Section 10

WASTE HANDLING, STORAGE AND TRANSPORTATION

10.1 Introduction

The Minimum Requirements for waste handling, storage and transportations are summarised in Table 10, at the end of this section.

The handling, temporary storage and transportation of Hazardous Wastes follows the same principles and requirements as those, which relate to dangerous goods in general. South Africa accepts the United Nations Recommendations for the transport of Dangerous Goods as incorporated in the International Maritime Organisation's Dangerous Goods Code IMDG and the International Civil Aviation Organisation's Regulations as given in their Technical Notes. These are both implemented as legislation through the Department of Transport's Merchant Shipping Act (Act 57 of 1951) and Aviation Act (Act 72 of 1962).

These principles also underlie the regulations relating to the transportation of dangerous goods by rail, as incorporated in Spoornet's Supplement 6 of the Official Tariff Book. Further, they are the basis of a series of SA Bureau of Standards on the Transportation of Dangerous Goods by Road currently nearing completion, as well as of forthcoming Standards on Handling and Storage. It is expected that these Standards will be made law by both the Department of Manpower and the Department of Transport in the future.

An additional requirement of the transportation of Hazardous Waste relates to the "duty of care" principle. This places responsibility for a waste on the Generator, and is supported by the "cradle-to-grave" principle, according to which a "manifest" accompanies each load of Hazardous Waste until it is responsibly and legally disposed of. This manifest is transferred from one transporter to the next along with the load, should more than one transporter be involved.

Once the waste is properly disposed of at a suitable, permitted facility, a copy of the manifest must be returned to the point of origin.

To minimise uncontrolled dumping of Hazardous Wastes, consignors and transporters must comply with the SANS 10406 on Transportation of Dangerous Goods. Inter alia, these require an adequate level of training of all personnel involved in the handling and transportation, by both parties. The consignor must satisfy himself of the competence of the carrier and the carrier needs to satisfy himself of the bona fides of the consignor to ensure that materials offered for transport are honestly described and suitably contained and labelled.

The objectives of the transportation of Hazardous Waste are:

- to ensure the correct packaging, temporary storage and collection of a waste prior to transportation, so as to prevent accidental spillage into the environment and minimise the impact should a spillage occur;
- to ensure that the Hazardous Waste is never "lost": this is achieved by use of a system of documentation or a manifest system;
- to ensure that the waste arrives safely at a permitted facility;
- to ensure that emergency procedures are in place before an accident occurs, and that the Hazardous Waste is correctly marked so as to aid the emergency team.

It should be noted that all aspects of handling explosive material, flammable material and
radioactive material are covered by specific legislation. The relevant Acts are the:

- Explosives Act, 2003 (Act 15 of 2003);
- Fire Brigade Services Act, 1987 (Act 88 of 1987); and

10.2 Collection and storage

A Generator who treats, stores for a period exceeding 90 days, or disposes of Hazardous Waste on site is subject to section 20(1) of the Environmental Conservation Act and must apply for a permit for a disposal site from the Competent Authority.

10.2.1 Collection

It is essential that all waste arisings should be accumulated at the point of origin as they occur and that they should not be allowed to lie around for any length of time. Such waste material must also not be mixed with other wastes of a different nature or composition. Mixing could result in severe reactions in the case of non-compatible materials and hinder later efforts to recover or recycle the waste material. Small additions of a highly toxic or Hazardous Waste mixed with a less toxic or General Waste would render both wastes Hazardous and so place an unnecessary (and avoidable) large volume in a higher waste category.

Once the waste has accumulated in a suitable container, the waste container itself must be clearly marked before temporary storage to prevent any risk of wrong identification resulting in environmental pollution. Guidance on compatibility of materials is contained in SANS 10232.

10.2.2 Temporary storage

The migration of leachate or spillage into the ground and groundwater regime around all temporary storage areas must be prevented. A temporary storage site therefore requires a firm waterproof base that is protected from the ingress of storm water from surrounding areas. It must also have an effective drainage system to a waterproof spillage collection area, where any spillage can be recovered and suitably treated. This area must be clearly demarcated and should not be accessible to unauthorised persons.

Waste materials should always be stored separately from other process chemicals or products.

If non-compatible wastes are to be stored, care should be taken to adequately separate them, to prevent possible interactions in the event of fire or spillage. Flammable or combustible wastes must in any event be stored separately from other waste materials.

10.2.3 Quantities of waste that can be temporarily accumulated

A Generator may accumulate the following quantities of Hazardous Waste on site for 90 days or less without a permit for a waste disposal site:

- Hazard Rating 1 = 10 kg
- Hazard Rating 2 = 100 kg
- Hazard Rating 3 = 1 000 kg
- Hazard Rating 4 = 10 000 kg

provided that:

- the waste is stored in such a manner that no pollution of the environment occurs at any time;
- the date upon which accumulation begins is clearly marked and visible for inspection on each container;
- while being stored on site, each container and tank is labelled or marked clearly with the words "Hazardous Waste";
- the Generator fences off the storage area to prevent unauthorised access and erects a weatherproof, durable and clearly legible notice-board in official languages at every entrance of the storage area with the words "Hazardous Waste: unauthorised entry prohibited".
The Generator who accumulates more than the above specified quantities or who intends to accumulate Hazardous Wastes for more than 90 days (non-continuous) is subject to the requirements of Section 20(1) of the Environmental Conservation Act unless he has been exempted from obtaining a permit by the Minister.

10.3 Packaging and labelling

10.3.1 Packaging

Hazardous Waste must be securely contained during handling, storage and transport to prevent risk to the environment. The ways of achieving this objective depend on the nature of the material, on its physical form, on quantity and on the degree of hazard of the material.

The container must be manufactured from materials that can resist effects of the material contained and that can withstand the physical methods used for the handling and the transport of the containers.

The type of packaging to be used is determined by a series of practical tests, related to the degree of hazard posed by the material to be contained, as categorised by the three Packaging Groups 1, 2 and 3 (Refer to SANS 10229 for details). This SANS is applicable to moderate quantities of material, ranging up to 450 litre capacity. If the waste material can be classified as Explosive, Flammable or Radioactive, further regulations apply when the material is being stored and transported. When larger quantities of waste are involved, bulk containers should be used as specified in SANS 10233.

10.3.2 Labelling

Labelling of containers with the correct Name and Description of the contents is essential for three basic reasons, i.e.,

- to correctly identify the material for purpose of recycling or recovery;
- to facilitate the correct emergency action in case of an accident;
- to ensure that the appropriate treatment and disposal methods are being used by the disposal contractor.

Labelling of hazardous substances must be done according to SANS 10233.

When Hazardous Waste is transported, further labelling of bulk containers and placarding of the vehicle is also required. (Refer to SANS 10233 for details).

10.4 Transport

10.4.1 Legislative control

The most important control measures for the transportation of Hazardous Wastes are:

Legislative:

The National Road Traffic Act (Act 93 of 1996);
The Hazardous Substances Act (Act 15 of 1973);

If the Waste is classified as Explosive, Flammable or Radioactive, additional regulations would apply respectively under:

The Explosives Act (Act 15 of 2003);
The Fire Brigade Services Act (Act 99 of 1987);
The Nuclear Energy Act (Act 46 of 1999).

Standards of South Africa

SANS 10230: Vehicle Inspection Requirements
SANS 10231: Operational Requirements
SANS 10232: Emergency Response Information
SANS 1518-1: Design Requirements for Vehicles.

10.4.2 Transport groups

Waste material that, because of its composition and physical properties, falls within the general
definition and technical norms for "Hazardous Substances" (SANS 10228), is, for the purpose of transport, just another hazardous substance and therefore subject to all the normal requirements and controls for the transport of hazardous substances. Typical examples of such waste would be spent sulphuric acid from an extraction unit or a flammable solvent residue from a scrubber unit.

These transport requirements include:

- the packaging/containerisation of the waste
- labelling of containers
- vehicle requirements and licensing thereof
- driver training, licensing and responsibilities
- loading of the vehicle and securing of the load
- placarding of the vehicle and transport documentation, etc.

Tank containers are normally used for liquid or sludge hazardous substances and have to be specially designed to cope with such loads.

Packaged waste material is normally transported in open trucks or in large quantities on a flat bed truck. In such instances, it is of utmost importance that the compatibility of waste materials in a mixed load should be observed since even a slight leak between non-compatible waste components may result in a fire on the vehicle or in worst case even an explosion.

Hazardous Waste should be controlled in the same way as hazardous substances with regard to identification and placards for transport purposes.

10.4.3 Packaging

SANS 10228 gives a full description of the various types of containers which can be used for the packaging and labelling of hazardous substances for transport purposes. This must be strictly followed.

For documentation purposes the following abbreviations should be used:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>Metal drums, barrels, kegs</td>
</tr>
<tr>
<td>DW</td>
<td>Wooden drums, barrels, kegs</td>
</tr>
<tr>
<td>DF</td>
<td>Fibreboard or plastic drums, barrels, kegs</td>
</tr>
<tr>
<td>TP</td>
<td>Tanks portable</td>
</tr>
<tr>
<td>TT</td>
<td>Cargo tanks (tank trucks)</td>
</tr>
<tr>
<td>TC</td>
<td>Tank cars</td>
</tr>
<tr>
<td>DT</td>
<td>Dump truck</td>
</tr>
<tr>
<td>CY</td>
<td>Cylinders</td>
</tr>
<tr>
<td>CM</td>
<td>Metal boxes, cartons, cases (including roll-offs)</td>
</tr>
<tr>
<td>CW</td>
<td>Wooden boxes, cartons, cases</td>
</tr>
<tr>
<td>CF</td>
<td>Fibre or plastic boxes, cartons, cases</td>
</tr>
<tr>
<td>BA</td>
<td>Burlap, cloth, paper or plastic bags</td>
</tr>
</tbody>
</table>

10.5 Emergency and remedial action

Accidents that can cause environmental pollution may occur during the storage and accumulation stage and the transport stage of the waste handling process.

10.5.1 Temporary storage and accumulation

If there is a spillage or pollution of surface water due to flooding of a storage area during heavy rains, the Generator must take all possible steps to recover the hazardous component and prevent any polluted water from entering sewerage systems or public streams. If and when it becomes obvious that such spillage cannot be contained on site, the Local Authorities, the Competent Authority and the Department must be advised of the incident immediately. Full co-operation must be given to these authorities to implement emergency action so as to minimise the adverse affects of such occurrence on the public and on the environment.

10.5.2 Transport

If there is a transport accident resulting in leakage or spillage of the Hazardous Waste, two distinct actions are required, i.e.,

- Emergency action must be taken to contain the spilled material and to prevent further
uncontrolled spillage or leakage. In addition immediate steps must be instituted to clear the road from any material that may delay or stop the traffic.

- These emergency actions are normally initiated by the driver of the vehicle and executed by emergency services personnel. Emergency action should follow immediately after the incident and would normally last for three to four hours thereafter.

- Remedial action must be taken to clean up and remove any spillage or residue and to ensure that no environmental pollution or contamination of water resources will take place at a later stage. The load must be properly loaded and secured on site!

**Emergency Action**

If a road accident causes leakage or spillage of Hazardous Waste, the driver of the vehicle must immediately notify the local emergency services of the incident, clearly stating:

- the location
- the nature of the load being carried
- the status at the site of the accident itself, i.e., whether further leakage is still taking place, whether the vehicle or the load is on fire and what the traffic situation is.

Until assistance arrives, the driver will be responsible for warning and if necessary regulating traffic. Bystanders must, under all circumstances, be kept away from the vehicle and its load.

The Transport Emergency Card (Tremcard), which must accompany the load, must be recovered from the vehicle and handed to the Police and/or emergency personnel on their arrival. The Tremcard information on emergency action and the HAZCHEM placard on the vehicle will provide the emergency services with the initial information required for action.

Since spillages of Hazardous Waste resulting from road accidents or failure of the containers normally happen outside the Generator's premises, arrangements must be made beforehand for good and prompt communication between the carrying vehicle and the Generator of the waste. When such an incident is reported the Generator must promptly inform the Local Authorities, the Competent Authority and the Department. In addition, the Generator must ensure that all technical information relating to the waste material is made available immediately to emergency teams on the site of the incident.

It should be noted that the Generator - or his representative, i.e., transporter - retains primary responsibility for ensuring that adequate steps are taken to minimise the effect of an accident or incident on the public and on the environment.

If there is a serious accident that results in substantial losses or consequential damage, it is advisable that the Generator should also advise its insurance company since they may wish to send an assessor to conduct an on-site inspection.

**Remedial action**

Remedial action to clean up any spillage remaining on site after an accident has to be initiated by the Generator.

Such remedial action may be undertaken by the Generator himself, a waste disposal contractor appointed by either the Generator or by the insurance company or, if this fails, by the State. In such event all costs relating to the remedial action will be recovered by the State from the Generator of the waste.

The remedial action will depend on the nature and properties of the waste material, on the physical environment in which it has been spilled and on the severity of the spillage. In some instances washing away of residues with water may prove adequate but in other instances chemical treatment of the residue or even digging up of soil and removal thereof to a disposal site may be required.

The major objective of the clean-up procedure must be to minimise the risk of contaminating the environment and in particular the water sources at a later stage.
10.5.3 Reporting of road accidents and spillage

All road accidents must be reported to the Department of Transport on the prescribed documentation. In addition, an incident report must be compiled, giving full details of the nature of the incident, amounts of waste material lost and remedial action taken to prevent environmental and water pollution. Such a report should be send to the Local Authorities, the Competent Authority and the Department.
### TABLE 10
Minimum Requirements for Waste Handling, Storage and Transportation

<table>
<thead>
<tr>
<th>Subject</th>
<th>Minimum Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification as disposal site</td>
<td>If a waste is held at a storage site for a period exceeding three months, the site automatically qualifies as a Waste Disposal Site, and must be registered as such and meet all the requirements of a disposal site.</td>
</tr>
<tr>
<td>Temporary storage area</td>
<td>A temporary storage area must have a firm, waterproof base and drainage system. It must be so designed and managed that there is no escape of contaminants into the environment.</td>
</tr>
<tr>
<td>Identification of waste</td>
<td>The transporter must be provided with accurate information about the nature and properties of the load.</td>
</tr>
<tr>
<td>Documentation</td>
<td>The transport operator must be provided with the relevant transportation documentation for the consignment.</td>
</tr>
<tr>
<td>Security of load</td>
<td>The load must be properly loaded and secured on site.</td>
</tr>
<tr>
<td>Hazchem placard</td>
<td>The transport operator must be supplied with the appropriate Hazchem placards.</td>
</tr>
<tr>
<td>Hazchem placard</td>
<td>The transport operator must ensure that the Hazchem placards are properly fitted to the vehicle.</td>
</tr>
<tr>
<td>Vehicle Roadworthiness</td>
<td>The Responsible Person must ensure that before the vehicle leaves the consignor's premises it is not overloaded or showing any obvious defect that would affect its safety.</td>
</tr>
<tr>
<td>Escape of hazardous spillage at site</td>
<td>The Department, Local Authorities, and the Competent Authority must be advised immediately, should it prove impossible to contain spillage of a Hazardous Waste on a site.</td>
</tr>
<tr>
<td>Protection against effect of accident</td>
<td>The Generator - or his representative, i.e., transporter - must ensure that adequate steps are taken to minimise the effect an accident or incident may have on the public and on the environment.</td>
</tr>
<tr>
<td>Spillage on site</td>
<td>The Generator must initiate remedial action to clean up any spillage remaining on a site after an accident.</td>
</tr>
<tr>
<td>Notification</td>
<td>All road accidents must be reported to the Department of Transport on the prescribed documentation.</td>
</tr>
<tr>
<td>Notification</td>
<td>In case of an accident, a full report, containing all the information listed in 10.8.2 must be sent to the Local Authorities, the Competent Authority and the Department</td>
</tr>
</tbody>
</table>
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A.1 Historical development

Increasing attention is being given to the impacts on health and to the environmental significance of chemical contaminants in wastes. This is for the most part due to an increasing awareness that improper disposal of such wastes has resulted in significant adverse health and environmental consequences. Unfortunately the awareness had to be triggered by actual or potential disasters, most of which are well documented in relevant literature. Such disasters, as well as uncontrolled dumping of hazardous waste, were subsequently addressed by International Organisations, mostly under the auspices of the United Nations:

In 1983, the United Nations Environment Program (UNEP) in conjunction with the World Health Organisation (WHO) published principles for the formulation and implementation of a hazardous waste management policy, as a code of practice.

In 1985, under the auspices of UNEP, the "Cairo Guidelines" on policies and legislation for the environmentally sound management of hazardous substances were adopted.

Also in 1985, an International Register of potentially toxic chemicals, with treatment and disposal options for hazardous waste, was published by UNEP.

In 1986, guidelines, policies and strategies for hazardous waste management in Asia and the Pacific were published by UNEP.

The UN Economic Commission for Europe started to focus particularly on low-waste and non-waste technologies in the later parts of 1980-1990.

The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal came into force on 5 May 1992. (It should be noted that a technical co-operation trust fund was established to support developing countries in need of assistance to implement the Convention).

Legislation in solid waste management in the USA and the European Community is being revised. In the United States, the mixture and derived-from rules that were promulgated on May 19, 1980 (45FR33066) were withdrawn on April 28, 1993. Alternatives proposed by the EPA on May 20 1992 contained three major options:

1. Concentration-based exemption criteria (CBEC) that would allow a listed hazardous waste to become non-hazardous if it does not exceed prescribed concentration limits for any of 200 constituents.

2. An expanded characteristic option (ECHO), which would add more constituents to the toxicity characteristic and would eventually establish concentration levels for all hazardous constituents.

3. A contingent management option that could be used in combination with CBEC or ECHO.

In the European Community, the EC Framework Directive, which is being revised, will set the principles of common waste management practice within the EC. Some inclusions in the draft directive are:
- export of waste is prohibited to any state, which is not a signatory of the Basel Convention. Export beyond 60° latitude and export of toxic waste to Africa, to the Caribbean Islands and to the Pacific States is also prohibited;
- the producer of waste is legally liable for damage and deterioration to the environment caused by waste, whether or not he is at fault;
- with regard to third party risk (transportation), an insurance policy or some other form of financial guarantee is compulsory;
- with regard to packaging of waste, the directive is heavily based on a dual system, i.e., the producer and retailer are obliged to take back and to recycle packaging;
- the strategy on Waste Management is based on a ladder approach, i.e.:
  - Prevent
  - Recycle
  - Incinerate
  - Landfill

In the UK, a waste management licensing system came into force in April 1993. This specifies that any residual pollution risk posed by a completed landfill be borne by the operator until the site has stabilised. Post-closure and other costs will therefore have to be paid by the operator.

New hazardous waste management plans are currently being drafted by, amongst others, Hungary, The Netherlands, Japan, Denmark and France. In addition, the Working Group on Hazardous Waste (WGHW) of the International Solid Waste Association (ISWA) has agreed to the following 10 priority work areas for fiscal years 1994-1997:

1. Household Hazardous Waste and small generators;
2. Contaminated sites;
3. Developing countries;
4. Safe or best Hazardous Waste practices;
5. Household waste transport;
6. Waste minimisation;
7. Sitting issues;
8. Socio-economic issues;
9. Hazardous waste handling; and
10. Industrial waste.

A.1.2 Current waste management approaches

In most industrialised countries, toxic waste management has only come within the ambit of government policy since the 1960's and has only really been addressed by governments during the 1970's.

Countries started slowly by developing procedures for the investigation and recording of quantities of "wastes" and toxic and/or "dangerous" waste, as well as investigating the origin and characteristics of these classes of materials. The first Act relating to public health dates from the early 20th century, whereas specific environmental protection legislation for the control of waste and more specifically of toxic waste, has only been in existence for 20 years at the most.
APPENDIX 1: INTERNATIONAL WASTE MANAGEMENT

The main stimulus for the passing of new legislation was the increasing awareness of detrimental effects on the environment as a result of careless disposal of wastes, be it uncontrolled dumping on, and/or discharges into surface and groundwater, careless storage and transportation, or inappropriate treatment. It was realised that if damage to human health and the environment was to be prevented, appropriate legislation was needed to control the separation of toxic and dangerous waste from ordinary domestic and non-hazardous industrial waste and to ensure its correct disposal.

A policy for toxic waste management must be consistent with policies developed to control the use of toxic substances, to conserve resources, to preserve health and to protect the environment. In such a policy, three objectives can be distinguished the:

a. protection of human health and the safeguarding of the environment against harmful effects caused by the collection, transportation, treatment, storage and disposal of toxic wastes;

b. promotion of waste avoidance, the use, re-use or reclamation and treatment of waste in order to minimise its potential impact on the environment; and

c. reduction or prevention of any dispersion of toxic waste into the environment.

The vital components of a policy with the above objectives are:

- legislation and regulations that are acceptable, implementable and affordable by all concerned;
- proper implementation and enforcement procedures;
- provision of adequate facilities for hazardous waste recycling, treatment and disposal activities.
- inclusion of Integrated Environmental Management (IEM) as part of an environmental policy.
Appendix 2

DEFINITION OF HAZARDOUS WASTE
(Section 2)

Considerable attention has been focused on the question of what constitutes a "Hazardous Waste." National systems differ both in the methods used for defining wastes and in the type of wastes included. These differences arise partly from variations in the institutional and legal frameworks of different countries and partly from the difficulty involved in distinguishing between wastes that are "normal" and wastes that are Hazardous.

The South African definition of Hazardous Waste is based upon the UNEP definition, "Waste, other than radioactive waste, which is legally defined as hazardous in the state in which it is generated, transported or disposed of. The definition is based on chemical reactivity or toxic, explosive, corrosive or other characteristics which cause, or are likely to cause, danger to health or to the environment, whether alone or in contact with other waste."

Internationally, many different "legal" definitions for hazardous waste exist. In most cases the definitions are relatively vague and mostly refer to a list of compounds and/or types of wastes concerned.

Some of the main identification criteria for such lists are:

- Type of hazard involved (flammability, corrosivity, toxicity, reactivity);
- The generic category of the products involved (e.g. pesticides, solvents, medicines);
- Technological origins (e.g. oil refining, electro-plating);
- Presence of a specific substance or group of substances (e.g. PCB, dioxin, lead compounds).

These criteria and others are used alone or in combination but in very different ways, depending on regulations. In particular, the compositional characteristics of waste may or may not be quantified. Where concentration levels are set, they vary from country to country.

This may be illustrated by the fact that waste containing 50 mg of cyanide per kg would be considered as hazardous in one country, but not in another where the standard is fixed at 250 mg/kg.

In general it can be stated that the legal definitions give no better understanding of criteria covered by such definitions. Terms like "it can lead to serious pollution" and "causes an increase in mortality or illness" are difficult to interpret in a totally objective way and need to be quantified for every waste material individually. If not quantified, misinterpretation and doubt as to the classification of a waste material or stream will continue.

South Africa has therefore decided that the most practical method of identifying and classifying hazardous substances is by:

- inclusion of lists of substances;
- incorporation of a degree of hazard approach, not only to designate a waste as hazardous or not, but also to differentiate between degree of hazard regarding disposal methods and sites;
- use of concentration levels and "total loading", or the assimilation capacity of sites, to guard man and the environment against future detrimental effects;
The use of "acceptably low risk" levels to allow for the delisting or reclassification of a Hazardous Waste as a General Waste for waste disposal, if it can be shown that the risk posed to the environment is acceptably low.

It is on this basis that the Hazardous Waste Classification System was developed.

**Lists of Hazardous Substances**
- A list of industries and processes is included (Section 3, Diagram I) to identify processes, which are likely to generate Hazardous Waste. Waste from these processes will be classified as potentially hazardous and as requiring to be controlled.
- A list of Hazardous Wastes is included in Appendix 9.4.
- SANS 10228 is used as an inclusive Hazardous Waste list, that is, a list explicitly identifying hazardous substances. The presence of a substance on the list automatically brings the waste into the regulatory control system. (Note: the absence of a substance from this list does not necessarily imply that the substance is not hazardous.)
- The Basel Convention also provides a list of hazardous substances.

**Degree of Hazard**
- SANS 10228 groups substances into 9 classes, according to characteristics such as flammability, corrosivity, reactivity or toxicity. These characteristics are defined by means of limiting parameters determined by standard test protocols.
- Wastes that fall within Class 6 of SANS 10228 are given a Hazard Rating for disposal. The Hazard Rating is derived from the inherent mammalian and ecological (acute and chronic) toxicity of compounds, including environmental fate and the Estimated Environmental Concentration (EEC) principle.

**Concentration Levels**
- The Estimated Environmental Concentration (EEC) is used to provide an exposure level and assimilation capacity approach. In this approach, chemical compounds are regarded as being hazardous above a threshold concentration. The EEC includes environmental fate and allows prediction of the fate of a waste contaminant.
- The SANS 10228 is to be expanded to include a no effect or "acceptably low risk" level. This will provide a list of substances that in certain quantities or concentrations will not pose an unacceptable risk to health and/or to the environment.

**Delisting by Exemption Approach**
The classification system also incorporates a "delisting by exemption approach". Generators are allowed to perform tests such as the TCLP test to prove that their wastes should be regarded as non-hazardous or of a lesser hazardous nature, and should therefore be exempted from disposal on a Hazardous Waste site, in which event it may be disposed of on an approved General Waste disposal site equipped with a leachate management system.
Appendix 3

WASTE MINIMISATION
(Section 3)

Waste avoidance, i.e., reducing waste without relying on recycling or re-use, is the most economically and environmentally beneficial waste minimisation option. Householders and businesses can contribute through ‘smart shopping’; e.g., avoiding excess purchases (especially food), packaging or shopping bags. Waste avoidance could be encouraged in future by such measures as pricing, with greater charges for bigger garbage bins, and take back schemes where an industry must take back the product when it becomes a waste.

Where waste is unavoidable, the recovery of resources by re-use, recycling and other processes can reduce reliance on virgin materials and the adverse impacts of waste disposal. Currently, many private industries, community groups, schools and municipalities run recycling schemes in South Africa. However, with the improvement of waste collection services and public education, it will be possible to separate most recyclable wastes at source. There is therefore a great deal of scope for the further development of recycling industries. For example, it would be possible to collect textiles in bins, in the same way as paper and glass are collected. The Departments of Environmental Affairs & Tourism and Water Affairs & Forestry strongly support the development of recycling industries and initiatives by the public sector.

Some wastes that can be recycled are listed in the paragraphs that follow.

1. **Paper**

Paper-fibre materials can be recycled to produce such products as tissue & toilet paper, newspaper, writing and office paper, and cardboard packaging. Predominant sources of recycled paper would include newsprint, magazines, cardboard, packaging, white office paper and liquid paperboard.

2. **Glass**

Recovered glass can be resold to the manufacturer. New glass bottle manufacture can contain over 90% recyclable glass (cullet), replacing virgin materials such as sand. It is also possible to use glass in the manufacture of bricks and the production of asphalt. Plate glass can be used in the production of sandblasting materials and sandpaper. Cullet must be sorted into three separate colour streams of amber, white and green. With new technology, colour sorting can be automated.

3. **Plastic**

A major difficulty with the recycling of plastics is the need to separate different types of plastic, as these have different melting points. Mixed plastic will not form a uniform and stable material. However, processes are being developed for the automated separation of plastics and also for fusing and subsequently laminating shredded plastics to make plastic sheets for use as wallboards and similar applications. Recycled waste plastic materials can also be used to generate electricity at Waste to Energy plants. Recyclable plastics include polypropylene, polystyrene, polyurethane, polyethylene, perspex, and polycarbonate. The most common recyclable 'household' plastics are PET and HDPE.
APPENDIX 3: WASTE MINIMISATION

PET (Polyethylene terephthalate) is used in the manufacture of soft drink and fruit juice bottles, pillow and sleeping bag filling, and textile fibres. Currently, recycled PET is more expensive than the raw product and recycled PET cannot be used in food packaging. However, it is possible to manufacture a multi-layer bottle that contains 38% recycled PET and a depolymerisation process (molecular components are chemically separated and then reconstituted) allows 100% incorporation of recycled PET.

High Density Polyethylene (HDPE) is used in the manufacture of such products as milk containers, shopping bags, freezer bags, bleach bottles, buckets, milk crates, and rigid agricultural pipes. Recycling options include the manufacture of mobile garbage bins from recycled HDPE.

4. Metal

Metal recycling is already an accepted activity where metal scrap is generally sold to merchants, who in turn supply homogenous and some mixed scrap to steel mills and foundries for re-use. Tin, steel and aluminium cans, used for aerosols, food and beverages, can also be recycled.

5. Tyres

The disposal of tyres in a landfill is a problem, as they are hard to compact and tend to rise up through the waste. In many countries, therefore, a levy is placed on tyres at point of sale to support tyre recycling technology and infrastructure.

Current recycling and re-use options include retreading of tyres and the use of tyres as fuel in cement kilns. Processes are also available for separating the steel from the rubber. The steel is then recycled and the rubber turned into rubber crumb. The rubber crumb can be used for retreading tyres, acoustic materials, roofing, runways, road base, oil spill absorbers, aggregate, asphalt, speed bumps, road barriers, mudflaps, floor mats, packaging, toys, watering systems, animal bedding and fences.

6. Oil

Oil from commercial and industrial premises can be filtered and used for fuel applications. A recently developed technology, Interline, enables used oil to be refined sufficiently to be re-used as a primary oil product. Used car oil from households and commercial organisations in South Africa is collected by some garages.

7. Textiles

Re-usable wastes in the form of fabric, fibre or flock can be put to many uses. These include cleaning clothes, padding, toy filling, upholstery, mattresses, carpets, and insulation.

Old clothes, suitable for use, can be recycled via welfare organisations, second hand shops. Clothing not suitable for use can be sold as rags for industry. Carpets can also be cleaned and resold.

8. Recyclable Organic Materials

Recyclable organic materials, including timber, garden, food and abattoir wastes, are a major contributor to the volume and toxicity of landfills. If this waste can be diverted from landfill, it can be used in the manufacture of compost and mulch.
Options for the recycling of waste foods from canteens, restaurants and stores includes their use by pig farmers. Householders can make compost or have 'earth worm farms'. Recycled timber that is suitable can be used for furniture, building material or firewood.

9. Construction and Demolition Waste

The main material that can be recovered from heavy construction and development activities is uncontaminated rubble (concrete, soil, rock, gravel, etc). This can be used for road construction. Separated concrete can be recycled into low strength concrete or road base. Other recyclable materials emanating from construction and development activities would include wood, asphalt, bitumen, plate glass, roofing materials, plasterboard and bricks.

10. Other waste

With ingenuity and the right collection systems, almost all waste can be recycled. Examples would include white goods, spectacles, cork, toys, etc. Workshops for repairing goods could also be set up.
Appendix 5.1

TESTS FOR HAZARDOUS PROPERTIES
(Section 5)

Ignitability

The ignitability or flash point is determined using a closed cup tester. The sample is heated at a slow constant rate with continual stirring. At intervals a small flame is directed into the cup, with simultaneous interruption of the stirring. The flashpoint is the lowest temperature at which application of the flame ignites the vapour above the sample.

Corrosivity

The corrosivity of a waste is determined by measuring the degree to which a coupon of standard steel has been dissolved. The coupon is immersed in the waste, which is stirred at a sufficient rate to ensure that the liquid is kept well mixed and homogeneous. The test is carried out at a constant temperature of 55°C for a period of 24 hours, which is ample time to determine whether the corrosion rate is greater than 6,35 mm per year and therefore regarded as corrosive.

Reactivity

There are no general tests for reactivity, although the EPA recommends that the specific release of hydrogen cyanide or hydrogen sulphide must be determined for cyanide and sulphide wastes. This is achieved by subjecting the wastes to 0.005M sulphuric acid (pH 2), under controlled conditions. The released gases are trapped in an absorber containing 1,25M sodium hydroxide and analysed by the standard methods.

Toxicity using the Toxicity Characteristic Leaching Procedure

As discussed in Section 2, the classification system devised for South Africa includes the Estimated Environmental Concentration (EEC) as an essential component. Where it is considered that mobility is overestimated, using the EEC approach, the Toxicity Characteristic Leaching Procedure and/or the Acid Rain extraction procedure where appropriate can be used to evaluate the mobility of a hazardous element or compound. The methodologies for these tests are set out in Appendix 8.
### Appendix 5.2

**LIST OF TERATOGENS**  
*(Section 5)*

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
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<tbody>
<tr>
<td>Ammonia</td>
</tr>
<tr>
<td>Bromotrifluoromethane</td>
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<tr>
<td>Caprolactam</td>
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<tr>
<td>Carbon disulfide</td>
</tr>
<tr>
<td>Carbon monoxide</td>
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<tr>
<td>Chlorinated biphenyls</td>
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<tr>
<td>Chlorine</td>
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<td>Chlorobenzene</td>
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<tr>
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<td>Diazinon</td>
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<tr>
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<tr>
<td>1,4-Dichlorobenzene</td>
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<tr>
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<tr>
<td>Di(2-ethylhexyl)phthalate</td>
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<td>Lead</td>
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<tr>
<td>Methacrylic acid methyl ester</td>
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<table>
<thead>
<tr>
<th>SUBSTANCE</th>
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</thead>
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<td>Methyl chloride</td>
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<td>Trichloroethylene</td>
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<tr>
<td>Trichlorofluoromethane</td>
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<tr>
<td>Vinylidene chloride</td>
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