

**DEPARTMENT OF ENVIRONMENTAL
AFFAIRS AND TOURISM**

**PROGRAMME FOR THE IMPLEMENTATION OF THE
NATIONAL WASTE MANAGEMENT STRATEGY**

Starter Document for Health Care Waste

**Framework Document on the
Management of Health Care Waste**

Final Draft

May 2000

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EXECUTIVE SUMMARY

A brief study into the current status of health care waste management, the approach used internationally and the needs in South Africa has been conducted as part of the implementation of the National Waste Management Strategy by the Department of Environment and Tourism. Two starter documents on the Management of Health Care Waste have been produced; a Background Document and a Framework Document that outlines a preliminary approach to the development of Guidelines and Regulations for health care waste management. This document is the Framework Document and should be read in conjunction with the Background Document.

Only limited consultation with I&APs was carried out because of limited time and funding. Consulted in the process were the Department of Environment and Tourism, Department of Water Affairs and Forestry and Department of Health, Pretoria, the Gauteng Department of Agriculture Conservation and Environment, a waste management company and a survey was conducted amongst 29 health care facilities.

In general, the state of health care waste management in South Africa is poor. Contributing to this state of affairs is a lack of training and awareness, limited financial resources, particularly at the Provincial health care facilities, plus a lack of capacity at the authority level. Disposal of health care waste to inappropriate landfills and informal dumps is common in South Africa. While some institutions are managing infectious waste in an acceptable manner, almost none have acceptable procedures and management systems in place for chemical, including pharmaceutical waste, and low level radioactive waste.

Codes of practice are available in South Africa for the management of infectious and radioactive health care waste and the Minimum Requirements documents published by the Department of Water Affairs and Forestry provide acceptable procedures for chemical waste, but these are not implemented correctly within health care facilities. These codes only need to be adapted, modernised in parts and integrated in order to provide an acceptable total approach to health care waste management.

South Africa requires a network of regional or local modern treatment facilities for infectious health care waste in order to be able to implement a “best practice” solution. However, in the short to medium term, an interim solution is required that can more safely dispose of infectious waste until a “best practice” solution is implemented.

It is recommended that:

- An integrated guideline covering the whole management process for all types of health care waste should be developed. This Framework Document, which has been produced as part of this study is meant to provide a starter document for the development of these guidelines.
- The starter documents produced in this study should be used as a basis for a programme of wider consultation with all I&APs.
- Provincial Governments need to undertake a survey to determine the quantities, types and location of all types health care waste within their areas as well as the status of the available treatment and disposal facilities.
- Training and awareness programmes must be developed based on the guidelines and run within all health care facilities.
- Sufficient funding must be made available in order to undertake the required studies and implement the training and awareness programmes.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1. GENERAL GUIDELINES FOR PROCESSES LEADING TO THE SAFE MANAGEMENT OF HEALTH CARE WASTE.....	1
1.1 INTRODUCTION.....	1
2. AVOIDANCE AND SEGREGATION OF HEALTH CARE WASTE.....	4
2.1 INTRODUCTION.....	4
2.2 WASTE AVOIDANCE.....	4
2.3 RECYCLING	4
2.4 SEGREGATION	5
2.5 RESPONSIBILITY	6
2.6 WASTE CONTAINERS.....	6
2.7 TRAINING	9
2.8 MONITORING AND RECORDING	9
2.9 PERSONAL PROTECTIVE EQUIPMENT (PPE).....	9
3. PACKAGING OF HEALTH CARE WASTE.....	10
3.1 INTRODUCTION.....	10
3.2 LABELLING.....	10
3.3 RESPONSIBILITY	11
3.4 CATEGORIES.....	11
3.4.1 <i>Infectious Waste</i>	11
3.4.2 <i>Chemical Waste</i>	12
3.4.3 <i>General Waste</i>	12
3.4.4 <i>Radioactive Waste</i>	12
3.5 TRAINING	12
3.6 MONITORING AND RECORDING	12
3.7 PERSONAL PROTECTIVE EQUIPMENT (PPE).....	12
4. HANDLING OF HEALTH CARE WASTE.....	13
4.1 INTRODUCTION.....	13
4.2 RESPONSIBILITY	13
4.3 CATEGORIES.....	14
4.3.1 <i>Infectious Waste</i>	14
4.3.2 <i>Chemical Waste</i>	14
4.3.3 <i>General Waste</i>	14
4.3.4 <i>Radioactive Waste</i>	14
4.4 TRAINING	14
4.5 MONITORING AND RECORDING	14
4.6 PERSONAL PROTECTIVE EQUIPMENT (PPE).....	14
5. COLLECTION OF HEALTH CARE WASTE.....	15
5.1 INTRODUCTION.....	15
5.2 RESPONSIBILITY	15
5.3 COLLECTION FACILITIES	15
5.4 CATEGORIES.....	16
5.4.1 <i>Infectious Waste</i>	16
5.4.2 <i>Chemical Waste</i>	16
5.4.3 <i>General Waste</i>	16
5.4.4 <i>Radioactive Waste</i>	16
5.5 TRAINING	16
5.6 MONITORING AND RECORDING	16
5.7 PERSONAL PROTECTIVE EQUIPMENT (PPE).....	17

6.	STORAGE OF HEALTH CARE WASTE	18
6.1	INTRODUCTION.....	18
6.2	STORAGE FACILITIES.....	18
6.3	RESPONSIBILITY	19
6.4	CATEGORIES.....	19
6.4.1	<i>Infectious Waste</i>	19
6.4.2	<i>Chemical Waste</i>	20
6.4.3	<i>General Waste</i>	20
6.4.4	<i>Radioactive Waste</i>	20
6.5	TRAINING	20
6.6	MONITORING AND RECORDING	21
7.	TRANSPORT OF HEALTH CARE WASTE	22
7.1	INTRODUCTION.....	22
7.2	VEHICLE REQUIREMENTS FOR THE TRANSPORT OF INFECTIOUS WASTE	22
7.3	RESPONSIBILITY	23
7.4	TRAINING	23
7.5	MONITORING AND RECORDING	23
7.6	PERSONAL PROTECTIVE EQUIPMENT (PPE).....	24
8.	EMERGENCY RESPONSE	25
8.1	REPORT.....	26
9.	TREATMENT AND DISPOSAL OF HEALTH CARE WASTE	27
9.1	INTRODUCTION.....	27
9.2	TREATMENT OF INFECTIOUS WASTE	27
9.3	DISPOSAL OF INFECTIOUS WASTE	31
9.3	TREATMENT AND DISPOSAL OF CHEMICAL WASTE.....	33
9.4	TREATMENT AND DISPOSAL OF RADIOACTIVE WASTE.....	34
10.	CONCLUSIONS AND RECOMMENDATIONS	37

APPENDIX 1: DEFINITIONS OF HEALTH CARE WASTE

A1:	THE SOUTH AFRICAN APPROACH TO THE CLASSIFICATION OF HEALTH CARE WASTE
A2:	DEFINITION OF HAZARDOUS WASTE
A3:	DEFINITION OF INFECTIOUS WASTE
A4:	CHEMICAL WASTE
A5:	RADIOACTIVE WASTE FROM HEALTH CARE FACILITIES
A6:	GENERAL WASTE FROM HEALTH CARE FACILITIES

APPENDIX 2: DEFINITIONS OF STERILISATION AND DISINFECTION

1. GENERAL GUIDELINES FOR PROCESSES LEADING TO THE SAFE MANAGEMENT OF HEALTH CARE WASTE

1.1 *Introduction*

In this section, some of the concepts introduced in the background document on health care waste are produced in the form of guidelines and regulations. Guidelines indicate that one should undertake some activity. However, where the issue is considered very important, the activity is made compulsory, i.e. it must be undertaken, and it therefore becomes a regulation or minimum requirement. Preferably, this document should be read in conjunction with the Background Document on the Management of Health Care Waste, where the rationale behind most of the proposals is given.

The proposed guidelines are essentially based on a number of important documents, many of which, are guidelines and that are already in place in South Africa:

- Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste, 2nd edition, Department of Water Affairs and Forestry, 1998
- Minimum Requirements for Waste Disposal to Landfill, 2nd edition, Department of Water Affairs and Forestry, 1998
- Minimum Requirements for Water Monitoring at Waste Management Facilities, 2nd edition, Department of Water Affairs and Forestry, 1998.
- Department of Health, Directorate of Health Technology,
 - Code of Practice for the Management and Disposal of Non-nuclear Radioactive Waste, WSCP91-1, November 1991, revised February 1997,
 - Guidelines for the Safe Transport of Radioactive Material”, November 1991, revised April 1994 and April 1997 and
 - “Requirements for the Safe Use of Unsealed Radioactive Nuclides”, April 1993, revised April 1994 and February 1997.
- SABS Code 0248:1993, South African Bureau of Standards, Code of Practice for the Handling and Disposal of Waste Materials Within Health Care Facilities.
- Pruss A., Giroult E., Rushbrook P.; Safe Management of Wastes from Health-Care Facilities, World Health Organisation, 1999.
- Department of Health, “Proposed Regulations for the Control of Environmental Conditions Constituting a Danger to Health or a Nuisance”, Government Gazette, 4 February 2000
- SABS Code 0228:1995, South African Bureau of Standards, The Identification and Classification of Dangerous Substances and Goods.

- SABS Code 0229:1996, South African Bureau of Standards, Packaging of Dangerous Goods for Road and Rail Transportation in South Africa.
- SABS Code 0230:1997, South African Bureau of Standards, Transportation of Dangerous Goods: Inspection Requirements for Road Vehicles.
- SABS Code 0231:1997, South African Bureau of Standards, Transportation of Dangerous Goods: Operational Requirements for Road Vehicles.
- SABS Code 0232-1:1995, South African Bureau of Standards, Transportation of Dangerous Goods - Emergency Information Systems, Part 1: Emergency Information Systems for Road Transportation.
- SABS Code 0232-2:1997, South African Bureau of Standards, Transportation of Dangerous Goods - Emergency Information Systems, Part 2: Emergency Information Systems for Rail Transportation.
- SABS Code 0232-3:1997, South African Bureau of Standards, Transportation of Dangerous Goods - Emergency Information Systems Part 3: Emergency Action Codes
- SABS Code 0233:1992, South African Bureau of Standards, Intermediate Bulk Containers for Dangerous Substances.
- SABS Code 1518:1996, South African Bureau of Standards, Transportation of Dangerous Goods - Design Requirements for Road Tankers.

One of the key objectives of the proposed guidelines is to rationalise some of these documents so that we end up with a consistent approach across legislation and guidelines developed by various Government Departments.

Some of the issues considered are that:

- Activities must be carried out in such a way that the health care waste does not cause a nuisance or a health or safety hazard for any handler thereof or any other person or the environment.
- Adequate provision of appropriate Personal Protective Equipment (PPE) for persons involved in the various stages of waste handling and disposal is essential. The decision on what type of PPE is to be worn is based on the job level and specific training of the persons involved, as well as the volume of health care waste to which they are exposed. For example, a nurse is trained in the handling of needles and therefore is less likely to prick herself than a person loading medical waste from a collection point into a vehicle. This same person is exposed to much greater amounts of health care waste than the ward nurse and therefore needs far better protection. Exposure is also increased by the means of handling of the health care waste. For example, the loader is again at a far greater risk, since the task is manual and containers are pressed up against the body, as compared to a person moving the waste on a trolley to a central collection point, or a nurse merely dropping the waste into the container.
- Written procedures for each phase in the handling of the waste, including disinfection and disposal arrangements must be readily available.

- Hand washing facilities and decontamination facilities must be provided and be ready for use at all times.
- Health care facilities must have a documented policy and procedure for managing spills of a hazardous substance. Spills must be cleaned up immediately.

Additional exposure risk is incurred through increased handling and transportation. Procedures must be designed to minimise these exposure risks. In terms of the “duty of care”, generators of health care waste must ensure that waste managed by external contractors is handled in a manner that is commensurate with the law and that any transporter, treatment facility and disposal site are permitted to handle the waste.

The sections below are considered in the order that the waste is managed, i.e. from its “cradle” where it generated to its “grave”, where the waste or the residues after treatment are finally disposed. The principles in the Environmental Management Act, the White Paper on Integrated Pollution and Waste Management and the National Waste Management Strategy are adhered to, e.g. Integrated Waste Management and the Precautionary Principle. Where international best practice is downgraded to take account of realities of the South Africa situation, note is made of this. This document is simply a starter document and all interested and affected parties in South Africa will have ample opportunity to comment. Clearly, our overall objective must be to develop an approach that takes into account all the requirements to manage health care waste safely, to protect both the health of the population and the environment. However, the approach must be appropriate and affordable.

2. AVOIDANCE AND SEGREGATION OF HEALTH CARE WASTE

2.1 Introduction

Waste avoidance is the first step in minimising the amount of waste generated at a health care facility followed by segregation of the different types of waste generated at the facility.

2.2 Waste Avoidance

Health care facilities and the staff should take all measures possible to avoid the production of waste. Opportunities exist in:

Source Reduction:

- Purchasing reductions: careful selection of supplies that are less wasteful or less hazardous, e.g. the replacement of chlorinated solvents, where possible with less hazardous alternatives.
- Use of physical rather than chemical cleaning methods; e.g. steam cleaning rather than using detergents and disinfectants.
- Prevention of wastage

Management and Control Measures

- Purchase of hazardous chemicals should be centralised
- Purchasing and use of chemicals and pharmaceuticals should be controlled and monitored on a regular basis.
- The quantities of both hazardous and general waste sent for treatment and disposal should be monitored and steps taken to minimise production as much as possible.
- Training programmes should be instituted for all staff that includes waste avoidance and minimisation of materials and wastes.

Stock management of chemicals and pharmaceuticals

- Small quantities should be ordered frequently rather than large amounts.
- The oldest batch should be used first (First in first out principal).
- All the contents of a container should be used.
- Expiry dates should be checked on delivery of supplies.

2.3 Recycling

The following should be instituted:

- Recyclable products should be purchased where possible.

- Sterilisation of reusable medical and other equipment using approved sterilisation procedures should be practised. (Under no circumstances must disposable items such as needles and syringes be recycled.)

2.4 Segregation

Segregation of health care wastes is essential for the following reasons:

- It ensures that hazardous waste and general (non-hazardous) wastes are separated. This is important in that it is dangerous to have hazardous waste being managed in the general waste stream. Conversely, the volume and contents of general waste e.g. high plastic content, is often not suitable for incineration. Secondly, from a cost point of view, it is important not to pay hazardous waste transport and disposal rates for general wastes. Segregation therefore forms the basis of a sound waste minimisation programme.
- It ensures that the hazardous wastes are sorted into correct categories for proper handling and disposal. Each type of hazardous health care waste has very specific packaging, handling, storage, transport and disposal instructions. Incorrect separation could have serious consequences e.g. needle stick injuries due to sharps being disposed of in infectious waste cardboard containers and sealed medium and high level radioactive sources ending up in the waste streams destined for incineration.
- From an environmental point of view, the incineration of chemicals and pharmaceuticals in infectious waste incinerators is not permitted, due to the increase in undesirable air emissions from the incinerators – in fact, the incineration of pressurised containers could lead to explosions.
- Radioactive waste, sealed and unsealed, must be carefully segregated from the other waste streams and managed according to the procedures of the Directorate of Health Technology, Department of Health.

The key to effective management of health care waste is the correct identification of the waste followed by segregation. Note that:

- Segregation is always the responsibility of the waste generator.
- Segregation should take place at or as near as possible to the source at which the waste is generated.
- ALL containers must always be clearly labelled.

Health care waste must be segregated into the following categories, see appendix 1 for the definitions of health care waste:

INFECTIOUS WASTE

This category includes:

- Human/animal anatomical waste
- Infectious non-anatomical waste
- Sharps and similar waste

CHEMICAL WASTE

This includes category includes:

- Pharmaceutical waste
- Pressurised container waste, such as gas cylinders and aerosols.

RADIOACTIVE WASTE

- Low-level radioactive waste, unsealed sources
- High-level radioactive waste, sealed sources

D. GENERAL WASTE

2.5 **Responsibility**

The person responsible for the segregation of health care waste must ensure that:

- All the necessary containers are available for staff to separate the waste into the various categories.
- That all containers are clearly labelled.
- That the containers are placed as close as possible to the area where the waste is generated.
- That staff are trained on how to segregate waste.
- That the segregation of waste is monitored and enforced.

2.6 **Waste Containers**

Containers as listed must be provided for the following categories of waste:

INFECTIOUS WASTE

Human Anatomical Waste:

Human Anatomical Waste must be placed within a waste container that is colour-coded RED.

Infectious Animal Anatomical Waste:

Infectious Animal Anatomical Waste must be placed in a container, which is colour-coded ORANGE.

Non-infectious Animal Anatomical Waste:

Non-infectious Animal Anatomical Waste must be placed in a container, which is colour-coded BLUE.

Infectious Non-Anatomical Waste:

All Infectious non-anatomical waste must be placed in a container that is colour-coded YELLOW. The container will typically consist of a cardboard box lined with strong, leak proof plastic.

Sharps:

Sharps and similar materials must be placed in specially designed sharps containers, which are colour-coded RED or YELLOW.

CHEMICAL WASTE

Chemical Waste must be sorted into a number of different categories:

Acids

Acid wastes must be segregated from other wastes and stored in a labelled 25l (or similar suitable size) plastic container, which seals with a screw cap lid. A funnel must be used for decanting purposes. Alternatively, the waste can be collected into the containers in which it was supplied.

Bases

High pH wastes must be segregated from other wastes and stored in a labelled 25l (or similar suitable size) plastic container, which seals with a screw cap lid. A funnel must be used for decanting purposes. Alternatively, the waste can be collected into the containers in which it was supplied.

Solvents

Solvent wastes must be segregated into non-chlorinated and chlorinated wastes and stored in separate labelled 25l (or similar suitable size) metal containers or drums, which seal with a screw cap lid. A funnel must be used for decanting purposes. Alternatively, the waste can be collected into the containers in which it was supplied.

Extremely toxic substances: Hazard Group 1

These wastes must be collected separately i.e. only one type of waste per container. Containers containing compatible wastes that will not react if mixed must then be packed into open head stainless steel 100l drums, which are filled with an inert absorbent packaging material, such as vermiculite. The individual containers, as well as the 100l drum, must be clearly labelled.

Cytotoxic or genotoxic waste

- Cytotoxic or genotoxic pharmaceutical waste and associated contaminated materials e.g. syringes, tubing, containers, preparation materials, vials and ampoules etc., must be discarded into containers as described for highly toxic wastes, which are labelled "CYTOTOXIC WASTE" or "GENOTOXIC WASTE".
- Sharp objects (needles, broken glass etc.) contaminated with cytotoxins must be placed into labelled "CYTOTOXIC SHARPS" containers.

Other Pharmaceuticals

Pharmaceuticals can also be collected into containers as described for extremely toxic substances – this would be advisable for liquid pharmaceuticals. Alternatively, solid pharmaceuticals can be collected into double, sealable plastic bags, labelled in conformance with national legislation. These must be colour-coded DARK GREEN.

Pressurised Container Waste

Pressurised Container Waste should be returned to the manufacturer as far as possible. If this is not feasible then a company specialising in the disposal of hazardous waste should be consulted.

Material Safety Data Sheets (MSDS's) must:

- Be available for all chemicals in the above categories in all areas where the substances are used, where the waste is generated and where it is segregated.
- Must, as a minimum, comply with the format as required by the Occupational Health and Safety Act 85 of 1993 and in an ISO 9000/14000 format.
- Must include a section on the classification of the waste according to the Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste.
- Include a section on the expected environmental fate, if dispersed into the environment, and
- The preferred disposal options should also be given.

GENERAL WASTE

Solid general waste must be placed in a waste container that is colour-coded BLACK. This could either be a plastic bag or rubber bin.

RADIOACTIVE WASTE

Waste generated in radioactive controlled areas must be segregated at the point of origin into three categories,

- ***Inactive waste:*** Laboratory utensils or other materials which have been inside a radioisotope laboratory or which have in some other way been in the vicinity of radioactive materials, but where the risk of contamination has been very small. This type of waste may be disposed of as normal refuse.
- ***Low Level waste:*** Radioactive waste, which does not exceed the activity limits specified in the code.
- ***High Level waste:*** Radioactive waste, which exceeds the activity limits specified in the code This waste must be stored for decay or disposed of at the Atomic Energy Corporation's nuclear waste site at Pelindaba.

An acceptable method of handling low level radioactive waste would be to dispose of it initially to a waste receptacle lined with a plastic bag. When full the plastic bag should be sealed, and then placed in a second plastic garbage bag, box or other suitable container (e.g. a drum) in a clean area of the user's premises. The outer containment must also be securely closed. No colour is specified in the code of practice from the Department of Health, but *it is proposed* that the bags and receptacle be WHITE to distinguish the waste from other types of health care waste. In the case sharps, these must be disposed in a sharps container, that is colour coded WHITE, in order to distinguish them from non-radioactive sharps waste.

OTHER

Any other waste not clearly defined by the categories above should be treated according to the Precautionary Principle. If there is any uncertainty about the classification, segregation or final destination of a particular waste, a company specialising in the disposal of hazardous materials, including health care waste, or the DoH, Department of Water Affairs and Forestry or Department of Environment and Tourism should be consulted.

2.7 Training

It is essential that all key staff members be given training in the identification and segregation of health care waste.

2.8 Monitoring and Recording

Records must be kept of:

- The amount of waste generated in each separate category.
- The costs involved.
- Any incidents/accidents involving the segregation of health care waste.

2.9 Personal Protective Equipment (PPE)

Appropriate PPE should be worn at all times whilst segregating health care waste. The minimum PPE for segregation should include: Latex gloves, an overcoat or uniform and closed shoes. In the case of chemical wastes, in addition to this minimum, safety glasses and respirators should be worn.

3. PACKAGING OF HEALTH CARE WASTE

3.1 Introduction

Health care wastes should be packaged in a specific manner and into custom designed containers:

- The container must be practical for use in the area where the waste is generated. Impractical packaging will lead to irresponsible disposal of health care waste.
- The packaging must be suitable to the type of waste e.g. sharps containers
- The packaging must clearly identify the type of waste it contains by being properly labelled and in most cases colour-coded.
- The packaging must at all times protect all persons involved with the collection, handling, storage and disposal of the health care waste.
- The packaging must be suitable for the end destination of the waste e.g. PVC packaging should not be used and dyes that colour or label packaging should not contain heavy metals such as cadmium and lead, when the wastes are to be treated by incineration.

When packaging is purchased to be used for the collection of each category of health care waste, it is essential that the following be conformed to:

- With all health care waste, external packaging must be labelled. In the case of toxic waste where smaller containers are packaged into a drum, each individual container must also be clearly labelled.
- Containers must be resistant to chemical attack, vibration and changes in temperature, humidity and atmospheric pressure.
- The appropriate packaging must be selected for a particular type of waste (See the Section on Segregation).
- In cases where the facilities for the refrigeration of infectious Health care wastes are lacking, it is recommended that the containers for infectious waste be purchased in a state where they already contain a predetermined quantity of disinfectant (10% of the volume of the container). The disinfectant should be of the type, which is glutaraldehyde or sodium metabisulphite based and should be in a solid form.
- All packaging must be leak proof and sealable.
- The size of the packaging must be appropriate for the volume of waste generated.
- The packaging must be easy to handle and transport.

3.2 Labelling

The following information must be clearly marked on the label

- Waste category
- Date of collection
- Detailed description of where the waste was generated
- Waste destination.
- Any required national or international warning signs or codes.

3.3 Responsibility

The person responsible for the packaging of health care waste must ensure:

- That the correct packaging is available for the type of waste being generated.
- That all packaging is very clearly labelled.
- That all packaging is correctly used.
- That an adequate supply of packaging is available at all times.

3.4 Categories

3.4.1 Infectious Waste

Human and Animal Anatomical Waste and Infectious Non-anatomical Waste

These wastes must be placed within a waste container that is rigid and leak proof. The container will typically consist of a rigid cardboard box or re-usable 200 litre wheeled plastic bin lined with a strong leak proof plastic bag. Bags should be closed when full with a tie or other acceptable means of closure. Boxes must be closed by placing on the lid and sealing with a plastic (non-PVC) tape. Wheeled plastic bins must have a lockable lid. Bags and containers must be marked with the International Infectious Substances Symbol.

Sharps:

- Sharps and similar materials must be placed in sharps containers. The containers must be located to permit the safe and convenient disposal of sharps. The recapping of needles is not recommended and needles should not be clipped, bent or broken due to the inherent dangers in these procedures. Sharps containers must be puncture proof and fitted with covers. They must be rigid and impermeable so that they can safely retain the sharps, as well as any residual liquids in e.g. the syringes. Containers must be tamper-proof and needles and syringes should not be able to be removed. This container is typically a lockable, puncture proof container. The design of the sharps containers should comply with BS 7320:1990, Specification for Sharps Containers. Of particular importance are the specifications for: Resistance to penetration
- Resistance to impact by vertical dropping and resistance to leakage after dropping
- Resistance to damage by toppling and resistance to leakage after toppling

3.4.2 Chemical Waste

Chemical wastes must be collected separately according to the categories described in the section on segregation. The containers must be strong, sealable, and manufactured from a non-reactive material. Wastes can either be collected directly into the container, or individually into the container in which they were supplied and then packaged into a sealable drum with absorbent, cushioning material e.g. vermiculite. Chemicals, which are potentially incompatible, must never be packaged or handled together. SABS Code 0229 [12] should be consulted for specific requirements for packaging of larger quantities for road and rail transportation.

Cytotoxic pharmaceuticals:

Cytotoxic pharmaceuticals must be placed in a hazard container, which visibly displays the toxic hazard symbol together with the word “CYTOTOXIC” printed boldly directly beneath the symbol in letters at least 7mm high.

Prior to a cytotoxic container being used, an absorbent material may be placed at the bottom of the waste container to absorb excess fluid.

3.4.3 General Waste

General waste is collected in waste bins or bags.

3.4.4 Radioactive Waste

Radioactive waste must be packed in specifically designed containers, whose surfaces can be easily decontaminated, see section B: Segregation.

3.5 Training

All key staff members must be given training in the packaging of health care waste.

3.6 Monitoring and Recording

Records must be kept of:

- The amount of waste in each different category, which is generated and packaged.
- The costs involved.
- Any incidents involving health care waste.

3.7 Personal Protective Equipment (PPE)

Appropriate PPE should be worn at all times whilst packing health care waste. The minimum PPE for packaging should include: Latex gloves, an overcoat or uniform and closed shoes. In the case of chemical wastes, in addition to this minimum, safety glasses and respirators should be worn. For the packaging of radioactive waste, the required lead aprons should be worn.

4. HANDLING OF HEALTH CARE WASTE

4.1 Introduction

The correct handling of health care waste must be done in such a way that it poses no threat to persons involved in handling the waste or in the vicinity. The purpose is to move the waste from the point where it is generated to a central storage point, in a manner that makes it accessible for final transportation and disposal.

Suitable carts/trolleys must be used for moving of the waste.

- Waste containers must only be moved when properly closed and labelled.
- Special routes for the movement of waste must be planned in order to minimise its passage through patient care areas and other clean areas.
- Waste disposal chutes must be avoided.
- Carts/trolleys must be kept scrupulously clean and should be constructed from a material, which is easy to clean and disinfect.
- Carts/Trolleys must be well maintained, so that their condition does not increase the risk of spillage e.g. sharp edges could puncture bags, wobbly wheels could cause balance problems etc.
- Carts/Trolleys must never be overloaded.

4.2 Responsibility

The person responsible for the handling of health care waste, must ensure:

- That the waste is correctly packaged before being removed.
- That suitable carts/trolleys are used for the handling of the various waste types.
- That the trolleys/carts are kept clean and are disinfected daily with an approved disinfectant. Disinfectants should be of a liquid type, such as 2% glutaraldehyde.
- That the waste is removed from the collection points on a regular basis. This must be based on a guideline timetable, according to the rate at which various wastes are generated and the putrescible nature of the waste.
- That the waste is packed properly onto the trolleys/carts i.e. the stacking must be stable and the cart/trolley must not be overloaded.
- That the route to be followed by the trolley/cart is carefully worked out, to avoid any problems.
- That the destination of the waste is clearly understood by the person handling the waste.

4.3 Categories

4.3.1 Infectious Waste

Containers must be properly sealed and labelled. In case of a spillage, the emergency and cleanup procedures must be followed.

4.3.2 Chemical Waste

- Material Safety Data Sheets (MSDS's) must be available to all persons handling chemical waste.
- Staff must be aware of the dangers of each individual category of chemical and know how to respond in an emergency.
- Incompatible chemicals must not be handled together.

4.3.3 General Waste

General waste must be handled hygienically.

4.3.4 Radioactive Waste

Persons specifically trained to do so must only handle radioactive waste.

4.4 Training

All key staff members must be given training in the handling of health care waste.

4.5 Monitoring and Recording

Records must be kept of:

- The amount of waste in each category that is generated and handled.
- The costs involved.
- Any incidents involving health care waste.

4.6 Personal Protective Equipment (PPE)

Appropriate PPE should be worn at all times whilst handling health care waste. The minimum PPE for handling should include: Leather gloves, an overcoat, overalls or uniform and closed shoes. In the case of chemical wastes, in addition to the minimum of latex gloves, an overcoat and closed shoes, safety glasses should be worn. For the collection of radioactive waste the required lead aprons should be worn.

5. COLLECTION OF HEALTH CARE WASTE

5.1 Introduction

Collection is the first step towards removing the health care waste from its point of generation to its final destination. Since, this is the last link that the waste has with its source, it must leave in a state that renders the source totally traceable and, also, in a state, which poses no risk to persons in the vicinity of the waste. Therefore, it is essential at this stage to ensure that:

- The waste is properly segregated.
- The waste is properly packaged.
- The waste is clearly labelled.
- The waste is safely collected

It is important that:

- Different waste types must not be combined during collection.
- Collection points and routes should be cleaned regularly.

5.2 Responsibility

The person responsible for the collection of health care waste must:

- Ensure that there is control over the internal collection of waste containers and their safe transport to a waste storage facility on a daily basis.
- Ensure that the appropriate range of containers, PPE and collection trolleys are available at all times.
- Ensure that used containers are immediately replaced with the correct new containers.
- Supervise all persons collecting and transporting health care waste.
- Ensure that waste bags are tightly closed or sealed, when they are about three quarters full, before being collected
- Ensure that containers are not overfilled.

5.3 Collection Facilities

- Drawings of the establishment must indicate exactly where the health care waste collection points are located.
- These points must be in an appropriate place, where they are both convenient to use and yet separate from patients, food areas and busy areas.
- Drawings must clearly indicate the paths used by waste collection trolleys through the facility.
- A collection timetable must be drawn up.
- The collection area must be easy to clean and maintain.

- A person/s must be appointed to control the collection of health care waste from each specific collection point.

5.4 Categories

5.4.1 Infectious Waste

- Infectious waste containers must be properly sealed and labelled, before collection.
- They must not be overfilled.
- Leakage of liquids from the containers must be avoided at all costs.
- Before a sharps container is moved the lids must be securely in place.
- A sharps container must only be filled to three-quarters of its volume.

5.4.2 Chemical Waste

- Chemical waste containers must be properly sealed and labelled, before collection.
- They must not be overfilled.
- Leakage of liquids from the containers must be avoided at all costs.
- Incompatible chemical wastes must be kept separate.
- Material Safety Data Sheets (MSDS's) for all hazardous substances must be available in all areas from which chemical wastes are collected.

5.4.3 General Waste

- Large volumes of general waste must not be allowed to collect near patients or food preparation areas.
- General waste must be removed from the areas where it is generated at least once a day and more frequently if necessary.

5.4.4 Radioactive Waste

Radioactive waste may only be collected and handled by staff fully trained to do so.

5.5 Training

It is essential to ensure that all key staff members are given training in the collection of health care waste.

5.6 Monitoring and Recording

Records must be kept of:

- The amount of waste in each category generated and collected.
- The costs involved.
- Any incidents involving health care waste.

5.7 Personal Protective Equipment (PPE)

Appropriate PPE should be worn at all times whilst collecting health care waste. The minimum PPE for collection should include: Leather gloves, an overcoat, overalls or uniform and closed shoes. In the case of chemical wastes, in addition to the minimum of latex gloves, an overcoat and closed shoes, safety glasses should be worn. For the collection of high-level radioactive waste, the required lead aprons should be worn.

6. STORAGE OF HEALTH CARE WASTE

6.1 Introduction

Storage of health care waste must always be a temporary measure taken between removing the waste from the source of generation and transporting it to its destination for proper disposal.

Drawings of the establishment must indicate exactly where the central storage area for health care waste is located.

6.2 Storage Facilities

Storage areas for health care waste must comply with the following:

- All health care waste must be stored in specially demarcated health care waste storage areas until it is loaded or removed for final disposal.
- Only wastes that are properly labelled must be accepted for storage.
- Separate storage areas must be provided for infectious waste, chemical waste and radioactive waste.
- Areas used for storage should be maintained in a clean condition and for infectious waste must be disinfected on a daily basis.
- Infectious waste, particularly anatomical waste must be stored in a cool place. Refrigeration at 4°C may be required if the facility cannot demonstrate that it can maintain the area free of odours, etc.
- All health care waste storage areas must be vermin, insect and rodent proof. The area must also be inaccessible for other animals and birds.
- They must have a floor, which is easily cleaned and is hard, impermeable and well drained. The wall finishing and general construction must also be easy to disinfect and maintain.
- Storage areas must be totally enclosed and lockable. Unauthorised entry must be prohibited.
- Adequate ventilation and lighting is essential.
- Incompatible chemical waste must be stored in separate banded areas.
- Flammable materials must be stored according to the requirements and in areas separate from materials that may assist a fire to spread.
- Fire detection and control equipment is essential.
- Provision must be made for infectious and general waste to be removed on weekends and public holidays.
- Storage areas must be separate from supply rooms and food preparation areas.
- Access must be restricted to authorised personnel only.
- There must be a water supply.

- Appropriate equipment for the cleanup and containment of any spills must be available.
- Appropriate warning signs, e.g. for radioactivity, etc. must be displayed prominently.
- Easy access for waste collection vehicles is essential.
- The area must be protected from the sun.
- The store must be designed to easily accommodate the volume of waste produced by the establishment.
- It must also be built to easily accommodate trolleys/carts and have enough space to load and offload comfortably.

6.3 Responsibility

The person responsible for the storage of health care waste must ensure the following:

- That the storage facilities are correctly utilised.
- That they are maintained in a hygienic state.
- That the storage facilities are kept locked, but at the same time are always accessible to authorised staff.
- Prevent all unsupervised dumping of health care waste elsewhere on the premises.
- Prevent unsupervised storage of anything other than health care waste in the storage facilities.
- That the infectious health care waste is not stored longer than the specified time periods.

These requirements should be included in the responsible persons job description and they must be provided with a written procedure.

6.4 Categories

6.4.1 Infectious Waste

The turn around time from the time that the waste is generated, to the time that it is disposed is critical. Infectious waste must:

- Not be stored for longer than 24 hours at any stage before being disposed.
- Must be collected properly and removed promptly once a day, or more frequently, depending on the volume produced.
- Be treated by the addition of a disinfectant and masking agent if it cannot be collected on time to the waste can reduce the generation and impact of odours. Alternatively, the waste can be refrigerated at 4°C, if facilities are available.
- Refrigeration may a requirement, if the facility cannot demonstrate that it can maintain the area free of odours or vermin.

6.4.2 Chemical Waste

- Material Safety Data Sheets (MSDS's) for all chemical substances must be available at the storage area.
- Chemical waste must be stored separately from other health care waste in a secure location.
- The wastes must be stored in compliance with the supplier's recommendations and incompatible wastes should not be stored together.
- Flammable solvent wastes should be stored in a separate bunded area so that in the event of a fire, it will not cause significant threat to other waste materials.
- Fire extinguishers should be available in accordance with local fire regulations.

6.4.3 General Waste

General waste may be stored in suitably situated and designed place, which facilitates collection. The storage area should be well removed from any patients or food preparing areas. Vermin and insect control in these areas are vital.

6.4.4 Radioactive Waste

Must be stored in containers that prevent dispersion, behind lead shielding. The waste must be labelled:

- Type of radionucleotide
- Date
- Details of where the waste originated.
- Responsible person.
- Details of required storage and handling conditions.
- Symbol indicating radioactive materials.
- The storage area must have as far as possible a flameproof structure and fittings.
- Air sampling and radiation alarms
- Fire resistant lockable drawers.
- A logbook, listing the number of containers, entry date, waste types etc.
- Protection from the environment.
- A moveable radiation shield.
- Be well secured.

6.5 Training

Ensure that all key staff members are given training in the storage of health care waste.

6.6 ***Monitoring and Recording***

Records must be kept of:

- The amount of waste in the various categories generated and stored.
- The costs involved.
- Any incidents involving health care waste.

7. TRANSPORT OF HEALTH CARE WASTE

7.1 *Introduction*

During the transport of health care waste, the risk of exposing uninformed persons to the health care waste is considerably increased. It is essential that they be carefully controlled.

A *waste manifest* or consignment note must accompany the waste from its place of production to the place of treatment and disposal. This note must be checked and signed off by an appointed person at each stage. All waste must be properly packaged, labelled and sealed before being loaded for transport. Vehicles must never be overloaded. All the applicable Road Transport regulations and codes of practice must be adhered to.

7.2 *Vehicle Requirements for the Transport of Infectious Waste*

Vehicles designed to transport infectious health care waste must have as a minimum:

- The loading compartment must be lockable.
- The compartment must be thermally insulated.
- The interior panel construction must be so tightly joined as to ensure a removable liquid air tight seal.
- The interior surfaces must be painted white with durable enamel paint.
- There must be a threshold of at least 100mm at the doors to prevent leakages spilling outside.
- The compartment must be equipped with spill kits that are regularly checked and replenished.
- A team adequately trained in the effective use of the spill kits and cleanup procedures must man the transport vehicles.
- The loading compartments must be meticulously disinfected and chemically cleaned on a daily basis.
- The body of the vehicle must be a suitable size, with an internal body height of 2.2m.
- There must be a bulkhead between the driver's cabin and the vehicle body designed to retain the load if the vehicle is in a collision.
- There must be a suitable system for securing the load during transport.
- All internal angles must be rounded and the internal finish must allow for steam cleaning.
- The vehicle must be clearly marked with the name and address of the waste carrier.
- The international hazard sign must be displayed on the vehicle, as well as an emergency number.
- The vehicle must not be used for the transportation of any other material.

- It must be kept locked at all times, except when loading/offloading.
- It must be easy to load and unload.
- The vehicle must have no sharp edges, which could damage bags or containers.
- The vehicle must be licensed according to the Road Traffic Act and be designed and operated according to SABS Codes 0230, 0231, 0232 and 1518.

CHEMICAL WASTE

- The vehicle must be placarded with the appropriate Hazchem decal and TREM (transport emergency) cards appropriate for the waste carried must be available.
- Material Safety Data Sheets (MSDS's) for all chemicals being transported must accompany the vehicle.
- The vehicle must be licensed according to the Road Traffic Act and be designed and operated according to SABS Codes 0230, 0231, 0232 and 1518.

RADIOACTIVE WASTE

- All transportation must comply with the International Atomic Energy Agency transport regulations (Regulations for the Safe Transport of Radioactive Material, IAEA, Vienna, 1985).
- Appropriate radiation warning signs are required on vehicles, except for consignments of low-level waste.

7.3 Responsibility

The person responsible for the transport of health care waste, must ensure:

- That the methods of transport of the health care waste are monitored.
- That the health care waste is transported in an appropriate vehicle.
- That the health care waste is destined for and reaches the correct destination.
- That the health care waste is collected at acceptable frequencies.
- That the transporter complies with all the requirements of all road transport legislation.

7.4 Training

A team adequately trained in the handling of health care wastes, as well as the effective use of the spill kits and cleanup procedures must man the vehicles.

Ensure that all key staff members are given training in the transport of health care waste.

7.5 Monitoring and Recording

Records must be kept of:

- The amount of waste loaded and transported.
- The costs involved.
- Any incidents involving health care waste.
- Incidents must be reported to the appropriate authorities.

7.6 *Personal Protective Equipment (PPE)*

Appropriate PPE should be worn at all times whilst loading, offloading and transporting health care waste. The minimum PPE for the aforementioned activities associated with transport, should include: Leather gloves – elbow length, a full overall, leather aprons which have a bib covering the chest area and extend to below the knees and closed shoes. In the case of chemical wastes, in addition to the minimum of latex gloves, overcoat and closed shoes, safety glasses should be worn. For the collection of radioactive waste the required lead aprons should be worn.

8. EMERGENCY RESPONSE

Health care facilities must have a documented policy and procedure for managing spills of infectious waste.

A method for the containment and isolation of each type of spill must be prepared.

Should a spill occur, the person/s designated for spill clean up must be notified immediately.

Equipment must be made available for:

- Spill cleanup
- Protection of employees, patients etc.
- Procedures for the proper disposal of waste spills must be prepared.

SPILLAGE PROCEDURES

1. Evacuate the area of spillage.
2. Secure the area
3. Determine the nature of the spill.
4. Inform the emergency response team leader.
5. Provide first aid to injured individuals
6. Decontaminate the eyes and skin of exposed personnel immediately.
7. Provide adequate PPE to persons involved in cleaning up the spill.
8. Limit the spread of the spill.
9. Disinfect the spilled material and area of the spill.
10. Collect all spilled and contaminated material. Place in appropriate containers for disposal. Sharps must never be picked up by hand!
11. Decontaminate and rinse the area.
12. Decontaminate any tools used to clean up the spillage.
13. Decontaminate or dispose of PPE if necessary.
14. Seek medical attention
15. Fill in an incident report.

SPILL KIT CONTENTS

1. PPE: PVC gloves – elbow length, closed shoes, full overall, safety glasses, and respirators if necessary.
2. Absorbent material e.g. vermiculite
3. Disinfectant e.g. a 2% solution of Glutaraldehyde
4. Broom, dustpan, spade
5. Medical waste containers

8.1 REPORT

All incidents must be documented.

The report must include:

- The nature of the accident or incident
- The place and time
- The persons directly involved
- Any other relevant information
- Recommendations to prevent the incident from reoccurring.

9. TREATMENT AND DISPOSAL OF HEALTH CARE WASTE

9.1 Introduction

After separating health care waste into its four different types, i.e. infectious waste, chemical including pharmaceutical waste, radioactive waste and general waste, different management procedures should be applied to the treatment and final disposal of each type. Treatment is in terms of IWM applied to unavoidable waste and that cannot be avoided, recycled or re-used. The objective of the treatment of waste is to eliminate or, at least, reduce the hazard to levels that minimise the risk to human health and the environment. Subsequent options for the treated waste still include the possibility of re-cycling and re-use, although, at this stage, any resulting residues are usually disposed to landfill. The options for treatment are extremely varied and include physical and chemical treatment, thermal treatment, biological treatment and stabilisation, cementation and microencapsulation.

9.2 Treatment of Infectious Waste

Infectious waste is treated at facilities owned and operated by the health care facility or at an off-site facility operated by a municipality or waste management company. However, the responsible person for waste generated at a health care facility must fulfil a “duty of care” and audit any off-site infectious waste treatment facility at least annually.

According to the Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste, *sterilisation* of infectious waste is a minimum requirement before disposal of any residue in a permitted H landfill (see appendix 2 for the definitions of sterilisation and disinfection).

- Incineration is an approved technology provided it meets the requirements, i.e.
 - It is a scheduled process (no.39) in terms of the Atmospheric Pollution and Control Act.
 - The Department of Environmental Affairs and Tourism has published regulations that include emission standards, structural requirements and operating parameters for incinerators. Current standards for large incinerators and proposed standards for small incinerators are included in table 1.

Recommended Technical Performance of Small Scale Incinerators Compared to Current Requirements for Large Incinerators*

Parameter	Small Scale Incinerators	Permitted Large Scale Incinerators	Comment
Hours of operation/week	Up to 10	≥40	
Quantity of waste, kg/week	Up to 50	4000 to 40000	Some large units operate at 300kg/hr for 6 days a week.
Stack Height, m	1.8 to 3	9	In practice stack heights for large incinerators are ~15m.
Particulate emissions, mg/Nm ³	360	180	These values are significantly higher than required by some overseas countries and may be lowered.
Metal emissions, mg/Nm ³	1	0.5 to 0.05	Typical emissions from health care waste include Cr, Mn, V and Ni.
Gas Combustion Efficiency, %	99.00	99.99	
Emission of Cl (as HCl), mg/Nm ³	<60	<30	
Operating temperature in combustion zone, °C	650	Not specified	
Minimum Wall Combustion Temperature, °C	Not specified	850	Secondary chamber temperature for large incinerators should be >1100°C
Secondary combustion zone residence time, s	Not specified	2	Small-scale incinerators do not have well defined combustion zones.
Stack gas exit velocity, m/s	1	10	The greater the stack exit the better the smoke dispersal.

- Proposed requirements for large scale incinerators burning more than 50kg/week include:
 - During permitting, the operator must demonstrate that the incinerator is operating efficiently and effectively within certain set operating parameters, i.e. temperature of combustion, maximum feed rate, etc. Adherence to these settings must be mandatory and verified by the permitting authority or their designated representative on a regular basis. Continued failure to comply will result in the loss of the permit.
 - The correct separation of infectious waste at source can greatly minimise the pollution potential of incinerators. Health care wastes that cannot be incinerated in infectious waste incinerators include aerosols and other pressurised containers that can explode and chemical waste, such as large quantities of pharmaceuticals, photographic wastes, solvents, batteries and broken thermometers with a high content of mercury.

- The use of PVC items that will require incineration due to their infectious nature should be restricted to only essential uses and the PVC bags used for blood, sera and other fluids, must be replaced by inexpensive non-halogenated plastics.
 - Incineration facilities that cannot demonstrate that their emissions are either below the emission standards (see table 1) and/or that they do not impact significantly on human health and the environment will be required to fit a gas cleaning system.
 - The ash must be classified according to the Minimum Requirements and, if required, treated to minimise its hazardous nature, and then disposed to an appropriate H or G landfill. For wet de-ashing systems the cooling water must also be evaluated for its potential impact on the environment and disposed accordingly.
 - For incinerators fitted with scrubbers the solid or liquid residues must be evaluated according to the Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste and disposed in a manner required by the regulations.
- Small incinerators, i.e. <50kg per week, are proposed for use at rural and remote locations where the low amounts of waste produced, long transport distances and the high costs of larger facilities requires the use of lower standards of performance. Note that the impact on the environment must still be acceptable.
 - Alternative modern technologies, such as autoclaving, microwaving and chemical disinfection are subject to the approval of the Department of Water Affairs and Forestry and the Provincial Department of Environment. It is proposed that:
 - “Any appropriate technology can be used, provided the operator/owner can demonstrate that it can meet all health, safety and environmental requirements including passing a full environmental impact assessment and public scoping study.”*
 - Issues that must be considered, when choosing an alternative technology to incineration, include:
 - That it should be appropriate technology that is cost effective.
 - The sterilisation or disinfection efficiency.
 - The waste should not be able to be reused.
 - The treatment of human and animal anatomical wastes.
 - The potential impact of poor segregation of wastes, e.g. effect of chemical wastes, aerosols, etc in the infectious waste stream.
 - The ability to meet the requirements of the Occupational Health and Safety Act.
 - The emergency procedures required, e.g. after a needle stick injury.

- The impact of the technology on the environment and the need to pass a full Environmental Impact Assessment that includes scoping with the public.
 - Any gaseous emissions including fugitive emissions.
 - Disposal of water, e.g. to sewer.
 - Regulatory requirements.
 - The quantity of waste for treatment and the capacity of the system.
 - The volume of waste and mass reduction.
 - The residues after treatment – classification and disposal procedures
 - Infrastructure requirements.
 - Training requirements.
 - Operation and maintenance requirements.
 - Available space.
 - Location.
 - Capital and operating costs – the technology should be cost effective.
 - Public acceptability.
- The areas where infectious waste is accepted, stored and treated must be maintained in an acceptable manner as outlined in section 6.2.
 - The person responsible for the treatment facility must ensure that the approved method of treatment is used at all times.
 - A team adequately trained in the handling of infectious wastes, as well as the effective use of the spill kits and cleanup procedures must man the treatment facility.
 - All key staff members are given training in the handling and treatment of health care waste.
 - Only waste accompanied by a waste manifest or consignment note may be accepted for treatment.
 - All health care waste accepted at the facility must be measured for radioactivity and only wastes below the approved level may be treated.
 - Records must be kept of:
 - The amount of waste treated.
 - The costs involved.
 - Any incidents involving health care waste.
 - Incidents must be reported to the appropriate authorities.
 - Appropriate PPE should be worn at all times whilst loading, offloading and treating health care waste.

- Any residues after treatment of the waste must be classified and disposed only at landfill sites permitted in terms of the Minimum Requirements.

9.3 ***Disposal of Infectious Waste***

As indicated in previous sections, the preferred approach to the management and disposal of health care waste is treatment (sterilisation) by incineration followed by the disposal of the usually hazardous residual ash, on a hazardous waste landfill. However, because incineration facilities and hazardous waste landfills are not always economically justified and available and a variety of other reasons (see Background Document), a significant percent of health care waste finds its way onto the general waste landfills and open dumps throughout the country. Since these are seldom properly operated, infectious waste is often left exposed, where it poses a major health threat to scavengers, the public and children who frequent the disposal sites.

Because of this, *it is proposed* that under certain circumstances, the authorities allow infectious health care waste to be disposed to selected permitted disposal sites. This could be an acceptable short or medium term solution to a major problem in South Africa and should be continued until the facilities are in place to allow a more acceptable solution to be implemented, e.g. regional treatment facilities become more widely available. Note that preliminary discussions with the Department of Water Affairs and Forestry indicate that they may oppose such an approach.

The authorities responsible for assigning health care waste to the different classes of landfill include the Department of Water Affairs and Forestry, the Department of Environment and Tourism, both National and Provincial, and the Local Authorities. The Local Authorities must approach DWAF and DEAT for directives and permission in this regard.

The criteria which the authorities will use for assigning infectious waste to the different classes of landfill, should be based on the following hierarchy:

- Wherever possible infectious wastes must be incinerated and the ash disposed of on a hazardous waste landfill.
- Where incineration is not possible, infectious wastes must be appropriately disinfected and disposed of on a hazardous waste landfill.
- Where no treatment is available, untreated infectious wastes must be disposed of on a hazardous waste landfill.
- Where there is incineration but no hazardous waste landfill, infectious wastes incinerator ash may be disposed of on a general waste landfill, depending on its hazard rating.
- Similarly, if there is no hazardous waste landfill, disinfected health care waste must be disposed of on a general waste landfill with proper procedures.
- Where there is no treatment and no hazardous waste landfill untreated infectious wastes may be disposed on a general waste landfill, with proper procedures.
- No infectious wastes waste may be disposed of on a general waste landfill without proper procedures.

In the above cases where there is no option but to use general waste landfills, the following must be complied with:

- Radioactive wastes, chemical wastes and in some instances hazardous incinerator ash arising from health care facilities will not be allowed to be disposed of on general waste landfills.

- b) The general waste landfill proposed for the disposal of infectious waste must be permitted in terms of Section 20 of the Environmental Conservation Act, Act 73 of 1989. Alternatively the Local Authority must have registered the landfill and be in the process of obtaining a permit.
- c) The Local authorities must identify, assess and register all *bona fide* cases of infectious waste generators for whom incineration, pre-treatment or disposal at a hazardous waste landfill facility are not realistic options.
- d) The Local authorities must qualify and quantify all infectious waste under consideration, and if incinerator ash is involved, this must be hazard rated.
- e) The Local authorities must apply to Department of Water Affairs and Forestry and Department of Environment and Tourism for formal permission to use the proposed general waste landfill, for the disposal of infectious waste. The application report must include a motivation based on all the above information
- f) Department of Water Affairs and Forestry and Department of Environment and Tourism must evaluate each application on its merits and, where appropriate, they may grant formal permission to use the proposed general waste landfill, for the disposal of Healthcare wastes, subject to certain conditions.
- g) The said conditions will relate to proper procedure, the principles of which are set out in the next below.

These principles used for the disposal of infectious waste to landfill already appear in the Minimum Requirements and form the basis for the guidelines. They include:

- The operation at the proposed landfill must comply with all the appropriate Minimum Requirements.
- All landfill staff must be educated regarding the risk associated with infectious waste disposal. They must be made aware of the fact that infectious waste is being disposed of at the facility and that it requires proper procedures to protect them and others.
- All landfill staff involved in handling infectious waste must have it written into their job description and must have been instructed / trained regarding the proper procedures for handling infectious waste on general waste landfills. They must have a sound knowledge of the requisite operating procedures and there must be a clear line of responsibility.
- Strict control must be maintained over the infectious waste throughout the whole disposal process, from when it arrives at the landfill and is recorded, until it is finally disposed.
- At the disposal point, someone in authority must supervise the operation.
- Regarding the operation, the most important element is the covering or the burial of the infectious waste, as soon as possible, to avoid or minimise the exposure of infectious waste to the elements and people. This must be expedited as soon as possible.
- If infectious waste is disposed of at the working face, the Sanitary Landfill principles of waste compaction and cover must be applied immediately. In this case, prompt and proper covering is of particular importance to minimise exposure. This may be achieved with other waste or soil as described in the case of putrescible waste disposal, in the Minimum Requirements.

- Alternatively, disposal may take place in a special area such as a trench in the completed landfill or in the soil adjacent to the landfill. Again, covering must be immediate to avoid exposure.
- Whichever approach is used, the principle is that the infectious waste is covered as soon as possible with other waste or soil, under informed and strict supervision, to minimise exposure. It must never be left unattended.
- In the case of sharps, wherever possible, plans should be made to have needles destroyed before disposal, by passing them through a needle destructor. Containers should also be disinfected with a disinfectant such as Glutaraldehyde or some other appropriate disinfectant.

9.3 Treatment and Disposal of Chemical Waste

The objectives of treating chemical including pharmaceutical waste are:

- To minimise the volume of waste that must be disposed.
- To minimise or even eliminate the hazard characteristics, i.e. the flammability, corrosivity, reactivity and toxicity of the waste.

Treatment technologies that are utilised overseas and South Africa include physical and chemical treatment, thermal treatment, biological treatment and stabilisation, cementation and microencapsulation.

It is unlikely that health care staff will be involved in the treatment and disposal of chemical waste, except for small quantities in laboratories and when discharged to sewer. Normally a waste management company will be employed to manage its treatment and disposal. However, the responsible person for waste generated at a health care facility must fulfil the “duty of care” and audit any treatment or disposal facility at least annually. The following must be adhered to:

- All waste treatment and disposal facilities must be permitted in terms of the Department of Water Affairs and Forestry Minimum Requirements. They must conform to all requirements, including monitoring for gaseous emissions, monitoring of ground and surface water, etc.
- A full environmental impact assessment and scoping report must be done before construction of any chemical waste treatment facility in terms of the Department of Environment and Tourism regulations.
- All wastes treated and untreated must be classified in terms of the Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste before disposal to an appropriate H or G site.
- Small amounts of selected waste streams arising at health care facilities, e.g. water miscible solvents such as ethanol and acetone, may be disposed to sewer but only with the permission of the municipality or other appropriate authority.
- The disposal of large quantities of heavy metals, water insoluble chlorinated solvents such as chloroform and flammable wastes such as ether to the sewer are not allowed.

- Small amounts of tissues, syringes, needles and blood products contaminated with cytotoxic drugs can be incinerated with the infectious waste stream. However, larger amounts including redundant stock must be managed as a hazardous chemical waste
- Mercury from broken thermometers, thermostats, specialised apparatus and laboratories and cadmium that can occur in batteries must be collected separately from other wastes, and managed, treated and disposed as a chemical hazardous waste.
- Pressurised gases, flammable wastes with a flash point <61°C, acids with a pH<6 and alkalis with a pH>12 may not be disposed to landfill.
- Treatment facilities for chemical hazardous wastes must conform to all relevant regulations concerning the management of hazardous materials, such as the Hazardous Installation Regulations.
- The areas where chemical waste is accepted, stored and treated must be maintained in an acceptable manner as outlined in section 6.2.
- The person responsible for the treatment facility and/or disposal must ensure that only approved methods of treatment and/or disposal are used at all times.
- The treatment and/or disposal facility must be manned by a team adequately trained in the handling of chemical wastes, as well as the effective use of the spill kits and cleanup procedures.
- An adequate health and safety policy that conforms to the requirements of the Occupational Health and Safety Act must be in place and operational. Appropriate PPE must be worn at all times.
- Material Safety Data Sheets (MSDS's) must be available for all chemicals being used for the treatment of chemical wastes.
- All key staff members of the facility must be trained in the handling and treatment of chemical waste.
- Only waste accompanied by a waste manifest or consignment note may be accepted for treatment and disposal.

9.4 Treatment and Disposal of Radioactive Waste

Only a few health care facilities will require to treat and dispose of radioactive waste. However, the staff at those facilities that do utilise radioactive materials have an important responsibility to themselves and public. The following should be noted:

- The safe management of radioactive waste within health care facilities is a responsibility of the Directorate of Health Technology, Department of Health in Cape Town.
- A number of important codes of practice have been published, see section 1, Introduction.

- If a sealed source is to be disposed of, written permission must be obtained from the Department and they are usually disposed of at the Atomic Energy Corporation's waste site at Pelindaba or as is the case with some imported sources, are re-exported to the country of origin.
- Sealed sources may not be treated at incinerators or disposed to landfill sites.
- Unsealed, low level waste can be discharged to sewer with permission or incinerated with infectious waste provided the level of activity falls within the guidelines.

Low-level radioactive waste may be disposed to an infectious waste incinerator, but the following must apply:

- An incinerator operator must have an authorisation to accept such waste and the Department undertakes regular monitoring of the radioactivity levels of incinerator ash.
- For radioactive waste under his control, the holder of an authority (the health care facility) must at all times ensure that:
 - (a) Disposal of radioactive waste to incinerators is restricted to suitable waste, which includes flammable solid waste (excluding sealed sources), animal carcasses, vials containing organic solvents and bulk solvents provided these are acceptable to the incinerator operator;
 - (b) Glass vials with closed metal caps must not be disposed to an incinerator because of the risk of an explosion and the possibility of radioactive glass residue in the slag; the contents of these should be transferred to plastic containers for incineration.
 - (c) The activity per waste package and the total activity disposed of per month must not exceed the specified limits;
 - (d) Short-lived materials not meeting the activity and/or surface dose-rate limits for packages are stored until they have decayed to below the specified limits;
 - (e) Accurate records must be kept of the nuclides and total activity disposed of per month to the incinerator;
 - (f) When disposing of radioactive waste at an incinerator, the holder of the authority or his agent shall liaise with incinerator operators to develop mutually convenient procedures for the receipt and disposal of the waste, which will minimise health hazards:
 - (g) When a package is sent to an incinerator, it must carry the following markings:
 - the warning sign for ionising radiation, information as to the sender,
 - information regarding the mechanism of disposal (i.e. "for incineration"),
 - information as to the radionuclide content and activity,

- a statement that the surface dose rate does not exceed 5 microsievert per hour (0.5 mR per hour),

For discharge to sewer of the low-level radioactive waste under his control, the holder of an authority must at all times ensure that:

- (a) Radioactive waste for disposal to the sewer is restricted to aqueous solutions of radioactive materials and macerated biological material where this is acceptable to the waste water authorities;
- (b) The activity per release and the total activity per month must not exceed the limits specified in the code.
- (c) Accurate records must be kept of the nuclides and total activity disposed of per month via the sewer;
- (d) Release of radioactive waste is confined to one release point for each laboratory;
- (e) At each release point there shall be a visible sign stating that radioactive waste may be released into the sewage system;
- (f) Water to dilute the discharge is flushed before and for at least one minute after the discharge;
- (g) Plumbing personnel are warned of the possible hazard prior to performing maintenance,
- (h) Liquid scintillation counting vials containing chemically toxic organic compounds (e.g. toluene, xylene, etc.) must not be disposed of via the sewer.

10. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be drawn from the current limited study:

- It is clear from the brief survey carried out at hospitals and with the authorities and waste managers that there are considerable problems with the management of healthcare waste in South Africa.
- A lack of training and awareness, limited funds, particularly at the Provincial health care facilities, plus a lack of capacity at the authority level have contributed to the poor state of health care waste management in South Africa.
- While some institutions are managing infectious waste in an acceptable manner, almost none have acceptable procedures and management systems in place for chemical, including pharmaceutical waste, and low level radioactive waste.
- Codes of practice are available in South Africa for the management of infectious and radioactive health care waste and the Minimum Requirements documents published by the Department of Water Affairs and Forestry provide acceptable procedures for chemical waste, but these are not implemented correctly within health care facilities. These only need to be adapted, modernised in parts and integrated in order to provide an acceptable total approach to health care waste management.
- The separation of health care waste into the correct categories followed by implementation of the appropriate treatment and disposal procedures will reduce the exposure of staff of health care facilities, the general public and the environment to the dangers posed by these wastes.
- South Africa requires a network of regional or even local modern treatment facilities for infectious health care waste in order to be able to implement a “best practice” solution.
- In the short to medium term, an interim solution is required that can more safely dispose of infectious waste until a “best practice” solution is implemented.

Recommendations are that:

- An integrated guideline covering the whole management process for all types of health care waste should be developed. This draft starter document has been produced as part of this study.
- The starter documents produced in this study should be used as a basis for a programme of wide consultation with all I&APs.
- Provincial Governments need to undertake a survey to determine the quantities, types and location of all types health care waste within their areas as well as the status of the available treatment and disposal facilities.
- Training and awareness programmes must be developed based on the guidelines and run within all health care facilities.

- Sufficient funding must be made available in order to undertake the required studies and implement the training and awareness programmes.
- An interim, short to medium term solution, to the problem of treating and disposing of infectious health care waste must be developed. It is recommended that the authorities allow disposal onto landfills under well-defined guidelines – see the text and the proposed guidelines in the framework document.

APPENDIX 1: DEFINITIONS OF HEALTH CARE WASTE

A1: The South African Approach to the Classification of Health Care Waste

The Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste, uses as a primary classification scheme the International Maritime Dangerous Goods (IMDG) Code, which has been published as SABS Code 0228. The code divides hazardous materials, in this case hazardous wastes, into nine categories based on their hazardous characteristics, i.e.

- Class 1, Explosives
- Class 2, Compressed Gases
- Class 3, Flammable Liquids
- Class 4, Flammable Solids
- Class 5, Oxidising Substances and Organic Peroxides
- Class 6, Toxic and Infectious Wastes
 - 6.1, Toxic (poisonous) Wastes
 - 6.2, Infectious Wastes
- Class 7, Radioactive Wastes
- Class 8, Corrosive Wastes and
- Class 9, Miscellaneous Dangerous Wastes

Note that infectious waste is a subcategory of Class 6. Other wastes produced in the Health Care Sector include toxic materials such as many pharmaceuticals, drugs and cytotoxic substances; flammable liquids such as ether, alcohol and many formulated products such as cough mixtures; radioactive substances, which are class 7; and compressed gases, which are class 2. Radioactive wastes and infectious wastes are generally managed separately from the other categories, which all classify as chemical hazardous waste, whether they arise from a health care facility or the chemical and petroleum industry.

A2: Definition of Hazardous Waste:

The definition of hazardous waste is defined in the Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste as:

Waste that may, by circumstances of use, quantity, concentration or inherent physical, chemical or infectious characteristics, cause ill health or increase mortality in humans, fauna and flora, or adversely affect the environment when improperly treated, stored, transported or disposed of.

Note that *infectious waste* is considered in this definition as a hazardous waste.

A3: Definition of Infectious Waste:

There are numerous definitions used for infectious waste and after considerable deliberation a modified version of the definition used in the Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste is recommended.

Infectious waste is that waste that contains or is suspected to contain pathogens, bacteria, viruses, parasites or fungi in sufficient concentration or quantity to cause disease in susceptible hosts. It includes any waste that is generated during diagnosis, treatment or immunisation of humans or animals; in research pertaining to this; in the manufacturing or testing of biological agents – including blood, blood products and contaminated blood products, cultures, pathological wastes, sharps, human and animal anatomical wastes and isolation wastes.

The definition is conservative and utilises the Precautionary Principal. Although much of the waste will not be hazardous, the risks posed by its potentially infectious nature are sufficient that it must be considered infectious unless proven otherwise. In South Africa, the waste is classified in terms of SABS Code 0228, “The Identification of Dangerous Substances and Goods” as Class 6.2 Infectious Substances

Within the definition of infectious waste are two subcategories that are sometimes referred to:

Anatomical (Pathological) Waste is waste that consists of tissues, organs, body parts, foetuses and animal carcasses (excluding blood and body fluids, teeth, hair, etc.).

The sub-category, anatomical waste, is a useful one since it is usually managed in different way to other infectious wastes. In terms of the Human Tissue Act, human tissue must be incinerated and because of its generally offensive nature, technologies such as autoclaving and microwaving are not generally appropriate. In South Africa, certain religious customs require the burial of certain items of anatomical waste.

Sharps are items that could cause cuts and puncture wounds and includes needles, hypodermic needles, scalpels and other blades.

Sharps and in particular needles that give rise to “needle stick” injuries are a major health hazard in Health Care facilities.

Infectious waste, such as old bandages, plasters, sanitary towels and babies nappies are often disposed with the general waste. In the UK, this infectious or potentially infectious waste collected from households with the general waste stream is not considered a major problem, because it is generated from a “generally healthy population”. The same approach is generally accepted in South Africa, since like other hazardous waste in general waste, it is usually catered for when the landfill sites are constructed and operated. However, when the potentially infectious waste is collected in increased volumes, such as *sanitary waste* from ladies toilets, in public areas such as large buildings, shopping malls and airports then the risk becomes slightly greater. In South Africa, there are a number of companies providing services that provide storage bins in toilets and a regular collection service. Often these wastes are disinfected with a “proprietary disinfectant”, the bins cleaned and the waste disposed to landfill. There has been no real control over this practice and *it is recommended that South Africa Guidelines developed and Regulations are promulgated to regulate this practice and that practitioners are permitted as waste treatment company in terms of the Minimum*

Requirements. Note that, disinfectants are often highly hazardous in their own right and their disposal to landfills should be controlled. Also, decisions must be made as to whether disinfection of this waste stream is acceptable or sterilisation will be required.

A4: Chemical Waste

The definition of chemical hazardous waste is included in section A3 under hazardous waste, if one excludes the infectious characteristic. Chemical hazardous waste includes any waste that has one or more of the following four characteristics:

- Corrosivity, pH <6 and pH >12
- Reactivity, (explosive, reacts with water, air or other wastes)
- Flammability, Flash Point <61°C
- Toxicity (poisonous)

Toxicity is defined in terms of the following parameters:

- Acute toxicity to mammals (LD₅₀ mg/kg)
- ecotoxicity (LC₅₀, fish, mg/l 96hr)
- chronic toxicity
 - carcinogenicity,
 - mutagenicity,
 - teratogenicity
- biodegradability
- persistency
- bioaccumulation
- concentration and
- assimilation capacity of the environment.

Using these parameters the Minimum Requirements, classifies chemical waste into five hazard groups (HG1, HG2, HG3, HG4, Non-toxic):

Extreme Hazard (Group 1): is waste of first priority concern, containing significant concentrations of extremely hazardous waste, including certain carcinogens and teratogens, such as mercury, dioxins and polychlorinated biphenyls, and infectious wastes.

High Hazard (Group 2): is waste of second priority concern with highly toxic constituents which are not persistent, including certain carcinogens such as arsenic trioxide and benzene.

Moderate Hazard (Group 3): is waste of third priority concern, which is moderately toxic or which contains constituents that are potentially highly harmful to human health or to the environment but are not persistent such as phenol and fluoride.

Low Hazard (Group 4): is waste that often occurs in large quantities and which contains potentially harmful constituents in concentrations that in most instances would

represent only a limited threat to human health or to the environment - ethanol, acetic acid.

Non-toxic - Hazard Rating Lower than Group 4: if the hazard rating falls below hazard rating 1 to 4, the waste can be considered as non-toxic (N/T) and be disposed of as a delisted hazardous waste in a permitted general waste landfill.

Within the definition of chemical waste are a number of subcategories that are sometimes used:

Genotoxic waste has mutagenic, teratogenic or carcinogenic properties.

Note that genotoxic wastes, which include *cytotoxic (or antineoplastic)* drugs, are simply a sub-class of chemical waste and generally fall into the extreme hazard, HG1, and high hazard, HG2, groups.

Pharmaceutical waste includes expired, unused, spilt and contaminated pharmaceutical products, drugs, vaccines and sera that are no longer needed.

This category, which is simply an indication of the source of the waste, is not very useful since it implies to many people that the wastes are somehow different to chemical and other wastes. Whilst some live vaccines and possibly sera must be managed as infectious waste, most pharmaceuticals contain one or more active chemical ingredients that are often toxic plus many other chemicals added to act as a carrier for the drug, to add flavour, etc. Almost all pharmaceuticals must be treated as a hazardous chemical waste.

Compressed gases include gas cylinders, gas cartridges and aerosols.

In general, gas cylinders are not a problem for the health facility as they are recovered by the suppliers, both because they are valuable and in terms of the duty of care. Compressed gases are SABS Code 0228, class 2 wastes. Aerosols should be discarded only when empty and never included in the infectious waste stream since they explode in an incinerator causing rapid expansion of the gas with a transient increase in the emission of particulates and other pollutants and potentially damage the incinerator.

Heavy Metal Wastes includes mercury from broken thermometers, blood pressure gauges and used batteries.

Mercury and its compounds are an extreme hazard, HG1 and must be managed as a chemical hazardous waste.

A5: Radioactive Waste from Health Care Facilities

Radioactive waste, which includes solid, liquid and gaseous wastes, contaminated with radioactive nuclides is generated in health care facilities in two forms, *unsealed* or open sources and *sealed* sources [5,8]. Sealed sources are usually contained in equipment or as needles or seeds that may be re-used after sterilisation for other patients. The disposal procedures for sealed sources differ from those for unsealed sources. Sealed sources are usually disposed at the Atomic Energy Corporation's landfill site at Pelindaba or even re-exported to their country of origin.

Radioactive material is defined [5] as:

“Any substance, which consists of or contains any radioactive nuclide whether natural or artificial and whose specific activity exceeds 74Bq/g (0.002µCi/g) of chemical elements and which has a total activity greater than 3.7kBq (0.1µCi).”

The unsealed sources of radioactive material used in health care facilities usually results in low-level radioactive wastes (<1MBq), but waste in sealed sources may be of fairly high activity. In general, the low-level waste can be disposed with the normal infectious waste stream provided the appropriate controls are in place [5]. However, the treatment of sealed or high level radioactive waste with the infectious waste stream must be avoided particularly when it is to be incinerated, since the ash and even the incinerator can end up being contaminated with unacceptable levels of radioactivity.

The definition of low-level waste is based on the concept of “Annual Limit on Intake” (ALI) and there are different ALI values published for ingestion and inhalation. The ALI_{min} is the lesser of these two values for each radionuclide and a table of values has been published [5]. For both solid and liquid waste the total activity supplied to the disposing facility, i.e. sewer, incinerator or even landfill cannot exceed 10 ALI_{min} per month for each laboratory or corresponding entity and each release to the sewer or package containing solid waste must not exceed 1ALI_{min}.

A6 General Waste from Health Care Facilities

General waste is defined in the Minimum Requirements for Waste Disposal to Landfill as:

“Waste that does not pose an immediate threat to man or the environment, i.e., household waste, builder’s rubble, garden waste, and certain dry industrial and commercial waste. It may, however, with decomposition, infiltration and percolation, produce a leachate with an unacceptable pollution potential”.

Clearly, most of the waste generated within a health care facility is of the general waste type, i.e. kitchen waste, waste from offices, packaging etc. and one of the key management problems is to ensure that the general waste stream does not receive infectious, chemical or even radioactive hazardous waste. Conversely, if the infectious waste stream receives too much waste that is not infectious and that could be disposed with the general waste stream, the costs for treatment and disposal rise considerably. Separation of these two waste streams is extremely important.

It must be recognised that the General Waste stream emanating from households and even health care facilities contains small amounts of chemical hazardous waste such as paint, oil and pesticides and infectious hazardous waste, such as old bandages, plasters, sanitary napkins and babies nappies. While under ideal circumstances, chemical waste should be separated at source and collected separately, as happens in a number of first world countries, it is unlikely that this will happen for many years in South Africa. However, landfills permitted in terms of the Minimum Requirements for Waste Disposal to Landfill are constructed and operated on the premise that the waste does contain these low amounts of hazardous wastes.

APPENDIX 2: DEFINITIONS OF STERILISATION AND DISINFECTION

The definitions of sterilisation and disinfection given below are based on those published by the Centre for Disease Control in Atlanta, Georgia [8]:

Sterilisation is a process that reduces the number of microorganisms by a factor of one million (10^6 or more than 99.9999% are killed).

High-level disinfection is when all microorganisms with the exception of small numbers of bacterial spores are killed.

*Intermediate Level Disinfection is where *Mycobacterium tuberculosis*, most viruses and fungi are killed, but not necessarily bacterial spores.*

Low Level Disinfection is where most bacteria, some viruses and some fungi are killed, but the complete absence of resistant microorganisms such as tubercle bacilli or bacterial spores cannot be relied on.

Note that although sterilisation implies the complete absence of any microorganisms, the definition allows the presence of small numbers of microorganisms. For disposal purposes, sterilisation is an ideal that should be achieved, if possible. *However, there may be circumstances where disinfection or possibly even no treatment could be acceptable, before disposal.* These