the Convention, which means that they have national legislation in place to control export and import (although not necessarily the infrastructure for proper implementation and enforcement). There is thus no longer any variation shown in this aspect in *Table 2.2*.

**Table 2.1**      ***Elements of a Regulatory Control System for Hazardous Waste Management***

---

- *Definitions of terms*, particularly *wastes and hazardous wastes*. Also a *classification system* to allow the unambiguous categorisation of wastes.
  - *Responsibilities placed on the waste generator*, which may include:
    - A requirement to *register* as a waste generator and provide regular information on waste sources, types, quantities and management methods.
    - A requirement to show that steps have been taken to *minimise the quantities* of waste being produced.
    - A *duty of care* whereby the generator remains legally responsible for the waste till it reaches its proper destination.
  - *Registration or licensing* of those involved in collection, transport, storage, treatment or disposal of wastes.
  - *Control over transport*, comprising:
    - A *manifest* or *tripticket* system for cradle-to-grave control, to ensure that wastes arrive at their designated destination.
    - *Standards* for design and construction of vehicles and specification of necessary features, covering bulk carriers and packaged waste carriers.
    - *Specification* of containers and packaging for holding the waste during transport.
    - *Labelling* of vehicles and the waste containers
    - *Contingency planning for, and emergency response to, spills and accidents.*
  - Controls over *import* and *export* of waste, to implement the Basel Convention. A particular issue is the application of such controls to materials destined for recycling - clearly recycling is to be encouraged, but this must be done in such a way as not to provide a loop-hole for those who wish to export wastes for dumping. The Convention now prohibits the export of all hazardous wastes from developed to developing countries, whether for disposal or recycling.
  - *Permitting* of each facility for the storage, recycling, treatment or disposal of (hazardous) wastes, to ensure that all facilities are designed and operated in an environmentally sound manner.
  - A requirement on national, regional and/or local authorities to prepare a *strategic plan* for the management of hazardous wastes, focusing in particular on the encouragement of pollution prevention and the arrangements to ensure that adequate facilities are made available both now and in the future for the treatment and disposal of all hazardous wastes.
  - Programmes for dealing with *old or abandoned hazardous waste disposal sites*.
- 

Source: ERM

**Table 2.2 - Elements in National Regulatory Control Systems**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
<i>Year of Latest Data Update</i>	1998	1998	1997	1997	1998	1998	1998	1998	1998
<i>Date of Main Legislation</i>	1983, 1990	1981, 1985	1995	1991	1972, 1997	1978, 1994	1975	1972, 1996	1980, 1992
<i>Registration/ Licensing (1)</i>									
Collectors/ Transporters	L	L, R	L	L	(2)	L	R	L	L
Treatment/Disposal Contractors	L	L	L	L	L	L	R	L	L (Waste producers R)
<i>Control over Transport</i>									
Manifest System	Yes	Yes	Yes	Yes	Yes	Soon	New	Yes	Yes
Control over Import	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control over Export	Yes	Yes	Yes	Yes	Yes	Yes	Soon	Yes	Yes
<i>Permitting of Facilities</i>									
Storage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Disposal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have all operating sites now been permitted?	Yes	Yes	Partly	Yes	Yes	Yes	Yes	Yes	Yes
<i>Planning and Establishment of Facilities</i>									
Is there a national strategy/ plan?	Yes	Yes	Under preparation	Yes	Yes	Under preparation	No	No	Yes
Are authorities required to produce a plan?	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Has this been done?	Yes	Yes	Not yet	No	Yes	Yes	No	Yes	Yes
<i>Old or Abandoned Hazardous Waste Sites</i>									
Is there a national inventory?	Yes	Yes	Under preparation	Yes	Yes	Yes	Yes	Yes	Yes
Is there a clean-up programme?	Yes	Yes	No	No	Yes	Yes	(3)	(3)	Yes

(1) L= licensing scheme, implying investigation by the authorities; R= registration, implying simply being listed in a register.

(2) Mainly under the Trade Act, not under the Hazardous Waste Act.

(3) No formal nationwide clean-up programme, but clean-up of individual sites is continuously proceeding.

(4) All permits are going to be revised in the near future.

(5) Some regions (local authorities) have prepared a clean-up program.

**Table 2.2: Elements in National Regulatory Control Systems (continued)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<i>Year of Latest Data Update</i>	1998	1997	1987(9)	1998	1998	1998	1998	1998	1998
<i>Date of Main Legislation</i>	1981, 1996	1982, 1984	1970, 1979	1994	1994	1986, 1988	1975, 85, 95	1974, 1990	1976 (84)
<i>Registration/ Licensing (1)</i>									
Collectors/Transporters	L	R	L	L	Yes	(8)	L	R	L
Treatment/Disposal Contractors	R	R	L	L	Yes	L	L	Sites, not contractors	L
<i>Control over Transport</i>									
Manifest System	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Control over Import	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control over Export	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Permitting of Facilities</i>									
Storage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Disposal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have all operating sites now been permitted?	Yes (4)	Yes	Yes	Yes	Yes	No	Yes	Yes (7)	Yes
<i>Planning and Establishment of Facilities</i>									
Is there a national strategy/ plan?	Under preparation	No	No	Yes	Yes	Yes	Yes	Yes	No
Are authorities required to produce a plan?	No, but from 1997 onwards	Yes	Yes	Yes	Yes, locally	Yes	Yes, locally	Yes	(6)
Has this been done?	1997 onwards	No	Partial	Yes	Yes	Partial	Yes, locally	Not fully	Partial
<i>Old or Abandoned Hazardous Waste Sites</i>									
Is there a national inventory?	Partially	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Is there a clean-up programme?	Yes	No (5)	No	Yes	Yes	Yes	Yes	No	Yes

(6) Provincial or State Responsibility.

(7) Officially yes, but doubtless some gaps.

(8) Only the regulation of transport of dangerous goods

(9) Source: D.C. Wilson, Summary and Analysis of Hazardous Waste Management in ISWA Countries. In: *International Perspectives on Hazardous Waste Management*, edited by William S. Forester and John H Skinner, Academic Press, (1987).

## 2.4

### ***PERMITTING OF FACILITIES***

A basic requirement of any regulatory control system is that facilities for waste treatment and disposal should be licensed or permitted by the competent authority. All the national control systems surveyed incorporate a requirement of this kind.

The permitting systems in a number of countries have, however, been developed in a number of distinct steps. An extension to the original requirement to license or permit treatment and disposal facilities was often the requirement to permit storage facilities. Some exemption is usual for temporary storage on a waste generator's premises pending collection, but care is required to ensure that such exemptions do not allow storage under insecure conditions or the accumulation of large quantities of waste pending economic recovery at some unspecified date in the future (which may or may not ever happen).

In many countries, a major motivation behind the updating of waste management legislation has been the tightening of requirements for the permitting of facilities. Many countries have now got very detailed technical guidelines and standards to be met by different types of facilities, which are either legally binding or enforced through incorporation in the specific conditions of the permit for an individual facility. Another recent development has been to tighten up the requirements for training and qualification of personnel involved in the management, supervision and operation of waste treatment and disposal facilities. For example, the 1990 legislation in the UK introduced the requirement for *Certificates of Professional Competence*, to be held by all individuals managing or supervising waste treatment or disposal facilities. Detailed requirements have been drawn up by a government supported *Waste Management Industry Training and Advisory Board* (WAMITAB) and the necessary training infrastructure is now in place.

*Table 2.2* includes a question as to whether all existing facilities have been permitted under the (new) regulations. This provides an indication of the state of implementation of the system: substantial progress has been made since 1987.

## 2.5

### ***PLANNING AND ESTABLISHMENT OF FACILITIES***

Another important feature of regulatory control systems is the measures to ensure that adequate facilities are available both now and in the future for the treatment and disposal of all hazardous waste. The various national approaches to achieve this objective are discussed in the next section. It can be argued that, whatever method is used, it is important that coherent plans should be produced, taking into account the types and quantities of wastes expected to be generated over the next, say, 10-20 years and the facilities that will be provided to deal with them.

These plans need to be prepared at both the national and regional or local level. Preparation of such plans is required in legislation in a number of countries. As noted in *Table 2.2*, however, even where this is the case, progress in actually producing the plans has often been poor.

## **2.6**

### ***OLD AND ABANDONED HAZARDOUS WASTE SITES***

Discussion so far has centered on the control of hazardous wastes currently being generated. A complementary aspect of regulatory control systems in a number of countries is the investigation and clean-up of old sites containing hazardous wastes that may pose a threat to public health or the environment, either through direct human contact or through the contamination of groundwater resources. The priority given to this element in the overall hazardous waste programme depends on national circumstances and the extent of the perceived problems (see also *Section 4.4.5*).

### **3** *DIFFERENT REGULATORY APPROACHES TO IMPLEMENTING A CONTROL SYSTEM*

#### **3.1** *ALTERNATIVE COMPLIANCE STRATEGIES*

Despite some measure of agreement on the significant elements to be incorporated in a regulatory control system, there are probably as many different approaches to implementing such a system as there are jurisdictions that have done so. The purpose of this section is to highlight some of these differences in philosophy and approach, pointing out both success stories and problems encountered.

In most countries, there is the recognition that simply passing legislation and enforcing it is not enough: a proactive *compliance strategy*, combining the 'stick' of legislation and enforcement with some forms of incentive or 'carrot', is generally preferred. Some aspects of such strategies are analysed in the following sub-sections.

#### **3.2** *RESPONSIBILITIES PLACED ON THE WASTE GENERATOR*

To place some set of requirements on waste generators is an essential element of any regulatory control system. Exactly what those responsibilities are is a key factor in determining the overall *compliance strategy* in a particular country (see *Table 3.1*).

##### **3.2.1** *Basic Responsibility to Comply with the Law*

The minimum requirements placed on waste generators will generally be to comply with the national law. The detail of these requirements will clearly vary depending on the other elements within the regulatory control system for hazardous waste management. Examples on which *Table 3.1* shows fairly universal agreement include:

- to know the waste, to characterise it and to decide whether and how it comes within the control system;
- to provide proper and secure storage facilities;
- to provide sufficient information to the vehicle operator so that he may ensure the availability of appropriately designed and constructed vehicles and trained drivers;
- to prepare the manifest or trip-ticket note to accompany each load of waste; and
- to obtain permits, if required, for on-site storage, treatment and disposal facilities.

**Table 3.1 - Responsibilities Placed on the Waste Generator (page 1)**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
Year Information provided	1998	1998	1997	1997	1998	1998	1998	1998	1998
<b>1 Basic Requirements</b>									
- know the waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- provide proper storage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- pack and label the waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- provide relevant compositional/safety data to transport & facility operators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- obtain permits if required for on-site storage, treatment & disposal facilities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- to prepare a manifest to accompany each load of waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>2 Registration Requirements</b>									
- keep records	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- declare/register with authorities as a hazardous waste generator	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- make regular reports to the authorities									
• on waste management	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
• on waste, treatment, disposal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
• frequency of reports	Report when transferring waste	Annual	3 months	Annual	Annual	Annual	3 months	Annual	Monthly
<b>3 Discharging the Responsibility</b>									
- OK if waste transferred to a registered/licensed transporter	Yes	No	No	No	No	No	No	No	No
- Must also ensure waste is delivered to an appropriately licensed treatment/disposal facility	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Formal 'duty of care'	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Formal transfer notes required at each step	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Strict, 'contingent' liability for any environmental damage (even if waste is delivered to a licensed treatment/disposal facility)	No	Yes (Haz. Waste)	No	No	No	No	Yes	Yes	No

**Table 3.1 - Responsibilities Placed on the Waste Generator (page 2)**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
Year Information provided	1998	1998	1997	1997	1998	1998	1998	1998	1998
<b>4 Requirements/Initiatives to 'Move Waste Management up the Hierarchy'</b>									
Statutory measures exist?									
• require proof that avoidance/minimisation or recycling/re-use not possible before granting permission for treatment/disposal of individual waste streams	No	No	No	No	No	No	No	Yes	No
• requirement to utilise the waste in-house or offer it for utilisation to a third party	No	No	No	Yes	No	No (2)	No	No	No
• requirement to send (monthly) reports to a Waste Exchange scheme	No	No	Yes	No	No	No	No	No	No
Requirement on industrial waste generators to prepare plans/audits?									
• prepare a waste management plan	Yes	No	No	No	No	No (3)	No	Yes	No
• prepare a waste management programme	No	No	No	Yes	No	No (3)	Yes	No	No
• undertake a waste audit	No	Yes	No	No	No	No (3)	Yes	Yes	No
• introduce a formal environmental management system (ISO 14000)	No	No	No	No	No (5)	No	No	No	No
'Voluntary' initiatives?									
• community 'right-to-know'	Yes	No	Yes	No	Yes	Yes	Do not know	Yes	Yes
• voluntary targets	Yes	Yes	Yes (1)	No	Yes	Yes	Do not know	Yes	Yes
<b>5 Information Dissemination and Use</b>									
Are there subsidised schemes available in your country to assist industry with their hazardous waste problems, through									
• an information clearing house?	Yes	No	Yes	No	Limited	No	Do not know	No	Yes
• provision of technical assistance?	Yes	No	Yes	No	No	No	Yes	No	Yes
• support for research and development?	Yes	No	No	Yes	Yes	No (4)	Yes	Yes	Yes
• support for demonstration projects?	Yes	Yes	Yes	Yes	Yes	No (4)	No	Yes	Yes

(1) Cleaner Production Programme

(2) Depends on the permit, some larger companies have to declare/register

(3) For some industries where required in permit, yes

(4) Special cases, yes

(5) Not yet, But probably some sort of ISO 9000/14000 in a few years.

**Table 3.1 - Responsibilities Placed on the Waste Generator (page 3)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<b>Year Information Provided</b>	1998	Information not available	Information not available	1998	1998	1998	1998	1998	1998
<b>1 Basic Requirements</b>									
- know the waste	Yes			Yes	Yes	Yes	Yes	Yes	Yes
- provide proper storage	Yes			Yes	Yes	Yes	Yes	Yes	Yes
- pack and label the waste	Yes			Yes	Yes	Yes	Yes	Yes	Yes
- provide relevant compositional/safety data to transport & facility operators	Yes			Yes	Yes	Yes	Yes	Yes	Yes
- obtain permits if required for on-site storage, treatment & disposal facilities	Yes			Yes	Yes	Yes	Yes	Yes	Yes
- to prepare a manifest to accompany each load of waste	Yes			Yes	Yes	Yes	Yes	Yes	Yes
<b>2 Registration Requirements</b>									
- keep records	Yes			Yes	Yes	Yes	Yes	Yes	Yes
- declare/register with authorities as a hazardous waste generator	Yes			Yes	Yes	Yes	Yes	No	Yes
- make regular reports to the authorities									
• on waste management	-			Yes, (6)	Yes, bi-annual	Yes	Yes	No	Yes
• on waste, treatment, disposal	Yes			Yes, (6)	Yes, annual	Yes	Yes	No	Yes
• frequency of reports	Annual			Annual	See above	Annual	Annual	-	Annual
<b>3 Discharging the Responsibility</b>									
- OK if waste transferred to a registered/licensed transporter	Yes			No	Yes	No	Yes	No	No
- Must also ensure waste is delivered to an appropriately licensed treatment/disposal facility	Yes			Yes	No	Yes	Yes	Yes	Yes
- Formal 'duty of care'	Yes			Yes	No	No	No	Yes (7)	No
- Formal transfer notes required at each step	Yes			Yes	Yes	No	Yes	Yes	Yes
- Strict, 'contingent' liability for any environmental damage (even if waste is delivered to a licensed treatment/disposal facility)	Yes			(10)	Yes	Yes	No	No	Yes

**Table 3.1 - Responsibilities Placed on the Waste Generator (page 4)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<b>Year Information Provided</b>	1998	information not available	information not available	1998	1998	1998	1998	1998	1998
<b>4 Requirements/Initiatives to 'Move Waste Management up the Hierarchy'</b>									
<i>Statutory measures exist?</i>									
• require proof that avoidance/minimisation or recycling/re-use not possible before granting permission for treatment/disposal of individual waste streams	No			No	No	No	No	No	No
• requirement to utilise the waste in-house or offer it for utilisation to a third party	No			No	No	No	No	No	No
• requirement to send (monthly) reports to a Waste Exchange scheme	No			No	No	No	No	No	No
<i>Requirement on industrial waste generators to prepare plans/audits?</i>									
• prepare a waste management plan	Yes			(6)	Yes	No	No	No	No
• prepare a waste management programme	No			(6)	-	No	No	No	Yes
• undertake a waste audit	No			(6)	Yes	Voluntary	No	No	No
• introduce a formal environmental management system (ISO 14000)	No			(6)	No	Voluntary	No	No	No
<i>'Voluntary' initiatives?</i>									
• community 'right-to-know' legislation	No			Yes	Yes	Yes	Yes	No	Yes (8)
• voluntary targets	No			Yes	Yes	-	Yes	No	No
<b>5 Information Dissemination and Use</b>									
<i>Are there subsidised schemes available in your country to assist industry with their hazardous waste problems, through</i>									
• an information clearing house?	No			Yes	Yes	Limited	No	Limited	Yes
• provision of technical assistance?	No			Yes	No	Limited	No	Limited	Yes
• support for research and development?	No			Yes	Yes	Yes	No	No	No
• support for demonstration projects?	-			Yes	Yes	Yes	No	Limited	Yes

(6) In preparation

(7) Duty of care included in legislation and detailed guidance/code of practice issued

(8) The most formal and comprehensive approach the "Toxic Release Inventory" legislation requiring each factory to report annually on its use and discharge of toxic chemicals

(9) Large quantity generators must submit waste management plan

(10) Only if composition of waste differs from prior compositional data

In general, the basic requirements placed on waste generators will follow directly from other elements of the regulatory control system discussed elsewhere in this report.

### **3.2.2 *Registration and Record-keeping Requirements***

A basic requirement in most countries is for the waste generator to keep records documenting the generation and disposition (details of collection and destination) of the hazardous wastes.

Most countries also have a requirement for hazardous waste generators to register with the authorities, and also to make regular reports to the authorities showing, for example, quantities and times of hazardous waste generated, the place of generation, and the places and methods of storage, treatment and disposal used (a notable exception is the UK). The frequency of reporting varies, from annual, through three-monthly (Croatia), to monthly (Hong Kong).

### **3.2.3 *Discharging the Responsibility***

One aspect which does vary widely between countries is what the waste generator is expected to do to fulfil their responsibility to ensure the proper management of the hazardous wastes, and also the point at which that responsibility is considered to be discharged.

Common responsibilities are for the generator to be responsible for choosing a licensed transporter and/or having the waste transported to a treatment, storage or disposal facility which is licensed to handle the particular type of waste. An interesting question is whether one or both of these is sufficient, or whether the generator retains some liability if either the transporter or the disposer should handle the waste in such a way as to cause environmental damage. Four basic approaches to this issue can be distinguished.

- The generator has discharged his responsibility if the waste has been handed over to a licensed transporter, on the logic that it is then the authority's responsibility to ensure that the transporter delivers the waste to a properly licensed facility.
- The generator has discharged his responsibility if the waste has been passed over to a properly permitted facility, the logic being that it is then the authority's responsibility to ensure that the facility operator complies with the permit conditions.
- The UK has pioneered the so-called *Duty of Care*, which is a statutory requirement placed on generators, whether of hazardous waste or not, to take all reasonable steps to ensure that their waste is handled in accordance with the law. This goes beyond passing the waste to an appropriately registered carrier (collector or transporter) or delivering it to a properly licensed facility. Generators can have certain obligations to investigate the companies who handle their wastes, such as to ensure that they are

competent and that they handle or otherwise dispose of the waste properly. The extent to which generator is obliged to follow through all stages of the chain depends on various factors such as the nature of the waste, the quantity/regularity etc. The generators must provide an adequate written description of the waste to enable the carrier and disposer/recoverer to assess properly what measures are required. Transfer notes are created at each transfer with the relevant information and signed as proof that the handover took place under the declared conditions.

The formal *duty of care* system as a legal instrument for enforcing responsibility on waste generators is probably unique to the UK; however other countries have recognised similar principles (without such a formal system), as shown by the number of positive replies in *Table 3.1*.

- In some countries, a system of no-fault or contingent liability applies where the waste generator can be held liable for the environmental damage caused by, for example, a landfill site to which it can be shown that his waste was delivered, whether or not that site was properly licensed at the time for the receipt of that type of waste. For example, this is the basis of the law in the United States. The high costs of clean-up of environmental damage caused by so-called uncontrolled hazardous waste sites, most dating from before current legislation, has caused many industrial waste generators to focus on waste prevention and other alternatives to landfill in order to reduce their environmental liability.

The frequency with which hazardous waste needs to be removed from the generator site (assuming that off-site treatment or disposal is to be undertaken) can be controlled in different ways. One option is to require permitting of on-site storage of hazardous wastes beyond a certain period, set at 28 days in the UK and 90 days in the US (see *Section 2.4*). An alternative is to require the waste to be delivered to a permitted transfer station or treatment facility at least once in a stipulated period (for example, once a year in Norway).

### **3.2.4 Requirement to 'Move Waste Management up the Hierarchy'**

In some countries, considerable recent attention has been paid to appropriate mechanisms to encourage or oblige waste generators to focus on waste avoidance, waste minimisation, recovery, recycling or re-use (using the terminology listed in *Figure 2.2*), that is 'moving waste management up the hierarchy'. There has been much innovation in this area over the last few years. Not all countries have been moving in this direction, but among those countries who have taken initiatives, the exact nature of those initiatives has varied widely.

One general theme is to encourage or force companies to examine their waste management practices, in the hope that that knowledge, combined with high treatment and disposal costs, will encourage some form of pollution prevention. Examples include:

- encouraging or making compulsory the introduction of formal environmental management systems, for example under the new international standard ISO 14000;
- requiring a formal waste management programme to be drawn up by each company (eg the Czech Republic);
- requiring each company with more than a certain number of employees to prepare a formal waste management plan (eg Austria);
- requiring the generator to submit monthly reports to a *waste exchange scheme*, summarising quantities and types of hazardous waste. The scheme then tries to match wastes generated with the requirements of potential users of secondary raw materials (eg Croatia).

A rather more formal approach is that pioneered by Germany under its new *Waste Avoidance, Recycling and Disposal Act for Promoting Closed Substance Cycle Waste Management and Ensuring Environmentally Compatible Waste Disposal*, which took effect on 7 October 1996. This Act requires generators and owners of waste to take care that waste shall already be avoided during production and consumption of their products and that any wastes which are, nevertheless, generated shall be recycled. The treatment or disposal of any waste is only permitted after submission of a detailed management certificate to the authorities, which must, inter alia, contain proof that the waste cannot be avoided or re-used/recycled. The details required in the management certificate are set out in a special *Waste and Residual Substance Monitoring Ordinance*.

An alternative approach is to put a requirement on the waste generator to utilise the waste as a source of secondary raw materials or energy or to offer waste not utilised in this manner to another party for utilisation (eg the Czech Republic).

A completely different approach has been adopted in the US. The incentive for pollution prevention is indirect, both via contingent liability for environmental damage from land disposal (see *Section 3.2.3* above), and also on the so-called *Toxic Release Inventory* legislation which obliges US companies to report publicly on the use and discharge of chemicals in annual reports. This so-called *community right-to-know* legislation has probably had more impact on reducing the generation and disposal of hazardous wastes and of water and air emissions in the US than any other legislation because company chief executives have found it to be in their financial self-interest to reduce their waste generation.

One side-effect has been the negotiation of many voluntary agreements between government and industry groups, whereby business have agreed to voluntary targets and timescales for waste reduction. An example is the so-called *WasteWiSe* programme in the US, a joint programme between the Environmental Protection Agency and more than three hundred major companies who have committed themselves to the implementation of three

significant waste prevention activities each year; to the expansion or improvement of programmes to collect recyclable materials; and to increasing their purchase of recycled products. The EPA supports the initiative through the provision of technical assistance and by recognising the members and their successful programmes. A similar, earlier, programme was the so-called 33/50 programme, in which more than 1,000 companies committed themselves to reducing their waste generation by 33% by one target date and by 50% by a second target date.

The US approach to *community rights-to-know* is more formal and far reaching than in most countries. Nevertheless, the principle of public access to hazardous waste data is widespread, as shown by the positive responses to this item in *Table 3.1*.

### **3.2.5 Information Dissemination and Use Measures**

The focus of this section so far has been very much on *requirements imposed on the waste generator*, either directly or, for example, in the case of 'community right-to-know legislation' by making it in the self-interest of the generator to reduce waste quantities. In the spirit of the combined approach of 'carrot' and 'stick', it is also worth pointing to measures which the authorities can take to encourage and assist waste generators, both to comply with hazardous waste management legislation, and more particularly to 'move waste management up the hierarchy'. In general, such incentive schemes can fall under one of two headings, *information dissemination and use* or *economic and financial instruments*. The former are dealt with in this section, while the latter are discussed in *Section 3.5* below.

Under the heading of *Information Dissemination and Use Mechanisms*, there are a number of ways by which a government or public authority can assist industry in complying with their obligations under the law by moving to more appropriate hazardous waste management practices. Some examples are given below (see *Table 3.1*).

- *Information clearing-house* - with a wide range of information (brochures, workshops etc) being provided by government to help firms know which approaches are available for source reduction or onsite/offsite recycling treatment and disposal.
- *Provision of technical assistance* - providing firms with up-to-date information and advice on available technology for pollution control, cleaner production, waste prevention, recycling etc, and facilitating technology transfer to/between local industry.
- *Support for research and development* - providing firms with information and technical assistance to support R&D activities.
- *Support for demonstration projects* - with government schemes being set-up to support the demonstration of innovative environmental protection/waste prevention/waste treatment technologies, and the transfer of the demonstrated technologies to other relevant companies.

In many countries, such schemes are targeted at encouraging environmental technology in general, rather than specifically focused on hazardous wastes.

### **3.3 CHOICE OF TREATMENT OR DISPOSAL OPTIONS**

The various regulatory control systems implemented around the world differ in the degree and methods of control over the choice of options available to a waste generator for the treatment or disposal of a specific waste. Three broad alternatives for exercising such control may be distinguished (*Table 3.2*).

#### **3.3.1 Powers of Direction**

Central (or regional) government may assume powers to direct a specific type of waste either to a particular treatment or disposal option or even to a particular site.

This is effectively the case where the waste is passed to a state utility (as in Denmark and, prior to privatisation, in Sweden). In Denmark, local companies are obliged to deliver their hazardous wastes either to one of the 25 central collection stations established through co-operation between the municipalities of an area, or one of 300 smaller local collection points, at least one per municipality. These collection and transfer points are then linked to the central state utility treatment and disposal facility.

There is a possible problem with directing waste to a particular option or facility, as the responsibility for deciding the most appropriate option for a particular waste is shifted from the generator to the state. Other countries which have such powers include Belgium, the Czech Republic, Hungary, and the Netherlands. In a larger number of countries, the treatment or disposal option to be used for certain waste types is specified in regulations. In Austria and Germany, recommendations are made in technical standards, but these are not mandatory.

A number of countries have included a power of direction to a specific facility (site) in legislation, to be held in reserve for use should the need arise.

#### **3.3.2 Prohibitions**

An alternative to direction is to prohibit the use of certain options for particular wastes. Such prohibitions are used in most of the countries surveyed (16/18), particularly regarding land disposal.

#### **3.3.3 Control via Site Permits**

The third option, which is used by all countries to a certain extent, is control via site permits. Waste can only go to a facility permitted to receive it, so that if, for example, the permits for all landfill sites exclude a particular category of waste, then that waste has effectively been prohibited from land disposal. This is the case in 50% of the countries surveyed. However, variations in standards of site permitting between local controlling authorities often

militates against the effectiveness of such control on a national basis. This applies, for example, in Belgium, Hungary, Japan and the UK.

### **3.4 PROVISION OF TREATMENT FACILITIES**

#### **3.4.1 *The Carrot and the Stick***

As discussed in *Section 2.1*, a necessary part of a regulatory control system is to provide adequate facilities for the treatment and disposal of hazardous waste and to ensure that the proper facilities are used.

This problem relates primarily to 'high technology' facilities for incineration and chemical treatment, the costs for which are often an order of magnitude greater than those for landfill disposal. If landfill and treatment facilities are allowed to compete for the same wastes, then treatment facilities are unlikely to be either financially viable or attractive to the private investor.

When faced with a stubborn problem, the appropriate solution is often similar to that traditionally used to encourage the stubborn donkey to move forward: that is, a combination of a carrot in front and a stick at the rear. In this context, the 'stick' is provided by restricting the choice of alternatives for any particular waste (*Section 3.3*) while the 'carrot' is provided by some form of financial support of the high technology facility<sup>(1)</sup>. The different approaches to facility provision are summarised in *Table 3.3*.

#### **3.4.2 *Public versus Private Sector***

Looking first at who provides the facilities, a number of cases may be distinguished. In Denmark, Finland and some German States (and previously in Spain (Catalonia) and Sweden), major treatment facilities are provided by a state utility, which is a co-operative venture between central government, local communities and industry. A state utility company also exists in Norway, but more as a facilitator and resource body rather than as a service provider: any person or company managing (undertaking collection, storage and treatment of) hazardous waste is required to have a corporate agreement with this company (*The Norwegian Resource Centre for Waste Management and Recycling, Norsas*).

In a number of other countries, the public and private sectors also collaborate in providing facilities, often with substantial initial investment from government (eg the Netherlands). In France, the facilities are entirely provided by the private sector, but substantial finance was originally made available on attractive terms by government. Of the countries with well-established systems, only the UK and USA have relied entirely on the private sector for the provision of facilities from the outset.

<sup>(1)</sup> David Wilson, *Attracting Investment in Hazardous Waste Facilities in Developing Countries*, 'ISWA Times', No 1, 1995, 1-4.

**Table 3.2 - Regulating the Choice of Treatment of Disposal Options for a Specific Waste**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
<i>Year of Latest Data Update</i>	1998	1998	1997	1997	1998	1998	1998	1998	1998
<i>Direction of Waste</i>									
To (a) particular site(s)	No	No	No (1)	Yes	Yes	No	No	Partial	Yes
To a particular option(s)	(1)	Yes	Yes	Yes	Yes	Yes	No	(1)	Yes
Powers exist, in reserve	Yes	Yes	Yes	-	-	-	Yes	Yes	-
<i>Prohibition of Certain Options for Particular Wastes</i>									
National regulations	Yes	Yes	Yes (1)	Yes	Yes	Yes	Yes	Yes	(1)
<i>Control via Site Permits</i>									
Strong national standards mean effective prohibition for certain waste	Yes	(2)	System not yet in place	Yes	Yes	Yes	Yes	(2)	Yes

(1) Recommendations are made in technical standards, but these are not mandatory.

(2) Strong controls exist in principle, but in practice there are wide local variations in what is/is not permitted at individual sites.

**Table 3.2 - Regulating the Choice of Treatment of Disposal Options for a Specific Waste (continued)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<i>Year of Latest Data Update</i>	1998	1997	1987 (5)	1998	1998	1998	1998	1998	1998
<i>Direction of Waste</i>									
To (a) particular site(s)	Yes	No	No	Yes	Yes	No	No	(4)	No
To a particular option(s)	Yes	No	Yes	Yes	No	No	Yes	Rarely	Yes
Powers exist, in reserve	No	No	Yes	-	-	Yes	-	Yes	No
<i>Prohibition of Certain Options for Particular Wastes</i>									
National regulations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Reserve powers	Yes
<i>Control via Site Permits</i>									
Strong national standards mean effective prohibition for certain waste	(2)	Yes (3)	(2)	Yes	Yes	Yes	Yes	In some cases	Yes

(1) Recommendations are made in technical standards, but these are not mandatory.

(2) Strong controls exist in principle, but in practice there are wide local variations in what is/is not permitted at individual sites.

(3) Prohibition for asbestos and PCB.

(4) Powers exist but not usually done.

(5) Source: D.C. Wilson, Summary and Analysis of Hazardous Waste Management in ISWA Countries. In: *International Perspectives on Hazardous Waste Management*, edited by William S. Forester and John H Skinner, Academic Press, (1987).

**Table 3.3 - Provision of Treatment Facilities**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
<i>Year of Latest Data Update</i>	1998	1998	1997	1997	1998	1998	1998	1998	1998
<i>State Utility Company</i>	No	No	No	No	Yes	Yes	No	Some states	Yes (3)
<i>Provision of Facilities</i>									
Private sector	Yes	Yes	- / New	Yes	No	Yes	Yes	Yes	(3)
Public sector	Yes	No	-	-	No	No	No	Yes	(3)
Public/Private collaboration	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
Public investment	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
<i>Financial Support</i>									
Indirect subsidy (of investment)	Yes	Yes	Not yet decided	Yes	Yes	Yes	Yes	Yes	Yes
Direct subsidy	No (1)	No	"	No	Yes	Yes	Yes (2)	No	Yes
Incentive levies/taxes (6)	Yes	Yes	(6)	Yes	No	No	Yes	No	No

(1) Yes in some cases, if the emissions are lower than the standards.

(2) France has a system for the direct subsidy of prices charged by a facility, so long as its use is seen as the most appropriate treatment or disposal option for the particular waste in question.

(3) In effect, a government utility with services provided by a private company under contract to Government, selected by international competitive tender.

(4) New landfill tax introduced in October 1996.

(5) Subsidy provided for the original state utility owned facility, which has now been privatised.

(6) See Table 3.5

(7) Source: D.C. Wilson, Summary and Analysis of Hazardous Waste Management in ISWA Countries. In: *International Perspectives on Hazardous Waste Management*, edited by William S. Forester and John H Skinner, Academic Press, (1987).

**Table 3.3 - Provision of Treatment Facilities (continued)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<i>Year of Latest Data Update</i>	1998	1997	1987 (7)	1998	1998	1997	1998	1998	1998
<i>State Utility Company</i>	No	No	No	No	Yes	Yes	No	No	No
<i>Provision of Facilities</i>									
Private sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Public sector	No	Yes	Yes	Yes	No	No	Yes	No	No
Public/Private collaboration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Possible	No
Public investment	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
<i>Financial Support</i>									
Indirect subsidy (of investment)	Yes	Yes	Yes	Yes	Yes	Yes	(5)	No	No
Direct subsidy	No	No	No	No	No	No	No	No	No
Incentive levies/taxes	Yes	Yes	No	Yes	No	No	No	Yes (4)	Some states

(1) Yes in some cases, if the emissions are lower than the standards.

(2) France has a system for the direct subsidy of prices charged by a facility, so long as its use is seen as the most appropriate treatment or disposal option for the particular waste in question.

(3) In effect, a government utility with services provided by a private company under contract to Government, selected by international competitive tender.

(4) New landfill tax introduced in October 1996.

(5) Subsidy provided for the original state utility owned facility, which has now been privatised.

(6) See Table 3.5

(7) Source: D.C. Wilson, Summary and Analysis of Hazardous Waste Management in ISWA Countries. In: *International Perspectives on Hazardous Waste Management*, edited by William S. Forester and John H Skinner, Academic Press, (1987).

Most countries reinforce the 'stick' of restricted choice of options with the 'carrot' of financial support. The major form of financial support is through indirect subsidy, that is by providing low cost finance for the facility which reduces (or even eliminates) the capital charges which must be met from revenues.

Of the 16 countries analysed in *Table 3.3* which have 'high technology' facilities in place for hazardous waste treatment, all but two provided indirect subsidy of at least the initial capital investment. In many cases, the facilities have been operational now for more than 10, or even more than 20, years, so that in some cases the memory of this initial subsidy has begun to fade. In many cases, recurring capital investment in plant expansion or to meet new standards, for example upgrades in gas cleaning requirements for incineration, are now met on a purely commercial basis from the fees charged for waste treatment.

The main point is that financial support was made available at the beginning, to ease the transition from cheap and uncontrolled disposal to the required use of relatively expensive treatment facilities.

One example of a more direct approach to subsidising the use of the most appropriate or 'best practicable' means of treatment or disposal for a particular waste is provided by France. The regional water authorities provide a subsidy of about 30-50%, which is paid directly to the site operator. The necessary revenue was originally raised from charges for waste water treatment, but alternative, more appropriate revenue sources have been studied.

The two exceptions to the 'subsidy' rule are the USA and the UK. In the USA, reliance is placed mainly on the 'stick', through rigid regulations that set down exactly what option may be used for a particular waste, and also the liability instrument (see *Section 3.2.3*). It is then left to the private sector to provide the necessary facilities. Once the control system was fully established, this mechanism became relatively effective. However, for at least the first 10 years after regulations were introduced in 1976, many of the facilities that existed before the regulations were introduced continued to work on 'interim status', due to the slowness in permitting these facilities. This created a disincentive to invest either in treatment plants or in state-of-the-art landfill sites that satisfied the new regulations, since older, less environmentally sound and therefore cheaper sites, often still existed in neighbouring states.

In the UK, reliance has also been placed on market forces to provide treatment and disposal facilities. However, in this case regulatory control over the choice of options was initially weak. Control was achieved primarily through site licensing or permitting, with the conditions being left largely to the discretion of local authorities. Some authorities took originally a more lenient view than others as to what wastes might be allowed in landfills. In the mid 1980s, the Hazardous Wastes Inspectorate, set up to oversee standards across

the country, stated that all existing merchant incineration and treatment facilities in the UK were on an economic knife edge as a result of 'unfair competition' from landfills. This situation has now been largely corrected due to the new, stricter, licensing permitting regime introduced under the 1990 legislation, and also the introduction of two nationwide Environment Agencies in 1996, which have taken over the waste regulation function from the (often small) local authorities.

### 3.5 *ECONOMIC AND FINANCIAL INSTRUMENTS*

A mechanism which has become very popular in the 1990s to encourage the move of waste management up the hierarchy, or to encourage better environmental management in general, is the use of so-called economic and financial instruments or market-based instruments. A classification and description of some of the economic and financial instruments available for hazardous waste management, is shown in *Table 3.4*. This also comments on the use of the instruments, summarising the more detailed information presented in *Table 3.5*.

A number of these instruments were also discussed earlier in this section. For example, item 8 in *Table 3.4* is provision of capital subsidy for new hazardous waste treatment or disposal facilities and the example under item 2 is of the French 'direct subsidy' for proper treatment or disposal, (see *Section 3.4*), while item 10 was discussed in *Section 3.2.3*.

Item 1 in *Table 3.5* and the last line in *Table 3.2*, both refer to incentive levies or taxes to discourage the use of treatment or disposal facilities, which are in use in 8 of the 16 countries for which data is available. For example, a landfill tax was introduced in the UK in October 1996, mainly to provide an incentive for recycling municipal solid waste. A graduated tax has been in use in the Flanders region of Belgium for many years, providing a zero tax on recycling, a maximum tax on landfill and a 30-50% tax on treatment. Waste generators in Croatia pay a fee for waste generation, which is graduated depending on the recycling, treatment or disposal method used.

The approaches taken in a number of countries to require waste generators to move waste management 'up the hierarchy', and/or to encourage such moves, were discussed in *Sections 3.2.4* and *3.2.5*. Several of the economic and financial instruments listed in *Tables 3.4* and *3.5* are also directed at this area, mainly limited subsidy schemes aimed at pollution prevention, waste minimisation and cleaner production. Such subsidies are commonly available for capital investment, research, development, demonstration projects and disseminating information. Some such schemes are part of more general schemes to subsidise investments in pollution prevention and pollution control, often directed in the first instance primarily at water and air pollution rather than at hazardous wastes. Schemes aimed particularly at hazardous wastes have been operational in Austria, Denmark and the Netherlands since the late 1970s or early 1980s.

**Table 3.4 Economic and Financial Instruments and Mechanisms for Hazardous Waste Management**

- 1 *Waste taxes/disposal levies* - used to direct behavior of hazardous waste generators away from generating these wastes. Waste taxes/disposal levies can however, if high, have a tendency to increase levels of illegal dumping, and, if low, fail to cover regulatory agency costs. Use becoming more widespread.
- 2 *Charge/rebate schemes* - with generators being encouraged to recycle particular kinds of hazardous wastes if they can receive back their fees once they take the wastes to a designated facility, contributing greatly to reduced illegal dumping. An example of such a scheme is in France where a levy on water use is collected by the 'Agency de Bassin', and used to subsidise treatment fees for hazardous wastes where it can be shown that waste is being managed by the 'Best Practicable Environmental Option'.
- 3 *Producer responsibility* - changing the assignment of responsibility for a waste from the immediate generator or public authorities, to the supplier of the product whose use gave rise to the waste. Although this is most often applied to waste packaging and to end of life consumer products such as batteries, automobiles and electronic goods (for example, in the German packaging directive), this measure could be applied to selected hazardous wastes such as solvents, lubricating oils, cleaning fluids, plating baths etc.
- 4 *Raw material taxes* - being levied on those raw materials whose use gave rise to the hazardous waste. Only used in the US, to finance Superfund.
- 5 *Product charges* - with a levy, charge or tax on products whose manufacture gives rise to hazardous wastes. Used, eg, in Belgium, Netherlands, Norway and Sweden.
- 6 *Subsidies for waste prevention* - to build on the current subsidy schemes to include provision of funding (in the form of cash, loans, grants and/or low interest loans) to full compliance audit, implementation of the action plans that come from their audits and installation/use of certain source reduction technologies. These would include process optimisation, good housekeeping, cleaner technologies, support for research and development and support for demonstration projects. Moderately widespread.
- 7 *Subsidies for in-house recycling and waste treatment* - including provision of a subsidy to selected firms to assist installation/use of certain recycling or waste treatment technologies. Less commonly used.
- 8 *Subsidies for (new) central or mobile recycling, treatment and disposal facilities* - providing some form of capital subsidy (in the form of grants, low interest loans, import duty exemptions etc) for first generation TSD facilities, in order to ease the transition from zero or very low treatment and disposal charges to the high charges required to support state of the art facilities.
- 9 *Accelerated tax depreciation and other tax preferences* - building on the current preferential tax system, including application to on-site hazardous waste prevention recycling and treatment technologies.
- 10 *Liability instruments* - with schemes designed to get hazardous waste generators to manage their wastes safely and effectively (ie US Superfund or other 'contingent liability' schemes).
- 11 *Compliance/Emissions Trading Mechanisms* - with permits for disposal of waste being tradeable between firms (an example of this is the US regional clean air incentives market (RECLAIM) scheme, which requires each firm (or facility) to reach stipulated annual total emissions targets). Not used for wastes.

**Source:** ERM

**Table 3.5 Economic and Financial Mechanisms for Hazardous Waste Management (page 1)**

Year Information Provided	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
	1998	1998	1997	1997	1998	1998	1998	1998	1998
<b>1 Waste Taxes/Disposal Levies</b>									
- used as instrument?	Yes	Yes	Yes (26)	Yes	No	Yes	Yes	Yes (27)	No
- year of introduction	1989	1991	-	1992	-	1996	1995	1992	-
- have levels of illegal dumping increased since introduction?	Do not know	No	-	Do not know	-	No	Yes	Do not know	-
- taxes/levies cover regulatory agency's cost?	No	Yes	-	Do not know	-	-	Yes	Yes	-
- scope of tax and levels of charges	(30)	(1)	(26)	(2)	-	(3)	-	(27)	-
<b>2 Charge/Rebate Schemes</b>									
- used as instrument?	No	No	No	No	No	Yes	Yes	Yes (28)	Yes
- year of introduction	-	-	-	-	-	1987	1995	1992	1994
- resulted in reduction of illegal dumping?	-	-	-	-	-	-	-	Do not know	No
- brief details	-	-	-	-	-	(9)	(10)	(28)	-
<b>3 Producer Responsibility</b>									
- used as instrument?	Yes	Yes	No	No	No	Yes	Yes	Yes	No
- year of introduction (legislation)	1993	1994	-	-	-	1994	1975	1992	-
- year of introduction (practical use)	1993	1995	-	-	-	Packaging waste 1997	-	1992	-
- applied to waste packaging?	Yes	Yes	-	-	-	Yes	Yes	Yes	No
- applied to selected hazardous wastes (please name)?	No	Haz. Packaging waste	-	-	-	-	Yes	No	-
- comments	-	Foreseen for batteries	-	-	-	-	-	-	-
<b>4 Raw Material Taxes</b>									
- used as instrument?	No	No	No	No	No (32)	No	No	No	No
- year of introduction	-	-	-	-	-	-	-	-	-
- which raw materials?	-	-	-	-	-	-	-	-	-
- brief details	-	-	-	-	-	-	-	-	-
<b>5 Product Charges</b>									
- used as instrument?	No	Yes	No	No	-	Yes	No	No	No
- year of introduction	-	1993	-	-	-	1996	-	-	-
which products?	-	(13)	-	-	-	Used car tyres	-	-	-
- brief details	-	(14)	-	-	-	(15)	-	-	-
<b>6 Subsidies for Waste Prevention</b>									
- used as instrument?	Yes	Yes	No	Yes	Yes	No	Yes	No	No
- year of introduction	not formal law	1994	-	1991	1986	-	1975	-	-
- form (eg loans, grants, low interest loans etc)	-	Grants	-	Grants	Grants	-	Grants	-	-
- activities supported	-	-	-	-	-	-	-	-	-
• R&D	Yes	Yes	-	No	Yes	Yes	Yes	No	-
• demonstration projects	Yes	Yes	-	Yes	Yes	Yes	Yes	No	-
• audits	Yes	No	-	No	No	No	No	No	-
• investment	Yes	No	-	Yes	No	No	Yes	No	-
- brief details	Yes	-	-	(17)	-	-	-	-	-

**Table 3.5 Economic and Financial Mechanisms for Hazardous Waste Management (page 2)**

Year Information Provided	Austria 1998	Belgium 1998	Croatia 1997	Czech Republic 1997	Denmark 1998	Finland 1998	France 1998	Germany 1998	Hong Kong 1998
<b>7 Subsidies for in-house Recycling and Waste Treatment</b>									
- used as instrument?	No	No	No	No	Yes	No	No	No	No
- year of introduction	-	-	-	-	1986	-	-	-	Under considera
- form (eg grants, low interest loans, import duty, exemptions, etc)	-	-	-	-	Grants	-	-	-	-
- to assist installation/use of certain recycling technologies?	-	-	-	-	Yes	-	-	No	-
- to assist installation/use of certain waste treatment technologies	-	-	-	-	Yes	-	-	No	-
- brief details	-	-	-	-	-	-	-	-	-
<b>8 Subsidies for (new) Recycling, Treatment and Disposal Facilities</b>									
- used as instrument?	No	No (20)	No	No	Yes	Yes	Yes	Yes	Yes
- year of introduction	-	-	-	-	-	-	1980	1972	1988
- form of capital subsidy (eg cash, low interest loans, import	-	-	-	-	Max 50% of investment	Max 30% of investment	-	Variable	User fees subsidi
- when used?	-	-	-	-	-	-	-	-	Yes
- still available?	-	-	-	-	Yes	Yes	-	Yes	Yes
- brief details	-	-	-	-	-	-	-	(29)	Financed by Gov
<b>9 Accelerated Tax Depreciation and other Tax Preferences</b>									
- Tax Depreciation used as instrument?	No	No	No	No	No	No	No	No	No
- Other Tax Preferences used (please specify)?	-	-	-	-	-	-	-	-	-
- year of introduction	-	-	-	-	-	-	-	-	-
- brief details	-	-	-	-	-	-	-	-	Under considera
<b>10 Liability Instruments</b>									
- used as instrument?	Yes	Yes	No	No	No	No	No	No	No
- year of introduction	1991	1996	-	-	-	-	-	-	-
- brief details	(31)	(23)	-	-	-	-	-	-	-
<b>11 Compliance/Emissions Trading Mechanisms</b>									
- used as instrument?	No	No	No	No	No	No	Do not know	No	No
- year of introduction	-	-	-	-	-	-	-	-	-
- brief details	-	-	-	-	-	-	-	-	-

(1) None for recovery, >70US\$/tonne for landfilling, 25US\$/tonne for incineration without energy recovery, 10US\$/tonne for incineration with energy recovery (Flanders only)

(2) Tax for landfilling varies from 210,-Kc/tonne of municipal waste to 600,-Kc/tonne of hazardous waste

(3) 90 FIM/ton of waste taken to a communal landfill

(9) Most of the money is used for collection of used lubrication oil. A part of the money is used for the treatment of oil contaminated soil.

(10) Levy on water use by the 'Agence de Bassin' is used to subsidise treatment/disposal fees for hazardous wastes where it can be shown that the 'proper treatment/disposal route is being used

(13) Batteries, solvents pesticides and herbicides

(14) Charge per package of the product. Products for use in private households are excluded.

(15) Importer and producers collect the money

(17) The State Environment Fund of the Czech Republic supported these activities up to maximum 60% of the investment costs

(20) Initial investment in central treatment facility subsidized by Government, no subsequent subsidies available

(23) For Contaminated soils and sites including hazardous waste stored on abandoned sites.

(26) A fee for waste generation rather than a tax. Graduated depending on the recycling, treatment or disposal method used

(27) Waste Tax only in 1/16 Lander (Schleswig-Holstein). The tax for hazardous waste in incineration plants is DM 100, the tax for hazardous waste in landfills is DM 25

(28) 7/16 Lander have a rebate scheme, as follows:

Lander	Rate (% of the Disposal Price)
Baden-Wuttember	12%
Berlin	8%
Brandenburg	8%
Niedersachsen	7%
Rheinland-Pflaz	7%
Saarland	15%
Thuringen	13%

(29) Subsidy available for recycling, treatment or disposal facilities using new technology

(30) Dump contribution determined in "Law on Clean-up of Contaminated Sites"

(31) Waste Management Law

(32) Only for gravel (not hazardous waste)

**Table 3.5 Economic and Financial Mechanisms for Hazardous Waste Management (page 3)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
		Information not available	Information not available	1998	1998	1998	1998	1998	1998
<b>Year Information Provided</b>			available						
<b>1 Waste Taxes/Disposal Levies</b>									
- used as instrument?	No			Yes	Yes	No (6)	No	Yes	No
- year of introduction	1998 expected			1995	1986	-	1999	1995/6	-
- have levels of illegal dumping increased since introduction?	-			No	No	-	-	Yes	-
- taxes/levies cover regulatory agency's cost?	-			No	Yes	-	No	No	-
- scope of tax and levels of charges	-			(4)	(5)	-	(7) 250:-/ton, f (8)		-
<b>2 Charge/Rebate Schemes</b>									
- used as instrument?	No			No	No	No	No	No	No
- year of introduction	-			-	-	-	-	-	-
- resulted in reduction of illegal dumping?	-			-	-	-	-	-	-
- brief details	-			-	-	-	-	-	-
<b>3 Producer Responsibility</b>									
- used as instrument?	Yes			Yes	Yes	No	Yes (11)	Yes	No
- year of introduction (legislation)	1996				1990	-	-	1995	-
- year of introduction (practical use)	1996			after 1994	1994	-	-	1997 onwards	-
- applied to waste packaging?	No			Yes (in preparation)	Yes, not haz. waste	-	No	Yes (some classes)	-
- applied to selected hazardous wastes (please name)?	-			Some kinds of haz.-	Lead batteries	-	Batteries	No	-
- comments	-			waste e.g. batteries	-	-	-	(12)	-
<b>4 Raw Material Taxes</b>									
- used as instrument?	No			No	No	No	No	No	Yes
- year of introduction	-			-	-	-	-	-	Early 1980's
- which raw materials?	-			-	-	-	-	-	Oil and Haz. Ma
- brief details	-			-	-	-	-	-	Finances Superf
<b>5 Product Charges</b>									
- used as instrument?	Yes			Yes	Yes	No	Yes	No	No
- year of introduction	1995			-	1) cars 2) lead/waste oil	-	1997	-	-
- which products?	Fuel, tyres, packaging, refrigeration (+coolant), car			Tyres, cars etc.	1)1978, 2)1994	-	Petroleum	-	-
- brief details	Law No. LVI of 1995			-	-	-	(16)	-	-
<b>6 Subsidies for Waste Prevention</b>									
- used as instrument?	No			Yes	Yes	Yes	No	Yes	No
- year of introduction	-			1974	1990 - 1996	1989	-	-	-
- form (eg loans, grants, low interest loans etc)	-			Grants	Grants	Several	-	Several	-
- activities supported	-			-	-	-	-	-	-
• R&D	-			Yes	Yes	Yes	-	Yes	-
• demonstration projects	-			Yes	Yes	Yes	-	Yes	-
• audits	-			Yes	No	Yes	-	No	-
• investment	-			Yes	No	-	-	No	-
- brief details	-			-	Cleaner production	(18)	-	-	-

**Table 3.5 Economic and Financial Mechanisms for Hazardous Waste Management (page 4)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
Year Information Provided		Information not available	Information not available	1998	1998	1998	1998	1998	1998
<b>7 Subsidies for in-house Recycling and Waste Treatment</b>									
- used as instrument?	No			Yes	Yes	No	No	No	No
- year of introduction	-			-	1990-1996	-	-	-	-
- form (eg grants, low interest loans, import duty, exemptions, etc)	-			-	Grants	-	-	-	-
- to assist installation/use of certain recycling technologies?	-			Yes	Yes	-	-	-	-
- to assist installation/use of certain waste treatment technologies-	-			Yes	Yes	-	-	-	-
- brief details	-			-	(19)	-	-	-	-
<b>8 Subsidies for (new) Recycling, Treatment and Disposal Facilities</b>									
- used as instrument?	-			Yes	Yes	Yes	No (20)	No	No
- year of introduction	-			-	-	-	-	-	-
- form of capital subsidy (eg cash, low interest loans, import duty -	-			-	(21)	-	-	-	-
- when used?	-			-	-	-	-	-	-
- still available?	-			Yes	Yes	-	-	-	-
- brief details	-			-	(22)	-	-	-	-
<b>9 Accelerated Tax Depreciation and other Tax Preferences</b>									
- Tax Depreciation used as instrument?	-			Yes	No	No	No	No	No
- Other Tax Preferences used (please specify)?	-			-	-	-	-	-	-
- year of introduction	-			-	-	-	-	-	-
- brief details	-			-	-	-	-	-	-
<b>10 Liability Instruments</b>									
- used as instrument?	-			No	Yes	No	No	No (24)	Yes
- year of introduction	-			-	1991-1993	-	-	-	Early 1980's
- brief details	-			In discussion	-	-	-	-	(25)
<b>11 Compliance/Emissions Trading Mechanisms</b>									
- used as instrument?	-			-	No	No	No	No	No
- year of introduction	-			-	-	-	-	-	-
- brief details	-			-	-	-	-	-	-

(4) 30 Dutch Guilders/ tonne hazardous waste to landfill site

(5) Financing the regulation system. 0.10 Norwegian Crowns/kg hazardous waste

(6) New law under parliamentary discussion

(7) SKR 250/tonne flat rate

(8) Landfill tax, all waste going to landfill: Two rates £7/tonne generally but £2/tonne for designated inert wastes. Upper rate increased to £10 in March 1998 budget.

(11) For batteries, only

(12) Various schemes being developed and introduced. So far mainly relate to various classes of packaging

(16) Used to finance contaminated site clean-up

(18) Several programmes at national and regional level

(19) Cleaner production programme, R&D and demonstration projects by waste generator

(20) Initial investment in central treatment facility subsidised by Government, no subsequent subsidies available

(21) Cash, investment tax exemptions

(22) Until 1993 many small receivers were subsidised, after 1993 only 1-2 waste treatment facilities are subsidised

(24) There is the additional policy of trying to ensure that all disposal options fully reflect the true cost

(25) Strict joint and several liability

(27) Waste tax only in 1/16 Lander (Schleswig-Holstein). The tax for hazardous waste in incineration plants is DM100/tonne, the tax for hazardous waste in landfills is DM25

(28) 7/16 Lander have a rebate scheme, as follows:

Lander	Rate (% of the Disposal Price)
Baden-Wuttember	12%
Berlin	8%
Brandenburg	8%
Niedersachsen	7%
Rheinland-Pflaz	7%
Saarland	15%
Thuringen	13%

**4.1 DEFINITIONS****4.1.1 Terminology and Purpose**

A necessary requirement of any regulatory control system is a legal definition. *Table 4.1* shows that all countries have a definition of hazardous waste: beyond that, the table suggests that the systems used in different countries have many similarities, but also differences in detail. Before discussing the detailed definitions, a comment is necessary on nomenclature or terminology. In this report, we use the generic term 'hazardous wastes', while in various individual countries terms such as chemical, special, poisonous, toxic, or difficult are used to describe such wastes.

It is extremely difficult to define a hazardous waste with any precision. Every national system differs both in the detailed method used for definition and also in the breadth of waste included. The importance attached to a legal definition of waste depends both on its purpose and the use that will be made of it.

In many countries, notably the Germany and the USA, one purpose is to separate hazardous from municipal or industrial waste, in order to allow more stringent control. The need for a clear-cut definition is greatest if national policy requires that hazardous wastes be treated and disposed of separately from non-hazardous wastes. Another common purpose of a definition is to achieve the most appropriate treatment for a particular waste. This, for example, is seen as paramount in Denmark.

In the UK, the primary control over hazardous waste treatment and disposal is through site licensing or permitting, which applies to all household, commercial and industrial waste. Official policy has in the past favoured the co-disposal of hazardous and municipal waste in landfill sites. Both the acceptable types of wastes and the disposal conditions may be included in the terms of the site permit. The main area where additional control over a hazardous waste is felt to be necessary is during transport. The definition of a 'special waste', for which a manifest is required, is thus framed in terms of protecting human health should a waste be illegally dumped in transit, rather than in terms of protecting the environment following proper disposal.

In Japan, the original (pre-1991) definition of a hazardous waste separated only those wastes for which incineration or chemical treatment is particularly difficult. A waste was hazardous only if it is a 'cinder, sludge, waste acid, a waste alkali, slag or dust' containing one of nine toxic substances above a prescribed limit when tested by an extraction test. In addition, wastes could only be classified as hazardous if they were generated from a specified facility. It was considered that these wastes required total isolation from the environment, by detoxification if appropriate or solidification in concrete and landfilling in a special concrete-lined disposal pit.

A modified definition of 'Wastes under Special Control' was introduced in 1991, but few details are available.

#### **4.1.2** *Types of Definitions*

Most countries have used a definition based on three criteria (see *Table 4.1*). These are lists of particular types of hazardous wastes, lists of industrial processes from which the waste is defined as hazardous and/or lists of substances, the presence of which is indicative of potential hazard.

In some cases, a listing on one or more of these criteria is judged to provide a sufficient definition. In other cases, a further reference is made to particular concentration levels for each of the substances, or to other indicative criteria.

These may include:

- the toxicity of the waste itself;
- the toxicity of an extract of the waste, usually obtained by means of a specific leaching test. Toxicity is generally defined by reference to concentrations of specific substances in the extract (eg in the USA and Japan);
- the ignitability or flammability of the waste;
- the corrosiveness of the waste; and
- the reactivity of the waste.

Many of the national definitions summarised in Table 4.1 have been amended since the original ISWA report was compiled in 1987, to fall in line with the requirements of the Basel Convention.

#### **4.1.3** *Classification Systems*

The problem with the Basel definition, and indeed with all the definitions discussed above, is that they are in effect *descriptions of waste*, whereas for the purposes of running an effective, regulatory control system, one requires rather a definitive *list of wastes* or waste catalogue. Much work over the last five years in many countries has been devoted to the development of such waste catalogues, often in the broader context of developing a comprehensive classification system for either all wastes, industrial wastes or hazardous wastes. The solution in Western Europe was meant to have been provided by the EU *Catalogue of Wastes*, published in 1994, but this appears to have raised as many problems as it has solved. Most EU member states have continued developing their own waste classification systems with the result that, while they share a number of common features, they also differ in the detail. Any detailed international comparison is difficult to carry out at this time, because the individual national systems are still in a state of flux.

One important aspect of a classification system is that it should be flexible, so that new types of waste do not evade control. This is a particular problem that must be addressed by any system relying mainly on listing specific types of waste or industrial processes. It is also cited by Denmark as the reason why they do not prescribe concentration limits.

#### **4.1.4**

#### ***Exclusions***

In comparing definitions of hazardous waste, it is important to note those categories of waste specifically excluded from the control system (*Table 4.1*). The reasons for such exclusions are generally concerned with problems of implementation, either because quantities are small or because the political or practical difficulties are too great.

- Hazardous wastes from households are outside the normal control system in all countries, although specific systems to encourage separation and delivery to special collection points have been/are being developed in many countries.
- Small quantity generators are often placed outside the system. For example, in the USA producers generating less than 1000 kg per month were excluded from control up to 1984, when a lower limit of 100 kg per month was implemented. It is estimated that this change increased the number of generators covered by the regulations by a factor of 10.
- Aqueous effluents discharged to sewer or treated on-site are controlled separately from hazardous wastes in most countries. For example, such wastewaters are specifically excluded from the definition of 'waste' in EU directives. However, in the USA wastewater treatment in surface impoundments or lagoons is controlled within the hazardous waste regulations.
- Sewage sludge is specifically excluded in some countries but not others.
- Mining wastes are often excluded from control, even though the nature of the wastes may be very similar to other hazardous wastes.
- Similar exclusions may apply to agricultural waste.
- Certain 'hazardous' wastes were already controlled in many countries under separate regulations and were therefore excluded from the new hazardous waste controls. Common examples are radioactive, pathogenic and conventional explosive wastes.

#### **4.1.5**

#### ***Special Rules***

Attention is drawn here to rules concerning the mixing of hazardous with non-hazardous waste and also residues resulting from the treatment of hazardous waste.

**Table 4.1 - Definitions of Hazardous Waste**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
<i>Year of Latest Data Update</i>	1998	1998	1997	1997	1998	1998	1998	1998	1998
<i>Is there a legal definition?</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Purpose of Definition</i>									
Control over transport	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control over treatment/disposal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Type of definition</i>									
List of waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
List of substances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
List of processes	No (3)	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Concentrations	Yes (4)	Yes	No	No	Yes	No	No	No	Yes
<i>Criteria</i>									
Toxicity of waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Toxicity of extract	Yes (4)	Yes	No	Yes	Yes	Yes	Yes	No	No
Ignitability/flammability	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corrosiveness	Yes (4)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reactivity	Yes (4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Special Rules</i>									
Mixing rule	Yes	Yes	No	Partial	Yes	Yes	Yes	Yes	Yes
Residue rule	Yes (5)	No	No	Partial	Yes	No	Yes	Yes	No
<i>Exclusions</i>									
Small generators (1)	No	No	No	No	No	No	100 kg	No	No
Wastewater	Yes	Yes	No	Yes	No	No	Yes	Yes	No
Sewage sludge	Yes	No	No	No	No	No	No	No	No
Mining waste	Yes	No	No	Yes	No	No	Yes	Yes	No
Agricultural waste	Yes	No (2)	No	No	No	No	Yes	Yes	No

(1) Quantity is that per month below which waste generator is exempt from the regulation.

(2) Except animal slurry.

(3) Yes in some cases, within Austrian Standard on Hazardous Waste.

(4) In some Federal Regulations.

(5) Only for packaging.

**Table 4.1 - Definitions of Hazardous Waste (continued)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<i>Year of Latest Data Update</i>	1998	1997	1987 (8)	1998	1998	1997	1998	1998	1998
<i>Is there a Legal Definition?</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Purpose of Definition</i>									
Control over transport	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Control over treatment/disposal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Type of Definition</i>									
List of waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partly	Yes
List of substances	No	Yes	Yes	Yes	Yes	Yes	Yes	Partly	Yes
List of processes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Concentrations	No	Yes	No	Yes	Yes	No	Partly	Partly	Yes
<i>Criteria</i>									
Toxicity of waste	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Toxicity of extract	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes
Ignitability/flammability	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Corrosiveness	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Reactivity	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
<i>Special Rules</i>									
Mixing rule	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes
Residue rule	No	No	No	No	No	No	No	No	Yes
<i>Exclusions</i>									
Small generators (1)	No	Yes	Yes	No	No	Yes	No	No	100 kg
Wastewater	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No (6)
Sewage sludge	Yes	No	Yes	No	Yes	Yes	Yes	No	No
Mining waste	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes (7)	Yes (7)
Agricultural waste	Yes, partial	Yes	Yes	No	No	Yes	Yes	Yes (7)	No

(5) Only for packaging.

(6) Partial exclusion for waste water treated exclusively in permitted treatment tanks. Wastewater treated in surface impoundments or lagoons is controlled as a hazardous waste.

(7) Subject to current review.

(8) Source: D.C. Wilson, Summary and Analysis of Hazardous Waste Management in ISWA Countries. In: *International Perspectives on Hazardous Waste Management*, edited by William S. Forester and John H Skinner, Academic Press, (1987).

Where the definition of a hazardous waste depends on the concentration of specific substances, either in the waste itself or in an extract, it is in principle possible to evade control by mixing the hazardous with a non-hazardous waste. This is permitted in some countries but not in others. For example, in the USA, the so-called 'mixing rule' states that if you mix a listed hazardous waste with anything else, then the result is a hazardous waste <sup>(1)</sup>. In France, special authorisation is required before such mixing, while in the Netherlands, mixing is forbidden.

The treatment of hazardous waste generally results in a residue for final disposal. The question is, whether these residues can be regarded as a non-hazardous waste. Again, in the USA, the so-called 'residue rule' states that any residue from treatment of a listed waste is also a hazardous waste unless specifically 'delisted', which is a lengthy and onerous process.

In the Germany, there is some confusion regarding the classification of fly ash from municipal incinerators, which some states define as a hazardous waste and others do not; however, the trend is towards its classification as hazardous waste. In some countries, such as The Netherlands, the normal concentration limits or criteria are applied to residues in determining whether or not they are a hazardous waste. In others, such as Sweden, fly ash from municipal incinerators is classified as hazardous waste.

## 4.2

### ***NATIONAL DATA MANAGEMENT SYSTEMS***

National data management systems for industrial and hazardous wastes may cover information both on waste quantities and on regulated parties such as generators, transporters, and treatment and disposal operators. *Table 4.2* summarises various national systems for collecting information on waste management.

Perhaps the most important characteristic of a national data management system is the one which is *not* included in *Table 4.2*, because it is more difficult to uncover in a survey of this kind. Particularly when one is thinking of establishing such a system, the key question is *what is the information going to be used for?* Clearly, it is interesting to collect statistics, and it is useful to be able to compare those statistics between countries, or between regions within the same country. However, simple curiosity is not enough to justify the significant resources required to set up and maintain a comprehensive, computerised, national data management system. Rather, the data management system must serve as a *management tool* for example:

- providing basic information required for industrial and hazardous waste management, allowing Government to develop a better understanding of the problem for policy and planning purposes;

(1) The US rule applies to waste listed (by name or process) in the regulations. It does not apply to waste that is hazardous by virtue of the extraction test, which if diluted below the limit is no longer considered as a hazardous waste.

- examining opportunities for and the measures required to promote, cleaner production, waste minimisation, recycling and re-use;
- examining destinations of wastes, ie which waste types are going to which types of facilities, both for facility development and planning purposes, and perhaps also for the direction of wastes to particular types of facilities.

Several countries, including Denmark, Germany and the Netherlands have had well established national systems since the early 1980s that produce information on a regular (annual, 3-yearly in Germany) basis. More recent systems include Austria, Hungary and Norway. There has been a general move in this direction over the last 10 years, but such systems are still not universal.

A number of alternative methods for data collection may be distinguished. Perhaps the most comprehensive is the (annual) report by waste generators, which may form part of a registration scheme. In Denmark, this is viewed, along with manifests (trip tickets), as a vital part of the system, providing good information and allowing government to learn more about waste generation and so to check the data. A report by treatment and disposal operators will in principle yield the same information, but may not give so much insight as to the origin of the waste.

Where manifests or trip tickets are notified to the authorities, this information could be used as the basis of information on those wastes treated or disposed of outside the factory. For example, a national data management system of this kind has been installed in France.

Sample surveys may be carried out by or on behalf of national governments. These may go directly to generating industries and to treatment and disposal operators, or they may simply seek information from regional or local authorities.

Those regional or local authorities may themselves carry out sample surveys. Such surveys were required in the UK from 1976-1996, but timescales were only imposed late in the process, so progress was slow. Available results were difficult to collate due to differing classification systems and to wide variation in the dates of the surveys. Following the amalgamation of the local Waste Regulation Authorities into national agencies in 1996, a national data management system is expected within a few years.

## **4.3** *COMPARATIVE STATISTICS FOR THE ISWA COUNTRIES*

### **4.3.1** *Problems in Comparing Waste Statistics*

Given the variability of waste definitions and classification systems discussed in *Section 4.1*, and the variety of bases used for national industrial and hazardous waste data management systems, it is not surprising that the

**Table 4.2: National Data Management Systems**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
<i>Year of Latest Data Update</i>	1998	1998	1997	1997	1998	1998	1998	1998	1998
<i>Primary level of data collection</i>	Regional/ enterprises	Regional	Reg. & nat.	Regional	Reg. & nat.	-	Regional	Reg. & nat.	Whole Territory
<i>National data management system</i>	Yes	Yes	Under development	Yes	Yes	Ready by 1997		Yes	Yes
• Is it computerised?	Yes	Yes	Under way	Yes	Yes	-	Yes	Yes	Yes
• Is it regularly updated?	Yes	Yes	Under way, tri- monthly	Yes	Yes	-	-	Yes	Yes
• Date of most recent data	1995	1995	End 1996, Partially	1996	1996	-	-	1993	1997
<i>Basic methods of data collection</i>									
• Regular, mandatory report by generators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
• Report by treatment/disposal (T/D) operators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
• Survey of manifests (trip tickets)	Yes	Yes	Yes	-	Yes	No	Yes	Yes	Yes
• Survey by national government									
- of Industry/ T & D operators	Yes	No	Yes	Yes	Yes	No	No	No	Yes
- of regional/local authorities	(Yes)	No	Yes	-	Yes	No	-	No	-
• Survey of industry and T & D operators by regional/local authorities	Yes, for first investigation	Yes	Yes	Partial	Yes	-	Yes	Yes	-

**Table 4.2 - National Data Management Systems (continued)**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<i>Year of Latest Data Update</i>	1998	1997	1987 (1)	1998	1998	1998	1998	1998	1998
<i>Primary level of data collection</i>	Regional	Regional	Reg. & Nat.	National	National	Reg. + Nat.	(2)	Local (3)	National
<i>National data management system</i>	Yes	No	Yes	Yes	Yes	Yes	In preparation	No	Yes
• Is it computerised?	Yes	In progress	Yes	Yes	Yes	Yes	-	No	Yes
• Is it regularly updated?	Yes	In progress	Yes	Yes	Yes	Yes	-	Partially	Partially
• Date of most recent data	1994	1994	1984 (1)	1995	Each month	1994	1994	1985 -1996	1996
<i>Basic methods of data collection</i>									
• Regular, mandatory report by generators	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
• Report by treatment/disposal (T & D) operators	Yes	Yes	No	Yes	Yes	Yes	Yes	Possible (4)	Yes
• Survey of manifests (trip tickets)	Yes	No	-	Yes	Yes	Yes	Yes	Possible (4)	No (5)
• Survey by national government									
- of industry/T &D operators	No	No	No	No	No	No	No	No	Yes
- of regional/local authorities	Yes	Partial	Yes	No	No	Partial	No	Yes	Yes
• Survey of industry and T & D operators by regional/local authorities	Yes	Partial	Partial	Yes	No	Partial	No	Partial	Yes

(1) Source: D.C. Wilson, Summary and Analysis of Hazardous Waste Management in ISWA Countries. In: *International Perspectives on Hazardous Waste Management*, edited by William S. Forester and John H Skinner, Academic Press, (1987).

(2) Local and regional by treatment operators.

(3) With the amalgamation of 100+ waste regulatory agencies into 2-3 national agencies from 1996, it is expected that a national system will emerge over the next few years.

(4) Acknowledged as potential data source to be utilised under new/planned schemes.

(5) Some states conduct surveys of manifests

problems of comparing waste statistics between countries is of almost nightmare proportions.

ERM recently undertook such an exercise for the fifteen Member States of the European Union, on behalf of the European Commission, with participation from EUROSTAT and the European Environment Agency. Having carried out personal interviews in all fifteen countries with the Agencies responsible for collecting and collating waste statistics at the national or regional level, we had considerable reservations about collating the available data into comparative tables, because there is so much variation in the underlying assumptions that any such comparisons could be misleading.

Our reservations in presenting comparative statistics based on information collected from the 18 members of the ISWA Working Group on Hazardous Wastes are even stronger.

**HEALTH WARNING! The comparative information which follows is based on information provided by 18 different countries, without any attempt to adjust the information to 'correct' the differences in assumptions made in each case. It is known that the systems used for data collection in the individual countries vary widely, so that any detailed analysis or interpretation of the comparative data will inevitably be uncertain. nevertheless, it has been felt that presenting the 'raw' country data may be helpful at a 'overview' level. YOU USE THIS INFORMATION AT YOUR OWN RISK!**

#### 4.3.2

#### *Comparative Quantities of Industrial and Hazardous Waste*

Table 4.3 shows comparative quantities of industrial and hazardous wastes for the countries included in the survey. The table comprises three columns as follows:

- A. General industrial waste, including the wastes similar to normal municipal or construction waste.
- B. 'Special' industrial waste, which by its nature needs to be considered separately from 'normal' waste. A legal definition of this kind exists in a number of countries, including Austria and France where it is much broader than the normal term 'hazardous waste'. In other cases, 'special waste' is used instead of 'hazardous waste', as in Sweden and the UK, where this definition (changed recently in both cases) was more restrictive than that used in other countries for 'hazardous waste'.
- C. Hazardous waste, as reported in national statistics.

The quantity of hazardous wastes reported for the USA stands out as relatively greater than for other countries. Of the 214 million (US) tons of hazardous wastes generated in 1995, 202 million tons was classified as wastewaters. Most of this is treated on-site in land-based treatment units, see Table 4.6 (regulated because, prior to legislation, many of these 'surface impoundments' or treatment tanks were unlined)

**Table 4.3 Comparative Quantities of Industrial and Hazardous Waste (all figures are in million tonnes per year)**

	Year of Latest Update	A (1) General/Industrial Waste	B (2) "Special"/Industrial Waste	C (3) Hazardous Waste (National Statistics)	Comments
Austria	1997	-	35,5	1.00	-
Belgium	1997	10.20	-	0.80	-
Croatia	1997	5.37	3.18	0.28	Column C based on estimations made at different levels & by different methodologies critically verified in the course of 1996 (1995 data).
Czech Republic	1997	48	-	2.60	1995 data
Denmark	1998	(0.70)	-	0.27 (1996 data)	82,500 t. delivered to the central treatment plant in 1996. (Figures taken from 1996 latest update).
Finland	1997	15.40	-	0.50	-
France	1997	50	18	2	-
Germany	1998	338	-	9	1993 data, including 5 new federal Laender. Of total, 85 million tonnes (A) and 3 million tonnes (C) are recycled
Hong Kong	1997	14.13	14.5	0.291	0.07 Mt/yr received at treatment centre and 0.24 Mt/yr landfilled (including asbestos and municipal and hazardous waste incineration ash). Column A includes all household, commercial and industrial waste, including construction and demolition waste.
Hungary	1997	-	-	3.50	Data from 1994.
Italy	1997	41	19.50	2.70	National statistics referred to are from a 1994 Ministry of Environment Report.
Japan	1993 (4)	395	-	(0.80)	Data in Column A for 1990. New definition of 'Wastes under special control' introduced in 1991: no data yet available. Figure in Column C for the previous, very restrictive definition.
Netherlands	1997	6.1	4.00	0.765	1993 data show 0.765 million tonnes, (column C), plus 0.562 million tonnes of oily waste from shipping and 2.6 million tonnes of contaminated soil (total in column B).
Norway	1997	4.20	-	0.65	-
Spain	1998	13.80	-	3.40	Data from 1994
Sweden	1997	3.4 - 4.5	-	0.33	-
UK	1997	70	2.5+	Higher	Column B is estimate for 1994, expected to increase under new definition.
USA	1997	-	-	214	1995 data. Includes 202 million tonnes of hazardous wastewaters.

(1) Column A: Industrial waste special to normal municipal or construction waste

(2) Column B: "Special" industrial (or other) waste, which by its nature needs to be considered separately from "normal" waste. Legally defined as such only in Austria and France.

(3) Column C: Based on official national statistics for hazardous waste.

(4) Source: Global Waste Survey, Final Report. International Maritime Organisation 1995

When one attempts to compare national statistics for hazardous waste generation at a level of detail greater than that of total quantities, the difficulties involved increase by at least an order of magnitude. Both the ISWA survey and the IMO's Global Waste Survey attempted to collect information on the percentage of waste generation by industry, by waste type and by the physical form of the waste. The most successful of these was the IMO's categorisation by a very limited range of waste types. *Table 4.4* shows this information for seven countries, two taken from the original IMO publication, one updated from that publication and a further four added by the ISWA survey.

Again, no clear patterns emerged: the only conclusion is that waste types vary widely between countries, depending partly on real differences in industrial production and waste generation patterns, and also probably by differences in definitions and waste statistics.

#### **4.3.3** *Extent of Import/Export*

Given the advent of the Basel Convention, it is interesting to compare information on the import and export of hazardous wastes on the countries surveyed. There is considerable variation in *Table 4.5* in the date of information supplied. However, given the reporting requirements under the Basel Convention, the data is likely to be more reliable than some others.

For most of the countries surveyed, some import and export of hazardous wastes still occurs. The quantities are generally small, with most waste destined for treatment in high technology facilities.

#### **4.3.4** *Availability of Facilities for Treatment and Disposal*

*Table 4.6* collates data on the approximate number of facilities for hazardous waste treatment and disposal in the countries surveyed.

In general, the numbers of specialised treatment facilities is relatively small, with the notable exception of Japan, where the statistics apply to industrial rather than hazardous wastes.

Data for the USA is given as % of the total wastes managed in 1995. In comparing these figures, it must be remembered that 94% of total hazardous wastes in the US are wastewaters; the vast majority of these are treated on-site (in facilities which are often not classified as hazardous waste treatment facilities in other countries). The hazardous wastes shipped off-site for treatment represented about 5% of the total, of which half was exported to another State within the US for treatment or disposal.

#### **4.3.5** *National Statistics on Controlled Hazardous Waste Sites*

*Section 2.6* drew attention to a particular component of many national hazardous waste management systems, that is systematic programmes to investigate and clean up old and abandoned hazardous waste sites. *Table 4.7* collates the limited information available from surveyed countries on the

estimated total number of waste sites within the country, the total number suspected of containing hazardous waste and the number which require immediate action. Of the 18 countries included in the overall survey, up-to-date information is available for 7, while old information from the 1987 report is shown for a further 2 for comparison.

**Table 4.4 Comparative Information on the Breakdown of Hazardous Waste by Waste Type (all figures as % of total Hazardous Waste)**

	Canada (1)	Croatia	Czech Republic	Germany	Netherlands (1)	Norway	Sweden
Acids/Alkalis	NS	3.8	2.5	5.7	3.8	28.6	2.3
Other inorganic wastes	60.4	19.9	2.1	10.1	NS	45.1	41.5
Oily Wastes	9.8	19.7	12.1	5.5	15.3	12.0	42.4
Solvents	8.4	NS	0.9	2.0	7.3	NS	5.0
Other organics	15.5	34.8	3.9	-	13.8	14.3	7.5
Sludges	5.8	NS	30.6	11.5	16.4	NS	NS
Miscellaneous	NS	21.8	47.8	65.3	43.9	NS	0.5

(1) Source: Global Waste Survey, Final Report. International Maritime Organisation, 1995

NS: Not Specified

**Table 4.5 - Import - Export of Hazardous Waste**

Country	Date information supplied	Imports	Exports
Austria	1997	1992: 15.000 tonnes (58.600 tonnes licensed) 1993: 3.300 tonnes (49.100 tonnes licensed)	1992: 20.800 tonnes (47.000 tonnes licensed) 1993: 36.400 tonnes (91.700 tonnes licensed)
Belgium	No data supplied		
Croatia	1997	None. Import of hazardous waste has been forbidden by the law's provisions.	Yes, under conditions of the Basel Convention. Small quantities of transformers and capacitors containing PCBs have been exported to France for incineration during the last three years (ca. 150t., 1994-1996).
Czech Republic	1997	1993: 14 200 t, mainly waste oils from Slovakia for treatment. 1994: 6 026t., mainly lead accumulators for treatment. 1995: 519t, waste oils from Germany for treatment	1993: - 618t., mainly discarded devices with PCB for treatment to France. 1994: 556t., mainly discarded devices with PCB for treatment to Finland. 1995: 1925t, mainly waste oils and PCB wastes, mainly to Germany and France.
Denmark	1998	1996 : 64.500	1000 tonnes per year via the central treatment plus up to 11,600 tonnes per year exempted wastes.
Finland	1997	1994 - For recovery 2,810.7 tons (metric). For final treatment 8271.7 tons of which physiochemical treatment 29,3 tons and for incineration 8242.4 tons.	For recovery 22,706.7 tons.
France	1997	100,000 tonnes per year for treatment, mainly from Germany, Switzerland and the Netherlands, plus 10,000 tonnes per year for landfill from the Netherlands.	About 8000 tonnes per year.
Germany	1998	1994: 100.098t/a (Municipal and hazardous wastes total). Largest quantities from the Netherlands, Switzerland, Austria and Belgium. 1995: 241, 053 t/a. Largest quantities from Switzerland, the Netherlands, Austria and Luxembourg	1994: 527.782 t/a (Municipal and hazardous waste total). Mainly hazardous waste. Largest quantities to Belgium, The Netherlands, France, UK and Denmark. 1995: 740, 272 t/a. Largest quantities to Belgium, France and the Netherlands.
Hong Kong	1997	None.	None since 1990.

**Table 4.5 - Import - Export of Hazardous Waste**

Country	Date information supplied	Imports	Exports
Hungary	1997	Minor.	Some 61,000 tons in 1995:
Italy	1997	No national information.	- 34.540 tonnes per year during 1989-1991; - 21.630 tonnes in 1992; - 19.095 tonnes in 1993. Main destinations are France, UK, FRG and Finland.
Japan	1997	Minor - 300 tonnes metal sludge for recycling in 1994.	Minor - 400 tonnes metal wastes for recycling (1994).
Netherlands	1997	1995:269,900 tonnes. Mainly from Germany, Belgium.	1995: 208,000 tonnes. Major waste types: waste oils, lead/and batteries. Main destinations: Belgium, France, UK, Germany and US. Main types of facilities: incineration and recycling. Small quantities for land disposal (mineshaft) in Germany.
Norway	1997	8,958 tonnes in 1995, inorganic waste and waste oil.	37,257 tonnes in 1995 for treatment. Solid and non pumpable organic waste. Lead/ acid accumulators from cars.
Spain	1997	25,000 tonnes in 1994, mainly copper for recycling	500 tonnes metal wastes for recycling, 7000 tonnes solvents for recycling (1994).
Sweden	1997	40,000 tonnes in 1994, mainly metals for recycling.	25,000 ton/a (1994), all for recycling in the EU. Mainly metals, solvents, oils, acids.
UK	1997	Imports for final disposal being phased out in developed countries. Imports for landfill discouraged for 10 years but not actually illegal. 3 year phase down programme with some exceptions for incineration imports. Imports for legitimate recovery allowed	Exports for final disposal have never been a major feature, and will be almost entirely forbidden in future. Exports for recycling etc. permitted subject to Based Convention decision III/1 etc.
USA	1997	Relatively small quantities from Canada	Relatively small quantities, mainly from Canada and Mexico

**Table 4.6 - Approximate Number of Facilities of Hazardous Waste Treatment and Disposal (page 1)**

Technology	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
<i>Year of Latest Update</i>	1997	1997	1997	1997	1998	1997	1997	1998	1997
Incineration	7/80 (10)	6/7	-/3 (9)	89	2/*	1/1	20/+	72(17)	2 (15)
Physical-chemical treatment	21 (11)	7	2-3 poorly equipped	20	1/*	1/+	8/+	240	2 (16)
Landfill	(12)	4	2	294	1/-	1/+	13/80	55	3
Surface impoundments	-	-	1	-	-	No	-	-	-
Aqueous waste treatment	-	-	-	-	-	-	-	-	-
Mineshaft disposal	-	-	-	-	-	No	1	18	-
Deep burial	-	-	-	-	-	No	-	-	-
Deep well injection	-	-	-	-	-	No	1	-	-
Landfarming	-	-	-	-	4	No (11)	-	-	-

x/y x commercial/publicly available facilities plus y in-house facilities

+ facilities known to exist, number not known

- no facilities

(+) facilities exist, but of little importance

\* no information available

(9) No strictly dedicated facilities for hazardous waste, except 3 in-house facilities and waste oil incineration in 5 thermal power plants.

(10) 7 includes 4 facilities for non-hazardous waste and hazardous waste; 80 facilities for waste oil.

(11) Includes 7 facilities for CPO (organic waste), 1 facility for CPA (inorganic waste) and 13 for both.

(12) Some landfills have a special permission for some substances.

(15) One rotary kiln and one cement kiln.

(16) Excludes in-house physical-chemical treatment process.

(17) Includes 22 rotary kilns for hazardous waste and 52 plants for municipal solid wastes which accept small quantities of hazardous wastes.

**Table 4.6 - Approximate Number of Facilities of Hazardous Waste Treatment and Disposal (page 2)**

Technology	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<i>Year of Latest Data Update</i>	1997	1997	1987 (1,2)	1997	1997	1997	1997	1997	1995 (8)
Incineration	1	12/+	160/360(3)	1/3	22(6)	-/*	1+2 cement kilns	4	2%
Physical-chemical treatment	-	+/+	1200/4500	5(1)	19(7)	2/+	App. 5	10	9% (13)
Landfill	1	6/+	10/20(4)	1(5)	7	+	3	100	0.5%
Surface impoundments	+	+/+	-	-	1	+	No	None	0.3%
Aqueous waste treatment (14)	-	-	-	-	-	-	-	-	64% (14)
Mineshaft disposal	-	-/-	-	-	-	1	No	None	-
Deep burial	-	-/-	-	-	-	-	No	None	-
Deep well injection	-	-/-	-	*	-	-	No	None	12%
Landfarming	-	-/-	-	2(1)	-	-	No	None	0.1%

x/y x commercial/publically available facilities plus y in-house facilities

+ facilities known to exist, number not known

(+) facilities exist, but of little importance

- no facilities

\* no information available

(1) Source: D.C. Wilson, Summary and Analysis of Hazardous Waste Management in ISWA Countries. *International Perspectives on Hazardous Waste Management*, edited by William S. Forester and John H Skinner, Academic Press, (1987).

(2) Japanese data is for industrial wastes, 1985.

(3) Sludge incineration plants only. Excludes incineration of waste oil (150/300) and of plastic (400/950).

(4) Type I landfill sites (concrete lined pits).

(5) One very secure landfill site for highly toxic solid wastes. Landfill of specific/other wastes permitted as an exception at a number of sites.

(6) 16 Incinerators for organic waste and 16 for waste oil

(7) Includes 3 for treatment of oil-based drilling fluids, 6 for oil-water separation, 2 for solvent recycling and 4 for treatment of photographic waste.

(8) US data from National Biennial RCRA Hazardous Waste Report, based in 1995 survey data. Figures are given not for numbers of facilities, but as % of total 208 million tons of wastes treated by each method.

(13) Figure here is for "other treatment" (18 million tons) plus solidification (1 million tons) (see also note 14).

(14) Aqueous wastes dominate hazardous wastes only in the US (a difference in definition). US figures include aqueous inorganic treatment units (elsewhere probably classified as physical-chemical treatment - see note 13).

**Table 4.7- National Statistics on Uncontrolled Hazardous Waste Sites**

	Austria	Croatia	Czech Republic	Denmark	Germany
<i>Year of Latest Data Update</i>	1997	1997	1997	1998	1997
<i>Estimated total number of waste sites:</i>	4,000	700	940	4048	No information
<i>Total number suspected of containing hazardous waste:</i>	2,300	150	-	-	"
<i>Sites requiring immediate action:</i>	133	50	-	1385	(3)

	Italy	Netherlands	Norway	Sweden	US
<i>Year of Latest Data Update</i>	1997	1997	1997	1997	1997
<i>Estimated total number of waste sites:</i>	5,000 (1)	7,500	3,500	7,000 approximately	-
<i>Total number suspected of containing hazardous waste:</i>	150 (1)	4350	2,100	1,000	20,000 (4)
<i>Sites requiring immediate action:</i>	100 (2)	1000	90	200	1,204 (5)

(1) Estimated by the Ministry for the Interior and Civil Prevention.

(2) Estimated by Regional Authorities, according to clean-up programs.

(3) Waste sites which are suspected of being contaminated have been systematically listed by the Federal States. The particular investigations are still in progress.

(4) Early, 1980s estimate.

(5) Final National Priorities List (NPL) Sites, as of March 4, 1999.

**5.1 GENERAL CONTROLS**

The control of collection and transport was discussed in *Section 2.3* and summarised in *Tables 2.1* and *2.2*. Four basic components can be distinguished:

- the registration or licensing of collectors and transporters;
- controls over transport which are common to those over the transport of dangerous goods, including packaging and labelling, the types of vehicles and containers used and procedures for the contingency planning and emergency response to accidental spills;
- a manifest or trip-ticket system to keep track of shipments of wastes, to ensure that they arrive at their designated destinations;
- specific controls over the import and export of wastes.

The requirements for registration and licensing of collectors and transporters were summarised in *Table 2.2* and discussed in *Section 2.3*. Controls similar to those over dangerous goods are dealt with in most countries under dangerous goods legislation. The focus in hazardous waste legislation in most countries is thus on implementation of the manifest system and also of controls over import and export. The latter are defined fairly precisely in the Basel Convention and the legislative provisions are similar in different countries.

**5.2 COMPARING NATIONAL MANIFEST SYSTEMS**

The focus of discussion in this section is thus on the manifest or trip-ticket system. As shown in *Table 5.1*, there is general consensus internationally on the need for such a system, although an examination of the date when it was first introduced in the different countries, compared to the dates of initial hazardous waste legislation in *Table 2.2*, shows that it was often a second or subsequent step in the evolution of the overall regulatory control system for hazardous wastes. Indeed, in Japan, Sweden and Finland the manifest system has been introduced some 20 years later than the first hazardous waste management legislation.

Despite the consensus on the need for a manifest system and of detailed requirements being laid down for example in EU Directives, the detailed working of such systems still varies considerably between countries, as summarised in *Table 5.1*.

**Table 5.1 - Characteristics of National Manifest Systems for Transport of Hazardous Waste**

	Austria	Belgium	Croatia	Czech Republic	Denmark	Finland	France	Germany	Hong Kong
<i>Year of Latest Data Update</i>	1998	1998	1997	1997	1998	1998	1998	1998	1998
<i>General</i>									
Is there a manifest system?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date when introduced	1984	1976	1996	1991	1974/75 +1997	1997	1985	1978	1993
<i>Record keeping</i>									
Does identification form manifest accompany each shipment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Is manifest signed at each stage?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does each operator keep a register?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Tracking of wastes</i>									
Does controlling authority get a copy of every manifest?	Yes	No	Yes	Yes	Yes	No	No (1)	Yes	Yes
Does it receive copy in advance of shipment?	No	No	No	No	No	No	No	No	Yes
Are copies matched to track the waste? Is this done:	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
- by generator who then notifies exceptions to the authorities?	No	No	No	-	No	No	Yes	Yes	Yes
- by the authorities?	Yes	No	Yes	Yes	No	No	No	No	Yes
- by central collection station?	No	No	No	-	Yes	No	No	No	-
<i>Information</i>									
- Are manifests used for statistical purposes?	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
- Is system computerised?	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes

(1) In France, the authority receives a periodical summary of manifests, primarily for statistical purposes.

**Table 5.1 - Characteristics of National Manifest Systems for Transport of Hazardous Waste (cont).**

	Hungary	Italy	Japan	Netherlands	Norway	Spain	Sweden	UK	USA
<i>Year of Latest Data Update</i>	1998	1997	1993	1998	1998	1998	1998	1998	1998
<i>General</i>									
Is there a manifest system?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes 1981/96	Yes
Date when introduced	1996	1985	1991	1980	1984	1988	1997	Update	1980
<i>Record keeping</i>									
Does identification form manifest accompany each shipment?	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes
Is manifest signed at each stage?	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes
Does each operator keep a register?	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes
<i>Tracking of wastes</i>									
Does controlling authority get a copy of every manifest?	No (2)	No	-	Yes	Yes	Yes	No	Yes	Yes (4)
Does it receive copy in advance of shipment?	No	No	-	No	No	No	No	Yes (3)	No
Are copies matched to track the waste? Is this done:	Yes	No	-	Yes	Yes	Yes	Yes	Partially	Yes
- by generator who then notifies exceptions to the authorities?	No	No	-	No	No	Yes	No	No	Yes
- by the authorities?	Yes	No	-	Yes	Yes	No	No	Yes	Yes (4)
- by central collection station?	No	No	-	No	No	No	Yes	No	No
<i>Information</i>									
Are manifests used for statistical purposes?	Yes	No	-	Yes	Yes	Yes	Yes	Yes	No
Is system computerised?	Soon	No	-	Yes	Yes	-	(Yes)	Partially	No

(2) Authority gets only a summary of manifests in every quarter.

(3) Not for repeat loads, within 12 months, which meet certain criteria.

(4) In the USA, some states receive copies of every manifest and use them to check each shipment.

Common features of most manifest systems include:

- the manifest serves as an identification form that accompanies each shipment of waste;
- the manifest is signed at each stage of transfer of responsibility, from the generator to the collector, from the collector to the transporter (at a transfer station if one exists), and from the transporter to the treatment or disposal operator; and
- each operator in the chain of custody is required to keep a register, which is open to inspection by the authorities.

Beyond these basic elements, the details of the various national manifest systems differ significantly. In only 60% of the cases does the controlling authority get a copy of every manifest.

In only two cases, the UK and the Czech Republic, does the controlling authority receive a copy of every manifest in advance of shipment, the purpose being to allow the authority to witness or supervise the treatment or disposal of the particular waste, should it wish to do so.

Not all countries use the manifest as a method of tracking individual shipments of waste to ensure that they arrive at their designated destination. Where this is done, the matching of manifests showing the dispatch and the receipt of specific shipments may be the responsibility of :

- the generator, who then notifies exceptions to the authorities;
- the authorities themselves; or
- where collection is the responsibility of a utility company, the central collection station (in Denmark and Sweden).

Where 'exception tracking' is practised, that is notification by the generator to the authorities if confirmation of receipt of the waste is not received, the delay involved in beginning the search for a 'lost' waste is considerable, eg 45 days in the USA and 3 months in France.

The use of information from manifests for statistical purposes is much more common now than in 1987, applying in nearly 80% of responding countries. Computerisation of the system is following behind.

In most countries, hazardous waste may move freely across internal boundaries within the country, for example between municipalities or between provinces or states. In Germany, however, a special permit is required before a shipment of hazardous waste is allowed to cross state boundaries. Obtaining such permits takes a long time and is becoming increasingly difficult for political reasons.