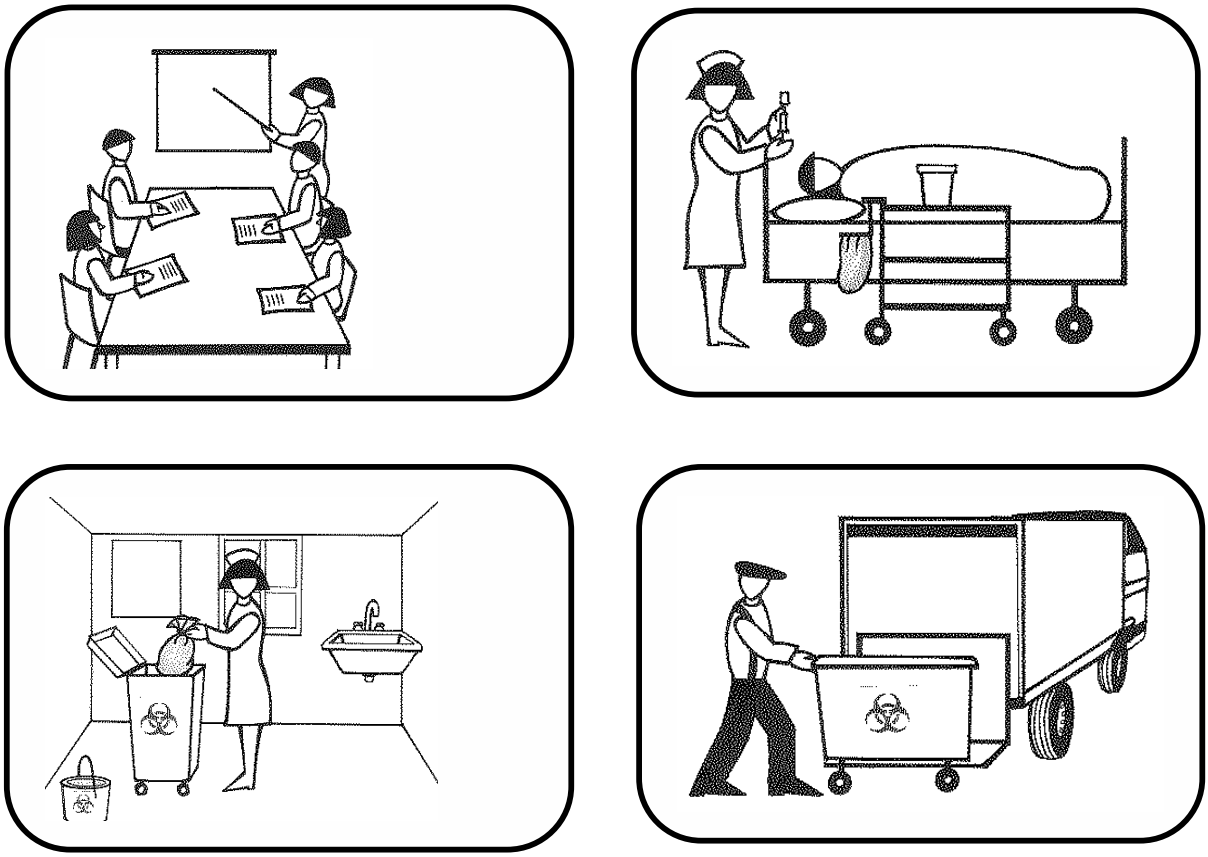
D A C E L

Guidelines for Sustainable Health Care Waste Management

D R A F T

September 2002

Guidelines
on Sustainable Health Care Waste Management in Gauteng



Department of Agriculture, Conservation, Environment and Land Affairs &
Department of Health, Gauteng

September 2003

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on Sustainable Health Care Waste Management in Gauteng

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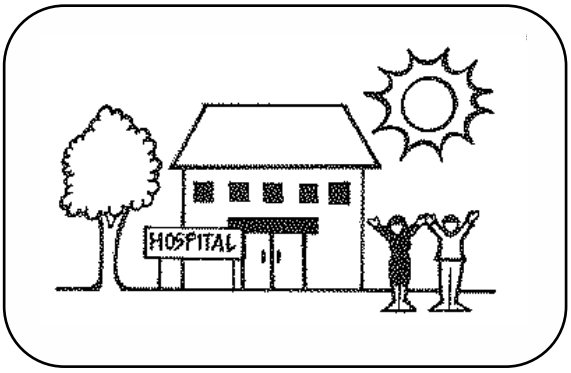
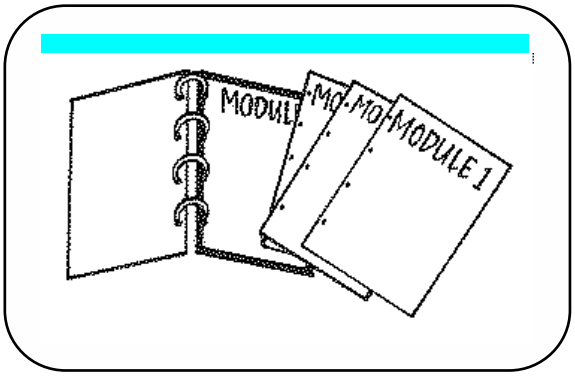
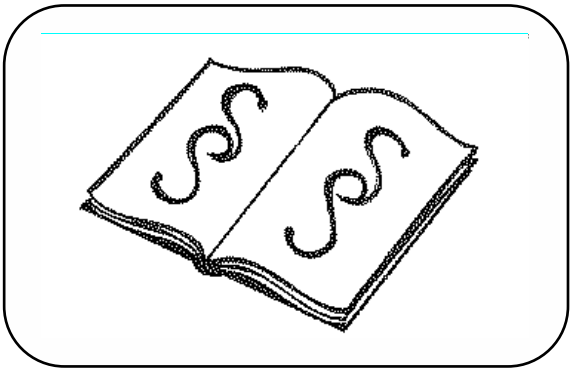
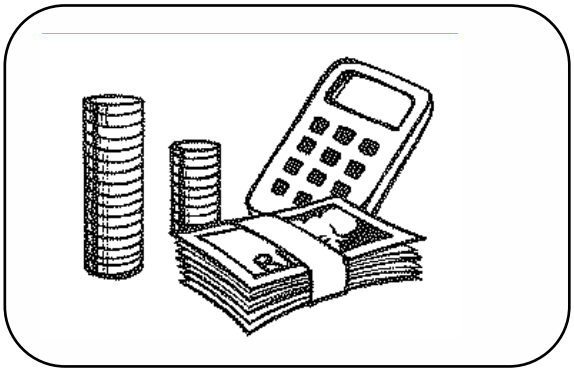








1. Module 1: General Introduction

1.1 Objectives of the Guidelines

Health Care Waste poses special environmental and health risks to the staff of health care facilities, to the patients and visitors, to workers collecting, transporting and treating the waste as well as to the society in general, thus requiring special efforts by the people involved to ensure responsible management of the HCW.

In meeting its constitutional responsibilities to ensure that every South African lives in an environment that is not harmful to his/her health or well being, the Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (DACEL) together with the Gauteng Department of Health (DOH) have embarked on a comprehensive programme to improve the standard of Health Care Waste Management. Preparation of these Guidelines is included in the project Sustainable Health Care Waste Management in Gauteng that forms part of this process.

The objective of these Guidelines is to empower managers and supervisors at health care facilities to be able to improve the standard of health care waste (HCW) management. Through planning and implementation of sound HCW management systems the purpose is to eliminate risk to the health and safety of people, whilst at the same time resulting in the smallest possible impact on the environment and reducing costs.

1.2 Background and Reasons for Action

The modern health care sector generates growing amounts of Health Care Waste (HCW), including both Health Care Risk Waste (HCRW) that present special health and environmental risks, as well as Health Care General Waste (HCGW) that can be considered to be similar to general waste.

The special risks associated with HCRW can be summarised as follows:

The infectious parts of the HCW present a risk of spreading infection if not handled properly;
Sharp and pointed waste, e.g. needles, scalpels, and broken glass, may cause injuries including abrasions to the skin;

- Used chemicals and outdated pharmaceuticals pose a health and environmental risk if not handled, treated and disposed of properly;
- Treatment of HCRW, as well as the decomposition of some already treated HCRW, may emit environmentally harmful substances to the atmosphere or other media, requiring that the emissions be reduced as much as possible;
- Pathological HCRW not properly controlled and managed, could be obtained illegally for people not authorised to handle the items, which creates strong opposition from the public;

Untreated HCRW or residuals of treated HCRW disposed of at landfills may generate leachate that can pollute both the surface and groundwater as well as the surrounding soil, if the landfills are not operated properly;

There are several good reasons for improving the standard of HCW management in Gauteng, which are among others:

Improving the occupational health and safety conditions for the waste management workers responsible for handling of the waste;
Protecting the health and safety of patients, visitors and staff at health care facilities;
Improving the environmental protection through sound treatment and disposal;
Meeting legislative requirements;

Saving money spent on costly containerisation, transport and treatment of HCRW by improving segregation, thereby only handling what is strictly needed as HCRW and letting the bulk of the waste be handled at a considerably cheaper rate as HCGW;

Improving the morale of the staff at health care facilities;

Improving the service delivery of the health care sector and the industry affiliated with the sector in terms of its commitment to comply with the "duty-of-care" principle.

1.3 Scope of the Guidelines

The Guidelines focus on health care risk waste (HCRW), but the management of the other components of HCW generated at health care facilities such as liquid waste, radioactive waste and HCGW, will be mentioned where its handling is closely related to the handling of HCRW.

Although the Guidelines are primarily developed for the Gauteng Province, it would to a large extent not only be appropriate for other South African provinces, but also to neighbouring countries on the subcontinent.

1.4 Who should read What

The Guidelines are primarily directed towards management and other key personnel, whilst also presenting information that is useful for other groups of employees, e.g. operational staff of health care facilities, including the various types and sizes of hospitals and clinics, affiliated laboratories, etc. In addition to these institutions the Guidelines will also be of value to companies and facilities that specialises in handling, transport, treatment and disposal of HCRW. Finally, the Guidelines may also be useful for officials from authorities that are responsible for environmental as well as performance monitoring of HCRW related activities.

The Guidelines are structured to consist of a number of specialised Modules, each providing relevant information directed towards various targets groups within the health care sector. Module 1 - this Module – comprises of general information that is considered to serve as a general introduction to the Guidelines and should therefore be read by all the target groups, before continuing to the relevant specialised Modules, Modules 2- 7.

Table 1.1 below shows in brief the contents of the eight Modules, together with recommended target groups to whom it would apply.

Table 1.1: Readers guide – who should read what

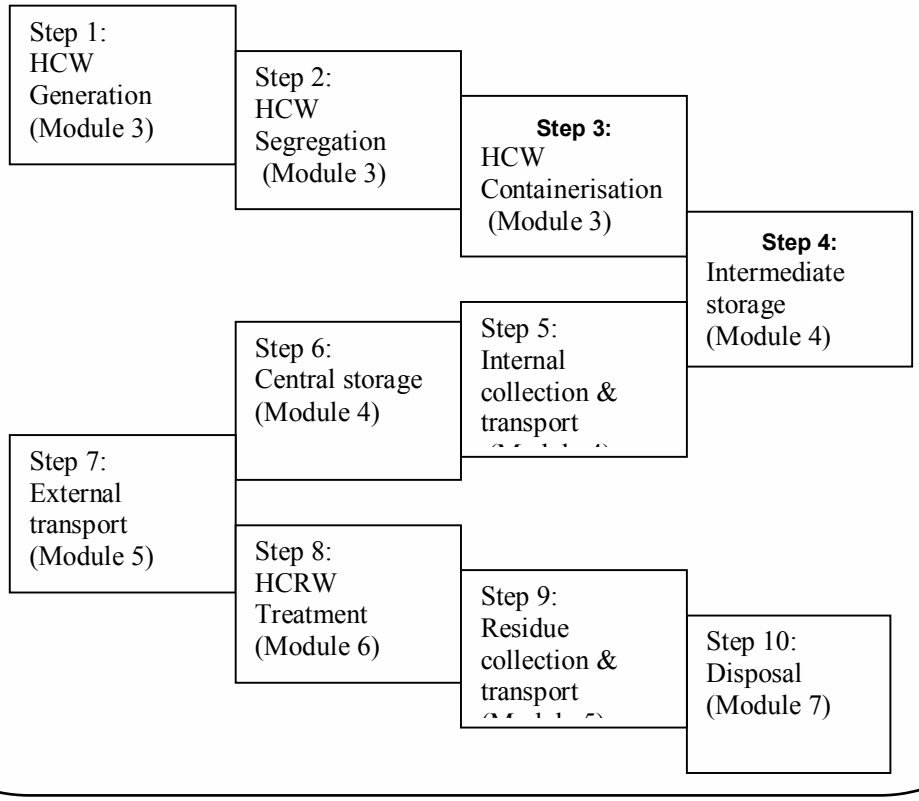
MODULE	CONTENT	MAIN Target groups
Module 1	General introduction to the Guidelines, including: • Overview of other modules • **Readers guide** • Definition of waste categories • Basic data and cost estimates • Overview of legislation • List references, abbreviations & glossary.	All.
Module 2	Recommendations on how to organise an improved HCW management system. Issues related to decision makers at HCF's.	Senior managers and other managers at HCF's, managers at service providers, as well as Environmental and Occupational Health and Safety Officers at HCF's.

MODULE	CONTENT	MAIN Target groups
Module 3	Recommendations on how to reduce the HCW generation, as well as improve HCW segregation and containerisation.	Managers and supervisors at HCF's with duties related to HCW segregation and HCW Management in general.
Module 4	Recommendations on the internal collection, transport and storage of HCW.	Managers and supervisors with duties concerning internal waste handling, as well as Environmental and Occupational Health and Safety Officers at HCF's.
Module 5	Recommendations on the collection and transport of HCRW for treatment and transport of residues to landfills.	Managers and supervisors responsible for transport of waste, typically service providers.
Module 6	Recommendations on various options available for treatment of HCRW with emphasis on environmental aspects.	Managers and supervisor at treatment facilities as well as managers and environmental officers at HCF's.
Module 7	Recommendations on proper handling of HCGW and treated HCRW residues at landfills with emphasis on environmental aspects.	Managers and supervisor at landfill as well as managers and environmental officers at HCF's.

1.5 The Flow of Health Care Waste

All HCW will pass through a number of different stages from generation at the health care facilities to its treatment/final disposal (from-cradle-to-grave). The diagram in Box 1.1 below illustrates the principles of the HCW flow path that is applied in these Guidelines.

Box 1.1: The Flow path of Health Care Waste



The diagram illustrating the HCW flow path is used in each of the following Modules of the Guidelines to indicate the steps that are considered in that particular Module. The different steps of the HCW flow path can be described as indicated in table 1.2 below.

Table 1.2: The Cradle to Grave of Health Care Waste Management

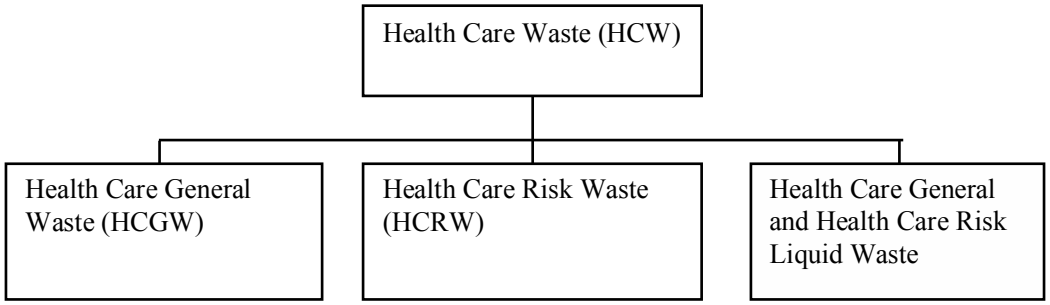
Step 1: Health Care Waste Generation	HCW generation is the activity that will, in the process of rendering health care services, result in the formation of both HCGW as well as HCRW.
Step 2: Segregation	Segregation is the systematic separation at the point of generation of HCW into HCGW and HCRW, after which it is further separated into subcategories as described in Module 4 below.
Step 3: Containerisation	Containerisation is the physical activity of placing the segregated HCW in dedicated containers designed for the various HCW fractions, including the sealing and marking of the containers for further handling along the HCW flow path.
Step 4: Intermediate Storage	Intermediate storage is the placement of the containerised HCW in suitable locations within the health care facility where isolation, and health protection as well as human control (e.g. limitation of access) are provided, with the intention of near future retrieval of the waste for treatment and disposal.
Step 5: Internal Collection and Transport	Internal collection and transport is the action whereby HCW is removed from the intermediate storage areas (or points of generation where no intermediate storage facilities exists), for transport to the central storage area or onsite HCRW treatment facility, should treatment be done on site.
Step 6: Centralised Storage	Centralised storage is the placement of HCW in a suitable location outside, but within the boundaries of the health care facility where isolation, environmental and health protection, as well as human control (e.g. monitoring for radioactivity, limitation of access, etc.) are provided, with the intention of future retrieval of HCW for treatment and/or disposal. The central storage area will serve all potential sources of HCW within that particular health care facility.
Step 7A: External Collection and Transport of HCRW	External collection and transport of HCRW is the loading and removal of HCRW from central storage areas by means of suitable designed for transport to the point of treatment outside of the boundaries of the health care facility. This step of the HCW flow path does not apply where the HCRW is treated on-site.
Step 7B: External Collection and Transport of HCGW	External collection and transport of HCGW is the loading and movement of HCGW by means of municipal or private waste collection trucks from the point of external storage, to the general waste disposal site.
Step 8: Treatment	Treatment of HCRW is any method, technique or process for altering the biological, chemical or physical characteristics of HCRW to reduce the hazards it presents and facilitate, or reduce the costs of disposal. Typical HCRW treatment methods are incineration, steam sterilisation and microwave inactivation.
Step 9: Collection and Transport of Treated HCRW Residues	Collection and transport of residues from HCRW treatment facilities is the loading and movement of treated HCRW by means of suitable designed vehicles from the point of treatment, to the final disposal at an appropriately permitted waste disposal facility.
Step 10: Disposal of HCGW or HCRW Residues	Disposal of residues is the intentional burial or deposit of residues from HCRW treatment processes or untreated HCGW at an appropriately permitted, designed, constructed and operated waste disposal facility.

1.6 Definitions of Health Care Waste Types

The Guidelines cover all categories of HCW generated at health care facilities, but special emphasis is put on the HCRW, as this posses the greatest environmental and health risks. HCGW is only taken into consideration from its generation, through segregation to containerisation. Animal carcasses, other than those used for research purposes, are not included. The radioactive waste is addressed by the National Nuclear Regulator Act, 1999 (Act 47 of 1999), and is handled according to this specific regulation. Hence, the handling of radioactive only interferes to a limited extend with other categories of HCW generated at health care facilities. Likewise, liquid waste is to a great extend discharged together with other wastewater, that is covered by its specific regulation.

The HCW stream can be divided into HCGW and HCRW as well as liquid and radioactive waste as indicated in Box 1.2 below.

Box 1.2: Primary division of Health Care Waste

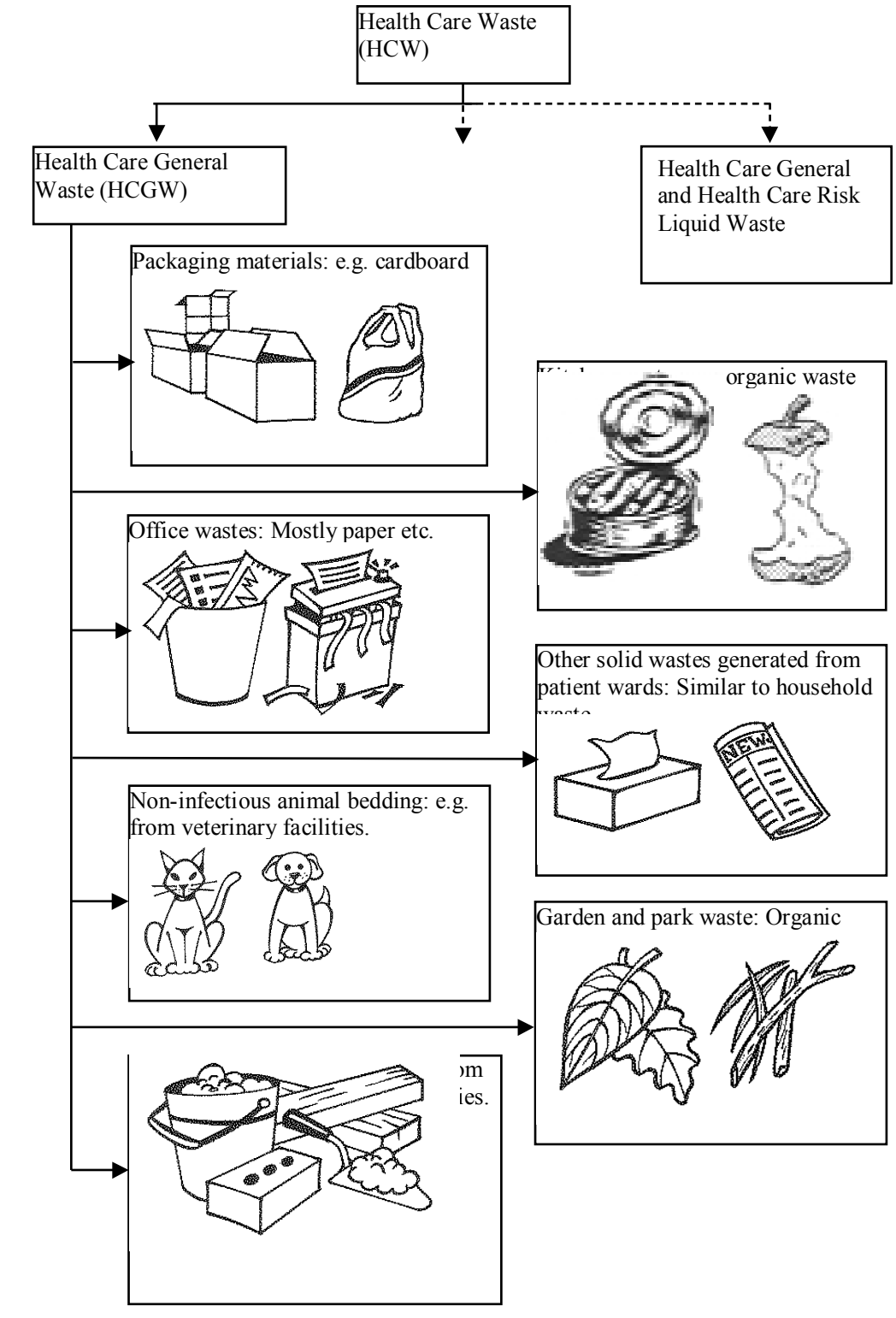


1.6.1 Health Care General Waste

HCGW is the non-hazardous component of HCW that includes many substances similar to general waste, but could also include certain non-infectious and non-hazardous liquids. (See Box 1.3 below). HCGW is generated among others during the administrative and housekeeping functions of health care facilities as well as by patients and visitors. HCGW may include a number of recyclable materials. HCGW generated at health care facilities forms part of the overall HCW management plan.

All HCW generated in isolation wards and TB wards are to be treated and disposed of as HCRW, irrespective of the waste characteristics.

Box 1.3: Examples of Health Care General Waste



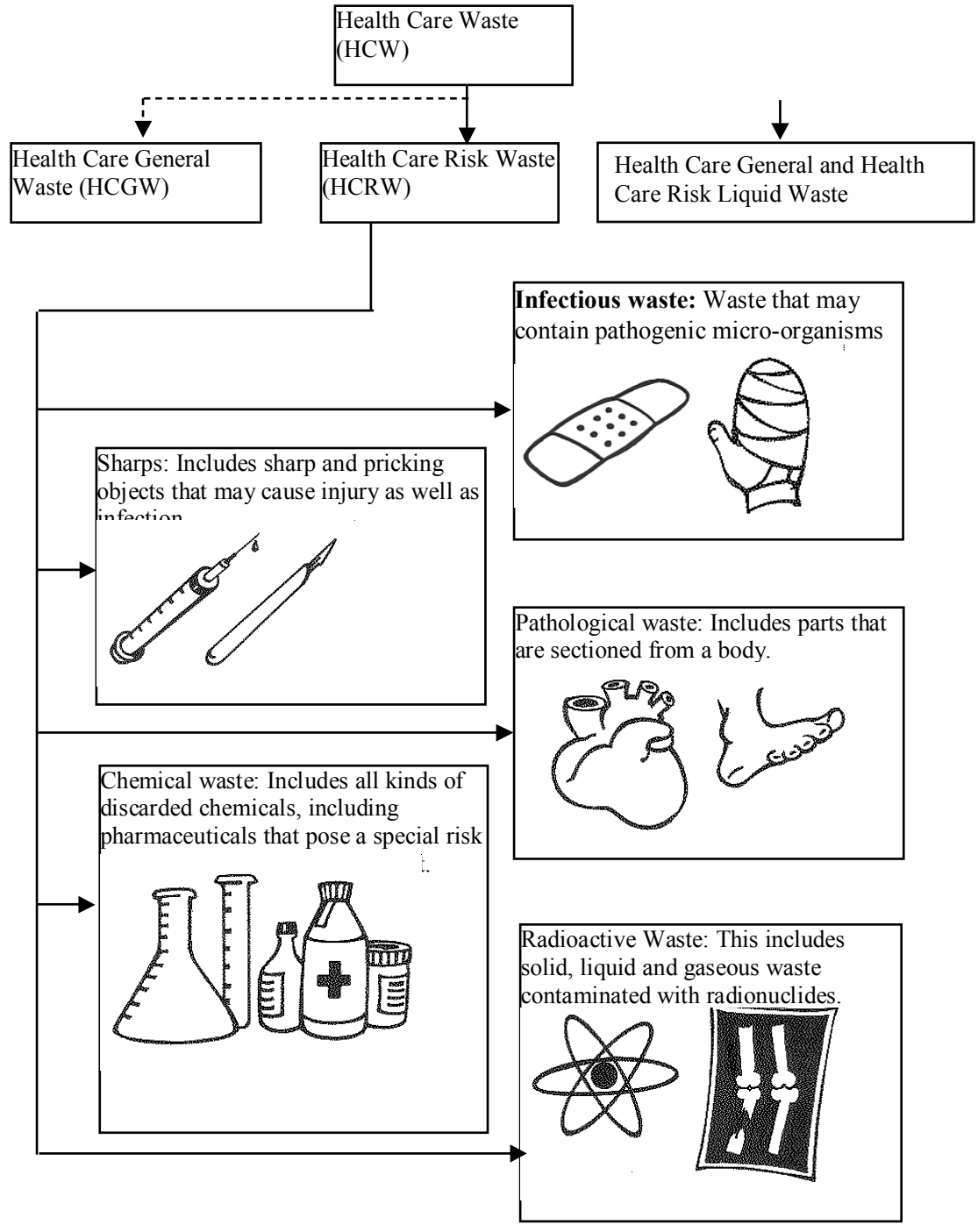
1.6.2 Health Care Risk Waste

HCRW represents the hazardous component of HCW generated at both large and small health care facilities. HCRW has the potential for creating a number of environmental, health and safety risks, depending on the particular type of HCRW that is handled as well as the way in which exposure takes place.

In Box 1.4 the five different categories of HCRW are defined and examples of the most commonly found components are presented. Liquid waste is in this guideline defined as any liquid waste that is discharged to the sewer system, e.g. via washbasins, sluices, drains etc.

Three of the components of HCRW may be infectious (infectious waste, pathological waste and sharps), but since pathological waste and sharps have additional features, it constitutes a separate category. HCRW further includes infectious or hazardous liquids, which may under certain conditions be disposed of to sewer.

Box 1.4: Examples of Health Care Risk Waste (redrawing needed !!!!)



1.6.3 Radioactive Health Care Wastes

The health care sector is one of the major users of radioactive substances. Due to its particular characteristics, the radioactivity, radioactive substances and waste containing radioactive substances can affect both human health and the environment, and hence the materials has to be handled with special precaution. For the same reason special legislation on radioactive substances as well as waste containing radioactive substances has been put into force.

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 radioactive material is defined as (ref. 10):

> "Any substance, which consists of or contains any radioactive nuclide, whether natural or artificial, and whose activity exceeds 74Bq/g (0.002 μCi/g) of a chemical element and has a total activity of greater than 3.7kBq (3700Bq, 0.1 μCi)."

Most of the radioactive waste commonly generated by nuclear medicine is defined as low-level radioactive waste. A substance is classified as low-level radioactive material when the radioactive activity is within defined limits, which are based on the Annual Limits of Intake, ALI for specific radioisotopes. ALIs are limits that are based on a recommended annual dose limit of 20mSv for radiation workers and the values differ not only for different isotopes but also for the pathway, i.e. ingestion and inhalation: in terms of the precautionary principle, the lowest value of the two, i.e. the ALI_{min} is used (ref. 10).

The most common unsealed sources from medical facilities contain species such as tritium, ^{3}H; carbon–14, ^{14}C; iodine, ^{123}I, ^{125}I; and phosphorus, ^{31}P. Low-level radioactive waste includes items that have become contaminated with radioactive material, or have become radioactive through exposure to neutron radiation. Examples of low-level radioactive waste include:

Solid waste such absorbent paper, swabs, glassware, syringes and vials,
Residues or unwanted solutions used for diagnostic or therapeutic use,
Liquids immiscible with water, such as liquid scintillation-counting residues, pump oil, etc.
Wastes from spills and from decontamination of radioactive spills,
Excreta from patients treated or tested with unsealed radionuclides,
Low-level liquid radioactive waste, e.g. from washing of apparatus, and
Gases and exhausts from stores and fume cupboards.

Radioactive materials of higher activity are normally used as sealed sources and can contain isotopes such as cobalt, ^{57}Co, caesium, ^{137}Cs; gold, ^{198}Au; radium, ^{222}Rd; and radon, ^{226}Ra. These isotopes which have longer half-lives are used in therapy, e.g. in cancer treatment. These wastes are generated in low volumes and usually only from the larger medical and research laboratories.

The handling of radioactive waste is further described in Section 3.9 in Module 3, and the treatment of the waste is presented as Section 6.12 in Module 6.

1.6.4 Liquid Waste

Liquid wastes generated at HCFs includes:

- Faeces and urine samples
- Faeces and urine collected from patients (urine bags, stoma bags)
- Termination of pregnancy residues
- Blood and blood products
- General effluents from toilets, kitchens, laundries, etc.
- Rinsing liquids from dialyses, etc.
- Disinfecting and cleaning solutions
- Liquids/effluents from laboratory equipment (autoanalysers etc.)
- Laboratory chemicals
- Solvents
- Liquid pharmaceuticals
- Oil and

- Radioactive liquids.

The liquid wastes listed above fall into three major categories:

Infectious and possibly infectious waste, i.e. items 1 to 5
Effluents that are chemically or possibly chemically hazardous, i.e. items 5 to 12, and
Radioactive waste, i.e. item 13

The main disposal options for liquid wastes include discharge to sewer, incineration and direct disposal to landfill. For further details on disposal of liquid waste, see section 3.10 in Module 3.

1.7 Description of Sources of Health Care Waste

The primary sources of HCW are hospitals and clinics and with laboratories, while general practitioners, dentists etc. are smaller primary sources. Furthermore, limited amounts of HCRW are generated by for example old age homes, residential properties, etc. However, there are considerable characteristic and qualitative differences between HCW being generated by the different health care facilities. While the smaller health care facilities (like e.g. primary health care clinics) only generate some of the above-mentioned categories of HCRW, the larger hospitals usually generates all categories of HCRW.

The sources can be divided into two distinct groups, major and minor HCW generators, based on its contribution towards the overall HCRW stream. See Box 1.5 below.

Box 1.5: Definition of Major and Minor HCRW Generators:

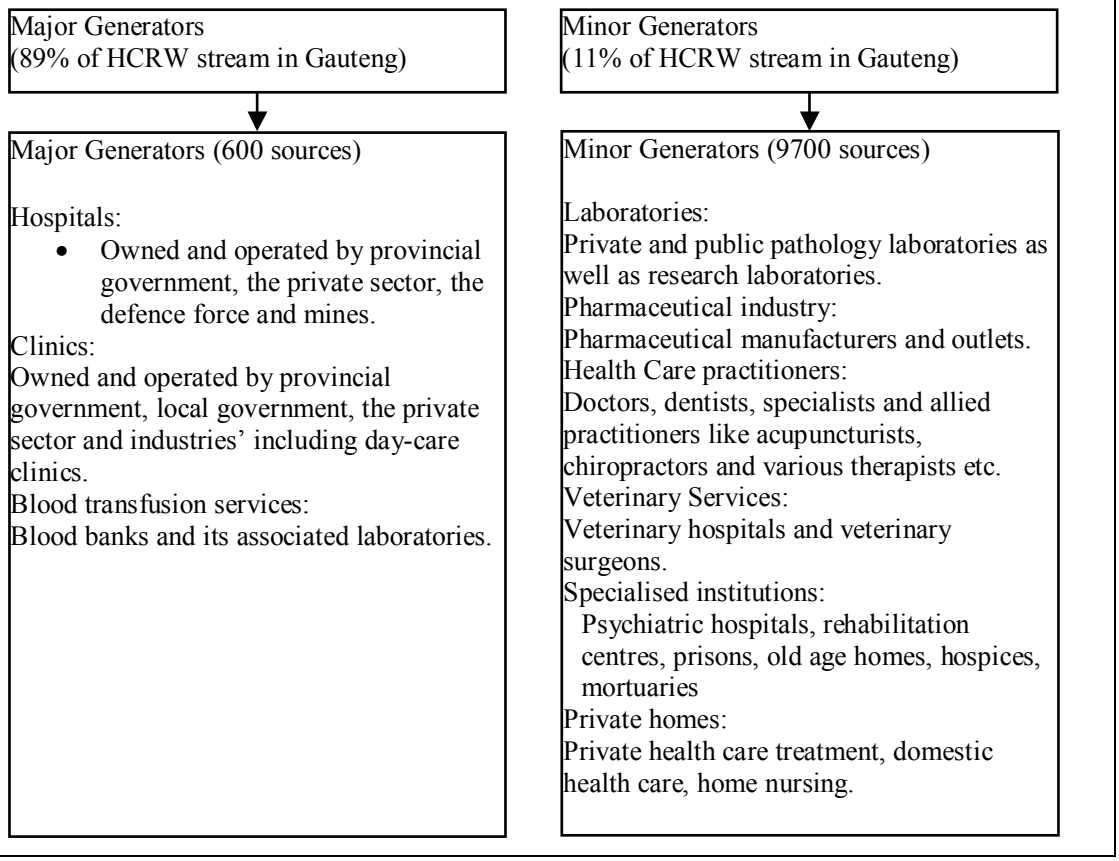
For the purpose of these Guidelines, the following definitions will apply:

Major generators: Health Care Facilities or similar generating more than 10 kg of HCRW per day (cf. Box 1.6 for examples)

Minor generators: Health Care Facilities or similar generating up to 10 kg HCRW per day (cf. Box 1.6 for examples)

In Gauteng, some 600 existing major sources of HCRW were found to generate in the order of 89% of the overall HCRW stream, whilst about 9 700 minor sources of HCRW were found to generate in the order of 11% of the HCRW stream (Status Quo Report, 2000, ref. 1). The HCRW sources were identified to be as presented in Box 1.6 below.

Box 1.6: The HCRW Generators



With the "duty-of-care" principle being entrenched in the National Waste Management Strategy (NWMS), health care facilities have the primary responsibility of ensuring that the HCW generated at the respective facilities, is treated and disposed of in an environmentally sound manner, whilst meeting the relevant occupational health and safety requirements.

1.8 Basic Data on Health Care Waste in Gauteng

The amounts of HCW generated within any particular area, is the basis for the development of any strategic plan. Although the amounts of HCGW generated at any health care facility will be significantly larger than the amounts of HCRW, the environmental as well as the occupational health and safety risks associated with HCRW will be significantly bigger than that of HCGW. The standards set for the management, treatment and disposal of HCRW is therefore significantly higher than that of HCGW.

1.8.1 Estimated Waste Quantities

In the year 2000 a survey was conducted to measure and calculate the amounts of HCRW generated at various types of health care facilities (Status Quo Study. ref. 1). The results of the survey are summarized in table 1.4 below.

Table 1.4: Summary of results from a HCRW survey conducted as part of the Status Quo Study for Gauteng, 2000.

Type of Health Care Facility	Ownership	Monthly HCRW mass (tonnes/month)
Hospitals	Public	430
	Private, mining & military	460
	Total amounts for hospitals	890
Clinics	Public	150
	Private	11
	Total amounts for clinics	161
Minor HCRW sources	Private	130
	Grand total for health care facilities in Gauteng	1 181

1.9 How Much does it cost

The total cost of health care waste management is made up of a number of elements, which includes capital investment as well as operational costs.

The capital investments in durable items typically include the following elements:

Equipment for waste collection (reusable containers, specially equipped nursing trolleys and racks for waste bags etc.)
Equipment for internal transport (trolleys etc.)
Storage rooms (intermediate and central storage rooms, technical installations)
HCRW treatment plant and equipment where treatment is undertaken onsite;
Vehicles and equipment for offsite transport of untreated/treated HCRW and HCGW where service is rendered in-house.

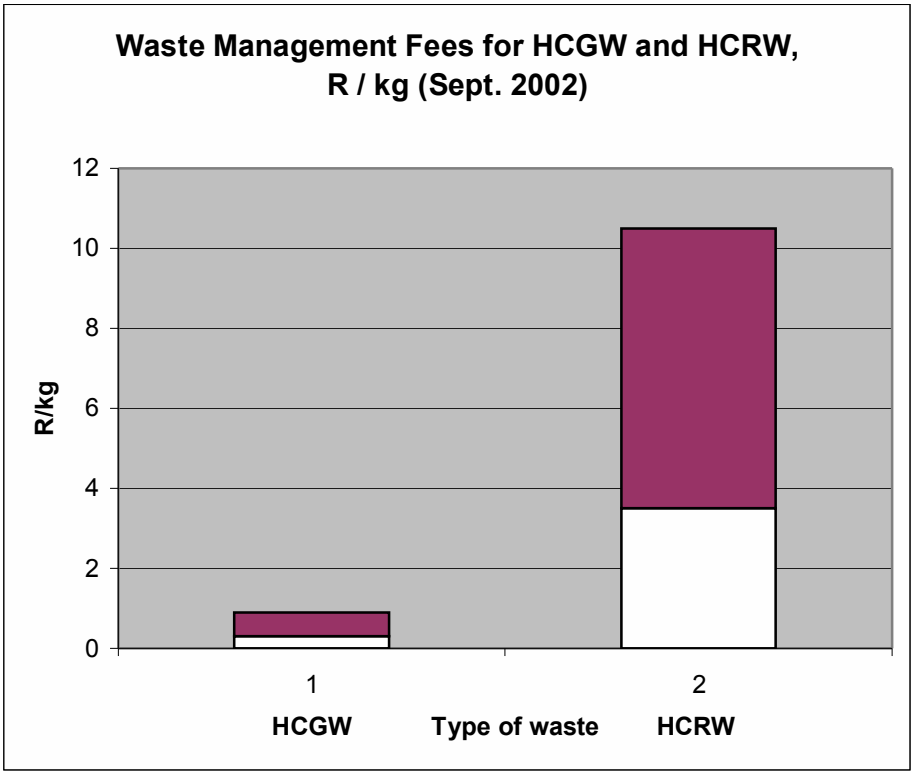
The operational cost elements typically include:

- Labour cost for segregation, containerisation and internal waste collection;
- Labour cost for operation of the treatment plant where the service is rendered onsite;
- Labour cost for offsite transport where the service is rendered in-house;
- Personal Protective Equipment (PPE) for all HCW workers;
- Consumption of waste bags, boxes and disposable containers;
- Consumables for HCRW treatment where rendered onsite;
- Consumables for offsite transport where service is rendered in-house;
- Cost of disposal of treated HCRW where undertaken onsite and HCGW where service is rendered in-house;
- Maintenance of all capital equipment;
- Waste collection, treatment and disposal fee where services are outsourced;
- Training of staff (initially and recurrently);
- Information materials (initially and recurrently).

Due to the increased environmental as well as occupational health and safety risks associated with the transport, treatment and disposal of HCRW, the fees for HCRW management are significantly higher than for HCGW. Typical management fees for HCGW are between R 0.30 /kg and R 0.60 /kg., including collection, transport and disposal. The fees for HCRW management fees typically range from R 3.50 /kg to R 7.00 /kg, including the supply of containers, collection, transport and treatment

of the waste and disposal of residues (all costs exclude VAT.), see Box 1.7 below. Internationally typical treatment fees for HCRW are in the range of R1.50 /kg –R 2.50 /kg excluding containerisation and transport.

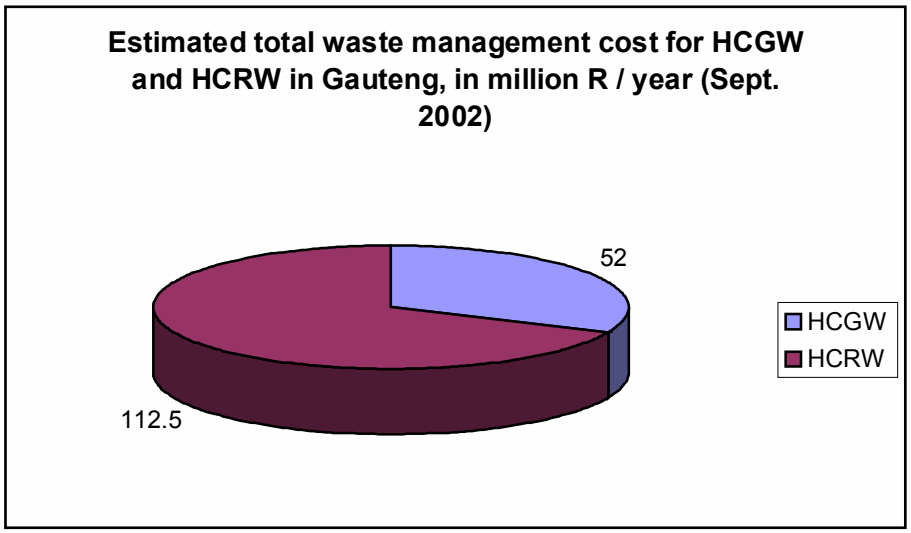
Box 1.7: Ranges of waste management fees for HCGW and HCRW



As indicated, there are major differences in the management fees respectively for HCRW and HCGW, and a wide range of management fees for HCRW. Hence, there seems to be considerable potential for savings by avoiding HCGW being disposed of as HCRW.

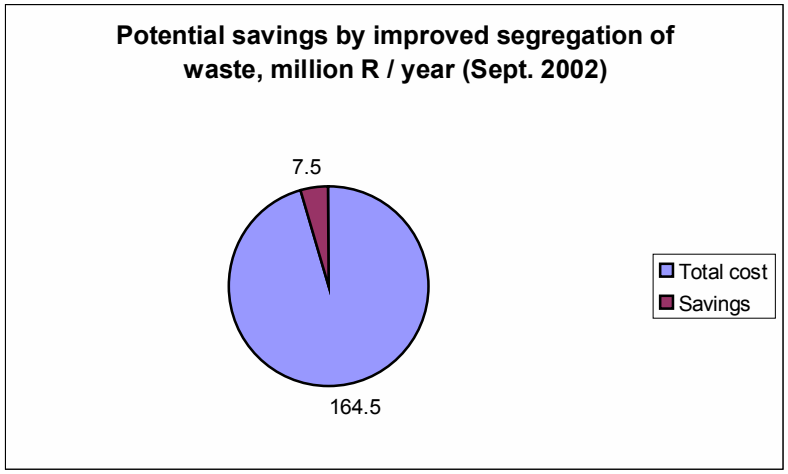
It has been estimated that the total cost of collection, transport, treatment of disposal of HCRW for all HCF in Gauteng amounts to about 52 million Rand per year, while the equivalent cost for HCGW has been estimated to be between 45 and 180 million Rand per year, see Box 1.8 below.

Box 1.8: Ranges of waste management fees for HCGW and HCRW



It is assumed that cost of HCRW disposal can be reduced through improved HCW segregation, which means that non-hazardous elements are moved from the HCRW to the HCGW categories. If it is possible to move e.g. 15% of the present amounts of HCRW to the HCGW category there is a potential for saving 7-8 million Rand per year, see Box 1.9 below.

Box 1.9: Potential savings by improved waste segregation



1.10 Regulation

This section includes a brief introduction to current regulations related to HCW Management. Table 1.5 below contains a list of regulations etc. that makes up the regulatory framework for HCW Management in South Africa that will, in the absence of any provincial legislation, also apply to Gauteng. For each regulation the following aspects are summarised:

The title of the regulation
Brief summary of the content of the regulation that is related to HCW Management

The party primarily responsible for enforcement
The target groups for reading
The Guideline module the regulation refers to.

The regulation is divided into the following categories:

Overall regulation (The Constitution, strategies, policies)
Laws, both national and regional
Guidelines and standards.

Table 1.5: List of overall regulation (The Constitution, strategies and policies) related to health care waste management.

Regulation TO BE REVIEWED BY LEGAL EXPERT	Contents TO BE REVIEWED BY LEGAL EXPERT	Responsible party TO BE REVIEWED BY LEGAL EXPERT	Target groups and Modules
The Constitution, Act 108 of 1996	States the right of a clean environment and access to affordable health care services for all South African citizens.	All authorities	Everybody; Module 1
White Paper on Integrated Pollution and Waste Management (IPWM), year ?	Establishes the principles for environmental activities, e.g. waste management.	National Department of Environmental Affairs and Tourism (DEAT)	Management at HCFs and treatment plants; Module 1
National Waste Management Strategy, year ?	Sets the framework for new initiatives within waste management nation wide	National Department of Environmental Affairs and Tourism (DEAT)	Management at HCFs and treatment plants; Module 1
Environmental Policy on Waste Disposal, year ?	Sets the framework for new initiatives for HCW Management at health care facilities ?	National Department of Health (NDOH)	Management at HCFs, treatment plants and transporters; Modules 1 -7
Health and Safety Policy 1.24 – Medical Waste Control, year ?	Establishes the overall framework for HCW Management at health care facilities ?	National Department of Health (NDOH)	Management at HCFs, treatment plants and transporters; Modules 1 -7
Infection Control Policy No 24 – Disposal of medical waste, year ?	Establishes the overall framework for disposal of HCRW ?	National Department of Health (NDOH)	Management at HCFs, treatment plants and transporters; Module 7
Infection Control Policy No 33 – Disposal of Human Tissue, year ?	Sets overall policy for management pathological waste ?	National Department of Health (NDOH)	Senior and middle management, Modules 1- 6
Infection Control Policy – How to deal with a blood spill, year ?	Gives practical guidance to prevent and to clean after blood spill ?	National Department of Health (NDOH)	Middle management, Modules 2 - 6
Health and Safety Policy – Recycling Policy, year ?	Sets overall policy for recycling of equipment and waste materials at health care facilities ?	National Department of Health (NDOH)	Management at HCFs; Modules 1- 6

Health and Safety Policy – Hazardous Chemical Spill, year ?	Gives practical guidance to prevent and to clean after spill of hazardous chemicals ?	National Department of Health (NDOH)	Management at HCFs, treatment plants and transporters; Modules 1- 6
Presmed Infection Control Policy – G4.1 year ?	????	National Department of Health (NDOH)	????

Table 1.6: List of national laws related to health care waste management.

Regulation	Contents TO BE REVIEWED BY LEGAL EXPERT	Responsible party TO BE REVIEWED BY LEGAL EXPERT	Target groups and Modules TO BE REVIEWED BY LEGAL EXPERT
Atmospheric Pollution Prevention Act 45 of 1965	Sets the standards for emission of pollutants to the atmosphere, e.g. from HCRW treatment plants	National Department of Environmental Affairs and Tourism (DEAT)	Management at HCF's and treatment plants; Module 2 & 6
Environment Conservation Act 73 of 1989			
Hazardous Substances Act 15 of 1973			
Health Act 63 of 1977			
Human Tissue Act 65 of 1983			
National Environmental Management Act 107 of 1998			
National Road Traffic Act 93 of 1996			
National Water Act 36 of 1998			
Nuclear Energy Act 46 of 1999			
Occupational Health and Safety Act 85 of 1993			
Medicines and Related Substances Control Act, 1965 (Act 101 of 1965);			
National Nuclear Regulator Act, 1999 (Act 47 of 1999)			
Minimum Requirements for Handling, Classification and Disposal of Hazardous Waste			
Minimum Requirements for Waste Disposal by Landfill			

The "Minimum Requirements for Classification, Handling and Disposal of Hazardous Waste" as well as the "Minimum Requirements for Waste Disposal by Landfill" are in itself not acts, but adherence thereto is enforced through the "Environmental Conservation Act, 1989 (Act 73 of 1989)".

In the context of future South African legislation, it is likely that national legislation will be the framework legislation setting minimum norms and standards which must be complied with by all spheres of government, while provincial and municipal legislation will address specific and technical issues pertinent to regional and local requirements, respectively.

Table 1.7: List of regional laws and local regulation related to health care waste management.

Regulation TO BE REVIEWED BY LEGAL EXPERT	Contents TO BE REVIEWED BY LEGAL EXPERT	Responsible party TO BE REVIEWED BY LEGAL EXPERT	Target groups and Modules
Gauteng legislation on HCW Management …..	……..		
Gauteng legislation on HCW Management …..	……..		
Gauteng legislation on HCW Management …..	……..		
Waste management related By-laws of Johannesburg, Tswane, etc	……..		

Table 1.8: List of guidelines and standards related to health care waste management.

Regulation	Contents	Responsible party	Target groups and Modules
Guidelines on emission standards for incinerators ? year ?	Sets standards for emission of pollutants from incinerators plants	DACEL	
SABS Code of Practice on Hazardous Substances Code 0228			
SABS Code of Practice for the Handling and Disposal of Waste			

Materials within Health Care Facilities – SABS 0248:1993; (being revised 2002)			

As the SABS Code 0248 (1993) for the Handling and Disposal of Waste Materials within Health Care Facilities is in the process of being revised during 2002, there is a risk of contradictions in standards between the various specifications and guidelines being developed. Ongoing communication and interaction between the parties responsible for the development of the respective documents is however intended to prevent any contradictions and to ensure uniformity in the standards laid down for HCW management in Gauteng.

1.11 Annexure 1.1: List of references

To be finalised

1. Feasibility Study into the Possible Regionalisation of Health Care Risk Waste Treatment / Disposal Facilities in Gauteng (The Status Quo Report), DACEL, Nov. 2000.

2. Sustainable Health Care Waste Management in Gauteng, South Africa, Project Documentation, DANCED, Nov. 2000

3. Health Care Waste Management Policy for Gauteng, DACEL, November 2001.

4. Scenarios for Sustainable Health Care Waste Management in Gauteng Province - A Feasibility Study – 2002.

5. DEAT Air Emission Guidelines, Bureau of Statistics SA. Data on xxxx.

6. Environmental Management System, ISO 14001, International Standardisation Organisation

7. Department of Water Affairs & Forestry: Minimum Requirements for the handling, classification and disposal of hazardous waste: Second Edition 1998

8. Department of Water Affairs & Forestry: Minimum Requirements for waste disposal by landfill: Second Edition 1998

9. Basel Convention: Technical Guideline on the environmentally sound management of biomedical and healthcare waste (Y1; Y3) : September 2001

10. Department of Health, "Guidelines for the Safe Transport of Radioactive Material", Directorate of Radiation Control, Cape Town, 2001

11. Department of Health, "Code of Practice for the Management and Disposal of Non-nuclear Radioactive Waste", Directorate of Radiation Control, Cape Town, November 1991, revised February, 2001.

1.12 Annexure 1.2: Abbreviations

to be FINALISED

Cd	Cadmium
CO	Carbon mono oxide
CO_2	Carbon dioxide
DACEL	Department of Agriculture Conservation Environment and Land Affairs
DANCED	Danish Co-operation for Environment and Development
DEAT	Department of Environmental Affairs and Tourism
DoH	Department of Health
DPTR&W	Department of Public Transport, Roads and Works
DTPW	Department of Transport and Public Works
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
ETD	Electro-thermal deactivation
EU	European Union
GDACEL	Gauteng Department of Agriculture Conservation Environment and Land Affairs
GDoH	Gauteng Department of Health
HCF	Health care facility
HCF's	Health care facilities
HCGW	Health care general waste
HCl	Hydrochloric acid
HCRW	Health care risk waste
HCW	Health care waste
HCWIS	Health care waste information system
HCWM	Health Care Waste Management
HF	Hydro fluoride
Hg	Mercury
HIV	Human Immune Deficiency Syndrome
MSW	Municipal solid waste
NDoH	National Department of Health
NGO	Non-Governmental Organisation
NH3	Ammonia
NOx	Nitric oxides
NWMS	National Waste Management Strategy
OHS	Occupational Health and Safety
REL	Rear End Loader
Pb	Lead
PE	Polyethylene
PM	Particulate matter
PP	Polypropylene
PPE	Personal Protective equipment
PVC	Polyvinyl chloride
R	South African Rand.
RSA	Republic of South Africa
SA	South Africa / South African
SO_2	Sulphur dioxide
TOC	Total Organic Carbon
US	United States
USA	United States of America
WHO	World Health Organisation

1.13 Annexure 1.3: Glossary

A number of the terms below are applicable for both health care waste management and other disciplines. However, the following definitions are related to the HCWM, and can as such not without reformulation be applied for other disciplines. The reference numbers refers to the references listed in Annexure 1.

Air Pollution	The presence of a material or substance in air that may be harmful to either the natural or human environment.
Air Quality Standards	The level of pollutants that by law cannot be exceeded during a specified time in a defined area.
Autoclaving	A sterilisation system making use of high-pressure steam for sterilisation of HCRW. The steam is led into the chamber, where the HCRW is heated over a specific period of time to ensure that all infectious micro-organisms present in HCRW are killed.
Awareness	Raising of knowledge of Health Care Waste in specific and defined target groups e.g. communities, pickers and households. Implemented by means of instruments like awareness campaigns, folders, public meetings, television spots, etc. The term is normally not used in relation to formal training programmes.
Biomedical and Healthcare Waste	Solid or liquid waste arising from healthcare (medical) activities such as diagnosis, monitoring, treatment, prevention of disease or alleviation of handicap in humans or animals, including related research, performed under the supervision of a medical practitioner or veterinary surgeon or another person authorised by virtue of their professional qualifications.
Capacity	The Quantity of solid waste that can be processed in a given time under certain specified conditions, usually expressed in terms of mass per 24 hours.
Capacity Building / Capacity Development	The improvement of knowledge on matters related to HCW Management through the dedicated efforts of training and transfer of skills to both individuals and facilities. Capacity Building is normally undertaken as formal training like on-the-job training, courses, study tours, development of systems and tools for facilities.
Chemical Waste	Wastes generated from the use of chemicals in medical, veterinary and laboratory procedures, during sterilisation processes and research.
Collection	The act of removing accumulated containerised solid waste from the generating source. Collection of solid and liquid waste by individuals or companies from residential, commercial, health facility or industrial premises; the arrangements for the service are made directly between the owner or occupier of the premises and the collector.
Community	The people living in the vicinity of a proposed, planned or developed activity.

Container	Reusable or disposable vessel in which HCW is placed at source for further handling, transport, storage, treatment and/or final disposal. The HCW container is an integral part of HCW management equipment.
Containerisation	The packing and storing of HCW in dedicated containers, specially designed and manufactured for the purpose, thereby ensuring the minimum risk of infection or injuries to persons responsible for handling the waste.
Cradle-to-grave	A policy of controlling a HCRW from its inception to its final disposal.
Danger Group	For transport purposes, hazardous substances that are listed in SABS Code 0228 are placed in a Danger Group.
Decontamination	The process of reducing or eliminating the presence of harmful substances, such as infectious agents, so as to reduce the likelihood of disease transmission from those substances.
Destruction	To neutralise or get rid of a waste by incineration or other physical or chemical means.
Disinfection	Treatment aimed at reducing the number of vegetative micro-organisms to safe or relatively safe level. Normally the treatment should result in destruction of pathogenic micro-organism leading to a 10^{-5} reduction in microbial concentration.
Domestic waste	Municipal solid waste generated from households
Duty of Care	This requires that any person who generates, transports, treats or disposes of waste must ensure that there is no unauthorised transfer or escape of waste from her/his control. Such a person must retain documentation describing both the waste and any related transaction. In this way, he retains responsibility for the waste generated or handled.
Electro Thermal Deactivation	Electro thermal deactivation is the selective absorption of energy at differential rates by the cells of the microbe, resulting in the weakening of the cell membrane under the imposed high voltage field, which ruptures the cells and causing it to die.
Emergency	A situation created by an accidental release or spill of hazardous chemicals or infectious materials, which poses a threat to the safety of workers, residents, environment or property.
Emissions	Gases or fumes emitted from a burn or non-burn HCRW treatment technology.
Environment	Environment is defined as i) the natural environment, consisting of air, water, land and all forms of life, ii) the social, political, cultural, economic and working context and other factors that determine people's place in and influence on the environment, and iii) natural and constructed spatial surroundings.

Environmental Impact Assessment (EIA)	An investigation to determine the potential detrimental or beneficial impact on the surrounding communities, fauna, flora, water, soil and air, arising from the development or presence of a facility.
Environmental Impact Control Report (EICR)	A report that details how any detrimental impacts, identified in the Environmental Impact Assessment, can be prevented or ameliorated by means of the design and operation of a facility.
Exposure	The intake of radiation or pollutant by organisms present in a particular environment (i.e. human, natural), which represents a potential health threat to the living organisms in that environment.
Flue gas (or exhaust gas)	Gases and suspended particles emitted from an incinerator or industrial stack or generally through a chimney.
General Infectious Waste	Infectious waste excluding sharps and pathological waste
General Waste	Waste that does not pose an immediate threat to humans or the environment, i.e. household waste, builders' rubble, garden waste, and certain dry industrial and commercial waste. It may, however, with decomposition, infiltration and percolation, produce leachate with an unacceptable pollution potential (see Waste).
Generator	The Generator is an industry or other party whose activities result in the production of waste. The responsibility for a Hazardous Waste remains from cradle-to-grave with the Generator of that waste and the Generator is held liable for any damage that the waste may cause to humans or to the environment.
Genotoxic	Description of a substance that is capable of interacting directly with genetic material, causing DNA damage that can be assayed. The term may refer to carcinogenic, mutagenic or teratogenic substances.
Groundwater	The water contained in porous underground strata as a result of infiltration from the surface. Water occupying pores in the soil and cavities and spaces in rocks in the saturated zone of the profile. This water may rise from a deep, magmatic source or be due to the infiltration of rainfall (recharge).
Hazardous Waste (alternative definition)	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. (See Waste)
Health Care General Waste (HCGW)	International term for waste generated in the health care system with characteristics similar to general waste, excluding general waste generated in isolation wards and TB wards. The latter will be regarded at HCRW.

Health Care Risk Waste (HCRW)	International term for waste generated in the health care system sector, which requires special management and treatment. HCRW includes infectious waste. General waste generated in isolation wards and TB wards will be included in this.
Health Care Waste (HCW)	International term for all waste generated in the health care system. HCW is the sum of HCGW and HCRW.
Human Tissue	The tissue, organs, limbs, blood, and other body parts that are removed during surgery and autopsy.
IMDG-RSA Code=SABS Code 0228	A code in which over 4 000 hazardous substances are listed and assigned a danger group for transport purposes. The Code forms the basis of the present system for classifying Hazardous Waste and is being upgraded for waste disposal purposes. In future hazardous substances will be assigned a hazard rating for waste disposal in the SABS Code 0228.
Incineration	The controlled burning of solid, liquid or gaseous combustible wastes to produce gases and residues containing little or no combustible material. Incineration is both a form of treatment and a form of disposal. It is simply the controlled combustion of waste materials to a non-combustible residue or ash and exhaust gases, such as carbon dioxide, acidic gases and water vapour.
Infectious waste	As defined in the DWAF Minimum Requirements: Any waste which is generated during the diagnosis, treatment or immunisation of humans or animals; in the research pertain 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 that contain or may contain infectious substances.
Integrated Health Care Waste Management	Is a holistic and integrated course of action that specifies the institutional, infra-structural and technological support, as well as human and financial resources required to establish and implement an integrated Health Care Waste Management Strategy.
Irradiation	Exposure to radiation of wavelengths shorter than those of visible light (gamma, x-ray, or ultraviolet), for medical purposes, the destruction of bacteria in milk or other foodstuffs, or initiation of polymerisation of monomers or vulcanisation of rubber.
Landfill (v)	To dispose of waste on land, whether by use of waste to fill in excavations or by creation of a landform above grade, where the term ‘fill’ is used in the engineering sense.
Landfill Operation Monitoring	The auditing and assessing of a waste disposal operation to determine whether it conforms to the site design and to the Minimum Requirements.
Leachate	An aqueous solution with a high pollution potential, arising when

	water is permitted to percolate through decomposing waste. It contains final and intermediate products of decomposition, various solutes and waste residues. It may also contain carcinogens and/or pathogens.
Liquid Wastes	Any waste material that is determined to contain "free liquids" – liquids, which readily separate from the solid portion of waste under ambient temperature and pressure.
Manifest System	A system for documenting and controlling the fate of HCRW from "cradle-to-grave".
Medical Waste	Waste generated from such places as hospitals, clinics, doctors' rooms, laboratories, pharmacies, and research facilities (refer to HCW/HCRW)
Micro-organisms	Any microbiological entity, cellular or non-cellular, capable of replication or of transferring genetic material.
Microvawing	Microvawing of HCRW is the sterilisation process making use of microwaves for heating the water within the HCRW, thereby destroying the pathological micro-organisms.
Minimum Requirement	A standard by means of which environmentally acceptable e.g. waste disposal practices can be distinguished from environmentally unacceptable waste disposal practices.
Monitoring	Continuous or periodic surveillance of the physical implementation of a project or activities to ensure that inputs, activities, outputs and external factors are proceeding according to plan.
Municipal solid waste	General waste for collection by municipalities, generated mainly by households, commercial activities and street-sweeping refer to HCGW: Municipal waste generated at health care facilities is characterised as HCGW
Non-thermal HCRW treatment process	
Off-site Facility	A clinical and related waste treatment, storage or disposal facility that is located away from the generating site.
On-site Facility	A clinical and related waste treatment, storage or disposal facility that is located on the generating site.
Permit	The permit issued by Department of Water Affairs & Forestry for the operation or closure of a landfill, in terms of Regulation 1549, promulgated under the Environment Conservation Act (Act 73 of 1989).
Permit Holder	The person who, having obtained a permit to operate a waste disposal site or other facilities that require a permit, in terms of Section 20(1) of the Environmental Conservation Act, is legally responsible for the site, both during operation and after closure.

Permit Procedure	The procedure to be followed and the necessary investigations to provide the Department with the necessary information so that a Permit can be issued.
Pharmaceutical Waste	Wastes from the production, preparation and use of pharmaceutical products.
Precautionary Principle	Where a risk is unknown; the assumption of the worst-case situation and making provision for such a situation.
Pyrolysis	The decomposition of organic material by heat in the absence of, or with limited supply of oxygen
Radioactive substances	Material containing, or contaminated with, radionuclides at concentrations or activities greater than clearance levels and for which no use is foreseen.
Radioactive waste	Material contaminated with a radio-isotope which arises from the medical or research use of radionuclides. It is produced, for example, during nuclear medicine, radio immunoassay and bacteriological procedures, and may be in a solid, liquid or gaseous form. These materials must be disposed of in terms of the Nuclear Energy Act (Act 92 of 1982) and the Hazardous Substances Act (Act 15 of 1973). In particular Section 3A, Hazardous Substances Act (Act 15 of 1973) regulates radioactive substances used for medical, scientific and industrial purposes.
Residual Wastes	Those materials (solid or liquid) which still require disposal after the completion of a treatment or resource recovery activity e.g., slag and liquid effluents following a pyrolysis operation, plus the discards from front-end separation systems.
Residue	A substance that is left over after a waste has been treated or destroyed. For incineration it includes wastes such as ash or slag.
Response Action Plan	A plan intended to counter or minimise the adverse effects of any malfunction of a landfill design element with immediate effect. A Response Action Plan is usually associated with the disposal of Hazardous waste.
Responsible Person	The Permit Holder or her/his legally appointed representative who takes responsibility for ensuring that all or some of the facets of any of the following are properly directed, guided and executed, in a professionally justifiable manner: investigating work, design, preparation, operation, closure and monitoring.
Risk	The probability of dangerous substances contained in the waste, leached there from, or released by emission, entering into the air, the surface environment or the water regime in unacceptable quantities or concentrations. The consequences of such occurrences could be manifested as a threat to public health or as the impairment of an eco-system or resource. Generally, risk is the scientific judgement of probability of harm.

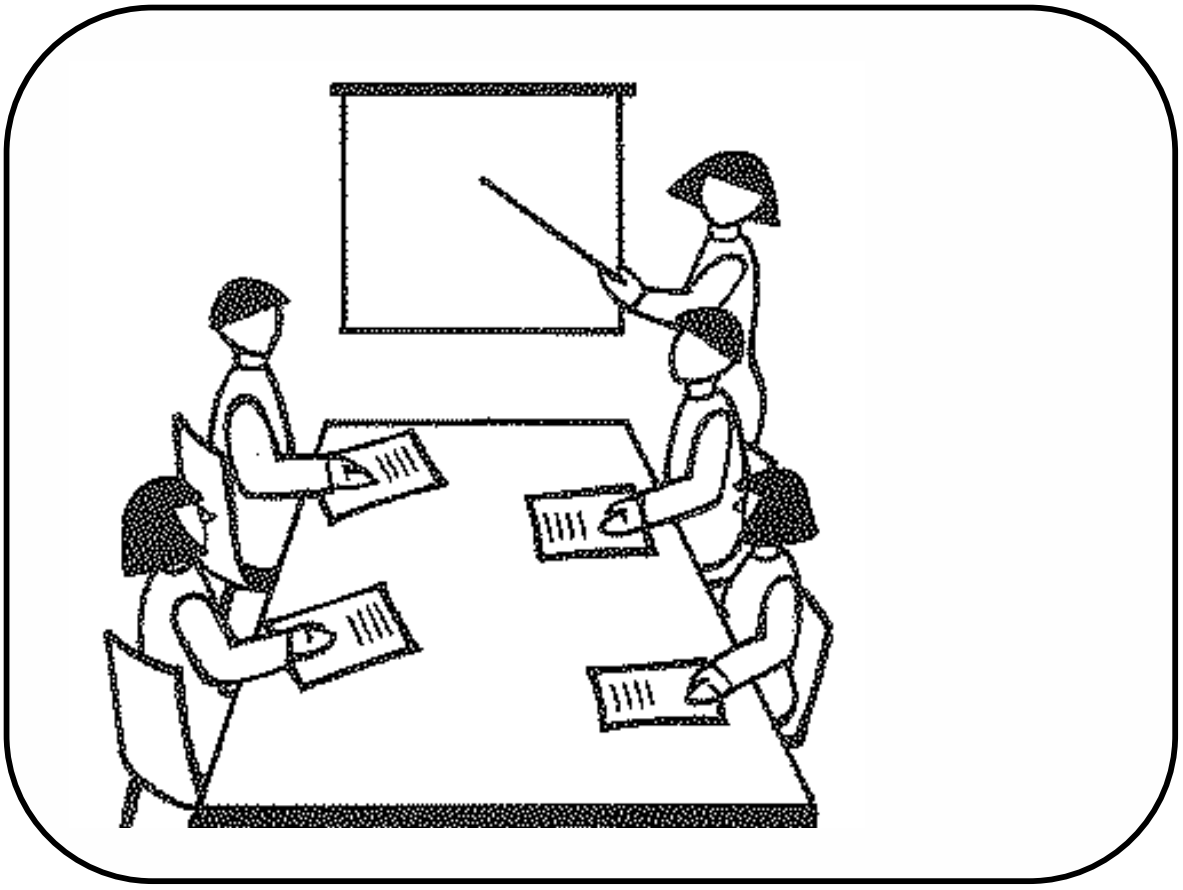
Risk Assessment	The identification of possible impacts of a landfill on the environment, so that they can be addressed in the design phase.
Sanitary landfill	An engineering method of disposing of solid waste on land in a manner that protects the environment, e.g. by spreading the waste in thin layers, compacting it to the smallest practical volume, and covering it with soil by the end of each working day, constructing barriers to infiltration, evacuating the gases produced etc.
Sanitation	The control of all the factors in the physical environment that exercise or can exercise a deleterious effect on human physical development, health and survival.
Scavenging	The manual sorting of solid waste at a landfill or at other places where waste is dumped, and recovering the valuable materials.
Segregation	The systematic separation of solid waste into designated categories
Sharps	Objects or devices having sharp points or protuberances or cutting edges capable of cutting or piercing the skin.
Sludge	The accumulated solids that separate from liquids such as water or wastewater during processing, or deposits on the bottom of streams or other bodies of water
Stakeholders	Any person, group of persons or organisation that may have a direct or indirect interest or involvement with any aspect related to the "cradle-to-grave" management of HCW. Often termed Interested and Affected Parties (I&AP).
Sterilisation	This is a process that kills virtually all micro-organisms, including bacteria, viruses, spores and fungi, thereby making an object free from micro-organisms. In practical terms it is a reduction of the content of micro-organisms of more than 10^6 (more than 99.9999% of the micro-organisms are killed), achieved by physical, chemical or mechanical methods or by irradiation.
Sustainability	A sustainable project should lead to improvements that will persist and spread beyond the project boundaries.
Thermal HCRW treatment process	
Transport	Internal transport is the conveyance of the HCRW from the point of generation to the point of treatment (when on the same premises as the generation) or temporary storage, if treated at a site other than the waste generation site. External transport is the conveyance of HCRW from the point of on-site storage, to the point of treatment, when treatment is done on a site other than that of the HCRW generation.
Transporter	A person, organisation, industry or enterprise engaged in or

	offering to engage in the transportation of waste.
Treatment	Any method, technique or process for altering the biological, chemical or physical characteristics of waste aimed at destroying or at least reducing infectiousness in order to minimise its pollution impact on the environment and its risk to the health of humans and animals. It is further intended to reduce the costs of disposal.
Waste	An undesirable or superfluous by-product, emission, or residue of any process or activity, which has been discarded, accumulated or stored for the purpose of discarding or processing. It may be gaseous, liquid or solid or any combination thereof and may originate from a residential, commercial or industrial area. This definition excludes industrial wastewater, sewage, radioactive substances, mining, metallurgical and power generation waste. After definition in Government Gazett No. 12703, August 1990. (See General Waste and Hazardous Waste)
Waste Disposal Site	Any place at which more than 100kg of a Hazardous Waste is stored for more than 90 days or a place at which a dedicated incinerator is located is termed a Waste Disposal Site. It must be registered as such in terms of the Environment Conservation Act (Act 73 of 1989).
Waste Disposal Site	In the context of this document, a waste disposal site is referred to as a landfill, because the vast majority of all waste is ultimately disposed of on land, whether it be in trenches or other excavations, or above grade.
Waste management	All activities, administrative and operational, involved in the handling, conditioning, storage and disposal of waste (including transport).
Waste Minimisation	The application of activities such as waste reduction, reuse and recycling to minimise the amount of waste that requires disposal.
Waste Segregation	The process of keeping source separated wastes apart during handling, accumulation (interim storage), storage and transport and to assist resource recovery and ensure appropriate designated treatment and/or disposal methods are utilised. Waste segregation should be practised both by generators and waste handling companies at the source for efficient waste management.
Waste Stream	A continuous flow of waste from an industry, activity, process or group.
Working Face	The active part of the landfill; where waste is deposited by incoming vehicles, then spread and compacted on the sloped face of the cell by a compactor. The width of the working face is determined by manoeuvring requirements of the vehicles depositing waste.

Guidelines on Sustainable Health Care Waste Management in Gauteng

<u>MODULE 2:</u> How to Organise a Health Care Waste Management System:

- Organising Steering Group
- Developing HCWM Plan
- Organising HCWM Team
- Conducting audit procedure
- Tender procedures
- Developing training programme



2. Module 2: How to organise a Health Care Waste Management System

2.1 Objectives of Module 2

The objective of this module is to equip management of health care facilities with tools required to develop plans for improving the standard of the HCWM system.

This module, furthermore, presents measures for:

Analysing the present state of the HCWM
Establishing a Steering Committee for preparing a plan for improving HCWM and monitoring its progress
Establishing a firm organisational structure, e.g. a HCWM Team, for carrying out the daily HCWM
Implementing "green procurement"
Developing Technical Specifications for waste handling equipment, services etc.
Implementing tender procedures for contracting service providers for collection, treatment and disposal of HCRW
Developing training programmes for the staff to improve their skills within HCWM
Conducting audits of the HCWM system.

The goal of this module is to make the individual HCFs able to introduce a planning system that currently will improve the HCWM of the facility.

2.2 Target Group for Module 2

The target group of this module includes management at health care facilities and other decision makers, involved in managing the health care waste and supervising those taking care of the daily HCWM. The target group for this Module also include staff responsible for procurement of equipment and articles for the daily operation of the entire health care facility. The module will not apply directly to operational staff.

2.3 Scope of Module 2

The module is focusing on the HCRW in larger health care facilities, public as well as private. However, the guidelines contained in this module can – with some modifications - also be applied to smaller health care facilities and other generators of HCRW. The last section on tender procedure is primarily directed towards private health care facilities, as the outsourcing of activities within public health care facilities is done by the Department of Health.

2.4 Reference to Other Modules

This Module should – like all the following modules – be read in conjunction with Module 1. For further information on ways and means to handle the HCRW in its different steps from generation at the health care facilities to its final disposal, reference is made to the following modules of these Guidelines.

Some legislation on HCW management will be of particular importance to the management of HC facilities, e.g. regulation concerning cleanliness and storage of HCRW as well as occupational health and safety. Regulation is dealt with in Module 1, including a summary of legislation that relates to HCW management.

2.5 How to organise a HCW Management System

This first section of Module 2 describes a procedure to set up a plan for improving the health care waste management at a health care facility to establish a firm organisation for carrying out the daily work.

The procedure described is following the general principles for implementing environmental management systems as described in the international standard for Environmental Management System, ISO 14001 (ref. 6).

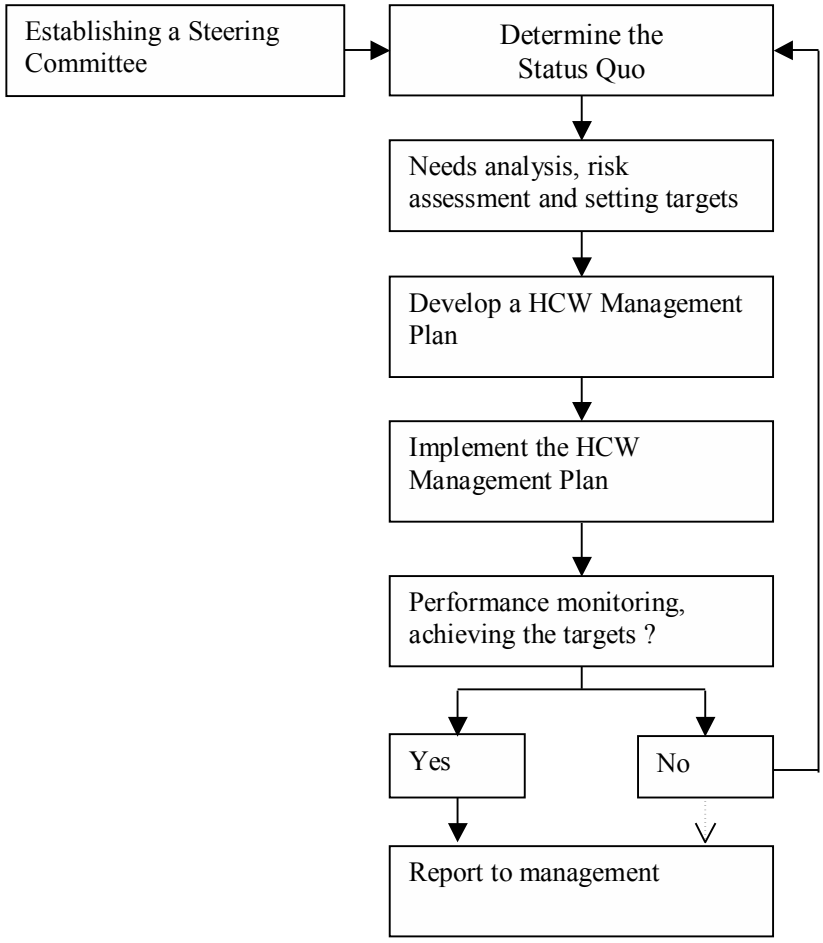
The environmental management systems normally covers all environmental aspects, while the present procedures, however, is focusing on the waste management aspects of health care facilities.

The following description is primarily applicable to large HC facilities, but will also be applicable for smaller HCF's, by allowing some modifications of the proposed procedures. Likewise it will also be appropriate for the organisations, taking care of the HCW downstream the HCFs, although the procedures have to be modified to a greater extend.

Due to the variance in duties and responsibilities for the individual stakeholders involved in the cradle-to-grave HCW management process, there is a need for allocation of responsibilities that is directly related to the HCRW management process. For that purpose a detailed and integrated system will be described, after which selected items will, in the form of a table, be allocated to the various stakeholders.

Setting up and implementing a HCW management plan for larger generators may include the following steps, as shown in Box 2.2 below.

Box 2.2: Setting up and implementing a HCWM Plan



Each of these steps of the HCWM Plan is described in further details below.

2.5.1 Determination of HCW Management Status Quo

The first requirement for setting up integrated HCW management systems is to make a detailed analysis of the Status Quo. Annexure 2.1 shows an example an audit form that can be used during the investigation of the Status Quo at a variety of health care facilities. Items that may not be appropriate for the particular facility to be investigated, can be omitted.
Although the survey will be adjusted to meet the needs of the particular health care facility, the following are typical areas to be reported on:

Size of Health Care Facility (HCF)
The size of the HCF in terms of the number of beds and average occupancy rate, average number of out-patients per month, number of samples analysed, or similar factors that will determine the size of the HCW stream, can be used as a basis to compare the HCRW generation rate at different times and with that of other similar facilities. In most health care facilities such data is already available from the HCF administration section as it is used in planning the facility's daily operation.

Waste Generation Rate
The HCRW categories and mass generated in accordance with the definitions provided in module 1. Where appropriate and possible, this information should reflect a breakdown by subdivisions like wards, departments etc. to get a better understanding of the way in which HCRW is generated within the larger health care facilities. Some of this data may already exist, as some HCF's remunerate the service providers according to the amount of HCRW collected. However, more detailed data on the waste stream may be required to improve the HCW management system and to cut down on the cost for disposal of HCRW.

The HCW Management Organisation and Resources
Another set of information that is important for the Status Quo is the resource allocation for the execution of HCW management functions within the health care facility, both in terms of human resources as well as material resources (equipment and materials). The names, levels, job descriptions and duties of each person involved in HCW management are to be listed, as well as the percentage time that each of these persons effectively spend on HCW management. Training activities to improve the awareness related to HCW management and infection control should be registered. As far as material resources are concerned, the capital infrastructure as well as the monthly operational costs is to be listed. It is finally important that the budget allocation (also in terms of the overall budget of the facility) is compared with the actual expenditure.

HCW Management Practices
Existing HCW management practices employed within the health care facility in terms of HCW segregation, containerisation, internal storage and transport, central storage, external transport, treatment and disposal, are to be evaluated and reported upon. Existing contracts with external service providers responsible for transport and treatment of HCRW should be listed. Other important aspects to note is for instance the level of compliance with legislation like for instance the relevant parts of the Occupational Health and Safety Act (NOSA). Finally, the existing organisation and procedures for infection control should be registered.

Documentation
Copies of relevant and important documentation like reports, minutes of meetings and notes taken during interviews and discussions held with affected staff members, is all to be included or referred to (as the case may be) in the status quo report, as such information may shed more light on a number of key elements in the HCW management process.

2.5.2 Needs Analysis and Setting Target

All information collected during the status quo analysis, is to be used to identify possible shortcomings that may exist with the present waste management system. This is to be done by comparing the status quo with these HCW management Guidelines, to determine the extent to which the existing system fulfils the requirements for sustainable HCW management.

A detailed analysis of strengths and weaknesses for HCW management in that particular facility is to be undertaken. This will among others include a risk assessment of aspects that are of particular importance within the health care sector, e.g. needle stick incidences. Weaknesses are, once identified and listed, to be converted into strengths by identifying the root cause of any particular weakness, and by identifying alternative ways to address such problems.

All needs identified are to be addressed and target for their fulfilment are set. The activities to fulfilling the needs make up the Plan for developing a sustainable HCW Management System (from here onwards referred to as "the Plan") for that particular health care facility.

2.5.3 Establishment of a HCW Management Structure

Establishment of a Steering Committee
For the development, implementation, execution and monitoring of a HCW Management Plan, tailor made for the health care facility, a certain Steering Committee (PG) could be established, that would include the following representatives:

The Management of the HCF (e.g. Technical Manager)
The Matron
The Waste Management Officer
Occupational Health and Safety Officer
The Infection Control Sister/Officer
Chief Pharmacist
Radiation Officer
Departmental heads.

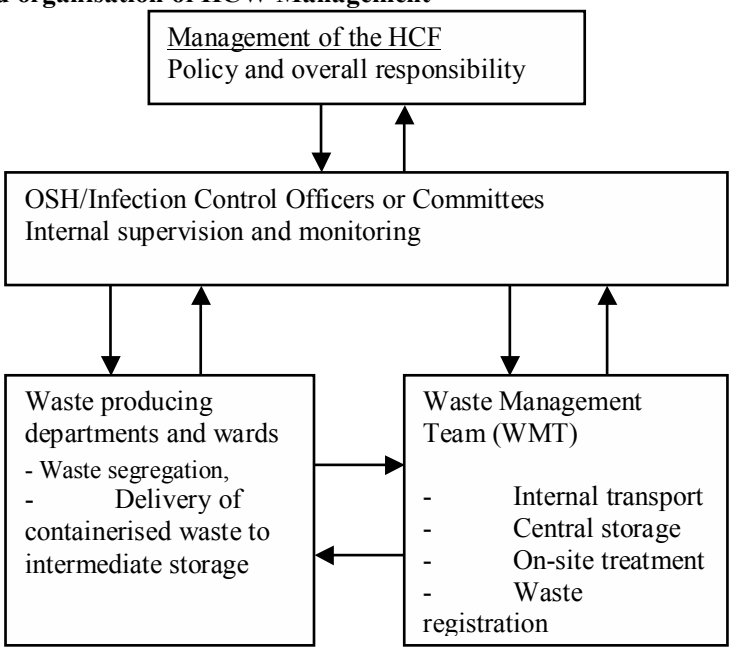
In cases where above-mentioned officers are represented in the Occupational Health and Safety Committee (OSHC) or the Infection Control Committee (ICC) it would be appropriate to let one of the latter committees be responsible for implementing the HCW Management Plan.

Establishment of a HCWM Team
Good administration and organization, together with the provision of the required resources is vitally important for the rendering of sustainable HCW management services at any HCF. The final requirement is of course a well-trained and well-informed workforce that is committed to ensure the successful implementation of an improved HCW management system.

Most HCF's already have a HCW management organisation, but it may not be a single unit. Therefore, a HCW Management Team (WMT) could be established to take care of the daily waste management. It is important that the Team is given clear tasks and responsibilities as well as clear understanding is made with those departments they will have to serve in terms of which types of waste they have to collect and when.

Although it will ultimately depend on the size and particular needs of the health care facility for which it is to be implemented, a typical HCW Management Team for a large HCRW generator could be structured as illustrated in Box 2.3 below.

Box 2.3: Proposed organisation of HCW Management



The responsibilities of the Waste Management Officer and each of the above mentioned Steering Committee members are briefly described in the following boxes (Box 2.4 – 2.10).

Box 2.4: Responsibilities for Waste Management Officer:

The Waste Management Officer (once appointed), will be directly responsible for implementation of the day-to-day execution of the HCW Management and as such he/she will be head of the HCWM Team. The Waste Management Officer should have direct access to all sections of the hospital where HCW is generated and should report directly to the (technical) manager of the hospital/clinic, superintendent, the Matron or similar, depending on the local situation. The specific duties and responsibilities are:

To liase with the affected members of the Steering Committee on the responsibilities of the various parties involved in HCW management, as well as ensure clear division of responsibilities between the HCWM Team and other departments of the HCF;
Supervise HCWM Team, and ensure that responsibilities are clearly defined and divided among the team members, as well as that they receive sufficient instruction and training;
To ensure through communication with the heads of the various departments that segregation of the waste is only done at source, that only containers sealed in the correct manner are handled by hospital attendants and ancillary staff, and that manual handling of HCRW containers is limited;
To liase with the Procurement Officer to ensure that the required infrastructure, equipment and materials are provided for the effective execution of the HCW management system;
To ensure that the requirements of the OHS Act are complied with and that Personal Protective Equipment (PPE) is supplied and utilized by affected workers;
To liase with the managers of nursing, medical and laboratory staff to ensure that concerns, problems etc. are being addressed and that staff is being trained and kept aware of correct HCW management procedures;
To monitor, report on and liase with relevant Heads of Departments on effectiveness of HCW segregation, containerisation and internal storage of HCW;
To manage and directly supervise the daily internal collection and transport of HCW containers from the internal storage areas to the central waste storage area, and that full containers are immediately replaced with the correct new/sterilized containers;
To prevent dumping or unauthorised storage of HCW containers in areas not designated for the storage or disposal of HCW;
To ensure and supervise the correct use of the central HCW storage area and that HCW is not stored for periods longer than what is specified for the particular conditions;
To coordinate and supervise any HCRW treatment activities that may be undertaken on site, and to ensure that the residue from the treatment process is disposed of on an appropriately permitted waste disposal site;
To liase with the Chief Pharmacist and Radiation Officer to obtain first hand knowledge on the procedures and equipment required for the handling, treatment and disposal of pharmaceutical, chemical and radioactive HCRW;
To liase with the contractors for external transport of waste to ensure clear understand between the two parties of the conditions for delivery and collection of waste;
To verify the credibility of contractors that are appointed to render any HCW management activities, and to undertake ongoing inspections on any external facilities used for the treatment/disposal of HCW;
To monitor the effectiveness and appropriateness of the procedures and equipment used for the loading and transport of HCW both onsite as well as offsite;
To monitor the effectiveness with which HCRW is treated and the residue disposed of by external contractors.
To ensure that emergency procedures are available, information on the emergency procedures are disseminated and that the required emergency equipment is available.
To investigate and report on any incidents.

Box 2.5: Responsibilities for Head of Facility.

The Head of the Facility, as the person ultimately responsible for the environmentally sound and safe management of HCRW, should:

Appoint staff members to serve on the Steering Committee;
Appoint a HCW Management Officer, and ensure that a HCWM Team with clear tasks and responsibilities is established;
Ensure that the HCW Management Plan remains updated;
Allocate sufficient human and material resources for effective implementation and maintenance of the HCW Management Plan;
Incorporate monitoring procedures in the HCW Management Plan;
Temporary reassign and immediately appoint a successor for any key member that may resign;
Ensure adequate and appropriate information and training for all affected staff members.

Box 2.6: Responsibilities for Heads of Departments.

The Heads of Departments within the health care facility to whom certain responsibilities may be delegated, should be responsible for:

Ensuring that all health care professionals are familiar with the segregation and storage requirements and that the required HCW management standards are adhered to;
Liaise on with the Infection Control Officer and HCW Management Officer to ensure that procedures are adhered to, that the required standards are maintained, and that the necessary corrective action is taken in the event of non-performance by any staff members;
Ensuring that appropriate training is provided to staff members within their departments so they are aware of the importance of proper HCWM;
Motivating staff members to comply with the requirements laid down for effective HCW management.

Box 2.7: Responsibilities for the Occupational Health and Safety Officer/Infection Control Officer.

The OSH/IC Officer will be the most senior person directly involved in HCW management and will have the duty and responsibility to monitor and audit the execution of the HCW management plan. The responsibilities for the OSH/IC Officer inter alia includes the following:

Identifying training requirements according to staff grade and occupation;
Organising and supervising staff training on HCW Management;
Liasing with the relevant management structures to coordinate the required training.

Box 2.8: Responsibilities for Chief Pharmacist and Radiation Officer.

The Chief Pharmacist and Radiation Officer have special responsibilities due to the specialised nature of the waste generated in their areas of jurisdiction. Their respective roles and responsibilities are:

- To liase with Department Heads, the Waste Management Officer, the Matron and Hospital Manager to advice on the ways in which pharmaceutical/radioactive HCRW is to be handled, treated and disposed of in a safe and environmentally sound manner complying with the relevant legislation;
- To coordinate continuous monitoring on the procedures followed for safe handling, treatment and disposal of pharmaceutical/radioactive HCRW;
- To ensure that appropriate training is provided to personnel dealing with pharmaceutical/radioactive HCRW;
- To ensure correct handling, treatment and disposal of genotoxic waste.

Box 2.9: Responsibilities for Matron or Senior Nursing Officer.

The Matron or Senior Nursing Officer as the most senior operational member of staff represented on the Steering Committee. The Matron's HCW management related duties are:

- To ensure appropriate HCW management training for all health care professionals, hospital attendants and ancillary staff, in the form of introductory training as well as refresher training;
- Liase with the Department Heads to ensure coordination of training as well as to identify and address any HCW management related problems that may exist in the respective departments;
- Liaise with the HCW Management Officer and other HCW specialist (Chief Pharmacist and Radiation Officer) to devise solutions to any problems identified and ensure effective implementation of the required HCW management measures.
- Ensure coordination of HCWM with the current activities within infection control.

Box 2.10: Responsibilities for Procurement Officer.

The Procurement Officer will be responsible for the supply of equipment and materials required for HCW Management. The particular duties are:

- To liase with the Waste Management Officer to ensure continuous and timely supply of the correct equipment and consumables required, without having a build-up of excess materials in the stores;
- To undertake quality control checks on materials and services (e.g. outsorced services) delivered and to have equipment and materials replaced that does not meet the required standards;
- To investigate the availability and cost effectiveness of new waste management products on the market;
- To investigate the availability and cost effectiveness of environmentally friendly products ("green procurement")
- To investigate the market of service providers for HCW transport, treatment and disposal
- Investigate out-sourcing of tasks within HCWM and take care of tender procedures.

2.5.4 Development of a HCW Management Plan

The HCW Management Plan is a description of the activities to be implemented for improving the management of HCW and will primarily be based on the findings of and needs identified during the HCW Status Quo analysis for that particular facility. For each activity a time schedule and a possible deadline should be indicated.

Compiling of the draft HCW Management Plan will be the responsibility of the Waste Management Officer, who is to circulate the document to other members of the Waste Management Steering Committee for evaluation, commenting and discussion.

It is proposed that the Waste Management Plan includes the information summarised in Box 2.11 below. Annexure 2.2 includes an example of a template for the development of a Waste Management Plan.

Box 2.11: Information to be included in the Waste Management Plan:

- Information on HCW categories generated
- If possible, estimated generation rates for each category (optional);
- Information on the existing human and material resources available and utilised for HCW management;
- Firm Plan for implementation of green procurement, including potentials for substitution of materials/equipment, targets and time schedule;
- Firm Plan for HCW reduction, reuse and recycling, including potential items, targets and time schedule;
- The requirements for improving HCW segregation and containerisation to meet the needs of the particular facility including plan for training and information on the issue as well as targets and time schedule;
- Plan for implementing a waste labelling and registration system;
- Reference to the applicable local, provincial and national standards, guidelines and legislation on HCRW management
- The need for in-house guidelines and standards that is related to HCW Management
- The technical specifications for interim storage facilities at source as well as operational procedures for interim storage;
- The technical specifications and operational procedures for onsite handling, transport and storage in a central storage area;
- Identification and evaluation of possible opportunities for outsourcing of HCRW management services
- Identification and evaluation of the most technically and financially feasible treatment options for the particular categories of HCRW generated;
- Requirements for record keeping and reporting on various aspects related to HCW management, with particular emphasis on the requirements for the HCWIS;
- Training requirements and procedures to be followed for implementation of training programmes.
- Comparison between estimated and actual costs of HCW management for the particular facility, as well as a comparison with the unit costs incurred by similar facility;
- A draft strategy and an action plan, including targets and time schedule for the various activities, required for implementation of the HCW Management Plan;
- Procedures for monitoring and revising the HCW Management Plan
- Information on the managerial outline, lines of communication, as well as contact details of the responsible persons that can be contacted in the event of an emergency.

Once the draft HCW Management Plan has been compiled, it is to be circulated to all members of the Waste Management Team, who should, after consultation with the affected staff from their respective departments, submit written comments on the document. After considering the comments, the Steering Committee is to discuss the document and reach agreement on the most effective way the upgrading of the HCWM is to be implemented. Where consensus cannot be reached even after specialist input was obtained, the final decision will be with the Head of the Hospital that will ultimately be the person responsible for the duty-of-care required in terms of the South African National Waste Management Strategy (NWMS, ref. xx).

Input from officials of the local authority will be advantageous, and where any of the waste management services are already outsourced, it is further important that the affected waste management contractor make input to the Waste Management Plan.

Once the consultation process is completed, the Waste Management Officer should finalise the waste management plan for official approval, circulation and implementation by the senior management of the health care facility. It is to be noted that the HCW Management Plan should be a living document that is to be updated whenever there is a change in the physical conditions or selected technology that will justify amendments to the plan. It is to be expected that there is a need to update the Plan with relatively small intervals in the beginning and later on with larger intervals.

2.5.5 Implementation of the HCW Management Plan

As the party responsible for duty-of-care of HCW generated within the facility, the Head of the Hospital is responsible for the implementation of the HCW Management Plan, see Box 2.12 below.

Box 2.12: Steps required for implementation of HCW Management Plan.

The following are the suggested steps for implementation:

Distribute the interim HCW Management Plan to all supervising staff responsible for HCWM and related tasks. This is to be done by the HCW Management Officer, in consultation with the Steering Committee;
Ensure that the job descriptions for persons responsible for the implementation and execution of the HCW Management Plan clearly defines their respective duties, and that this is communicated to such staff members;
Ensure that the formal contracts, detailing the tasks and responsibilities for activities that are to be outsourced, are in place and that the contractor's role and responsibilities are clearly defined in the HCW Management Plan;
Undertake a broad awareness campaign amongst affected employees on all levels, not only to introduce the HCW Management Plan, but also to highlight the roles and responsibilities of the various stakeholders. This is also providing an opportunity to address questions put forward for clarity;
Task specific training programmes on the equipment to be used, is to be initiated on the different levels for all staff members affected by HCW Management. Attendance of training should be compulsory and the students are to be examined to ensure effectiveness of the training;
On arrival of any additional/new equipment ordered for implementation of the HCW Management Plan as well as on commencement of any outsourcing contracts that are entered into, implementation of the final HCW Management Plan can commence;
The HCW Management Plan is to be reviewed annually, or whenever conditions at the health care facility change to such an extent that a revision of the Plan may be justified.

2.5.6 Performance Monitoring, Reporting and Implementation of Remedial Measures

Throughout the process, it is important that the success of the HCW Management Plan implementation be monitored and reported upon. Wherever problems are identified, the required remedial measures are to be implemented and the effect thereof monitored. The monitoring and reporting procedures, described in Box 2.13 below, are to be implemented.

Box 2.13: Steps required for Performance Monitoring, Reporting and Implementation of Remedial Measures for HCW Management plan.

The following are the suggested steps for Performance Monitoring, Reporting and implementation of remedial measures:

A formal audit covering the full waste stream from generation to central storage/collection and which are jointly undertaken by the Waste Management Officer and the Occupational Health and Safety/Infection Control Officer, is to be undertaken on e.g. a monthly basis. Reports on these formal audits, also including recommendations on ways in which the problems can be rectified, are to be copied to all members of the Steering Committee, and circulated to the senior personnel in the affected departments/wards, or contractors where services are outsourced;
A formal audit on the treatment and disposal (as well as transport where offsite treatment facilities are used), is to be undertaken by the waste management officer and the WM/OHS/IC Officer on a three monthly basis;
Informal follow-up audits are to be undertaken within two weeks from the date on which audit reports on the formal audit are distributed to ensure compliance or positive action regarding required remedial measures;
Discussion on audits should be placed on the agenda to form part of all Steering Committee meetings;
Incentives and possibly penalties/corrective actions should be used to ensure compliance by both internal as well as external personnel.

2.6 Waste Minimisation, Green procurement and Environmental Management

There are a number of alternative procedures and methodologies available that will reduce the mass of HCRW requiring treatment, whilst ensuring that the waste will cause less environmental problems in managing it. These procedures and methodologies include:

Waste minimisation
Reuse
Green Procurement.

It will be the responsibility of the management and the Steering Committee of the HCF to ensure that the above measures is considered in connection with the HCWM Plan, while it primarily will be the responsibility of the health care professionals and workers, in cooperation with the procurement department, to introduce the new ideas in the daily work. Hence, more details are included in Module 3 on waste generation, segregation and containerisation, as well as in Annexure 3.1.

Waste Minimisation represents all measures required to prevent waste from being generated e.g. through more effective planning of work that will result in the correct use of appropriate products. Another way in which waste minimisation can be achieved is through effective segregation of HCW, thus reducing the amount of HCRW that requires treatment.

Reuse stands for renewed use of reusable rather than the once-off use of disposable products regularly used at health care facilities, e.g. different glassware such as petri dishes, linen, bandages, etc. Reuse of different products usually requires cleaning / sterilisation of the items before being reused. Through

careful investigation, a substantial number of disposable products used at health care facilities could be replaced with reusable products. However, new initiatives have to be considered against the background of possible risks of infection.

Green Procurement is the selection of environmentally less hazardous materials in the procurement process and products that generates less waste during and after use. This could for instance include procurement of mercury free thermometers, PVC-free plastic products or the substitution of plastic products that contains heavy metal dies or colouring. Products with only the minimum packaging required would further result in less waste being generated. New initiatives have to be balanced in relation to the functionality and cost effectiveness of the alternative products.

Finally, the introduction of a complete environmental management programme, like for instance the international standard ISO 14001 (ref. 6), can be considered. Such environmental management programmes do not only include waste management, but all environmental aspects related health care facilities, including wastewater management, emissions from energy production, energy savings, etc.

The full range of options for waste minimisation, re-use of products, the introduction of "green-procurement" and implementation of environmental management system are summarised in the Box 2.14 below.

Box 2.14: Waste minimisation, green procurement and environmental management options (for further details, see Annexure 3.1)

Waste minimisation
Options:
Procedures to reduce the generation of waste;
Effective segregation of HCW;

Increased recycling
Option:
Use of reusable products where appropriate;
Use of waste products for alternative applications
Recyclable materials separated from HCGW.

Introduce "green procurement"
Options:
Substitution of PVC containing products;
Substitution of heavy metal containing products, e.g. Hg-free thermometers;
Non-heavy metal containing dies and colourings;
Substitution of supplies being excessively packaged;
Substitution of products with disposable containers.

Environmental management systems.
Options:
Introduction, execution and monitoring of Environmental management systems.

2.7 Tender Procedures for Contracting Service Providers

An important point in the establishing the sustainable HCWM system at a HCF is to get the best service at the best price. This can be ensured through selecting service providers through a tender procedure. Such tender procedure will normally include the steps shown in Box 2.15 below.

Box 2.15: Different steps of the tender procedure

Selection of tender strategy in consultation with end users;
Identification of services to be outsourced
Development of tender materials that will address the needs of end users;
Appoint tender adjudication committee;
Formulate tender adjudication criteria;
Call for interest (pre-qualification tender);
Selection of qualified bidders;
Invitation to main tender by pre-qualified tenders (submitting tender materials);
Adjudicate once tenders officially closed;
Select most suitable service provider based on tender adjudication criteria, in consultation with tender adjudication committee;
Negotiate minor terms of contract with successful bidder;
Appoint successful contractor;
Roll-out of contracts;
Regularly performance monitoring and contract management.

The first step in outsourcing certain activities is to establish a strategy for how the outsourcing should take place. Such a strategy should among others include considerations on:

What is the overall purpose of outsourcing (cost reduction, improved service etc.)
Which activities should be outsourced and how does it fit into other plans of the HCF
Who should be responsible for the outsourcing and how should it be organised.

The second step is to identify and describe the service/activity that should be outsourced. It is important to describe the activity precisely, and to ensure that the consequences of outsourcing for other parts of the organisation has been thoroughly evaluated.

The third step is to appoint tender adjudication committee. This committee has to set up the adjudication criteria, and later to evaluate the bids in relation to the criteria.

The forth step is to prepare the tender materials, that includes the description of the services and the conditions for bidding and for adjudication of the submitted proposals.

The fifth step is to call for interest: The first step in approaching possible bidders is the announce the need for services, e.g. through advertising in newspapers that interested parties can express their interest in submitting a proposal to the HCF in this or that way (pre-qualification tender)

Based on the expression of interest the tender adjudication committee will evaluate the incoming expression of interests to select those companies that is considered to be capable of conducting the service.

The sixth step is to invite those parties that are selected for the bidding. They will then receive the tender materials.

In the seventh step the incoming proposals will be received within a certain deadline and studied by the tender adjudication committee. The proposals will be opened and the committee will evaluate them according to the criteria established.

Based on the criteria, the winner will be selected by the tender committee.

When the service provider has been selected through the tendering procedure the final step is to negotiate and sign the contract. It is further important that the outsourcing organisation allocate time and resources regularly to monitor the received services, to ensure that service is carried out according to the conditions agreed upon.

2.8 Developing Training Programmes

Another important point for a well functioning waste management system is information, training and instruction of the employees, especially those with specific tasks within the waste management unit. Hence, all doctors, nurses, assistant nurses and the relevant general workers should be trained and informed about the correct HCW management practises.

Table 2.1 below contains suggestions for items to be introduced to the different groups of employees through training programmes or the like.

Table 2.1: Training needs - proposals for training programmes

Topics	Waste Manage-ment Unit (WMU)	Responsible at department level	Nurses, ass. nurses, workers	ICC, physicians
Waste Management				
Definition of health care waste categories	Classroom	Classroom	On-the-job	Classroom
Health, safety & environmental impacts	Classroom	Classroom	On-the-job	Classroom
Organisation of HCWM	Classroom	Classroom	On-the-job	Classroom
Procedures for HCWM (Code of Practice)	Classroom	Classroom	On-the-job	Classroom/Print
Instructions concerning segregation	Classroom	Classroom/On-the-job	On-the-job/Print	Classroom
Instructions concerning storage	Classroom/On-the-job	Classroom	Print	
Instruction concerning treatment	Classroom/On-the-job			
Instructions concerning external transport	Classroom/On-the-job			
Auditing of HCWM	Classroom	Classroom		
Legislative aspects of HCWM	Classroom	Classroom		Classroom
Infection Control				
Sources of infection hazards	Classroom	Classroom	On-the-job	Classroom
Principle for infection control	Classroom	Classroom	On-the-job	Classroom
Personal hygiene	Classroom/On-the-job	Classroom/On-the-job	On-the-job	

Notes: Classroom: Class room training
On-the-job: On the job training and information

Print: Printed information materials

It is important that the training is considered as a current activity, not only to ensure that new staff members are receiving the necessary information and training, but also to ensure that all the staff maintain a high level of awareness.

2.9 Annexure 2.1: Example of an Audit form for HCW Generators.

AUDIT FORM FOR HEALTH CARE WASTE GENERATORS

Auditor's Information:

The following audit form is generic and could be used to audit most of the Health Care Waste (HCW) generators in Gauteng. It is however important to recognise that there will be certain elements of audits that will be unique for any particular facility to be audited and some alterations to the forms may therefore be required.

Due to the wide spectrum of potential HCW generators to be audited, the following audit form is intended to cover the full spectrum, allowing users the opportunity to make deletions where required, rather than to add items to the audit. The audit is further subdivided in a way that will cover both the initial status quo investigation, as well as the routine audits. Once the status quo information is electronically captured, it will be printed on all future audits forms, only requiring the confirmation of the validity thereof by the auditor.

Where onsite HCRW treatment facilities are used, the audit thereof will be undertaken according to the generic audit forms to be developed for HCRW treatment facilities.

Section:	Description:	Page Number:
1	Audit Team Details.	
2	Health Care Facility Classification Details.	
3	HCW Management Policies & Procedures.	
4	HCW Generation.	
5	Financial Recording and Auditing.	
6	HCW Management Equipment and Infrastructure.	
7	Internal HCW Management.	
8	Occupational Health and Safety.	
9	HCW Collection and Transport.	
10	HCW Treatment / Disposal.	
11	General comments and recommendations	

SECTION 1 – AUDIT TEAM DETAILS

1.1 Lead Auditor Details:	Auditor Name:		
	Representing:		
	Tel Number:		
	Fax Number:		
	Cel Number:		
	Email address:		Signature

1.2 Audit Team Members:	Name (1):		
	Representing:		
	Tel Number:		
	Fax Number:		
	Cel Number:		
	Email address:		Signature

Name (2):		
Representing:		
Tel Number:		
Fax Number:		
Cel Number:		
Email address:		Signature

Name (3):		
Representing:		
Tel Number:		
Fax Number:		
Cel Number:		
Email address:		Signature

1.3 Audit Undertaken:	Date:	
	Time:	to

SECTION 2 – HEALTH CARE FACILITY CLASSIFICATION DETAILS

2.1 Facility Details:		
Facility Name:		
Former Name (If applicable):		
Physical Address:		
	Code:	
Postal Address:		
	Code:	

2.2 Contact Details:	
Contact Person: Prof./Dr./Sr./Mr./Ms.	
Tel Number:	
Fax Number:	
Cel Number:	
Email address:	

2.3 Community Served:	
Urban (City)	1
Urban (Town)	2
Rural	3
Informal Settlement	4

Note: Please tick the appropriate box.

2.4 Type of Facility:		Classification:
Hospital	1	Category 1
Clinic	2	Category 1
Blood Bank	3	Category 2
Laboratory	4	Category 2
Medical Practitioner	5	Category 3
Veterinary Surgeon	6	Category 3
Dentist	7	Category 3
Medical Specialist	8	Category 3
Pharmacy	9	Category 4
Pharmaceutical Industry	10	Category 4
Old Age Home	11	Category 5
Hospice	12	Category 5
Mortuary (Independent)	13	Category 5

2.5 Affiliation / ownership:	
National Government	1
Provincial Government	2
Local Government	3
Private (Group)	4
Private (Independent)	5
Others (Please Specify)	6

2.6	Specialist Activity:	
2.6.1	Category 1 Facilities	
2.6.1.1a	Hospital Type:	
General Hospital		1
Training Hospital		2
Central Hospital		3
Regional Hospital		4
District Hospital		5
Sub-District Hospital		6
Mine Hospital		7
Military Hospital		8
Special Infectious Hospital		9
Psychiatric Hospital		10
Rehabilitation Hospital		11
Chronic Care Hospital		12
Other (Please specify)		13

2.6.1.1.b	Clinic Type:	
Day Surgery		1
Primary Health Care Clinic		2
Dental Clinic		3
Industrial Clinic		4
Step Down Clinic		5
TOP Clinic		6
Sick Bays		7
Examination Rooms		8
Human Resource Centre		9
Mobile Clinic		10
Ante-natal clinic		11
Other (Please specify)		12

2.6.1.2a	Types of Wards	
Cardio-thoracic		1
Ear, nose & throat		2
Eye Surgical		3
Gynaecological		4
ICU – Surgical		5
ICU - Cardiology		6
ICU - Neurology		7
Labour		8
Maternity		9
Medical		10
Neurological		11
Neuro-surgical		12
Orthopaedic		13
Paediatric		14
Plastic Surgical		15
Psychiatric		16
Surgical		17
Urological		18
Vascular surgical		19
Other (Please specify)		

2.6.1.2b	Types of Theatres	
Cardio-thoracic		1
Dermatology		2
Ear, nose & throat		3
Eye		4
Gynaecology		5
Maxillo-facial		6
Multidisciplinary		7
Nephrology - kidney		8
Oncology		9
Plastic surgery		10
Pulmonology		11
Urological		12
Vascular		13
Other (Please specify)		14

2.6.1.2c	Types of Dept's.	
Accounting		1
Administration		2
Bio kinetic		3
Blood bank		4
Central sterilisation		5
Dieticians		6
Doctors suites		7
Filing / Archives		8
Hospital management		9
Housekeeping & Cleaning		10
Kitchen		11
Maintenance		12
Mortuary		13
Nuclear Medicine		14
Occupational therapy		15
Orthotistic		16
Out-patients		17
Pathology		18
Pharmacology		19
Physiotherapy		20
Psychology		21
Radio-therapy		22
Rehabilitation		23
Security		24
X-Ray		25
Other (Please specify)		26

2.6.2	Category 2 Facilities			
2.6.2.1a	Blood Bank Type:		2.6.2.1b	Laboratory Type:	
Mobile blood donation clinic		1	Pathological	1
Permanent blood donation clinic		2	Research	2
Hospital blood bank		3	Pathology	3

Central blood bank	4	Biochemistry	4
OPTIONS TO BE LISTED		Microbiology	5
		Haematology	6
		Histology/Sistology	7
		Nuclear Medicine	8
		Serology	9
		OPTIONS TO BE LISTED	

2.6.3 Category 3 Facilities			
2.6.3.1a Medical Practitioner Type:		2.6.3.1b Veterinary Services Type:	
Independent Practitioner	1	Private Veterinary Surgeon	1
Conglomerate of Practitioners	2	Public Veterinary Surgeon	2
Medical Care Centres	3	Veterinary Research Centre	3
OPTIONS TO BE LISTED		OPTIONS TO BE LISTED	
2.6.3.1c Dentist Type:		2.6.3.1d Medical Specialist Type:	
Independent Practitioner		Independent Practitioner	
Conglomerate of Practitioners		Conglomerate of Practitioners	
Medical Care Centre		Medical Care Centre	
OPTIONS TO BE LISTED		OPTIONS TO BE LISTED	

2.6.4 Category 4 Facilities			
2.6.4.1a Pharmaceutical Industry Type:		2.6.4.1b Pharmacy Type:	
Pharmaceutical Manufacturer	1	Medicine Dispensary	1
Pharmaceutical Importer	2	Pharmacy	2
Pharmaceutical Distributor	3	Hyper Pharmacy	3
OPTIONS TO BE LISTED		OPTIONS TO BE LISTED	

2.6.5 Category 5 Facilities			
2.6.5.1a Old Age Home Type:		2.6.5.1b Hospice Type:	
Without Health Care Facilities	1	Cancer Care Centre	1
With Health Care Facilities	2	OPTIONS TO BE LISTED	
Chronicle Illness Facilities	3		
OPTIONS TO BE LISTED			

2.7 Infrastructure & Staff	
2.7.1a Category 1 Facility Infrastructure	2.7.1b Category 1 Facility Staff

	No.	% Use
Wards		
Theatres		
Departments		
Laboratories		
Number of Beds - Formal		
Number of Beds - Informal		
On-site HCRW treatment plant		
Average in-patients per month		
Average out-patients per month		
Number of surgeries per month		
Kitchen		
Canteen		
Floor area of facility (m^2)		
Stand area (ha)		
Storeys / floors		
Intermediate HCW stores		
Central HCW stores		
Distance to cent. HCW store-m		

	HCW Job Descript. Available ?	No. Full time	No. Part time	No. Con - tract
Specialists				
Doctors				
Doctors in training.				
Sisters				
Senior nurses				
Nurses				
Nurses in training				
Nursing assistants				
Porters				
Management				
Administration				
Kitchen				
Laundry				
Housekeeping / cleaning				
HCW Internal collection				
HCRW on-site treatment				
Garden maintenance				
Technical maintenance				
Others (please specify)				

2.7.2a Category 2 Facility Infrastructure

	No.	% Use
Research laboratories		
Test and control laboratories		
Blood transfusion rooms		
Blood storage rooms		
Distance to cent. HCW store (m)		
Floor area of facility (m^2)		
Stand area (ha)		
Storeys / floors		
Intermediate HCW stores		
Central HCW stores		
Distance to cent. HCW store (m)		

2.7.2b Category 2 Facility Staff

	HCW Job Descript. Availabl e?	No. Full time	No. Part time	No. Con-tract
Scientists				
Laboratory technicians				
Gen laboratory assistant				
Cleaners				
HCW management staff				
Others (Please specify)				

2.7.3a Category 3 Facility Infrastructure

	No.	% Use

2.7.3b Category 3 Facility Staff

	HCW Job Descript. Availabl e?	No. Full time	No. Part time	No. Con-tract

Consulting rooms		
Mini theatres		
Overnight facilities		
Floor area of facility (m^2)		
Stand area (ha)		
Storeys / floors		
Intermediate HCW stores		
Central HCW stores		
Distance to cent. HCW store-m		

Specialists				
Doctors				
Dentists				
Veterinary surgeons				
Medical assistants				
General assistants				
Cleaners				
HCW management staff				
Others (Please specify)				

2.7.4a Category 4 Facility Infrastructure		
	No.	% Use
Pharmaceutical factories		
Pharmaceutical stores		
Pharmaceutical dispatch areas		
Pharmaceutical retail areas		
Floor area of facility (m^2)		
Stand area (ha)		
Storeys / floors		
Intermediate HCW stores		
Central HCW stores		
Distance to cent. HCW store (m)		

2.7.4b Category 4 Facility Staff				
	HCW Job Descript. Available ?	No. Full time	No. Part time	No. Con - tract
Pharmacists				
Management				
Administration				
Sales				
Cleaners				
HCW management staff				
Others (Please specify)				

2.7.5a Category 5 Facility Infrastructure		
	No.	% Use
Single rooms		
Double rooms		
Wards		
Floor area of facility (m^2)		
Stand area (ha)		
Storeys / floors		
Central HCW stores		
Distance to cent. HCW store-m		

2.7.5b Category 5 Facility staff				
	HCW Job Descript. Available ?	No. Full time	No. Part time	No. Con - tract
Nursing staff				
Management				
Administration				
Cleaners				
HCW management staff				
Others (Please specify)				

SECTION 3 – HEALTH CARE WASTE MANAGEMENT POLICIES & PROCEDURES

3.1 Existence of Health Care Waste Management Policies & Procedures							
	Internally developed	Centrally developed	NOSA	SABS	ISO 14001	OHS act compliant	Gauteng HCW policy compliant
Internal HCW management policy							
Internal HCW management procedures							
Occupational health procedures							
Occupational safety procedures							
Environmental standards							
Emergency procedures							
Medical waste management plan							

3.2 Revision of Health Care Waste Management Policies & Procedures				
	Date of latest revision	Frequency of revision	Party responsible for revising	Party responsible for approval of revision
Internal HCW management policy				
Internal HCW management procedures				
Occupational health procedures				
Occupational safety procedures				
Environmental standards				
Emergency procedures				
Medical waste management plan				

3.3 Dissemination of Information for Health Care Waste Management Policies & Procedures				
	Circulation of written documentation	Distribution of written documentation	Induction training	Refresher training

Internal HCW management policy				
Internal HCW management procedures				
Occupational health procedures				
Occupational safety procedures				
Environmental standards				
Emergency procedures				
Medical waste management plan				

3.4 Target Groups for Dissemination of Health Care Waste Management Policies & Procedures

	Chief Executive Officer	Dept. Heads	Matron/ Senior Nursing Officer	Hospital Engineer	Infection Control Officer	Pharma-cist	Laboratory Supervisor	Safety Co-ordinator	Cleaners / HCW worker
Internal HCW management policy									
Internal HCW management procedures									
Occupational health procedures									
Occupational safety procedures									
Environmental standards									
Emergency procedures									
Medical waste management plan									

3.5 Existence of Health Care Waste Management Strategic Plan

	Internally developed	Centrally developed	Senior management	Middle management	Health care professionals	Infection control

Strategic plan development						
Strategic plan information dissemination						
Strategic plan implementation						
Compliance monitoring						
Strategic plan revision and updating.						

SECTION 4 – HEALTH CARE WASTE GENERATION

4.1 Average monthly HCW generation rates over the previous year.					
Health Care Risk Waste	HCW generated (kg/litre)	HCRW treated on-site (kg/litre)	HCRW treated off-site (kg)	Discharged to sewer (litre)	Radioactive waste to AEC (kg)
General Infectious Waste					
Sharps					
Pathological Waste					
Pharmaceutical / Chemical					
Liquids					
Radioactive Waste					
(Silver recovery)					
Other (please specify)					
Total HCRW					
Health Care General Waste					
General / non-infectious					
Liquids					
Foodstuffs used as pigswill					
(Cardboard recovery)					
(Paper recovery)					
(Plastic recovery)					
(Metal recovery)					
(Glass recovery)					
Other (Please specify)					
Total HCGW					
Total HCW					

SECTION 5 – FINANCIAL RECORDING AND AUDITING

This Section will to a greater or lesser extent apply to all five categories of health care waste generators and users of these audit forms will be required to apply this Section to the extent to which it may be appropriate for the particular facility.

5.1	Estimated annual capital cost of HCW management: (Please combine where individual costs cannot be presented)			
	Internal Costs (Rands):		Outsourced Costs (Rands):	
	HCGW	HCRW	HCGW	HCRW
HCW bins.				
HCW reusable containers.				
Nursing trolleys (specialised)				
HCW collection trolleys.				
Upgrade of HCW storage areas.				
Upgrade of HCRW treatment facility.				
Others (Please specify)				
Total annual HCW management capital costs.				

5.2	Estimated annual operational cost of HCW management: (Please combine where individual costs cannot be presented)			
	Internal Costs (Rands):		Outsourced Costs (Rands):	
	HCGW	HCRW	HCGW	HCRW
Waste bin maintenance.				
Nursing trolley maintenance.				
HCW collection trolley maintenance.				
HCW storage area maintenance.				
HCRW treatment maintenance.				
Other maintenance (Please specify)				
HCW disposable containers.				

Internal collection and transport.				
External collection and transport.				
Treatment.				
Disposal.				
Other service costs (Please specify)				
Total annual HCW management operational costs.				

5.3 Income generated from HCW recovery (Rands)	
Cardboard recovery	
Paper recovery	
Plastic recovery	
Metal recovery	
Glass recovery	
Silver recovery	
Other service costs (Please specify)	
Total recovery income generated	

5.4 Percentage of annual budget allocated for HCW management.										
< 0,5%	0,5 - 1,0%	1,01 - 1,5%	1,51 - 2,0%	2,01 - 2,5%	2,51 - 3,0%	3,01 - 3,5%	3,51 - 4,0%	4,01 - 4,5%	4,51 - 5,0%	>5,01 %

5.5 Annual HCW management budget:					
	Financial admin	Health care professional	Infection control	Cleansing department	Others (Please specify)
Annual budget centrally done internally by:					
Annual budget internally done by:					
Consultation for budget with:					

5.6 Financial management and control systems:							
	Financial admin	Health care professional	Infection control	Cleaners	Waste collectors	None	Others (please specify)
HCGW quantities verified on collection by:	1	2	3	4	5	6	7
HCRW quantities verified on collection by:	1	2	3	4	5	6	7
Invoices for external services verified by:	1	2	3	4	5	6	7
Payment made at individual health care facility by:	1	2	3				
Payment made from central facility by:	1	2	3				

5.7 Financial Auditing			
	Internal	Central	External
Financial audits undertaken:	1	2	3

SECTION 6 – HEALTH CARE WASTE MANAGEMENT EQUIPMENT AND INFRASTRUCTURE

Note: Please tick or complete the appropriate box.

6.1 Types and average number of containers used / circulated per month for HCW collection:						
	Size (1)	No.	Size (2)	No.	Size (3)	No.
Health Care Risk Waste						
Plastic Bags						
Cardboard Boxes						
Plastic Box Containers						
Wheelie Bins						
Sharps Containers						
Bio-Hazard Containers						
Other (state)						
Health Care General Waste						
Plastic Bags						
85-Litre Waste Bins						
Wheelie Bins						
Skip Containers						
Roll-on Roll-off Containers						
Static Compactor						
Other (state)						

SECTION 7 – INTERNAL HEALTH CARE WASTE MANAGEMENT

HCW source identification: Ward / department / theatre					
7.1 HCW containers					
7.1.1a Supply of appropriate HCRW containers					
	Excellent	Good	Acceptable	Poor	Unacceptable
General Infectious Waste					
Sharps					
Pathological Waste					
Pharmaceutical / Chemical					
HCRW Liquids					
Radioactive Waste					
(Silver recovery)					
Other (Please specify)					
Comments:					

7.1.1b Supply of appropriate HCGW containers					
	Excellent	Good	Acceptable	Poor	Unacceptable
General / non-infectious					
Foodstuffs used as pigswill					
(Cardboard recovery)					
(Paper recovery)					
(Plastic recovery)					
(Metal recovery)					
(Glass recovery)					
Other (Please specify)					

Comments:

7.1.2a Effective distribution and accessibility of HCRW containers					
	Excellent	Good	Acceptable	Poor	Unacceptable
General Infectious Waste					
Sharps					
Pathological Waste					
Pharmaceutical / Chemical					
HCRW Liquids					
Radioactive Waste					
(Silver recovery)					
Other (Please specify)					
Comments:					

7.1.2b Effective distribution and accessibility of HCGW containers					
	Excellent	Good	Acceptable	Poor	Unacceptable
General / non-infectious					
Foodstuffs used as pigswill					
(Cardboard recovery)					
(Paper recovery)					
(Plastic recovery)					
(Metal recovery)					
(Glass recovery)					

Other (Please specify)					
Comments:					

7.1.3a Physical condition of HCRW containers					
	Excellent	Good	Acceptable	Poor	Unacceptable
General Infectious Waste					
Sharps					
Pathological Waste					
Pharmaceutical / Chemical					
HCRW Liquids					
Radioactive Waste					
(Silver recovery)					
Other (Please specify)					
Comments:					

7.1.3b Physical condition of HCGW containers					
	Excellent	Good	Acceptable	Poor	Unacceptable
General / non-infectious					
Foodstuffs used as pigswill					
(Cardboard recovery)					
(Paper recovery)					
(Plastic recovery)					
(Metal recovery)					

(Glass recovery)					
Other (Please specify)					
Comments:					

7.1.4a Effectiveness of HCRW container removal, cleansing or replacement					
	Excellent	Good	Acceptable	Poor	Unacceptable
General Infectious Waste					
Sharps					
Pathological Waste					
Pharmaceutical / Chemical					
HCRW Liquids					
Radioactive Waste					
(Silver recovery)					
Other (Please specify)					
Comments:					

7.1.4b Effectiveness of HCGW container removal, cleansing or replacement					
	Excellent	Good	Acceptable	Poor	Unacceptable
General / non-infectious					
Foodstuffs used as pigswill					
(Cardboard recovery)					
(Paper recovery)					
(Plastic recovery)					

(Metal recovery)					
(Glass recovery)					
Other (Please specify)					
Comments:					

7.2 HCW generation area					
	Excellent	Good	Acceptable	Poor	Unacceptable
Sufficient staff					
Staff appropriately trained					
Appropriateness of nursing trolleys					
Condition of nursing trolleys					
Safe HCW handling practices applied					
Prevention of spillage / litter					
Removal of spillage / litter					
Effective segregation of HCW					
Appropriate containerisation					
Prevention of access to HCW containers					
Odour generation from containers					
HCW management general appearance					
General OHS awareness by staff					
Effective injury reporting system					
Inoculation programme in place					
Anti retroviral treatment available					
Other (Please specify)					

Comments:

7.3 Intermediate HCW storage area					
	Excellent	Good	Acceptable	Poor	Unacceptable
Intermediate storage facility provided					
Accessibility for internal collection					
Suitable ventilation					
Suitable illumination					
Access control					
Demarcation of areas for HCW types					
Facility for storage of radio-active waste					
Sufficient space for empty and full cont.					
Facility for approved disposal of liquids					
Litter or spillage of HCW inside area					
Timely removal of HCRW and HCGW					
Odours generated in storage area					
General OHS awareness by staff					
Effective injury reporting system					
Inoculation programme in place					
Anti retroviral treatment available					
Others (Please specify)					
Comments:					

7.4 Container marking / identification system used:						
	Container colour coding	Manual marking	Labelling or tagging	Bar-coding	Transponder tagging	No system used
Method of identification						

7.5 Information presented in container marking / identification system:					
	HCW category	HCRW subcategory	HCW source per facility	HCW source per ward / dept / theatre	Date of containerisation
Identification information presented					

7.6 Internal collection and transport					
	Excellent	Good	Acceptable	Poor	Unacceptable
Appropriate and sufficient trolleys					
Physical condition of HCW trolleys					
Cleanliness of HCW trolleys					
Sufficient staff					
Staff appropriately trained					
Staff using appropriate PPE					
Collection roster and routes developed					
HCRW supervised at all times					
HCRW only placed in secured areas					
General OHS awareness by staff					
Effective injury reporting system					
Inoculation programme in place					
Anti retroviral treatment available					
Others (Please specify)					

Comments:

7.7 Central HCW storage area					
	Excellent	Good	Acceptable	Poor	Unacceptable
Central storage facility provided					
Accessibility for internal collection					
Suitable ventilation					
Suitable illumination					
Access control					
Protection against natural elements					
Prevention of rodents and vermin					
Demarcation of areas for HCW types					
Facility for storage of radio-active waste					
Sufficient space for empty and full cont.					
Litter or spillage of HCW inside area					
Timely removal of HCRW and HCGW					
Suitable access for collection vehicles					
Effective HCW recording system					
Odours generated in storage area					
General OHS awareness by staff					
Effective injury reporting system					
Inoculation programme in place					

Anti retroviral treatment available					
Others (Please specify)					
Comments:					

SECTION 8 – OCCUPATIONAL HEALTH AND SAFETY

8.1	Is HCW management addressed during occupational health and safety meetings?	Yes	No

8.2 Frequency of occupational health and safety meetings:				
Monthly	2-monthly	3-monthly	6-monthly	Annually

8.3 Frequency of Personnel Protective Equipment issuing:							
	Daily	Weekly	Monthly	Six monthly	Annually	As Required	Not Issued
Aprons							
Gloves							
Goggles							
Face Masks							
Safety Shoes							
Overhauls							
Other							

8.4	Is a Policy / Guideline available that outlines the emergency procedures required in case of an injury / spills (e.g. needle-stick injury) or contamination of a HCW worker?	Yes	No

8.5 Number of injuries in the last year caused by used sharps:					
	0	1-10	11 - 20	21- 30	More than 30
Needle stick injuries					
Cuts by sharps objects					

8.6 Actions taken after injuries with sharps:						
	Anti-retroviral treatment given?	Internal incident reporting?	Internal investigation and prevention?	OHS Act requirements met?	Dept of Labour requirements met?	Follow up testing?
Needle stick injuries						
Cuts by sharps objects						

8.7 Number of HCRW spills in the last year:					
	0	1-10	11 - 20	21- 30	More than 30
Infectious waste					
Sharps					
Pathological waste					
Liquid waste					
Radioactive waste					
HCGW					

8.8 Actions taken after HCRW spills:				
	Safe removal of HCW	Disinfection of affected area	Internal reporting	Internal investigation and prevention
Infectious waste				
Sharps				
Pathological waste				
Liquid waste				
Radioactive waste				
HCGW				

8.9	What precautions are taken to prevent infection from such injuries/spills e.g. Hepatitis B & AIDS?

.....

.....

.....

8.10 Occupational health and safety training for various staff groups:							
	Monthly	3-monthly	6-monthly	Annually	Bi-annually	Induction only	Not applicable
Chief Executive Officers							
Dept. Heads							
Matron/ Senior Nursing Officer							
Hospital Engineers							
Infection Control Officers							
Pharmacists							
Laboratory Supervisors							
Safety Co-ordinator							
Cleaners / HCW workers							
Others (Please Specify)							

8.11 Party responsible for implementation and monitoring of occupational health and safety:								
Chief Executive Officers	Dept. Heads	Matron/ Senior Nursing Officer	Hospital Engineer	Infection Control Officer	Pharmacist	Laboratory Supervisors	Safety Co-ordinator	Others (Please Specify)

SECTION 9 – HEALTH CARE WASTE COLLECTION AND TRANSPORT

9.1 Internal or external service provision:					
	Internal service	Partially outsourced	Fully outsourced	Start of contract	End of contract
Internal HCW collection and transport					
HCRW collection and external transport					
Collection of expired pharmaceuticals					
Collection of HCRW with a silver contents					
HCGW collection and external transport					
Collection of segregated recyclable HCGW					

9.2 Frequency for collection and removal of HCRW:							
	Infectious Waste.	Sharps.	Pathological.	Pharmaceutical / Chemical.	Radioactive Waste.	HCRW liquids.	Silver recovery
Daily.							
Daily, excluding weekends.							
Every second day.							
Twice a week.							
Once a week.							
Every two weeks.							
Once a month.							

9.3 Frequency for collection and removal of HCGW:							
	HCGW	Liquids	Recyclable cardboard	Recyclable paper	Recyclable plastic	Recyclable metal	Recyclable glass
Daily.							
Daily, excluding weekends.							
Every second day.							
Twice a week.							
Once a week.							
Every two weeks.							
Once a month.							

9.4 HCW mass / volume data recording for transport:					
	Mass recording only.	Volume recording only.	Combination of mass and volume.	Fixed amount per facility	Others (Please specify)
HCGW.					
HCGW recyclable recovery.					
HCRW					
Silver recovery.					

9.5 Contact details of HCGW collection and transport service provider:	
Company Name:	
Contact Person:	
Telephone Number:	
Fax Number:	
E-mail:	

9.6 Contact details of HCRW collection and transport service provider:	
Company name:	
Contact Person:	
Telephone Number:	
Fax Number:	
E-mail:	

9.7 Contact details of HCGW recyclable collection service provider:	
Company Name:	
Contact Person:	
Telephone Number:	
Fax Number:	
E-mail:	

9.8 Contact details of expired pharmaceutical collection service provider:	
Company Name:	
Contact Person:	
Telephone Number:	
Fax Number:	
E-mail:	

SECTION 10 – HEALTH CARE WASTE TREATMENT AND DISPOSAL

In terms of the "Duty-of-Care" principle, generators of HCW are responsible for the safe and environmentally sound treatment and / or disposal of all waste generated on its premises. It is therefore expected, even where HCW treatment and disposal services are outsourced, that the generator will ensure that the services rendered comply with the required Guidelines for HCW management in Gauteng:

10.1 Internal or external service provision:					
	Internal service	Partially outsourced	Fully outsourced	Start of contract	End of contract
HCRW treatment					
HCRW residue disposal					
HCGW disposal					

10.2 Estimated percentage of HCRW treatment / disposal undertaken at respective facilities:					
	General infectious %	Sharps %	Pathological %	Pharmaceutical / chemical %	Liquids %
Sewer disposal.					
On-site treatment.					
Off-site treatment.					

10.3 Technology used for HCRW treatment**:**					
	General infectious %	Sharps %	Pathological %	Pharmaceutical / chemical %	Liquids %
Autoclaving.					
Electro Thermal Deactivation					
Incineration.					
Microvawing.					
Other (Please specify)					

10.4 HCW mass / volume data recording for treatment / disposal:					
	Mass recording only.	Volume recording only.	Combination of mass and volume.	Fixed amount per facility	Others (Please specify)
HCGW.					
HCRW					

10.5 Contact details of HCRW treatment service provider:	
Company Name:	
Contact Person:	
Telephone Number:	
Fax Number:	
E-mail:	

10.6	Method of disposal of untreated HCGW and treated HCRW residues:		
	General Waste Landfill %	Hazardous Waste Landfill %	Other (Please specify) %
Health Care General Waste			
Health Care Risk Waste			

10.7 Contact details of landfill operator for HCGW:	
Company name:	
Contact Person:	
Telephone Number:	
Fax Number:	
E-mail:	

10.8 Contact details of landfill operator for HCRW residues:	
Company name:	
Contact Person:	
Telephone Number:	

Fax Number:	
E-mail:	

SECTION 11 – GENERAL COMMENTS AND RECOMMENDATIONS

11.1 General comments

11.2 Recommendations:

2.10 Annexure 2.2: Example of a Template for the development of a Waste Management Plan

Template for:

HEALTH CARE WASTE MANAGEMENT PLAN FOR HOSPITAL

September 2002

PREPARED BY: …….

Job Ref.No.	x	Prepd.	xTOK/NJB
Edition	V01	Checked	x….
Date	2003-08-11	Appd.	x….

Table of contents

1. Introduction

This Health Care Waste Management Plan (HCWMP) is prepared for …..Hospital, by the Waste Management Steering Committee, with the following representatives:

The Management of the HCF
The Matron
The Waste Management Officer
Occupational Health and Safety Officer
The Infection Control Officer
Chief Pharmacist
Radiation Officer
Departmental heads.

The Plan is approved by the Management of the ….. Hospital by ……, 2002, and is due to revision by ……, 2003.

1.1 Objectives of the Waste Management Plan

The Waste Management Plan has the objective of:

Ensuring that the health care waste management at the hospital currently will be improved to reach international standards.

1.2 Scope of the Waste Management Plan

The Waste Management Plan covers the following Health Care Waste categories:

…….
…….
…….

The HCWM is valid for the following period: 06/2002 – 12/2003, and is due to revision 01/2003.

2. Status Quo

2.1 Basic data on the hospital

Number of beds, departments, staff etc.

2.2 Description of the present HCW Management System

2.2.1 Description of the overall organisational structure of the hospital

Organogram, number of staff in different departments, responsibilities.

2.2.2 Description of the organisational structure of the HCW Management

Organogram, number of staff in different departments, responsibilities.
Description of present HCW Management practices.
Information and training activities.

2.3 Amounts of waste

Includes the latest data on the amounts of waste generated at the hospital divided on the various categories and on the various department if possible.

2.3.1 HCRW

2.3.1.1 General infectious waste

Sharps

Pathological waste

……..

……..

2.3.2 HCGW

2.4 Estimates of waste generation rates

Estimates of waste amounts generates at various department, divided on various categories, and comparing with previous generation rates.

2.5 Cost of waste management

Information from bookkeeping department on fees paid for disposal of waste.

3. Problem identification, needs analysis and risk assessment

This chapter includes a problem identification and a risk assessment.
The problem identification is based on the auditing, end reports from the various heads of department that have collected input from their staff.

The needs analysis is carried out through a comparison between the problems identified and the standards set for the various areas.

The risk analysis is carried out for those areas that include special risks of the human health and environmental pollution, e.g. needle stick injuries.

3.1 Problem identification

The problems can be divided into categories following the waste flow:

Waste generation, segregation, containerisation:
Human health (acute/permanent problems)
Environmental pollution
Internal transport and storage
Human health (acute/permanent problems)
Environmental pollution
…….

3.2 Needs analysis

The needs analysis is responding to the problems identification. For each problem the needs for implementing measures to overcome the problem will be described.

3.3 Risk assessment

For those problems that impose special risks, a risk assessment will be carried. This will also be taken into consideration in the description of needs.

4. Possible Solutions and Targets

For each of the problems identified a possible solution is described and targets for its accomplishment is established.

The targets include a description of how the problem should be addressed and within which time frame the problem will be solved.

The description of the solutions and the target are responding to the individual problems, and hence they will follow the waste flow.

The solutions include among others:

Introduction of new procedures
Provision of new equipment and materials
Training and information
Out sourcing of functions
…..

5. Plan of Action

The plan of action describes the various activities that need to be implemented in order to overcome the problems and needs. The plan furthermore describes who will responsible for the various activities, and how they should be financed.

The various activities that have to be implemented in the Plan can e.g. divided on the various departments.

A special summary of the activities for the coming half year will be prepared, so it becomes obvious what will be monitored at the next audit.

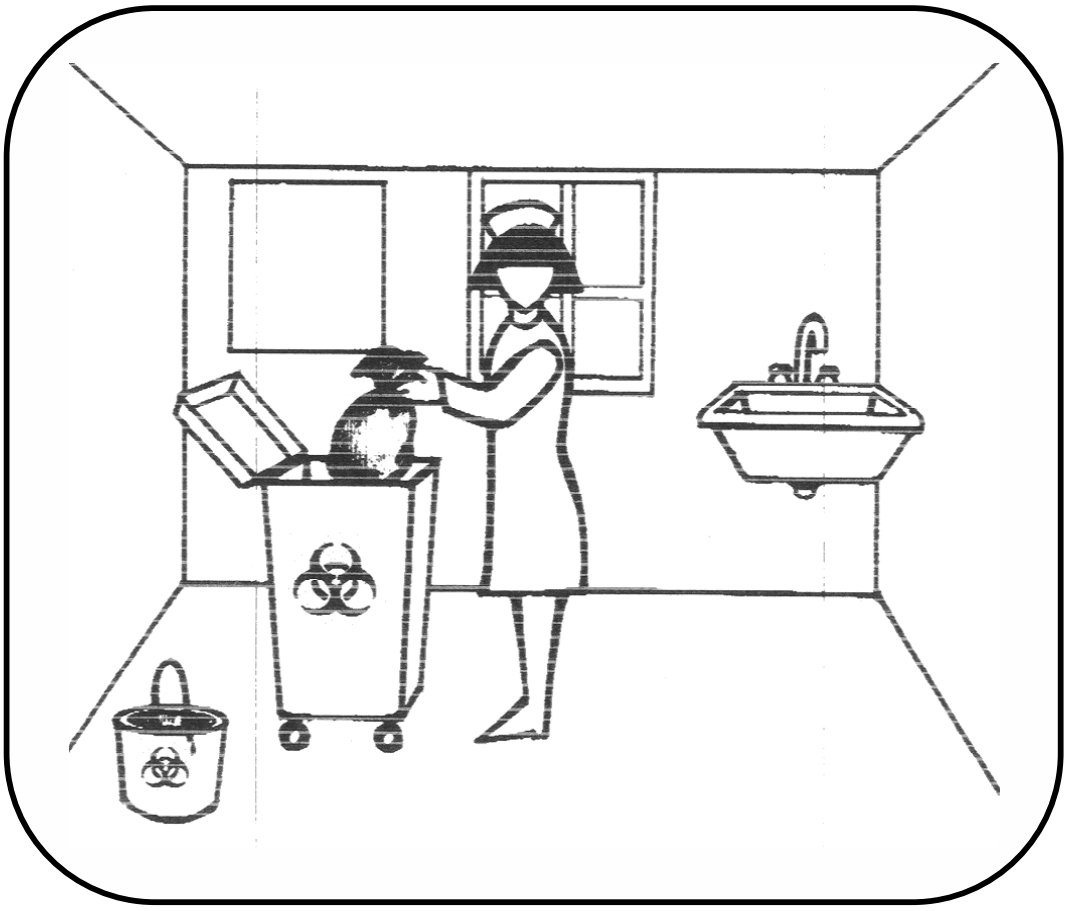
6. Monitoring

The monitoring will measure how the various activities described in the previous Plan has been implemented. The monitoring will result in a report to the management of the hospital and the HCWM Steering Committee, indicating which activities that successfully have been implemented and which have not.

Guidelines
on Sustainable Health Care Waste Management in Gauteng

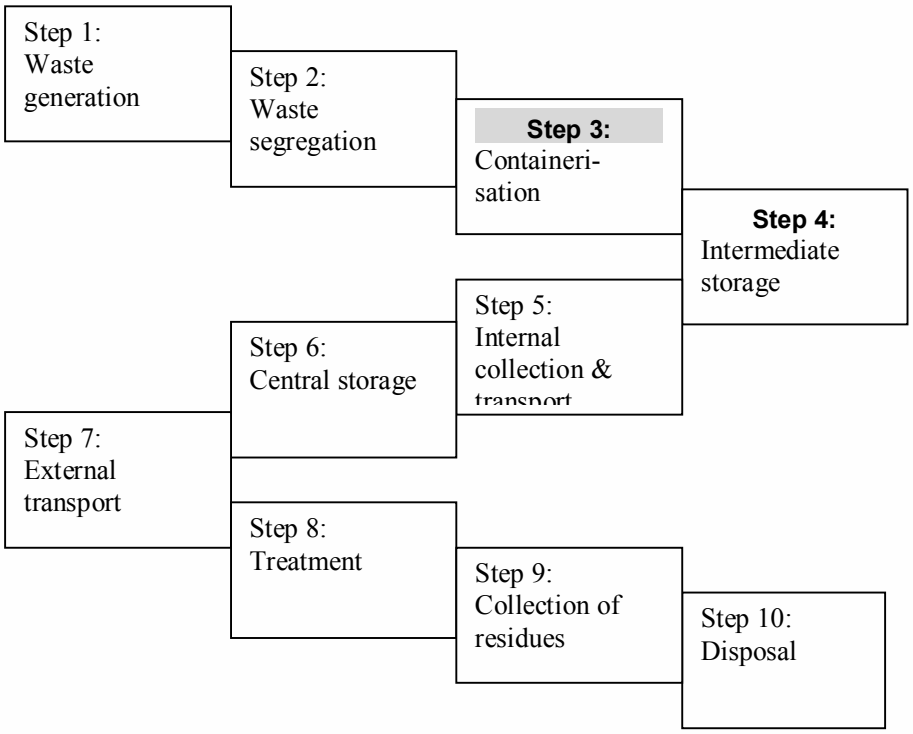
MODULE 3: HCW generation, segregation and containerisation:

- Waste reduction, reuse & recycling
- Waste Segregation
- Registration
- Labelling
- Examples on containers
- Guiding prices



3. Module 3: HCW Generation, Segregation and Containerisation

Box 3.1: Steps of the HCW flow included in this Module



3.1 Objectives of Module 3

The first step in handling of Health Care Waste (HCW) after generation is the segregation – or sorting or separation as it is also called – of HCW. The HCW is sorted into Health Care General Waste (HCGW) and a number of Health Care Risk Waste (HCRW) sub-categories that require specific handling and / or treatment procedures. Once sorted, the waste is deposited or containerised in containers that are appropriate for the particular type of waste. This activity is considered to be the most fundamental step in any HCW management system, and is likely to have a significant impact on the effectiveness with which the remaining activities of the system will be implemented.

The objective of Module 3 is therefore to provide guidance and information required to assist generators of HCW to execute the HCW segregation and containerisation activities in such a way that it will ultimately result in the efficient and environmentally sound, yet occupational healthy and safe, treatment and / or disposal of HCW.

Although the information provided may be too detailed for the smaller health care facilitiess, the parties responsible will be required to use sound judgement on the extent to which this particular Module of the guidelines will apply.

Important Note

Segregation and containerisation of HCW should take place at the source/point of generation, rather than when the waste has already been mixed, since:
It is more efficient to do the segregation and containerisation at source;
Internal transport of HCW is safer when HCRW is separated from the HCGW;
There is a reduced risk of injuries and infection when HCW is sorted at source, rather than when HCRW and HCGW has already been mixed.

The packaging – or containerisation – of the HCW will depend on the characteristics of that particular waste category, the safety precautions required, the rate at which the HCRW is generated and the transport and treatment methods proposed.

3.2 Target Group

The focus of this module is directed towards the parties responsible for the generation of HCW (i.e. the health care professionals), describing the actions that are required for the subsequent segregation and containerisation of the various HCW categories. Although the activities described in this module is extremely extensive and will therefore address the most extreme cases like for instance large hospitals, smaller generators like clinics and even general practitioners are expected to evaluate this module and to identify the particular items that may be relevant to them.

3.3 Scope of Module 3

This module will in essence address the activities that are associated with the health care professionals, and over which they have an impact. The following aspects are therefore addressed in this module:

HCW generation, and the various ways in which the volume of disposable HCW can be reduced through green procurement, minimisation, re-use and recycling;

HCW segregation, not only into the two main categories of HCGW and HCRW, but also subdividing the HCRW into general infectious waste, pathological (anatomical) waste, sharps, chemical/pharmaceutical waste and radioactive waste;

HCW containerisation, packaging the waste into containers appropriate for HCGW or the particular HCRW category.

3.4 Reference to Other Modules

The information in this Module is to be read in conjunction with Module 1, which is the Module designed to address all the cross cutting issues identified in the process of integrated HCW management.

Readers are also referred to Module 5 to obtain a better understanding on the interfacing that needs to take place in terms of HCW management inside the health care facility in the form of internal transport and storage.

3.5 What are to be considered in HCW Generation?

The hierarchy to be followed in the process of HCW generation, includes in accordance with the National Waste Management Strategy (NWMS) issued in 1999, the following steps:

Waste avoidance
Reuse
Recycling
Treatment
Disposal.

Each of these steps is described in the following sections.

3.5.1 Waste Avoidance

The first objective is to prevent waste from being generated. Some examples of actions aimed at avoiding the generation of waste are presented in Box 3.2

Box 3.2: Examples of actions that will result in waste avoidance.

Waste avoidance could be achieved in a number of ways that *inter alia* include:
Refraining from generating waste through disposal of materials unless it is unavoidable, provided that the health and safety of people are not put at risk;
Limiting the use of disposable items through increased use of reusable items, once again on condition that it will not create an increased health risk to patients.

3.5.2 Green Procurement

Green procurement is a process of intentional selection of products during the purchase process that will not only assist in generating less waste, but that will also ensure that waste being generated, can be treated and / or disposed of in an environmentally sound manner.
Examples of green procurement are presented in Box 3.3.

Box 3.3: Examples of Green Procurement.

Green procurement can be achieved by purchasing:
Products with only the minimum required amount of packaging;
Reusable products or products that are recyclable, whilst being non-infectious;
Plastic bags, containers or similar items to be incinerated, that is made of Polypropylene (PP), alternatively of Polyethylene (PE), or any other plastic material that can be demonstrated to produce minimum emissions if incinerated. PVC may only be used where it cannot reasonably be substituted by other plastic material for medical or technical reasons;
Plastic, paper, cardboard or other materials that do not contain dyes or colouring agents that contain heavy metals, chlorinated or other halogenated compounds, and shall be of such a nature that minimum pollution is caused when incinerated or disposed of;
Disposable receptacles that are designed with a view to minimising the wastage of materials without compromising on the strength of the containers, thus avoiding excessive disposal of paper, cardboard, plastic, metal etc.

3.5.3 Waste Reuse

The use of reusable products rather than disposable products is to be encouraged as far as possible, provided that it will not create a risk of infection when reused. In some instances the products may be reused for the same purpose initially intended for, although in other instances the product may be

reused for an application completely different from its initially intended use. Examples of the reuse of products are presented in Box 3.4.

Box 3.4: Examples of reuse of materials or products.

Products can be reused in a number of ways, provided that the health of staff or patients is not put at risk due to the risk of infection, for example by:
Making use of reusable linen;
Making use of reusable theatre outfits;
Purchasing products that are packed in reusable containers;
Reusing the containers used for the supply of chemicals, for the containerisation and offsite transport of the products when used (waste);
Reusing packaging materials for alternative purposes.

3.5.4 Waste Recycling

The recycling of waste materials is yet another way of reducing the waste stream. Materials like glass, paper, cardboard, plastic, metal etc. should therefore be recycled where financially viable and practically possible, provided however that it would not in any way create any risk of infection.

Important Note

The following is to be considered during the establishment of a recycling system:
It is stated categorically that *no HCRW, or HCGW that came into contact with HCRW*, is to be recycled;
Should HCRW have been treated with non-thermal technologies to the point where it is classified as non-hazardous for disposal at general waste disposal sites, such materials may be recycled if it is considered to be economically viable and aesthetically acceptable;
Waste avoidance and waste reuse is preferred over waste recycling, as the latter will not only require additional energy consumption, but it is also likely to result in some form of pollution during its processing or by the disposable residues.

3.5.5 HCW Treatment and Disposal

The remainder of the HCW stream for which the aforesaid minimisation measures may not be feasible, is to be treated and / or disposed of in an environmentally sound manner.

3.6 How to Segregate the Waste

Effective segregation of HCW into the main categories of HCGW and HCRW, with the latter at the same time being segregated into its subcategories as indicated below, is one of the fundamental requirements for the implementation of an effective HCW management system. The categories into which HCRW is to be segregated are as follows:

- General infectious waste;
- Pathological (anatomical) waste;
- Sharps;
- Chemical / pharmaceutical waste;
- Radio-active waste (requiring specialised handling, treatment and disposal)

The extent to which segregation of HCRW is undertaken primarily depends on the proposed method in which the waste is to be handled and treated. For some treatment technologies, HCRW initially segregated into different categories may be combined at the time of treatment. Initial segregation was therefore undertaken in the interest of worker safety (as in the case of sharps), or for the sake of specialised storage (as in the case of pathological waste).

Limitations inherent to certain treatment technologies results in the need for certain HCRW streams to remain separated from segregation to treatment/disposal:

Where incineration is the elected treatment technology, general infectious waste, sharps, pathological waste as well as chemical/pharmaceutical waste (in limited proportions) may be treated together. The amount of PVC is however to be limited for this treatment technology;

Should steam sterilisation be the elected treatment process, only general infectious waste, sharps and some parts of pathological waste may be treated together. The remaining categories are to be treated in another way, and will therefore have to remain separated all the way from segregation, through the HCRW flow path to the treatment process.

Important Note

A number of important considerations are to be taken into account when segregating HCW:
All HCW shall be sorted at source and no after-sorting of HCRW at any point of the waste stream shall be permitted;
Where HCW is poorly sorted or where there is any doubt as to the contents of the receptacles / bags, it shall all be *treated and disposed of as HCRW*;
Provision of waste collection receptacles of appropriate design for anatomical waste, infectious waste and sharps etc. shall be provided at source to ensure that all waste is effectively containerised when segregated.

The bulk of the HCW generated at most of the health care facilities is HCGW - or general waste as it is referred to when generated outside of health care facilities. The aspects to be considered for HCGW management are presented in Box 3.5.

Box 3.5: Aspects to be considered for *HCGW* management.

The following aspects are to be considered in the management of *HCGW*:
HCGW normally poses no special risk, but since it contains organic degradable and other harmful materials, it should be collected regularly and kept in safe places to prevent unauthorised access, thus minimising the risk of unintentional spreading of contaminated materials through wind or rain;
HCGW is not infectious and can be disposed of at general waste disposal sites without the need for any further treatment, as in the case of HCRW;
All HCGW that cannot viably be reused or recycled and that was *not* contaminated by HCRW, shall be disposed of via the conventional general waste disposal system. This will reduce the need for costly treatment of HCW as well as the risk of unacceptable emissions resulting from thermal / chemical / mechanical / disinfecting treatment.

3.7 Packaging and Containerisation

There are a number of alternative reusable as well as disposable containers available in the market, each designed for the particular needs of the HCW category to be collected. The factors to be considered when selecting any particular type of container, are as presented in Box 3.6.

Box 3.6: Considerations when selecting a HCW container.

The size and type of HCW containers used will *inter alia* depend on the following:

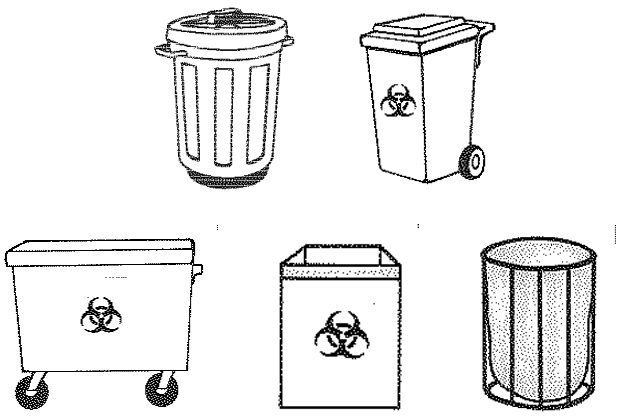
Design criteria for containers:
The amount, density and categories of HCW generated between collection rounds;
A maximum allowable mass of 15 kg is to be adhered to where HCW containers are to be handled manually. Manual handling and lifting as well as the number of transfers is therefore to be minimised through the use of trolleys, wheelie bins, or similar mechanisms.
The protection that HCW containers will have against the natural elements during all phases of the HCW management process;
The expected lifecycle for reusable containers.

Occupational health and safety design criteria:
Any container systems being used will have to meet the occupational health and safety requirements, whilst ultimately being affordable to ensure the system's financial sustainability
The security measures that are to required to prevent tampering with radioactive, anatomical- or pharmaceutical waste during the HCW management process;
The risk of abuse of containers through inappropriate uses, theft, vandalism, etc.

Design criteria for interfacing with HCWM system:
The requirements for the containers to be compatible with the interfacing components for the remainder of the HCW management process, like collection, transport and treatment;
The storage space available for HCW containers before use, resulting in the need for it to be stackable, collapsible, foldable, round, square etc.
The storage space available for HCW containers when in use at source, at the source, in the sluice or at the central storage area;
The need as well as the feasibility of stacking full HCW containers in multiple layers at various storage areas as well as during transport;
The form of internal transport to be used, as well as the need for containers to be able to access all required areas during internal transport;
The need for ramps and lifting platforms when transporting HCW containers internally as well as externally to the treatment facility;
The feeding mechanism used at the treatment facility;
The availability of sterilisation / disinfection processes for reusable containers;
The availability of transport for distribution of sterilised/disinfected reusable containers or new disposable containers.

Examples on different types of containers for collection of HCW are illustrated in Box 3.7 below.

Box 3.7: Examples on containers for HCGW and HCRW collection



Important Note

All HCRW containers shall be marked with the following symbol printed in red, unless the colour of the container is red, in which case the printing shall be done in white:
The international ISO biohazard symbol (cf. WHO Guidelines and SABS codes)

- Text clearly identifying the contents as HCRW/Infectious Waste/Medical Waste/Clinical Waste (any of the mentioned terms are acceptable, to allow for cost-effective use of various existing national and international products);
- The intended contents of plastic bags may be indicated by the use of colour coding only, thus allowing for savings by avoiding printing of plastic bags.

Forming an integral part of the containerisation system is the need for a uniform marking / labelling system. The labelling should be based on the principles listed in Box 3.8 below.

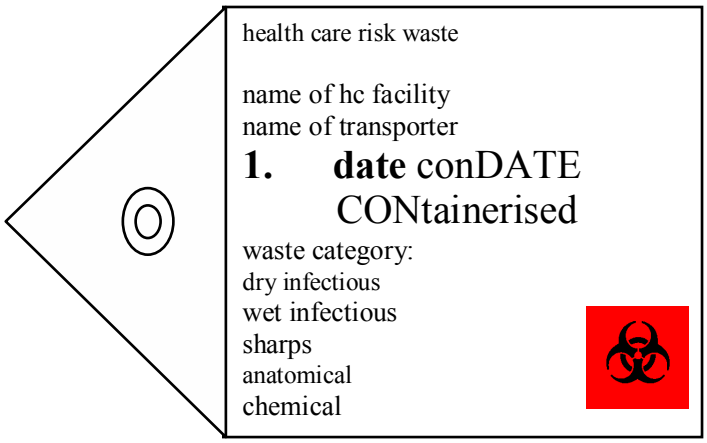
Box 3.8: Principles for labelling of HCRW containers

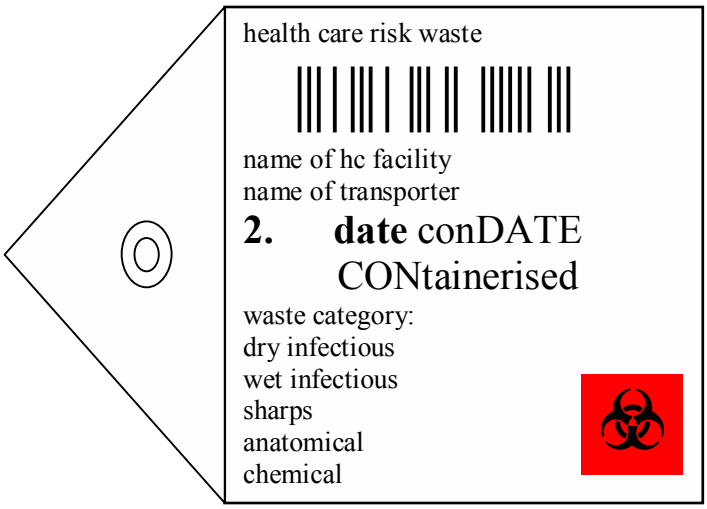
All containers shall be labelled in such a way that the following information is clearly visible:
Waste category
Preferably the following additional information should also appear on the label:
Date;
Name of health care facility;
Department identification (if applicable).

Box 3.9 presents an example of labels for registering HCRW containers.

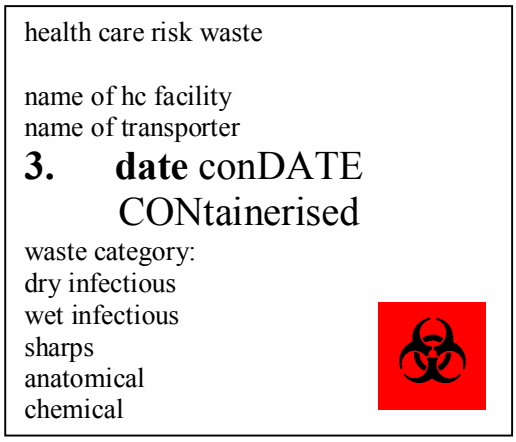
Manual recording – a

Option 1A & 1B: Printed tie-on label with or without barcoding or stamped tie-on label without barcoding attached to container with cable tie or alternative method used to seal the reusable container.





Option 2A & 2B: Printed stick-on label with or without barcoding or stamped stick-on label without barcoding attached to all disposable containers (both cardboard and plastic disposable containers).



3.7.1 Health Care General Waste

The HCGW containers may vary from small 85-litre bins with / without plastic liners or 240-litre wheelie bins with / without liners, to bulk 5,5-m^3 skips and even up to 20-m^3 roll-on-roll-off containers. The aspects to be considered when selecting the most appropriate HCGW container, are presented in Box 3.10.

Box 3.10: Considerations in selecting HCGW containers.

The type of container used for HCGW will to a large extent depend on:
The waste generation rate for the particular health care facility;
The storage space available for the HCGW containers;
Access to the storage area for pedestrians as well as HCGW collection vehicles;
The availability of any particular type of waste collection vehicle used by the local authority or contractor that is responsible to render the HCGW management service;
Where HCGW plastic bags are used the colour to be used may be any colour other than red or yellow. Preference should be given to black, beige or transparent.

3.7.2 General Infectious HCRW (non-sharp and non-pathological)

General infectious HCRW (infectious waste that does not include sharps or pathological waste) could, after segregation, alternatively be placed in plastic bags positioned within fixed or mobile racks, within reusable plastic containers or alternatively within disposable cardboard containers. In South Africa the colour of the bags used for general infectious HCRW is elected to be red, thus indicating that it contains HCRW.

The criteria used when selecting containers for general infectious HCRW are presented in Box 3.11.

Box 3.11: Criteria in selecting containers for general infectious HCRW.

The following aspects will impact on the type and size of container selected for containerisation of general infectious HCRW:
The container size is determined by the:
- infectious HCRW density, thus by final mass of full container to be handled;
- rate at which infectious HCRW is generated;
- space available for placing of containers at infectious HCRW source;

The implications of sterilisation / disinfection of reusable containers at the:
- infectious HCRW source;
- treatment facility;

The logistics for delivery of:
- sterile / disinfected reusable containers during collection of full infectious HCRW containers;
- sterile / sterile reusable containers during dedicated delivery rounds;

The need for marking of containers with:
- permanent pen markers;
- bar-coded printing / stickers;
- transponder tags;

The need for a HCRW tracking system by means of:
- repeated weighing and manual recording;
- a manifest system;
- a transponder system.

The criteria used when selecting plastic liners for storage of HCRW is as follows:
The thickness of for instance the polyethylene bags should be at least **80 microns** when not permanently placed inside a container / covered bag holder, and at least **60 microns** when used as a permanent inner liner for a disposable container.
The outer dimensions of the bags can vary between **….x ….** mm to **….x…..** mm or …. litre to …. litre.
Receptacles other than bags should have a clearly marked red identification of the hazardous contents of the container.

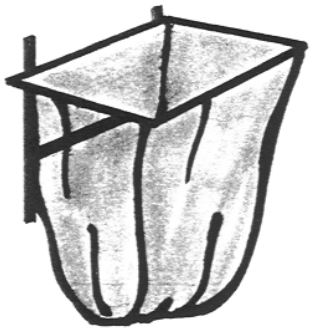
Based on the above considerations, there is a wide range of alternative containers on the market that will ensure that the general infectious HCRW is managed in a safe and healthy manner. A number of these containers are presented in Box 3.12.

Box 3.12: The following options are internationally or locally available for general infectious waste containers:

Plastic bags for non-sharp infectious waste;
Disposable cardboard boxes with liners for non-sharp infectious waste;
Disposable cardboard boxes with plastic lamination for non-sharp infectious waste;
Reusable plastic containers for non-sharp infectious waste (with or without plastic liner and with/without wheels);

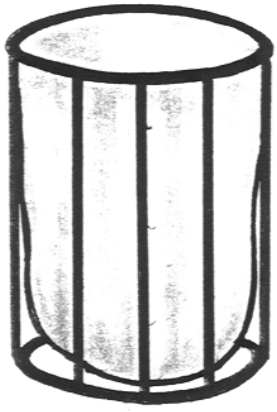
Pictures of selected containers are shown in Box 3.13.

Box 3.13: Examples on containers for general infectious HCRW collection



Metal rack with plastic liner, hanging on wall

Cardboard box with plastic liner



Metal rack with plastic liner, standing on floor

Wheelie bin with plastic liner inside

3.7.3 Pathological Waste

Pathological waste usually includes larger body parts that may require larger bags or containers. If the pathological waste is treated different from the remainder of infectious waste - like through incineration or at crematorium - it will be appropriate to pack it in bags of a colour other than red, for example yellow (???), or alternatively with a clearly defined marking. The types and sizes of pathological waste containers can also vary significantly, and the criteria used for this are presented in Box 3.14.

Box 3.14: Criteria used for selection of pathological waste containers.

The following criteria is used in selecting containers that will be suitable for pathological waste:
Container size is determined by the:
- Rate at which pathological waste is generated;
- Space available at pathological waste source;
- Size of the pathological items to be disposed of;
- Pathological waste density, thus by final mass of full container to be handled.

The handle design is determined by the:
- Maximum allowable load to be carried in the container;
- Impact that the handle material (plastic or metal) will have on the treatment process;
- Comfort required during the handling of the containers;

The lid design is determined by:
- The standard of seal that will be required;
- The need for the lids to be reopened.

The type of material used for manufacturing of the container will be determined by:
- The cost of the alternative materials, with then understanding that no PVC shall be used for any disposable containers that are to be incinerated.

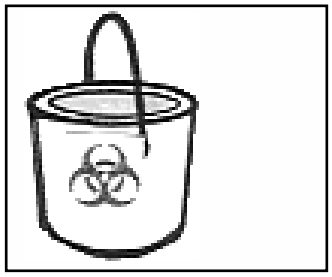
Having considered the criteria to be used in selecting appropriate pathological waste containers, the options available in the market is presented in Box 3.15.

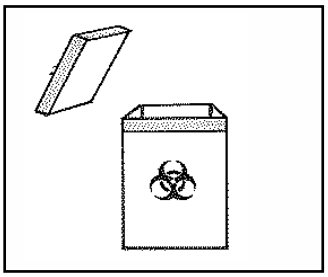
Box 3.15: The following options are available for pathological containers:

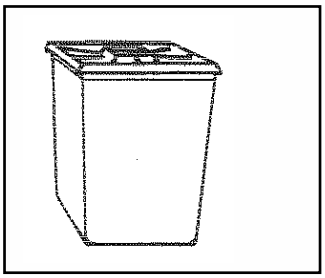
Disposable cardboard boxes with liners for pathological waste;
Disposable cardboard boxes with plastic lamination for pathological waste that is packaged in a disposable leak-proof inner container/bag;
Disposable puncture proof plastic containers for non sharp waste;
Reusable plastic containers for pathological waste that is packaged in a disposable leak-proof inner container/bag.

Examples on different types of containers for pathological waste are shown in Box 3.16 below.

Box 3.16: Examples on containers for pathological waste







3.7.4 Sharps

Collection and transport of sharps require special packaging, i.e. containers that are tamper proof, puncture proof, spill proof and totally moisture resistant, that will prevent those handling and transporting it from being exposed to the sharp objects, some of which may be infectious.
The criteria use in selecting appropriate sharps containers is presented in Box 3.17 below:

Box 3.17: Criteria used when selecting sharps containers.

The criteria used when selecting appropriate containers for sharps are as follows:

- The sharps container size is determined by the:
  - length of the sharps to be disposed of;
  - rate at which sharps waste is generated;
  - space available at sharps source, e.g. on nursing trolley.
- The protection required for any persons handling the equipment;
- The risk associated with the removal of needles from syringes when considered as an option to save space in the sharps containers;
- The financial implications associated with the use of retractable needles;

The type of material used for manufacturing of the container will be determined by:

- The container being tamper proof, puncture proof, spill proof and totally moisture resistant
- The cost of the alternative materials, with then understanding that no PVC shall be used for any disposable containers that are to be incinerated.

Based on the above criteria, the containers that are likely to be appropriate for sharps will allow for all aspects presented in Box 3.18 below.

Box 3.18: Alternative options available for sharps containers.

The following items will be applicable for sharps containers:

Plastic containers of solid polymer, e.g. polypropylene;
An indicator for the maximum fill level that should preferably be transparent;
Sharps containers are to be red or alternatively yellow with significant red markings, including the international biohazard symbol to indicate that it contains infectious materials;
Sharps' containers should be provided with lids that fit tightly and that cannot be reopened once closed, thus preventing users at health care facilities as well as those responsible for handling and transporting the containers, from getting in direct contact with the infectious sharp objects;
The sizes of containers should be selected to have sufficient capacity to contain the amount of the sharps that can be expected to be generated over a period of 1-4 weeks, thus preventing users from over-filling the containers on the one hand, whilst at the same time preventing that containers become unhygienic due to an excessive service period;
Although a substantial space saving can be achieved through this, the increased risk when separating needles from syringes is not considered to be justifiable;
In some departments relatively long needles are used and appropriately long sharps containers need to be provided to such departments.

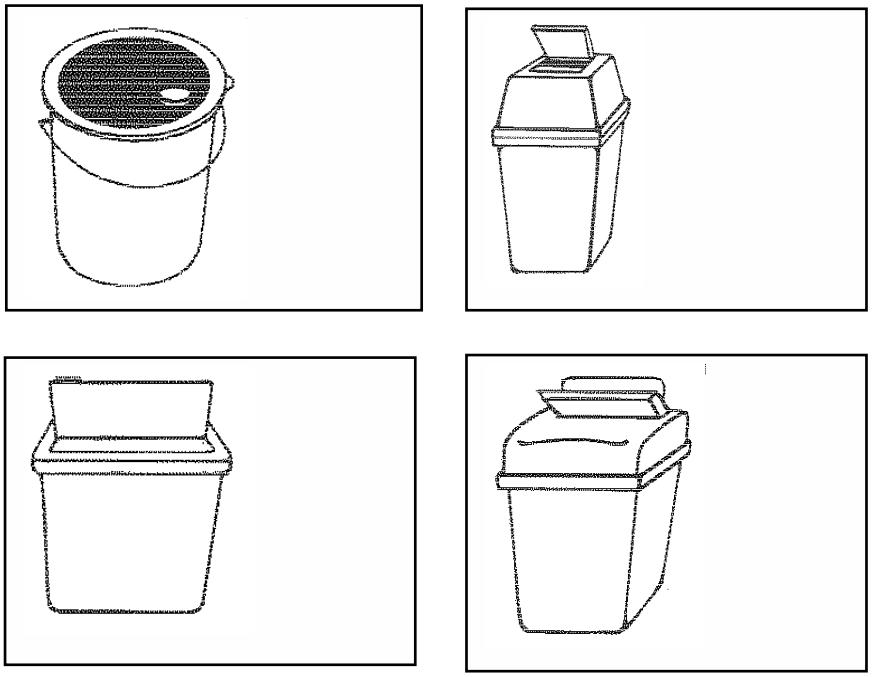
The alternative options available for sharps containers are presented in Box 3.19.

Box 3.19: The following options are available for sharps containers:

Disposable puncture proof plastic containers for sharps;
Disposable cardboard containers for sharps (e.g. the WHO/UN container used in disaster management areas)
Reusable puncture proof plastic containers for sharps that require a mechanised emptying and disinfection system;

Examples on different types of containers for sharps collection are shown in Box 3.21 below.

Box 3.21: Examples on containers for sharps.



3.7.5 Chemical / Pharmaceutical Waste

The first objective should be for used or expired chemical / pharmaceutical waste to be re-containerised in the same containers by which it was initially supplied, for return to the suppliers of the products. The suppliers of the products are then, with its specialists knowledge of that particular product, to take responsibility for the safe and environmentally sound treatment and disposal of such chemical / pharmaceutical waste. Should this service not be locally available by suppliers as it may be imported products, the necessary steps are to be taken to dispose of such waste in an environmentally sound manner. Some liquid chemicals can for instance safely be discharged via the sewer. Table 3.1 below presents a number of alternative chemical waste products that can safely be disposed of to sewer.

Table 3.1: Chemical waste products that can safely be disposed of to sewer

Type of Chemical	Means of disposal	Constraints/Precautions
Feaces	Sewer	Avoid splash/spills use gloves and face/eye protection
Urine	Sewer	Avoid splash/spills use gloves and face/eye protection
Liquid remnants from TOP abortions	Sewer	Avoid splash/spills use gloves and face/eye protection
Acids	Sewer	If pH xxxxx
Bases	Sewer	If pH xxxxx
Rinsing liquids containing bloods products	Sewer	If there are visible blood products a disinfectant (e.g. chloral tablets) should be added and allow to react before discharge
Solvents	xxxx	xxxx

etc.	xxxx	xxxx

The first aspect to consider is whether the waste is in a liquid or solid state, and what the requirements will be for disposal of such liquids to sewer. Even though a number of local authorities may make use of the same utility company for the treatment of sewerage, each local authority has its own bylaws that will prescribe what the composition of the liquid should be in order for it to be disposed of to sewer.

Any Health Care Facility opting to dispose of liquids to sewer, is further to ensure that discharges to the sewer systems do not contain unacceptable risk of infection by carrying out necessary disinfection of particular types of liquid waste, e.g. from laboratories, blood banks etc. Should the disposal of chemical / pharmaceutical liquid waste to sewer not be acceptable from either a health or technical point of view, the waste is to be disposed of through the HCRW disposal system.

Chemical / pharmaceutical liquids waste is, where possible, to be containerised in the containers initially used for the supply of the product. The next step would be to obtain approval from the party responsible for collection and ultimate treatment of the waste, as to whether their particular treatment process can effectively, safely and in an environmentally sound manner treat the waste under consideration. Should this not be possible, alternative treatment processes are to be investigated and should no effective process be available, the last option would be to have such waste disposed of at a hazardous waste disposal site.

Where solid chemical / pharmaceutical waste is to be disposed of, the same procedure for approval from the HCRW management facility should be obtained, and should no facility be available that can treat such waste in a safe and environmentally sound manner, arrangements are once again to be made to have such waste disposed of at a hazardous waste disposal site.

Under all circumstances it is to be ensured that HCRW treatment facility operators are aware of the chemical / pharmaceutical contents of any container, to allow them to sufficiently blend the contents of the container with other parts of the HCRW stream, in order not to create a shock effect on the treatment facility that could for instance result in explosions or other undesirable reactions should treatment thereof be permitted.

Cognisance is however to be taken of the fact that clear identification of pharmaceutical waste is likely to result in an increased occurrence of theft of such waste resulting in a need for increased security around the waste whilst being stored and transported. The criteria used for selection of chemical / pharmaceutical containers are shown in Box 3.22 below.

Box 3.22: Criteria for selection of chemical / pharmaceutical containers

The container size is determined by:
The infectious waste density, thus by final mass of full container to be handled;
The rate at which infectious waste is generated
The space available at infectious waste source.

The types of containers suitable for chemical / pharmaceutical waste will be similar to that of general infectious waste, provided of course that cognisance be taken for liquid containers to be properly closed and stacked upright when containerised. Attention is also to be given to the risk of possible damage to liquid containers (particularly glass containers) whilst being handled or transported. Should this risk be significant, it is suggested that puncture proof reusable containers or disposable buckets be used for the containerisation of liquids (whilst still being contained in the containers in which it was initially supplied).

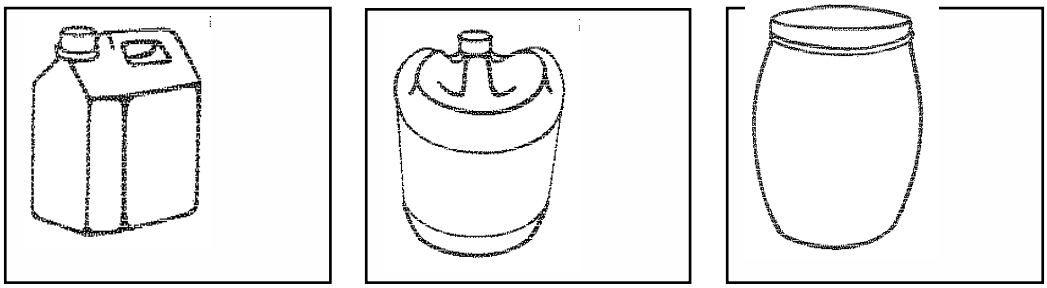
Based on the above, the following options are available for containerisation of chemical / pharmaceutical HCRW:

Box 3.23: Options available for chemical / pharmaceutical HCRW containers:

Heavy duty plastic bags for dry chemical / pharmaceutical HCRW;
Disposable cardboard boxes with liners for dry chemical / pharmaceutical HCRW or secondary containerised liquids that will not be at risk of being damaged;
Disposable cardboard boxes with plastic lamination for dry chemical / pharmaceutical HCRW or secondary containerised liquids that will not be at risk of being damaged;
Reusable plastic containers for dry chemical / pharmaceutical HCRW secondary containerised liquids;
Reusable cardboard boxes with lamination for dry chemical / pharmaceutical HCRW or secondary containerised liquids that will not be at risk of being damaged;
Plastic drums (size xx):
Steel drums (size xx)
Glass bottles
etc.
etc.

Examples on different types of containers for chemical and pharmaceutical waste are shown in Box 3.24 below:

Box 3.24: Examples on containers for chemical and pharmaceutical waste



3.8 Specification and Prices of Containers etc

This section includes guiding specifications and prices of containers for HCRW that are known to be available at the South African market.

Table 3.2 below shows some guiding specifications and prices of different types of waste containers etc.

Table 3.2: Guiding specification and prices of waste containers

Item	Technical specification	Approximate price in Rands/unit (excl. VAT)
Waste plastic baskets	12-15 litre	30 - 50
Stainless steel racks for plastic bags	- xxx	300 - 600
Black bags (polypropylene), small, 40 litre	60 µm, PP	xxxx
Red bags, small, 40 litre	80 µm, PP	0.60
Black bags, big, 110 litre	60 µm, PP	
Red bags, big, 110 litre	80 µm, PP	1.10
Plastic buckets with lids	12-15 litre, PP	12.05
Needle box, SA-design	1 litre, PP	7.00 - 15.00
Needle box, SA-design	5 litre, PP	7.00 - 18.00
Needle box, SA-design	10 litre, PP	12.90 - 27.00
Foreign needle box, small size	1½litre, PP	xxxx
Foreign needle box, medium size	2½ litre, PP	xxx
Foreign needle box, large size	3 litre, PP	xxx

3.9 Handling of Radioactive Materials and Waste

The radioactive substances and waste containing radioactive substances can be divided into two categories as mentioned in Module 1, section 1.6.3:

Low level radioactive unsealed materials
High level radioactive sealed materials.

For the low level radioactive materials the limit that a laboratory or other entity, such as a medical facility, can discharge either to sewer for liquids or to a registered incinerator or landfill is $10ALI_{min}$ per month.

Disposal procedures for sealed high level radioactive materials differ from those for unsealed radioactive material. Sealed sources are usually contained in equipment or as needles or seeds that may be re-used after sterilisation for other patients. Each time a sealed source is to be disposed of, written permission must be obtained from the Department. Sealed sources 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 infectious waste incinerators or disposed to landfill sites. In fact, some of the higher active sources can lead to contamination of incinerators and possibly other waste treatment facilities. It is not unknown for a whole incinerator to be dismantled and disposed as a radioactive waste due to accidental contamination with an active long lived radioactive isotope.

3.10 Disposal of Liquid Waste

3.10.1 Discharge to Sewer

When a liquid waste is discharged to sewer, the hazardous contents of the waste are treated at a biological treatment facility that is essentially designed to handle human faeces, urine and other wastewater generated by households, commercial institutions such as hotels, restaurants and offices and to some extent industry.

The process commonly includes screening of the waste to remove large pieces of insoluble material such as plastics, which are non-biodegradable, but solids below about 0.5cm pass through into the plant. The solids or "screenings" that are collected are usually incinerated or sometimes landfilled. The wastewater is then treated using a biological process, such as the activated sludge process. The residence time of the waste in the plant is usually fairly short, i.e. from 8 hours up to 24 hours, because the human and other wastes that are normally discharged are readily biodegradable and the COD of such water is often fairly low, i.e. ~800 mg/l. The clarified water that is generated must meet standards that are set by the Department of Water Affairs and Forestry and, provided it meets these standards, can be discharged to watercourse. The biological sludge that builds up is removed and usually dried on drying beds, where most of the pathogens such as the E. Coli, that are present in the sludge, are killed: note that even after drying, the sludge retains large amounts of water. The disposal of the sludge can be a problem, but depending on the heavy metal content, it can be used as an organic fertiliser on land, composted with other organic wastes, disposed to general waste landfill or, if necessary, to a hazardous waste landfill.

As indicated above wastes that are greater than ~0.5cm in size and that do not break up during transport through the sewer system will be screened out at the works. It is therefore important that, where possible, large objects are not discarded to sewer. Some hospitals macerate placentas, aborted foetuses and some other wastes prior to discharge to sewer and, according to the authorities in Johannesburg, provided the size of the waste is decreased below ~0.5cm, so that it is not screened out at the plant, and the waste is non-toxic and biodegradable, e.g. no plastic or pharmaceuticals items are discarded, it is an acceptable practice.

3.10.2 Liquid Infectious Health Care Wastes

The sewer accepts human faeces, urine and other bodily fluids that contain pathogenic organisms such as E. coli, etc. However, the general population is considered healthy, whereas a medical facility *could possibly* discharge a variety of highly pathogenic organisms in relatively high quantities from wards that treat communicable diseases. In general, most patients are not highly infectious and their faeces and urine will be no more pathogenic than that of the general population. However, sputum, faeces and urine from patients with TB and highly infectious diseases such as Ebola, etc. should be managed as highly infectious waste and added to the infectious waste treatment and disposal system or, if considered appropriate, discharged to sewer after treatment, e.g. with a chemical disinfectant such as glutaraldehyde, that will assist in reducing the pathogen load.

3.10.3 Liquid Chemically Hazardous Health Care Wastes

While disposal of liquid waste to the municipal sewer is extremely convenient, it must be recognised that, for many classes of chemical compounds, this is not an acceptable option. Some of the reasons are:

a) Certain compounds such as chlorinated hydrocarbons, cytotoxic drugs and liquid pharmaceuticals are toxic to the bacterial population that is used to treat the sewage.
b) Some organic compounds generated and used in medical facilities are not readily treated by biological means, as they are not biodegradable or are biodegraded very slowly under the treatment plant conditions: the residence time in the sewage plant is relatively short. General classes of poorly biodegradable organic compounds that should not be discharged include:
   - Mineral Oils
   - Ethers (EXAMPLES TO BE INCLUDED)
   - Polymeric Compounds (EXAMPLES TO BE INCLUDED)
   - Tertiary and volatile aliphatic hydrocarbons (EXAMPLES TO BE INCLUDED)
   - Poly-nitro, poly-sulphonated or poly-chlorinated aromatic compounds (EXAMPLES TO BE INCLUDED)
   - Tertiary aliphatic alcohols (EXAMPLES TO BE INCLUDED)

c) Heavy metals bind strongly to the sewage sludge and, when these reach high amounts, this potentially valuable organic fertiliser cannot be used on land and becomes a disposal problem for the Council.

d) Flammable solvents that are immiscible in water can lead to explosions in the sewer lines.

The sewer disposal regulations for Johannesburg are given in table 3.3: note that these may differ slightly in each area depending on local circumstances.

Table 3.3: Typical limits set by large sewer treatment plants (similar to Johannesburg Metropolitan Council) for the discharge of industrial effluents

PARAMETER OR SUBSTANCE	LIMITS/CONCENTRATION
Permanganate Value (PV)	≤ 1 400 mg/l
pH	?6,0
Electrical conductivity (at 20^0C)	≤ 500 mS/m
Caustic alkalinity (as $CaCO_3$)	2 000 mg/l
Substances not in solution (including fat, oil, grease & wax)	2.000 mg/l
Substances soluble in petroleum ether	500 mg/l
Sulphides, hydro-sulphides & polysulphides (as S)	50 mg/l
Substances capable of releasing hydrogen cyanide (as HCN)	20 mg/l
Formaldehyde (as HCHO)	50 mg/l
Non-organic solids in suspension	100 mg/l
Chemical Oxygen Demand (COD)	≤5 000 mg/l
Sugars and/or starch (as Glucose)	1 500 mg/l
Available chlorine (as Cl)	100 mg/l
Sulphates (as SO_4)	1 800 mg/l
Fluorine-containing compounds (as F)	5 mg/l
Anionic surface active agents	500 mg/l
Iron (as Fe)	20 mg/l
Phenolic compounds (as Phenol)	20 mg/l
Total Group 1 Metals: CrO_3, Cu, Ni, Zn, Ag, Co, W, Ti & Cd	≤ 50 mg/l; Individual metal: ≤ 20 mg/l
Total Group 2 Metals: As, B, Pb, Se & Hg	≤ 20 mg/l; Individual metal: ≤ 2.5 mg/l
Total Group 3 Radioactive wastes or isotopes	As laid down by NNR

The current sewer discharge regulations in most South African cities are quite generous compared to those used internationally. Note from table 3.3, the discharge of acids, i.e. with a pH <6 and bases, with a pH >12, is prohibited and, thus, even mildly acidic solutions should not be discharged to sewer. The regulation is there essentially to protect concrete sewer pipes from corrosion. It is important to note that the sewer discharge limits are significantly higher than those for discharge to a river or other watercourse and, therefore, the dirty or grey water that is discharged to sewer would have a significant adverse impact, if discharged directly to the environment. For example, the recent proposals for discharge limits to watercourse include a COD standard of 30 mg/l, whereas a sewer can accept up to 5000 mg/l and, under certain circumstances higher levels can be discharged, at a cost, if negotiated with the authorities.

Small quantities of water miscible solvents, such as methanol, ethanol and acetone can be discharged to sewer, but the discharge of organic solvents with low flash points, such as diethyl ether, and a low solubility in water, such as chloroform, should be avoided. The indiscriminate discharge of

pharmaceuticals, both liquid and solid to sewer, a practice that occurs at some hospitals in South Africa, should be stopped, as the biodegradability and, the possible ecotoxicity of many of the ingredients are not well known: these waste should be handled as chemical wastes. The amounts of heavy metals that can be discharged to sewer are relatively high, but the direct discharge of strong heavy metal solutions from laboratories should be avoided and the wastes included in the chemical waste stream. Note that blood and other blood products are acceptable as the actual concentration of Fe (iron) is not very high and considerable dilution occurs.

The one factor that limits potential damage to the sewer system is the extremely large dilution of a potentially hazardous waste that occurs with general effluents produced by households and commercial sources. For example, in Johannesburg, it is estimated that the amount of industrial waste discharged represents only 2.5% of the total effluent that is treated and, because the amounts of water treated at the two sewage works is so large, e.g. the Northern Works treat 305 million litres a day, the risk posed by the discharge of a small amount of potentially hazardous waste from a medical facility is very low. However, this does not mean that the facility needs not control the wastes actually discharge to the sewer system: the proper segregation and management of all waste streams is required. However, the Johannesburg sewer system is not typical and smaller sewage works are present in many areas including ERWAT on the East Rand, and the potential risks associated with the discharge of hazardous wastes are, therefore, considerably greater. The discharge of potentially hazardous chemicals to sewer is controlled by the municipality, council or Metro and, because the quantities of hazardous materials that can be discharged varies widely, each medical facility must negotiate with the authorities and obtain a letter of authorisation or a permit for any wastes of concern.

3.10.3.1 Liquid Radioactive Wastes

The discharge of low-level liquid radioactive waste to sewer is allowed under well-defined conditions: this aspect is considered in more detail in section 3.9.

3.11 Importance of Cooperation

Since the waste generation and containerisation is only the first step in a comprehensive process of HCW management that will lead to the treatment and / or ultimate disposal thereof, it is important that the persons identified as the target group for this module, be made aware of its role and responsibilities. It is vitally important for these people to have a clear understanding of the impact that some of their actions, or failure to take certain actions, will have on the people responsible to fulfil other activities in the line of duty.

In Annexure 3.2 a template of a Code of Practice (COP) is shown as a means to create a common understanding of the waste management procedures.

For the sake of creating a better understanding and awareness amongst people generating the HCRW, it may be justified to have the contractor that interfaces with them, make a presentation on aspects that may be problematic to them and improvements that they may wish to see in the present HCW management system exercised by the health care facility. Should the time permit, a visit to the transport part of the operation, as well as to the treatment and disposal side, could be invaluable, as the people responsible for the generation and containerisation of the HCW will then be able to get first hand information on the way in which their actions will impact on humans, as well as the environment.

A video, posters, visual presentations etc. presenting the full HCRW flow path with commentary on the important considerations during each of the phases, may be very valuable for training of health care professional that may not have the time available to go on site visits.

3.12 Annexure 3.1: Examples of Waste Reduction, Reuse and Recycling Activities

Purchasing Practices (green procurement)

- Purchase recycled content material where appropriate (e.g. office paper, envelopes, toilet tissue, paper towels) and look for Environmental Labels. Work with purchasing committees to determine which products may be suitable.
- Work with suppliers to have oversized packaging materials minimised, and in general returned or recycled.
- Work with suppliers to have packaging materials returned or recycled.
- Use building construction products with recycled content materials (e.g. drywall, asphalt).
- Use environmentally responsible vehicles and maintenance products (e.g. propane as fuels, rerefined oils, retreated tires, recycled antifreeze).

Waste reduction

- Use two-sided photocopying.
- Use electronic mail (i.e. personal computers or phone messages).
- Buy in bulk (e.g. food and drink containers in the cafeteria and soaps and detergents in housekeeping).
- Avoid products with excess packaging and work with suppliers to reduce it.
- Reroute publications such as magazines, newspapers and journals.
- Circulate memos or documents.
- Use bulletin boards for posting announcements.
- Single space texts.
- Use two-way envelopes for billing.
- Make sure staff understand how to use equipment to reduce wastage.
- Use the reduction feature on your copier to fit more than one paper per page.
- Use permanent tape dispensers, not disposable ones.
- Use refillable pens instead of disposable ones.
- Purchase durable equipment, furnishings and supplies.
- Install energy efficient appliances (e.g. lighting).
- Use water-saving devices.
- Turn off lights and office equipment when not in use.
- Use incinerators that meet the new discharge guidelines and have and energy recovery system.
- Use computer fax software to send facsimiles without making hard copies.
- Use nonsolvent liquid scintillation cocktails in laboratories.
- Use less hazardous radioactive materials where appropriate.
- Develop microtesting procedures to reduce chemical usage.
- Make sure biomedical waste is properly segregated from general waste to reduce disposal costs and increase materials for recycling.
- Explore opportunities to reduce formalin usage in sample analysis by replacing with cold, physiological saline solutions where appropriate.
- Substitute formalin solutions with commercially available, less toxic cleaning solutions in dialysis machines.

Recycling

- Newspapers and telephone books can be given to farmers or humane societies as bedding.
- Recycle used towels and rags to rag recyclers.
- Use plain paper fax machines; these are recyclable and the messages will not fade.

- Recycle the following items in "blue box" programs, where available:
  - glass bottles from juice bottles or baby formula,
  - juice and food material containers,
  - newspapers and
  - plastic containers (e.g. pop containers or other types where appropriate).
- Recycle cardboard with commercial recycler or through your supplier.
- Recycle pallets with commercial recycler or through you supplier.
- Include pickup of containers as part of the supplier's role in your contract.
- Work with suppliers to help them design workable packages that are recyclable.
- Send unwanted old equipment, furniture or medical supplies overseas.
- Pool local business together who recycle material and contract for the services of the same recycler to reduce pickup costs.
- When purchasing products, ensure that all packages can be returned to supplier or recycled at your facility.
- Use a distribution network to recycle materials back to a central location for better material marketing.
- Explore waste recycling options for food waste either as:
  - human food
  - animal feed either directly or through a commercial processor and as
  - composting or vermiculture and use compost at your facility in landscaping.
- Contract a shredding company that recycles your shredded paper.
- Involve ambulatory patients in waste minimisation programs (e.g. psychiatric and geriatric patients in composting projects).
- For large waste generators, explore processing equipment such as balers or compactors for recyclable materials.
- Locate markets for recyclable materials which are generated in sufficient quantities, such as:
  - office paper,
  - cardboard,
  - plastics,
  - solvents (xylenes, toluenes, CFCs),
  - oils (vegetable and hydraulic) and
  - construction and demolition materials such as drywalls, asphalt, concrete, wood.
- Install silver recovery units for photo processing wastewaters.
- Evaluate opportunities for anaesthetic gas recycling.

Reuse

- Donate used publications to doctors' offices, nursing homes or the local library.
- Reuse worn cloth diapers and towels as rags.
- Reuse scrap paper for notepads and draft copies.
- Reuse old envelopes by applying labels (with nonsolvent glues) on top of old addresses.
- Use reusable diapers, incontinence and underpads where appropriate.
- Use reusable urine trays.
- Use reusable drapes and gowns where appropriate.

3.13 Annexure 3.2: Template of a Code of Practice (COP) aimed at creating a common understanding of the waste management procedures.

TEMPLATE FOR:

CODE OF PRACTICE FOR THE HEALTH CARE WASTE MANAGEMENT AT ..... HOSPITAL

September 2002

PREPARED BY .....

Ref.No.	TOK 00-09-24 COP SA HCWM Guidl.doc	Prepd.	BL/TOK/JB/NJB
Edition	V01	Checked	
Date	2003-08-11	Appd.	

Table of contents

1. Introduction

The Code of Practice (COP) for Health Care Waste Management at …..... Hospital is a set of general instructions for how to handle all solid and liquid wastes arising from activities taking place within the premises of …..... Hospital.

The COP describes the principles for management of Health Care Waste (HCW), defines the different types of waste categories and describes the different handling procedures. In this respect, the Code of Practice shall be considered as the internal by-law for Health Care Waste Management.

A complete and updated version of the full COP including annexes must always be found at the ..... HOSPITAL management office. The ..... HOSPITAL management is responsible for updating the COP.

1.1 Objectives of the Code of Practice

The Code of Practice has the objective of:

Guiding all staff members of ..... HOSPITAL in proper; occupationally safe; hygienically appropriate and environmentally sound internal handling of all wastes generated within the premises of ..... Hospital.
Providing an integrated umbrella under which waste management procedures work.
Informing outside agencies how waste management is managed in the ..... HOSPITAL.

1.2 Limitations of the Code of Practice

The Code of Practice does only cover Health Care Waste.

However, the management organisation at ..... HOSPITAL, under the Internal Services and Cleansing Division, is responsible for collection and disposal of street sweepings, garden waste and other such waste arising outside the health care areas. Demolition waste generated at the hospital will occur in relation to construction work and will be the responsibility of the contractor.

Radioactive wastes are out of the scope of this COP.

1.3 Components of the COP Document

The present main document forms the complete Code of Practice (COP).
The main document applies to the upper management of ..... Hospital (..... HOSPITAL) and the management of the Engineering Department.

Where required, separate COP must be prepared for departments with special needs, such as laboratories, blood bank, Gynaecology and obstetric department ionisation and radiation units (e.g. oncology), however following the overall guidelines laid down in the present COP.

Special COP and operation and maintenance manual will be prepared for operation of the treatment facility (in case of on-site treatment).

1.4 Content of the COP

The ..... HOSPITAL waste management organisational set-up
Responsibility and obligations for the HCW management
Waste categories and definitions
Sorting requirements
Packaging requirements
Collection requirements

Storage at department level
Storage at hospital level
Internal transportation
- External transportation

Treatment requirements
Emergency procedures
- Procedures for registration and monitoring

1.5 List of COP copyholders

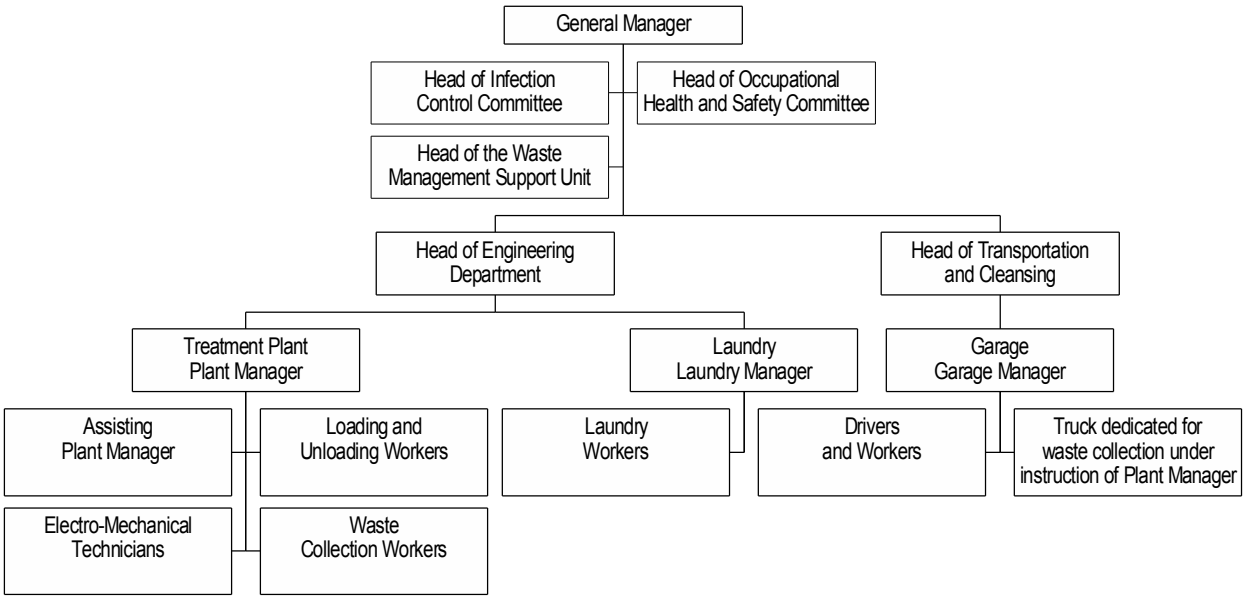
The following staff must hold a copy of the COP:

- Head Manager of the ..... HOSPITAL
- Chief Nurse of the ..... HOSPITAL
- Manager of the Infection Control Committee (ICC)
- Laboratory Manager
- Manager of the treatment plant

A copy of the COP must be accessible by all staff via the above-mentioned persons.

HOSPITAL Waste Management Organisation

The organisation for management of waste at …..... HOSPITAL is headed by the Engineering Department and is organised as follows:



In relation to HCWM the overall ICC must observe the occupational safe operation of HCWM and is responsible for continued development and improvement of training of staff at all level within HCWM.

In addition to this the ICC with the OS&H organisation must be responsible for:

Registration of all emergency situations occurring related to handling of Health Care Waste.
Monitoring certain elements of potential infectious waste management programs, such as waste related injuries and waste disposal violations.

Establishing recommendations/specifications for purchasing waste containment bags and disposal boxes for sharps.

Environmental monitoring of the performance of the treatment plant.

3. Waste Definitions

3.1 A Standard Definition for Health Care Waste (HCW):

Health Care Waste is defined as the total waste stream from health care, and Health Care is defined as follow:

Health Care is medical activities such as diagnosis, monitoring, treatment, prevention of diseases or alleviation of handicaps, in human or animals, including research performed under supervision of medical, dental or veterinary practitioner.

At ……. Hospital, the following waste categories are defined as HCW:

Health Care Risk Waste (HCRW)
Infectious Waste
Sharps
Pathological Waste
Hazardous Chemical Waste
Pharmaceutical waste
Radioactive waste
Pressurised containers

Health Care General Waste (HCGW).

The definitions of the above-mentioned waste categories are:

3.2 Health Care Risk Waste

3.2.1 Infectious Waste

All items suspected to contain pathogens (bacteria, viruses, parasites or fungi) in sufficient concentrations or quantities to cause disease in susceptible hosts. This categories typically includes:

Cultures and stocks of infectious agents from laboratory work Waste from surgery and autopsies on patients with infectious diseases (e.g. tissues, materials or equipment having been in contact with blood)
Waste from infected patients in isolation wards (e.g. excreta, dressings from infected or surgery wounds, clothes saturated with human blood or other body fluids).
Waste that has been in contact with infected patients undergoing haemodialysis (e.g. dialysis equipment such as tubing and filters, disposable towels, gowns, aprons and gloves).
Infected animals from laboratories.
Any other utensils and materials having been in contact with infected persons and animals.

3.2.2 Sharps

All sharps objects such as needles, syringes, scalpels, infusion sets, saws, knives, blades, broken glass, nails and any other item that could cause a skin cut or puncture.
Sharps waste includes both items which may or may not be infected since it is normally not possible to determine whether an individual item has been contaminated with an infectious agent.

3.2.3 Pathological Waste

It consists of " All human tissues, organs, body parts, placenta, non-viable foetuses and animal carcasses, blood and body fluids requiring disposal".
Within this waste category, recognisable parts of the human body or animals are also known as "anatomic waste".

However in this Code of Practice pathological waste is handled separately.

3.2.4 Pharmaceutical Waste

All expired, unused, spilled and contaminated pharmaceutical products, drugs vaccines. All sera and bottles, boxes and vials used to contain pharmaceuticals, which are no longer required.

A sub-category of pharmaceutical waste is "genotoxic waste"(also known as anti-neoplastic drugs) which is potentially highly hazardous if not carefully handled.

Genotoxic waste includes primarily cytotoxic drugs. Pharmaceutical waste is handled separately.

3.2.5 Hazardous Chemical Waste

All discarded solid, liquid and gaseous chemicals, for example from diagnostic and experimental work, and cleaning housekeeping and disinfecting procedures. Chemical waste items may be hazardous or non-hazardous. To protect health it is suggested that all chemical waste from health care should be considered to be hazardous if it has at least one of the following properties:

Toxic to humans in low or modest concentrations
Corrosive for acids of pH 2 and bases of pH 12
Flammable
Pungent or disagreeable odour
Reactive (explosive, water reactive, shock sensitive)

The main types of hazardous chemicals used in health care and hospital maintenance and most likely to be found in waste, are the following:
Formaldehyde
Photographic chemicals
Organic compounds (disinfectants, oils, pesticides)
Inorganic compounds (inorganic acids, caustic and ammonia solutions, oxidising agents, reducing agents.

Although hazardous chemical waste is defined separately and separately collected, final disposal will be as for HCRW.

3.2.6 Radioactive Waste

All solid, liquid and gaseous waste contaminated with radionuclides generated from in vitro analysis of body tissue and fluid in vivo body organ imaging and tumour localisation and investigative and therapeutic procedures.

The radioactive waste will not be further dealt with in this COP but handling must comply with Atomic Energy Agency (AEA) procedures in compliance with applicable regulations.

3.2.7 Pressurised containers

Several forms of gases are used in health care and are often stored in pressurised containers such as compressed gas cylinders, cartridges and disposable aerosol cans. Normally when these are empty or contain unusable residues they are returned to the supplier for refilling. A more serious waste hazard exists where taps and valves on pressurised cylinders become corroded and it is no longer possible to know if the cylinder is still under pressure.

3.3 Health care general waste (HCGW)

Waste items generated from food preparation, cleaning and sweeping, equipment repair and replacement, clerical and office services, packaging and cardboard materials, damaged containers, and discarded flowers, bags, wrappings and plastic films.

All waste which is obviously or potentially infectious, including all sharps whether infectious or not, shall be considered as health care risk waste (HCRW). If in doubt, waste should be considered as HCRW and be treated as such.

4. Internal Health Care Waste Management (HCWM) Procedures

4.1 Main principles of HCWM

IN PRINCIPLE:
All waste generated must be sorted and packed as close to the source (point of generation) as possible and the waste generated must in principle be touched only by the person generating the waste.

The main principle of waste handling is therefore:

Segregation of the waste into well defined waste categories and collections
Intermediate storage of the waste until transportation to final disposal
Internal transportation of each waste category between intermediate storage rooms to the central storage room
Treatment of all HCRW. Only exceptions are:
Outdated medicine returned to producer;
Pathological waste handled separately by the Pathology Department;
Chemicals from development of films, to be returned for extraction of silver, and;
Chemical acids at different Department (Pathology, Laboratories etc) to be neutralised before discharged into sewage system..
Landfilling of all HCGW, other domestic waste and ashes.

INTERNALLY, THE WASTE MUST BE DISPOSED OF FOLLOWING THE PRINCIPLE THAT:

All HCRW must be disposed of in YELLOW/RED bags or HCRW containers. All HCGW shall be disposed of in BLACK bags. Radioactive waste must be disposed of into containers approved by …….

The Code of Practice for each health care waste category is described in the following and covers:

Source separation
Packaging procedures
- Labelling/Marking

Intermediate storage
Collection
Internal transportation
Central storage.

Where a department has special demands these must be appended as an annex to the COP. Among special departments are blood bank; laboratories; experimental medicine/surgery; Gynaecology and Obstetric and faculty laboratories.

4.2 Health Care Risk Waste (HCRW)

4.2.1 HCRW handling at department level

Sorting of HCRW

All segregation of HCRW must take place as close to the point of generation as possible e.g. near to patient bed. In most cases near a nurse trolley.
Solid HCRW must be placed in yellow/red bags mounted to nurse-trolleys or ……..
Moistened HCRW must be placed in a small yellow/red plastic bag and tightly closed with a knot.
Liquid HCRW (also includes hazardous chemical waste), must be placed in leak-tight containers placed at nurse trolley or in a separate room within the department (……. litre containers).

Sharps and pricking items must be placed in small “sharp” containers, placed at nurse trolleys or tables near frequent hypodermic needle users.
Yellow/red plastic bags (small and large) and containers (small or large) required to do proper sorting must be ordered by department chief nurse at the local store.

Storage of HCRW

HCRW in small yellow/red plastic bags must, when full, be tightly closed with a knot and then be placed in a big yellow/red heavy-duty plastic bag mounted to a rack in the department’s intermediate storage room.
Sharp containers must, when full, be sealed with correct lid and thereafter be placed in a big yellow/red plastic bag mounted to a rack in the department’s intermediate store or ……..
Big containers (5-15 litre) with liquids must, when full, be sealed with correct lid and placed at the floor in the department’s intermediate storage room and labelled /marked.
When a big yellow/red heavy duty bag in the intermediate storage room is 3/4 filled, the bag must be removed from the rack, sealed by a twisted steal wire or ……, placed on the floor and labelled. A new empty big yellow/red heavy-duty bag shall hereafter immediately be mounted to the rack.
All big containers and big yellow/red heavy-duty bags filled and placed at the floor must be labelled or marked with department name and number.
Daily cleaning of the intermediate storage room is the responsibility of the department to which the intermediate storage room belongs.

4.2.2 Collection and transportation of HCRW

HCRW in big yellow/red bags, big containers and buckets, placed at the floor of the intermediate storage room, safely sealed and appropriate labelled or marked, must be collected at least once per working day by waste collectors.
Undamaged, correctly sealed and labelled bags/containers are collected by the waste collector in a bar fence trolley/wheelie bin or …… and brought to the Central storage room and is the responsibility of the manager of the central storage room.

Central storage room

HCRW brought to the central storage room in bar fence trolley/wheelie bins is immediately after arrival at the central storage room transferred into yellow feeding/loading containers of the treatment plant.
The yellow feeding/loading containers are brought directly to the feeding ramp for the treatment plant.
Immediately after a yellow feeding/loading container is emptied into the treatment plant the container must be cleaned and parked at the area determined for these containers.
Whenever the treatment plants are not in operation the filled yellow feeding/loading containers shall be brought to the cold store.

4.2.3 Treatment of HCRW

The treatment plant shall under normal operational conditions operate for 5 hours per day.
During operation hours the treatment plant shall have continuous feeding of HCRW.
Removal of residues from the treatment plant shall be at least each morning before start of operation
All residues shall be placed in an …… container.
……. containers shall be covered before transport
Due care shall be taken to avoid dust, e.g. by light sprinkling of water
The …… container will, when required, be brought to landfilling outside the hospital premises.

Pharmaceutical waste

Medicine that has been opened and/or returned from patients shall be handled as infectious waste.
Medicine in unbroken original package shall be returned to the Pharmacy

4.4 Hazardous Chemical Waste

Hazardous chemical waste shall be handled by the same procedures as HCRW.

Most hazardous chemical waste is generated at laboratories where special Code of Practice shall be applied. *Many types of chemicals cannot be mixed* that is why all types of hazardous chemical waste shall be kept separate unless otherwise indicated in Special Code of Practice.

4.5 Health care general waste

Health care general waste (HCGW) shall at all times be kept separate and treated separately from all other waste generated at the ……. HOSPITAL.

4.5.1 HCGW handling at department level

Sorting of HCGW

All segregation of HCGW shall take place as close to the point of generation as possible. In most cases at patients beds, outpatients departments and at offices.
HCGW shall be placed in dustbins sealed with a black plastic bag, except for cardboard.
Cardboard shall be separately collected and folded, in order to occupy as little space as possible.

Storage of HCGW

HCGW in the small black plastic bags, shall at least at the end of each working day or when full, be tightly closed with a knot, and be placed in a big black heavy-duty plastic bag mounted to a rack in the department's intermediate store.
When a big black bag, in the intermediate storage room, is 3/4 filled, the bag shall be removed from the rack, sealed by a twisted steal wire by personnel from the department, and then placed on the floor.
A new empty big black bag shall hereafter immediately be mounted to the rack.
All cardboard material shall be folded and placed on the floor within the intermediate storage room.
Black plastic bags, steal wires and containers required to do proper sorting, shall be ordered by department chief nurse at the local store.
Daily cleaning of the intermediate storage room is the responsibility of the department to which the intermediate storage room belongs.

4.5.2 Collection and transportation of HCGW

HCGW in undamaged big black heavy-duty bags placed at the floor of the intermediate storage room, safely sealed, and cartons (folded/ flattened), shall be collected once per working day by waste collectors.
Undamaged, correctly sealed bags/containers are collected by the waste collector in a bar fence trolley/wheelie bin and brought to the Central storage room and is the responsibility of the manager of the central storage room.
Departments without direct access to the main corridor will have their waste collected from the terrain. A collector with a pick-up truck will bring the waste to the central storage room.

Central storage room

HCGW brought to the central storage room in bar fence trolley/wheelie bins is immediately after arrival at the central storage room transferred into …….. container for HCGW.

4.5.3 Disposal of HCGW

All HCGW placed in hook-on containers will at least once per day be emptied and an empty hook-on container will replace the full container.
The HCGW in hook-on containers will be transported to an approved landfill for HCGW.

The head of the central storage room has the responsibility for correct handling.

5. Emergency procedures

For emergency situation all departments shall have their own detailed Emergency plan. This chapter only describes the basic emergency procedures in connection with HCWM.

5.1 Human injuries

Immediate human injuries occur from pricks, tissue scratches, inhalation etc.
A First Aid Box, with the necessary items, shall be present at all departments
If a superficial injury occurs First Aid may relieve the injury
For significant injuries a Doctor shall be consulted
In severe cases the injured person shall be brought to the emergency department.
All injuries shall be reported to the local ICC nurse, the OS&H and the Medical Insurance

5.2 Spillage during transportation of HCRW

If solid HCRW is spilled during transport inside a hospital, the waste shall immediately be shovelled into a yellow/red plastic bag.
If solid HCRW is spilled during external transportation, the waste shall immediately be shovelled into a HCRW container, regardless of whether packed in a yellow/red plastic bag or not.
If liquid HCRW is spilled during transportation inside a hospital, the manager of the central storage room shall be contacted for immediate action. The collector makes the contact.
If liquid HCRW is spilled during external transport, the spillage shall be remedied by shovelling sand and/or dirt on to of the spilled liquids, where after the socked sand/dirt shall be shovelled into a HCRW container.
All spillages shall be reported to the head of the central storage room.

5.3 Damaged packaging at departments or intermediate storage rooms

If packaging material (i.e. plastic bags or plastic containers) of waste is damaged within the department, repackaging shall be done immediately; for solids by putting the damaged packaging and the waste into new plastic bag; for liquids by filling the liquid into a new container.
If sharps are spilled utmost precaution must be taken during unloading; heavy-duty plastic gloves must be used during this process.
If a big plastic bag is damaged in the intermediate storage room reloading of all waste and the damaged plastic bag must be placed in a new plastic bag.
If a liquid container is damaged in the intermediate storage room, the liquid must be filled into an undamaged container.
Damage to packaging material must be reported to the head of department and if at the intermediate storage room, also to the head of the central storage room.

6. Monitoring Plan

The monitoring plan for the HCWM system shall be carried out to follow the development for the different types of waste generated at different parts of ……... HOSPITAL.

Monitoring of environmental components and health surveillance of employees is set separately by …….. and by the ..…... Hospital ICC and is not included in this Code of Practice.

6.1 Registration of HCRW

By every collection of HCRW from the intermediate storage rooms, each yellow/red bag and/or HCRW container will be registered by department number at a registration form placed at the bar fence trolley/wheelie bin.

The total number of yellow feeding/loading container emptied into the treatment plant everyday will be registered at the central storage room
Records of the registered yellow/red bags and containers emptied into the treatment plant shall be kept in a computer system at the central storage room

6.2 Registration of HCGW

By every collection of HCGW from the intermediate storage rooms, each black bag will be registered by department number at a registration form placed at the bar fence trolley/wheelie bin.
A weight is installed at the Central storage room for weighing of the waste generation (HCRW and HCGW).

Appendix A

General Important Telephone Numbers

Main phone switch board xxxx
Guard at main gate xxxx
Fire department xxxx
Civil defence department xxxx
Chairman of ICC xxxx
Chairman of OHSC xxxx
Head of Poison Control Centre xxxx
Head of Engineering Department xxxx
Head of transportation and cleansing division xxxx
Incineration Plant Manager xxxx
Emergency department xxxx

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Appendix B

Picturegram of Health Care Waste Flow

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Appendix C Possible Waste Management Solutions

Typical Problem	Possible Solution, depending on local conditions
IV lines puncture bags and cause injuries	Place IV lines in plastic bucket in stead of in bags to avoid penetration. Bucket should have a sealed lid when full If using saline/glucose etc. in plastic bottles: leave the bottle on the sharp end of IV line, thus avoiding penetration or pricking accidents by the IV lines sharp end. (Do not use, or use carefully, this method with glass bottles, as the glass may break and result in cutting accidents) Do not recap IV line, as some back-flow may occur, which may be a cause of infection
Glass saline/glucose bottles are used in large numbers and is expensive to dispose via special containers	Ensure that bottles do not contain potentially infectious material by avoiding back-flow to the bottles when removing the IV line after use. In this case bottles can be considered as non-infectious waste and handled separately, for example, collected used the empty cartons/boxes that the glass bottles where delivered in.
Blood bags are leaking or occurring in great numbers	Use large buckets with lids in stead of the usual yellow/red bags. Place 1-4 used blood bags in a small yellow/red bag and tie it securely with a knot before placing the tied small bags in a large heavy duty yellow/red bag with extra thickness or use 2-3 large plastic bags in side each other to ensure no leakage. Also use more small bags if needed.
Recapping of needles/syringes is difficult to avoid	Bring the needle boxes, on a nurse trolley or by hand, to the patient when giving injections, thus ensuring that there is a safe way to avoid recapping. Place the empty syringe, after needle has been detached and placed in the needle box, in the nearest yellow/red bag, e.g. on a rack of the nurse trolley or at the nurse station or similar.
Soaked dressings etc. leak/drip blood	Place soaked dressings in small yellow/red plastic bags and tie a secure knot before further placing in bags etc.
Lines for hemodialysis etc. are sharp and penetrate bags and cause injury/risk	Most hemodialises lines have a sharp end that can be detached. This end is normally used to rinse the line before use. Hence, the sharp end can be detached after rinsing and before use and placed in a sharp container, thus, allowing the line to be placed in a yellow/red bag after use.
Waste has been sorted wrongly and some infectious waste is now in a bag for non-infectious waste	Close the bag, which has been contaminated by infectious waste, and place this bag in a larger yellow/red bag. Do not attempt to remove the infectious waste by hand
How can very long needles, disposal endoscope instruments etc. be handled	Buy extra long safety boxes (e.g. 50 cm tall) for use in the departments generating this kind of waste only. If this is impossible reuse large empty jerry cans, chemical containers or similar for this purpose. Do not bend or manipulate long needles, as this increase the risk of picking accidents and infection
How to handle mis-segregation waste	If infectious waste is placed wrongly in a bag for non-infections waste place the bag in a large yellow/red bag and treat all the waste as HCRW If sharps (IV lines, needles etc.) are wrongly placed in a plastic bag. The entire bag shall be handled with particular care. For example, by placing the entire bag in a special large hard plastic bin in which the waste is transferred to the final treatment. After washing the bin may be used for the same purpose again.
How to handle dripping blood bags, placenta etc.	If affordable, use disposable plastic containers/buckets with tightly closing lids. If financial constraint does not allow for optimum handling of such blood dripping waste use e.g. 60-100µm small plastic bags that are filled lightly only and tightly sealed with a full knot. Two small bags may be necessary to avoid dripping. The sealed small bag(s) are placed in a large 80-100µm plastic bags. Preferably the large bag is protected by a hard casing during transport, e.g. a reusable large plastic container that is washed after each use.

Appendix D

Definitions

GENERATION SOURCE is the place, where the waste occurs, e.g. is generated.
COLLECTION POINT is the point, where all waste generated is segregated and disposed off by the generator (i.e. the first person who has the waste in hand) into relevant bins, bags or containers.
A NURSE TROLLEY is provided for departments with bed patients and in some cases also for other kind of departments. It has a rack mounted designed for yellow/red bags for HCRW. Further more it has small containers for sharps and shelves for new bandages, cotton, syringes etc.
INTERMEDIATE WASTE STORAGE ROOM is a room designated to receive and store segregated waste. It is provided with a rack for yellow/red bags and another rack for black bags.
A BAR FENCE TROLLEY/WHEELEY BIN is a trolley used for collection of yellow/red and black bags, as well as containers for chemical waste (HAZARDOUS CHEMICAL WASTE) only. The bar fence trolley/wheeley bin is used for internal transportation of such waste only. A bar fence trolley/wheeley bin must never be used outside the planned routes.
PICK-UP TRUCK is a vehicle for transportation of HCRW only.
The CENTRAL STORAGE ROOM is situated at the ……. It serves as the ultimate centre for handling HCRW for all the ..….. HOSPITAL.
TREATMENT PLANT is where all HCRW are treated. The treatment plant is located close to the central storage room.
FEEDING TROLLEY is a trolley for loading HCRW into the treatment plant .
HOOK-ON CONTAINERS is for storage of HCGW only, at all the hospital.
COLLECTION FORM is for registration of all Health Care Waste, collected and shows, at the same time, the route of collection.
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Appendix E

ABBREVIATIONS.
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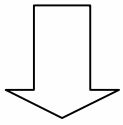
3.14 Annexure 3.3: Example of a poster illustrating waste segregation

General Waste:	General Infectious Waste:	Sharps:
	….	
….	….	…..
….	….	….
…..		….

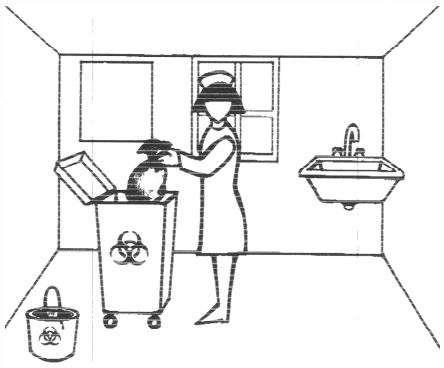


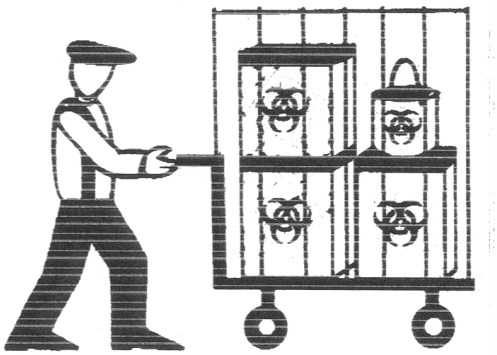
<u>IMPORTANT NOTE:</u> NEVER DISPOSE OF HELTH CARE RISK WASTE IN GENERAL WASTE CONTAINERS!!!

Guidelines
on Sustainable Health Care Waste Management in Gauteng

MODULE 4: Internal transport and storage:

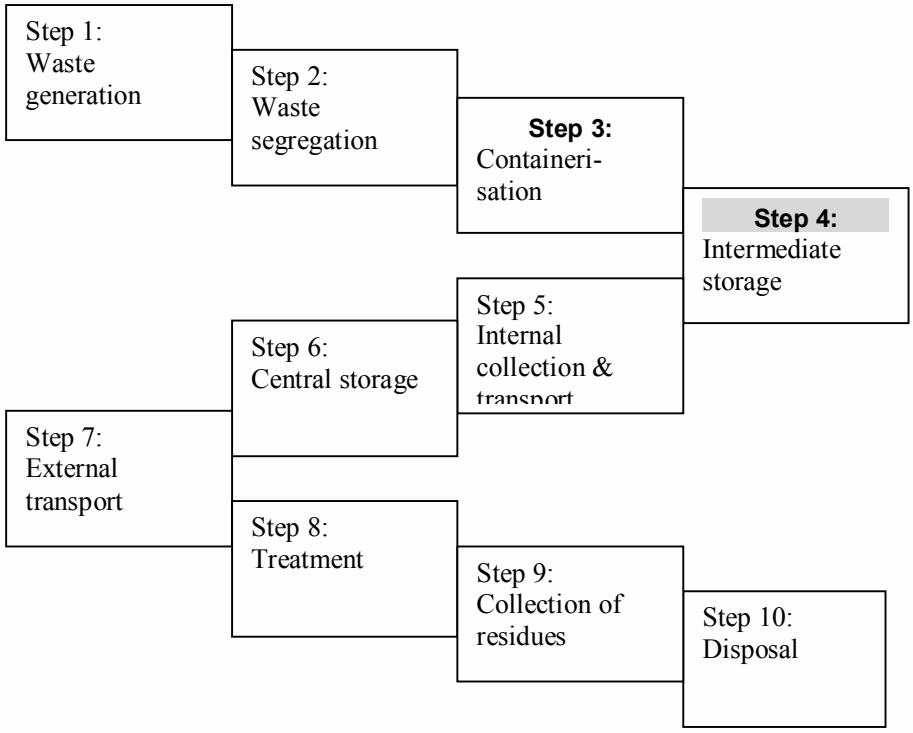
- Collection
- Intermediate storage
- Internal transport
- Central storage
- Examples on transport equipment





4. Module 4: Internal Transport and Storage

Box 4.1: Steps of the HCW flow included in this Module



4.1 Objectives of Module 4

This module of the Guidelines includes recommendations on the internal collection, transport and storage of HCW at health care facilities. The number of steps in this "internal management" of the waste depends on the character and size of the particular institution.

In principle the "internal handling" includes the following steps:

Transport from the department to an intermediate storage room;
Intermediate storage;
Internal transport from intermediate to central storage room;
Central storage.

The objective of Module 4 is therefore to provide detailed guidance on the execution of each of the above steps. Although the information provided may be very detailed for the smaller health care institutions, the parties responsible will be required to use sound judgement on the extent to which this particular Module of the Guidelines will apply.

4.2 Target Group

For this Module of the Guidelines the focus will be on the HCW workers (cleaners and general assistants) and primarily their managers within the health care institutions that are responsible for the collection of HCW from the various sources and transport to the storage areas.

In some instances nurses and in-ward assistants will be totally responsible for or otherwise to some extent participate in the internal transport of the waste from the wards to the intermediate storage rooms. It is therefore also important for those particular staff groups to get familiar with the contents this Module.

4.3 Scope of Module 4

After the successful execution of the activities described in Module 4 on the generation, segregation and containerisation of HCW at health care facilities, the next step is to transport such HCW containers (cardboard boxes, plastic bags, sharps containers, specicans, etc.) from the source where it was generated, to an intermediate storage facility, which is likely to be a dedicated room or the sluice in the case of larger clinics and hospitals. In the case of smaller clinics and other small HCW generators, this facility will probably not exist and the activity is then to transport the HCW directly from the source to the central storage area.

Where the central storage areas in larger health care facilities are not within close proximity of the source or intermediate storage areas, the waste collected from the intermediate storage areas are to be moved in larger volumes by means of a trolley or bulk HCW container to the central storage area. From the central storage area, the waste will be collected for onsite- or offsite treatment.

This module would therefore describe all of the activities required for transport of HCW from the source to the intermediate storage area, the intermediate storage of the HCW, the internal transport to the central storage area and finally the storage of HCW at the central storage area.

4.4 Reference to Other Modules

The information in this module is to be read in conjunction with Module 1, which is the module designed to address all the cross cutting issues identified in the process of integrated HCW management.

To get a better understanding of the interfacing that needs to take place in terms of HCW segregation and containerisation on the one side, and external HCW collection and off-site transport on the other side, readers are referred to Modules 4 and 6 respectively for more information.

4.5 Collecting HCW from Source and Transport to Intermediate Storage

The steps mostly involved in the collection of HCW from the source for transport to the intermediate storage rooms are presented in Box 4.1:

Box 4.1: Steps involved in collection of HCW from source for transport to the intermediate storage area.

Sharps like needles and used on patients are either to be placed directly into a sharps container (if provided on the nursing trolley), or alternatively it is to be carried in a suitable puncture proof container like for instance a kidney dish, to the nearest available sharps container;
General infectious waste generated at the patient is either to be placed into an infectious waste container (plastic bag) provided as part of the nursing trolley, or alternatively it is to be carried in a leak proof (like for instance stainless steel) container to the nearest general infectious HCRW container;
Liquid or pathological HCRW is to be carried in a leak proof (like for instance stainless steel) container to the nearest specican container. If applicable, the pathological waste is to be placed

in a separate plastic bag and sealed before being placed in the specican;
Removing plastic HCW bags that are hanging from racks and bundling (without excessive deformation) the open end of the liners, or in the case of rigid containers, bundling while the liner remains inside the rigid containers. Replace all containers removed with empty containers that meets the particular requirements for the type of waste to be collected;
Removal of sharps containers that reached the full mark from nursing trolleys or brackets;
Closing and sealing the bags/liners, followed by closing and sealing of lids where rigid containers (disposable or reusable and including sharps containers) are used;
Marking or labelling the sealed containers if required;
Replace all removed containers with empty containers that meets the particular requirements for the type of waste to be collected;
Collecting and transporting (where applicable) full containers from the source to the intermediate storage areas.

The closing and sealing procedure for sharps containers and specicans will be dependant on the design of the particular container.

It is however to be emphasised that intermediate storage areas (like for instance sluice rooms) are likely to be available only in larger health care facilities, as the central storage area may be some distance away from the point of generation. For smaller health care facilities like clinics, it is unlikely that there would be any intermediate storage facilities, resulting in a need for the HCW bags and rigid containers to be collected and transported directly to the central storage area.

Although the allocation of responsibility for this activity may vary according to the size of the health care institution, transporting of HCW from the source to the intermediate storage area is likely to be the responsibility of cleaners in larger facilities, and that of the nursing staff in smaller facilities. Care should in all instances be taken when HCW bags and rigid containers are carried to prevent direct contact with the HCW. Box 4.2 includes recommendations regarding the handling of general infectious HCRW containers/receptacles as well as spillage.

Box 4.2: Recommendations related to the handling of general infectious HCRW containers/receptacles as well as spillage:

General infectious HCRW bags and liners that are not contained in rigid containers should be carried in such a way that it does not come in contact with the human body, thus preventing injuries/infection due to incorrectly segregated sharps in the bags;
General infectious HCRW bags and liners should also be handled carefully to avoid compressing the waste, thus preventing damage to the bags that could lead to spillage or human contact with the contents of the bags;
Bags with holes should be placed inside another bag to prevent spilling of HCW. If the bag is however damaged to the extent that there is a risk for the HCW to spill during re-bagging or if HCW is already spilt, a dedicated scoop and hand broom should be used to recover the waste and deposit it in another container. The area where the spill took place, as well as any equipment used during the clearing up of the HCW, is then to be disinfected;
Should HCGW bags on visual inspection be found to contain HCRW, such bags are to be re-bagged in a red bag indicating for it to be handled and treated as HCRW. Under no circumstances is further segregation of HCW allowed (should HCGW and HCRW have been mixed), as this will pose a serious risk of infection to workers.

4.6 Intermediate Storage of HCW at Health Care Facilities

The rate of HCW generation, the size of containers used as well as the distance from the HCW source to the central storage area on the health care facility premises, will determine the need for intermediate

storage facilities. In smaller clinics and at health care practitioners, the short transport distance from the generation point to the central storage area will enable health care professionals to transport the containers from the source, directly to the central storage area. Box 4.3 details recommendations related to the provision of intermediate storage areas.

Box 4.3: Recommendations related to the provision of intermediate storage areas.

For hospitals and larger clinics it is recommended that dedicated intermediate storage areas for HCW be established for each ward/department or group thereof;
If sluice rooms have sufficient space available, this can be used as intermediate HCW storage areas;
Although the size of the intermediate storage areas is ultimately determined by the rate of HCW generation in its service area, the type of containers used as well as the frequency of HCW collection, a *minimum* size of 2 ℜ3 meters is recommended. But will depend on the type of containers being used and may be bigger where wheelie bins are used. In addition to full containers, the area should also allow for the storage of empty containers. Backup storage space is also to be allowed for in the event of a sudden increase in the HCW generation rate;
Intermediate storage areas should be well ventilated, well illuminated and easy to clear, for example by providing a tiled floor and walls. HCW that is likely to generate odours is to be removed more frequently;
Access to intermediate storage areas should preferably be easy for waste collection via the main passages, thus avoiding movement of HCW through wards;
Intermediate storage areas should be lockable to ensure controlled access;
Each ward/department should ideally be equipped with an intermediate storage area, but depending on the availability of space and distances, intermediate storage areas could be shared by two or more wards/departments, assuming that responsibility for cleaning and orderliness could be managed.

For smaller HCW generators, where transport of HCW containers from the source to the central storage area will not have a significant impact on the daily health care activities, there is no need for intermediate storage areas. The requirements for such central storage areas will be dealt with under Section 4.8 of this Module.

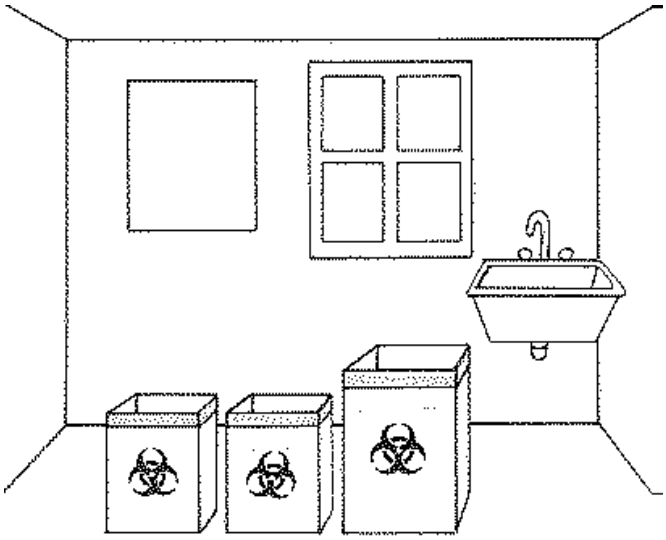
The various options available for intermediate HCW storage dealing with its location, size and the frequency of collection, is presented in Box 4.4.

Box 4.4: Options available for intermediate storage of HCW:

Sluice rooms used as intermediate storage areas or dedicated intermediate storage areas provided;
Direct transport of HCW for storage at mortuary, at central storage area or at on-site treatment facility, depending on type of HCW;
Size of intermediate storage area to accommodate collection rounds undertaken less than once a day or at least once a day, with the option of allowing for on-call collection for “problem wastes” like anatomical waste;
Intermediate storage area dedicated to each ward or department, or for groups of wards or departments;
Intermediate storage area capacity for HCRW only, for both HCRW and HCGW, for full containers only or for both full and empty containers.

Figure 4.1 illustrates a typical layout of the primary installations that are to be provided for an intermediate storage room.

Figure 5.1: Example of a layout for an intermediate storage room



4.7 Internal Transport between Intermediate and Central Storage Areas

To prevent a build-up or the prolonged storage of HCW at or near the point of generation, internal collection and transport of HCW is required. Internal collection of HCW is therefore the removal of HCW from the intermediate storage area (or point of generation where no intermediate storage area exists), for transport to the central storage area or onsite treatment facility (where applicable). The rate of HCW generation, the types of containers used, the distance between the internal storage (or generation) area and the central storage area as well as the accessibility for different types of trolleys to both the intermediate as well as the central storage areas will inter alia determine the internal transport system to be used.

Box 4.5 provides a number of recommendations related to internal transport of HCW.

Box 4.5: Recommendations related to internal transport of HCW:

There should be no accumulation or storage of HCW inside the wards/departments;
All HCW shall be removed from internal storage areas for transport to the central waste storage area at least once a day;
Collection of HCW from intermediate storage areas should preferable be done by dedicated cleansing or waste management staff that have received the necessary training;
In the case of small generators, the health care professionals may be responsible for the removal of HCW;
Staff responsible for HCW management shall only handle the HCW once containerised and shall not undertake any form of segregation. HCW workers should be appropriately informed about the way in which containers are to be handled as well as the risks of infection as well as the associated occupational health and safety risks;
All activities related to internal collection and transport of HCW shall conform with the requirements of the OHS Act;
HCW bags are to be carried away from the body, e.g. the legs, (due to the risk of pricking) and such handling is to be limited to the closing and deposition of HCRW bags into the collection trolley. The number of containers carried should

be limited to what can be carried safely without coming in direct contact with the body. The mass of individual HCW containers to be handled manually should not exceed 15 kg and containerisation of HCW should in all instances ensure a safe working environment;
All personal protective equipment (PPE) required such as gloves, aprons etc., are to be provided to all persons responsible for the handling of HCW containers;
Only one unit of each type of receptacle should be in use at an identified location at any time to minimise the filling time and allow for best possible reduction of odour, whilst limiting access to the HCW;
Wherever practical, all internal transfer/transport of HCW should be based on wheeled transportation to secure best possible ergonomics for workers while securing cost-efficient and flexible collection. Manual transport of HCW should be avoided wherever practical, with heavy or awkward lifts and manipulations not being permitted under any circumstances;
Based on the building configuration as well as the distance from the various intermediate storage areas to the central storage area, a decision could be taken on the viability of using a small tractor as a driving mechanism for multiple trolleys;
Equipment used for transport of HCW shall ensure safe transport thereof, avoiding spills and preventing unauthorised persons from coming into contact with the HCW. Trolleys, when loaded, shall not be left unattended;
The transport equipment used shall be easy to load and unload, whilst securing the HCW containers during transport;
HCRW containers shall only be loaded to the design level and shall be secured to prevent containers from dropping of the trolleys;
The equipment used should be durable with low maintenance requirements. It should further be easy to clean and disinfect (metal items should preferably be manufactured from stainless steel);
Transport equipment should be easy to move and manoeuvre and should be able to get access to all places from which HCW is to be collected or to which HCW is to be delivered. This includes allowance for elevator sizes in the event of multi storey buildings;
Precise trolley dimensions for the loading areas is determined by the types and sizes of HCW containers to be transported;
It is further important during the design of the trolleys to pay attention to the type and size of wheels to be used, to the comfort of the handle and the way in which it will be placed when parked to avoid a tripping hazard, that there are no protruding elements and that the trolleys are equipped with “bumpers” to prevent damage to walls and frames. The trolleys should however not become too heavy to be pushed/pulled.

Box 4.6 below presents examples on different types of trolleys and wheelie bins for internal transport of HCW.

Box 4.6: Examples of trolleys and wheelie bins for internal transport (wheelie bins could also be used for external transport) (REDRAWING NEEDED !!!!)

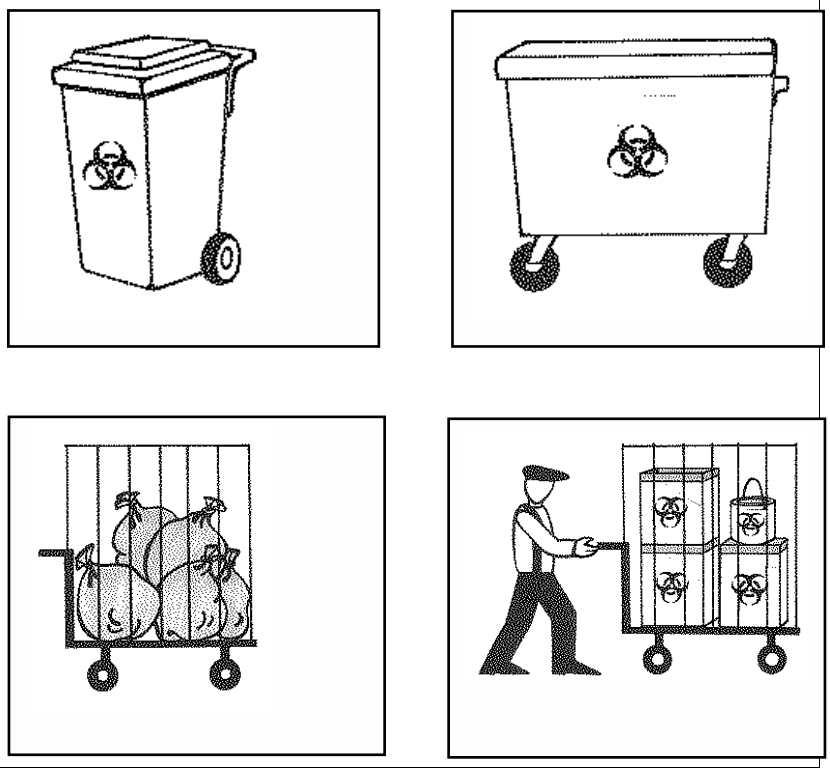


Figure 4.2 presents a typical example of the way in which HCW containers are to be carried in a safe manner.

Figure 4.2: Necessary personal protective equipment to use for carrying HCRW

The required training should therefore include the aspects as presented in Box 4.7.

Box4.7: Training requirements for staff responsible for internal collection and transport of HCW

Procedures for safe handling and loading of various HCW containers;
Emergency procedures in the event of an accident or HCW spillage;
Occupational Health and Safety requirements, including the correct use of personal protective equipment.

Standard procedures related to this are to be compiled and distributed to all affected members of staff. In addition to this, the information is also to be conveyed by means of graphic illustrations like for instance posters, particularly as many of the persons involved in this activity may not be able to be capacitated by means of written procedures and manuals due to the many different languages used in South Africa.

The most prominent options for rendering the internal collection and transport service is summarised in Box 4.8. These include consideration of the responsible parties, frequency of service delivery, as well as the alternative types of collection equipment to be used.

Box 4.8: The following options are available for internal collection and transport of HCW:

Service delivery by health care professionals at small HCW generators, or by internal or external cleaning staff or by waste management staff at larger HCW generators;
Fixed collection schedule less than once a day, once a day or more than once a day. Alternatively when called upon or when full containers are observed;
Manual carrying of HCW containers over short distances, movement by means of individual trolleys over medium distances or motorised movement of multiple trolleys over long distances to central storage areas;
Trolley bins for collection of bagged HCW or caged collection trolleys for collection of bagged or boxed HCW.

In Table 4.1 below examples of equipment for internal transport of HCW, including technical specifications and typical prices, are shown.

Table 4.1: Guiding specifications and prices of internal waste collection and transport equipment.

Item	Technical specification	Approximate price in Rand / piece
240-litre wheelie bin	Plastic.	xxxx
660-litre wheelie bin	Plastic	xxx
Expanded metal cage trolley (±0,7 x 1,5 metres)	Powder coated steel.	xxx
Expanded metal cage trolley (±0,7 x 1,5 metres)	Galvanised.	xxx
Bar fence trolley (±0,7 x 1,5 metres)	Powder coated steel.	xxx
Bar fence trolley (±0,7 x 1,5 metres)	Galvanised.	3-5,000
Electrical carts		20 – 50,000
Gas driven carts	xx	xx

4.8 Storage of HCW at the Central Storage Area

Having collected and transported the HCW from the various sources (or intermediate storage areas) inside the health care facility, the HCW is to be accumulated at a central onsite storage area from where it is to be collected for onsite- or offsite treatment. Centralised storage can therefore be described as the placement of HCW in a suitable location outside the health care facility, but within the outer perimeter thereof, with the intention of near future removal for treatment and/or disposal.

Although limited, there may be situations where the health care facility, and therefore the sources of HCW generation, are spread over such large areas, that the establishment of a second central storage

area may be justified to reduce the transport distance between the intermediate storage areas and the central storage area.

A number of recommendations related to the central storage of HCW are presented in Box 4.9.

Box 4.9: Recommendations related to central HCW storage:

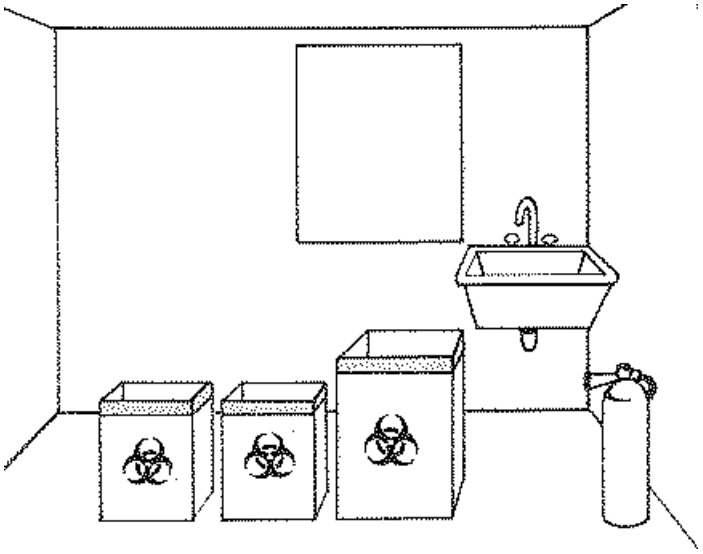
The following requirements exists for central HCW storage areas:

Each health care facility should have at least one dedicated central HCW storage area serving as either i) the interface from where service provider collect waste for off-site treatment or ii) from where waste is brought to the nearby on-site treatment facility;
The size of the central storage area will be determined by the total volume of HCW being generated between external collection rounds, with adequate allowance for backup in the event of a sudden increase in the HCW generation rate or alternatively a temporary breakdown in the HCW collection service;
Should an onsite treatment facility be used, the size of the central storage area could be reduced, depending on the availability and efficiency of the on-site treatment operation;
For smaller HCW generators, the intermediate and central storage areas could be combined;
The central storage area should be well ventilated and illuminated, be equipped with any required monitoring facilities (e.g. monitoring for radioactivity) and should also provide easy access for trolleys delivering HCW and trucks collecting HCW. Ramps should not have an incline of more than 1:10 (vertical : horizontal);
The central storage area is to provide effective access control by means of a lock to prevent unauthorised human and animal access, ensure isolation from the elements, protect waste from rodents, insects and vectors;
Clear signage should be provided at the entrance that indicates the contents of the room, the contact details for the responsible person as well as contact details for use in the event of an emergency;
The central storage facility should be placed away from food storage and kitchens;
The configuration of containers during storage will depend on the type of containers being used:
HCRW cardboard boxes (as well as reusable boxes) may only be stacked to a maximum height of three boxes;
Sharps containers are to be stacked in a configuration that will prevent it from collapsing;
Wheelie bins are not be stacked at all;
High density waste like for instance blood or pathological waste in specicans, not to be stacked at all;
HCGW and HCRW may be stored in the same room, provided that the various HCW categories are separated to the extent that it will avoid unintentional mixing;
Where justified, bulk HCGW storage containers, with or without compaction equipment to reduce the volume, may be considered as part of the central HCW storage facility;
As most HCW contains biodegradable materials, the packaging should be tight and the storage time limited;
The central storage room temperature should be kept down by protecting it from temperature increases resulting from direct sunlight and un-insulated corrugated iron walls/roofs. Although it is preferred that HCRW be removed daily, the maximum storage time for HCW should be 72 hours (in moderate climates) and 48 hours (in hot climates);
All pathological waste as well as other HCRW, where required due to climatic conditions or extended storage periods, shall be cooled / refrigerated by means of i) dedicated cooling / refrigeration facilities for HCW at the central storage area,

or ii) the possible use of the morgue for cooling down of pathological waste;
In the event of pharmaceutical waste being stolen, a dedicated area with increased security is to be provided for the storage of such waste;
The floor of the central storage should be hard standing and impermeable with a floor drain and water supply as part of a wash facility. The floor should be free from damp and moisture;
The storage room should be easy to clean and disinfect. For this purpose walls with ceramic tiles are preferred;
A supply of cleaning equipment, protective clothing and waste bags or containers should be located conveniently close to the storage area;
There should be no sources of open fires that can result in the outbreak of a waste fire;
Where the distance from the any of the sources to the central storage area exceeds 500-m, the establishment of a second central storage area should be considered, in order to get a shorter travelling time between the source and the HCRW central storage areas.

Figure 4.3 shows an example of a layout for a central storage room indicating required equipment and fixed installations.

Figure 4.3: Example of a layout for a central storage room



The training required would go hand-in-hand with the training of the internal collection and transport staff, which will ultimately be responsible for the placing of containers inside the central storage area as well as the maintenance of the facility. Training will furthermore include the particular occupational health and safety as well as the emergency response measures that are to be implemented and adhered to for the central storage area.

In Box 4.10 a number of what is considered to be the most prominent options for centralised HCW storage, are considered.

Box 4.10: The following options are available for centralised storage of HCW:

Single or multiple centrally located storage areas for large health care facilities;
Dedicated expired pharmaceutical storage area that will reduce the risk of theft and reuse of pharmaceutical waste.
Storage area sized for storage of HCRW only, storage of both HCRW and HCGW, storage of full HCW containers only or full HCW containers with dedicated area for new/sterilised empty containers.
Single or multi layer stacking depending on the type of containers to be stacked;
Storing smaller containers in larger containers for easier handling.
HCW collection less than daily, daily or more than daily or as called upon;
No refrigeration or dedicated refrigerated facility at central storage area, or the use of the mortuary as refrigerated area for pathological waste;
Storage of HCGW in disposable plastic bags, small reusable containers, uncompacted bulk containers or in bulk compacter containers.

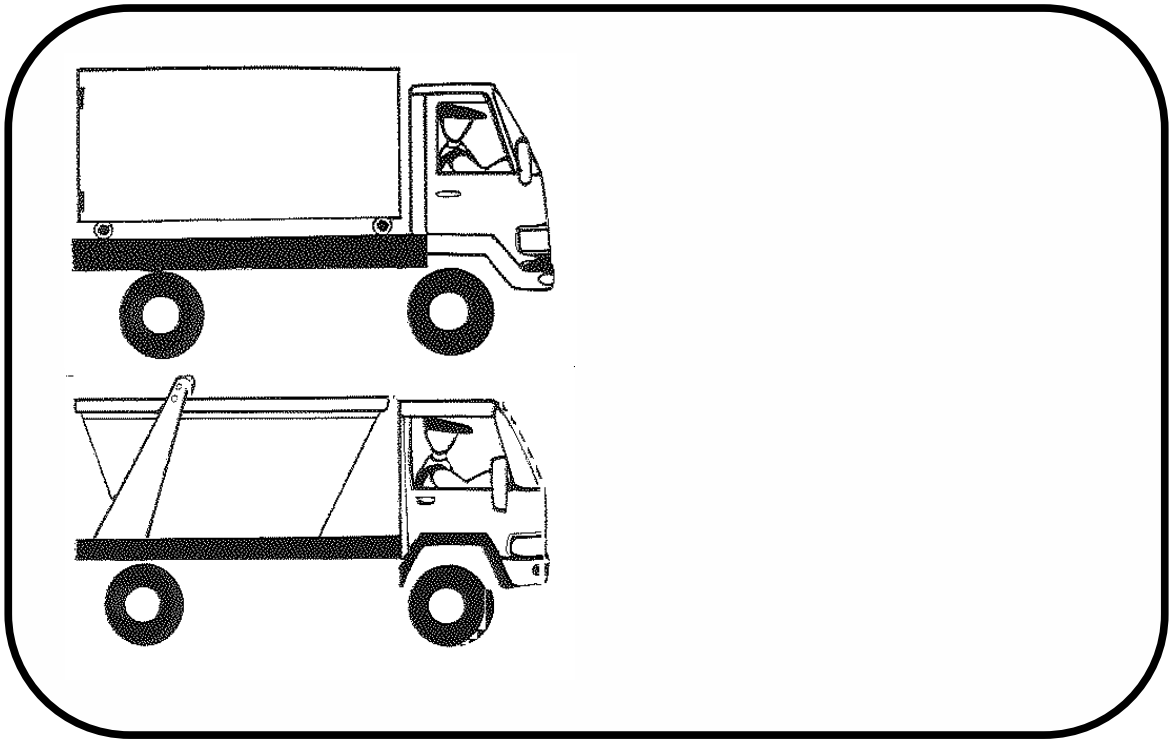
4.9 Annexure 4.1: Proposals for posters and other info materials

(TO BE FINALISED AND INSERTED ON COMPLETION OF THE PILOT PROJECTS)

Guidelines
on Sustainable Health Care Waste Management in Gauteng

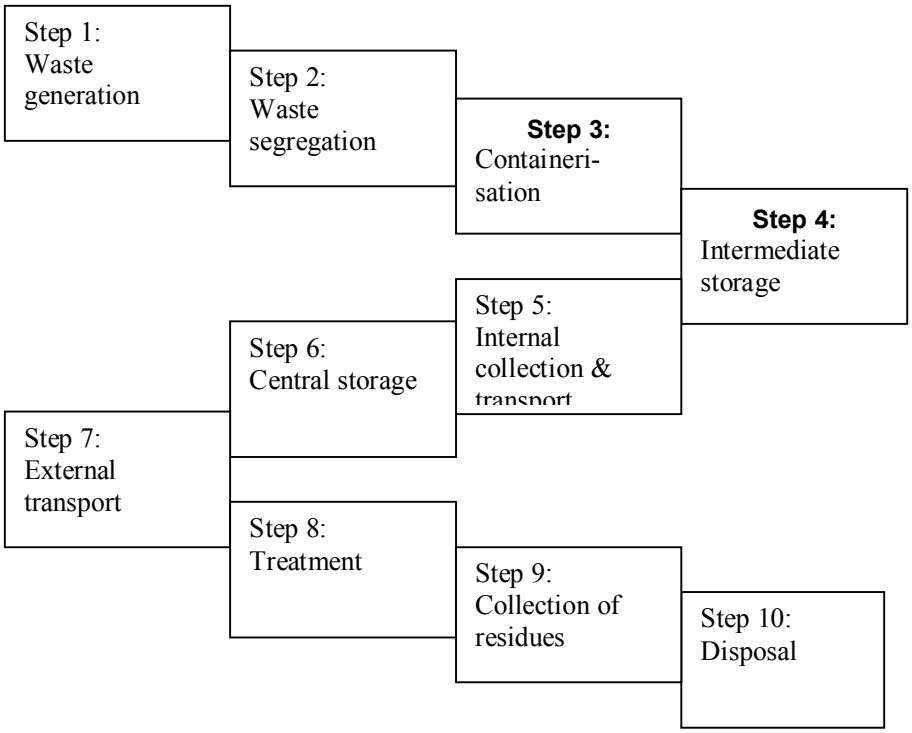
<u>MODULE 5:</u> Transport of Health Care risk Waste and Residues:

- Loading and unloading health care risk waste
- External transport
- Loading and unloading residues
- Examples on transport equipment



5. Module 5: Transport of HCRW and residues

Box 5.1: Steps of the HCW flow included in this Module



5.1 Objectives of Module 5

This module of the Guidelines includes recommendations on the collection of HCRW from central storage areas at health care facilities for transport to offsite treatment facilities (where treatment of HCRW is not done onsite), as well as on the collection of residues from HCRW treatment facilities for disposal at appropriately permitted waste disposal sites.

The objective of Module 5 is therefore to provide detailed guidance on the execution of each of the above activities.

5.2 Target Group

This Module of the Guidelines will focus on the HCRW handlers responsible for collection, loading and transport of HCRW, from the central storage areas to the treatment facilities where it is to be offloaded. It also addresses responsibilities for vehicle drivers transporting HCRW between the generators and the treatment facility, as well as for those transporting residues between the HCRW treatment facility and an appropriately permitted disposal site. As some of the HCW workers and truck drivers may not be familiar with the terminology used in the Guidelines, this Module is also directed at the middle management who is responsible to supervise and overlook the daily activities of the HCW workers and truck drivers.

5.3 Scope of Module 5

After the successful execution of the activities on the internal transport and storage of HCW at central storage areas as described in Module 5, the next step would be to collect and transport HCRW from the central storage areas to the HCRW treatment facility (where offsite treatment facilities are used).

In principle the activity on collection and transport of HCRW includes the following steps:

Collection of HCW from the central storage areas at health care facilities for loading onto dedicated HCRW vehicles;
Transport of HCRW from the health care facilities to the regional HCRW treatment facilities;
Offloading and storage of HCRW at the regional HCRW treatment facility.

Another area of external transport that will be dealt with is the transport of residues from the HCRW treatment facility, to the appropriately permitted waste disposal site. The collection and transport of residues from the HCRW treatment facilities will include:

Collection of containerised residues from on-site or regional HCRW treatment facilities
Transport of residues from the HCRW treatment facility to an appropriately permitted waste disposal site for disposal.

5.4 Reference to Other Modules and Documents

The information in this module is to be read in conjunction with Module 1, which is the module designed to address all the cross cutting issues identified in the process of integrated HCW management.

To get a better understanding of the interfacing that needs to take place in terms of internal HCW transport and storage at health care facilities on the one side, treatment of HCRW in the middle as well as disposal of residues on the other side, readers are referred to Modules 4, 6 and 7 respectively for more information.

This document should also be read in conjunction with the following relevant Acts and SABS Codes on the transport of hazardous materials:

National Road Traffic Act (Act 93 of 1996);
SABS Code 0228: Identification and classification of dangerous goods;
SABS Code 0229: Packaging of dangerous goods for road and rail transportation in South Africa;
SABS Code 0230: Transportation of dangerous goods – Inspection requirements for road vehicles;
SABS Code 0231; Transportation of dangerous goods – Operational requirements for road vehicles;
SABS Code 0232; Transportation of dangerous goods – Emergency information system;
SABS Code 0233: Intermediate bulk containers for dangerous substances;
The United Nations document titled "Recommendations on the transport of dangerous goods - model regulation".

5.5 How to Load HCRW for Transport to Treatment Facility

Where there is no on-site HCRW treatment facility available, all HCRW and HCGW stored in the central storage area are to be collected and transported to a regional treatment/disposal facility, as applicable to the respective HCW categories.

External transport of HCW can therefore be considered to be the movement of HCW by means of suitable designed vehicles from the point of external storage, to the point of treatment/disposal outside the boundaries of the health care facility. External transport of HCRW would be in an uncompacted state as containerised at source, whilst HCGW may be in either an uncompacted or compacted state, depending on the volumes generated as well as the containers and vehicles used.

Only companies authorised through registration with the regulatory authorities will be allowed to transport HCRW. The precautions to be taken when transporting HCRW are presented in Box 5.1.

Box 5.1: Provisions for transport of HCRW from health care facility to treatment facilities.

Registration:
In Gauteng all transporters of HCRW are to register with DACEL;
The registration and reporting procedures should include the physical address of the depot where vehicles will be stored and where it would be available for roadworthiness as well as health and safety inspections;
Responsibilities:
Without affecting the duty-of-care principle for generators of HCRW, transporters of HCRW will be held liable for ensuring that all HCRW entrusted to it will be treated and disposed of in accordance with the requirements of the Gauteng Health Care Waste Management Policy.
Recording:
Mass recordings on HCRW transported is to be submitted to DACEL in the required format for capturing on the HCWIS;
Existing manifest requirements shall be complied with until such time that a more elaborate HCRW tracking system is introduced;
Where the billing system is fully or partially based on the mass of the HCRW removed, such mass recordings shall be undertaken at the point where HCRW is collected. The same applies to the recording of the number of bins, where volume recording is used for the billing.

A number of recommendations related to the transport of HCW are presented in Box 5.2. Also included are some of the requirements for the transport of hazardous materials, which in South Africa include HCRW.

Box 5.2: Recommendations related to the transport of HCW between the central storage areas and the treatment/disposal facility:

Health Care Risk Waste

Loading of HCRW:
No HCRW containers shall be left unattended;
Central HCRW storage areas are to be closed and secured on completion of the HCRW collection;
Waste to be transported of-site should be bundled to suitable volumes and sizes to avoid excessive handling of numerous smaller units;
Where possible, HCRW containers should not be lifted or moved manually in a way that it will bring the personnel in close contact with the waste containers. Movement of HCRW containers should rather be by means of trolleys or other means of wheeled transportation to protect workers against possible injuries or infection from needle pricks, or alternatively from sustaining injuries through heavy and awkward lifts;
Any HCRW containers exceeding the allowable mass limit of 15 kg shall not be lifted manually. To ensure minimum ergonomic strain, lifting tailgates, ramps or other elevating systems should be applied where the type of container selected will result in the allowable lifting mass being exceeded;
Where containers are to be stacked, the maximum allowable stacking height for the particular types of containers are to be adhered to and containers are to be secured when loaded.

HCRW vehicle design:
Transport vehicles should be for the sole purpose of transporting HCRW and should not be used for any other purposes;
All HCRW vehicles are to meet the standards laid down by the National Road Traffic Act (Act 93 of 1996), as well as the bylaws of the respective local authorities in which area of jurisdiction it has to operate;
Access to the HCRW vehicle's loading compartment shall be safe and unobstructed, thus ensuring easy access for the HCRW management staff;
The type and size of the HCRW collection vehicles used would to a large extent depend on the type of containers to be used, the amount of HCRW to be collected per collection round, as well as the need to optimise the payload by for instance the use of double level loading compartments;
Storage compartments for HCRW collection vehicles should not have any holes or openings that could result in leaking of liquids that may have spilt from containers;
The inner surface of the collection vehicle's storage compartment should be rust free by being galvanised, manufactured from stainless steel or covered by zinc or other materials approved by the regulating authorities;
The internal finish of the load compartment should allow for easy cleaning, e.g. angels should be rounded;
There should be a bulkhead between the drivers cabin and load compartment, designed to retain the load, should the vehicle be involved in an accident;
There should be a suitable method for fastening the closed HCRW containers, thus reducing the risk of spills;
Vehicles are to be equipped with emergency equipment required by national or local legislation, including spill kits containing at least all personal protective equipment like masks, glows and overalls, as well as folded HCRW containers, brooms, scoops and disinfectants, together with fire extinguishers and the staff should be trained in the effective use thereof;
Where transport of HCRW is to be undertaken over long distances like in the case of inter-provincial transport, HCRW collection vehicles are to be refrigerated;
Where the bylaws from neighbouring local authorities differ, the stricter bylaws should be used as the design criteria for the vehicle.

HCRW vehicle identification:
The HCRW transporting vehicle should be marked with the name and address of the waste carrier as well as an emergency telephone number for use in the event of an accident;
HCRW collection vehicles shall be clearly marked as transporting HCRW by inter alia displaying the international hazard sign on the vehicle;

HCRW vehicle maintenance:
Vehicles shall be well maintained, which should include a programme of preventative maintenance;
Cleaning and disinfection of HCRW collection vehicles should be undertaken at ……. intervals, using …….. or similar (according to the suppliers specifications), as a disinfectant;

Emergency procedures to be followed in the event of an accident:
Assuming for the worst case scenario that the truck driver and his/her crew is unable to assist emergency workers in the event of an accident, the following procedures are to be followed:
Identify the contents of the vehicle by means of the hazardous waste signage displayed on the outside of the vehicle;
Verify if there is any risk of a fire on the HCRW transport vehicle, and if so, distinguish the fire by means of the fire extinguisher provided on the truck, or alternatively by means of an external fire extinguisher;

Put on the necessary personal protective equipment (PPE) which should at least consist of sterile gloves, before attending to any injured persons;
Having given the necessary attention to injured persons or having transferred this responsibility to other professionals like paramedics, the emergency kit on the vehicle is to be located;
Provided that the emergency kit can be reached without the risk of being contaminated by HCRW, the PPE (leather gloves, goggles, mask, apron and gumboots) is first of all to be located and put on, after which an assessment of the extent of the spillage is to be made;
If the containers are not damaged, it is simple to be packed back into the loading compartment in as far as possible. Where this cannot be done due to the loading compartment not being accessible, damaged or the weight of the containers being too much for manual lifting, the containers are merely to be stacked as close as possible to the truck;
Where spillage occurred, the broom and scoop provided as part of the spill kit should be used to clear and HCRW for re-containerisation into the initial containers (if undamaged), or alternatively into the folded cardboard boxes with plastic liners that are to be provided as part of the spill kit;
With all the solid HCRW being re-containerised, the contaminated area is to be disinfected with …… that will also be included in the spill kit;
Throughout all of this, it is to be ensured that no inexperienced person or person not properly equipped to deal with HCRW, be allowed to approach the areas where HCRW spillage has occurred;
Only once the damaged vehicle(s) and any remaining spillage were removed from the scene, can final disinfection be undertaken;
All PPE used during the cleanup operation, is thereafter to be removed and bagged for disposal as HCRW.

For any spillage incidents that did not result from a vehicle accident, the procedures presented above (excluding bullets 1 to 4) will apply.

Occupational Health and Safety:
It is important for the HCRW collection staff are properly trained and equipped not only to execute their duties in terms of environmental standards, and OHS requirements, but also in terms of emergency procedures in the event of accidents, spills, leakage, etc.
All inoculation and anti-retroviral (if required) programmes should be in place and all treatment be documented for staff that may come in contact with HCRW;
The training as well as the inoculation and anti-retroviral programmes should apply to permanent as well as temporary staff employed for HCW management;
It is recommended that illustrative posters, e.g. inside the waste collection compartment, be displayed to remind the staff of the most urgent environmental as well as the OHS measures that are to be adhered to.
No collection crewmembers are allowed to travel in the HCRW loading compartment.

Health Care General Waste:

The system used for HCGW collection from small generators will in most instances be determined by the system proposed by the local authority that renders the service. Should the service be outsourced, financial considerations for making it viable will have a significant impact on the selection process;
When justified by the rate at which HCRW is generated at any particular health care facility, onsite compactors are used to reduce the HCGW storage space required, whilst at the same time reducing the environmental impact of the HCGW;
Should bulk open containers (skips or roll-on roll-off containers) be used for on-

site collection and storage of HCGW, such containers should be readily accessible for deposition of waste, whilst at the same time protecting the environment against the impacts that rain and wind will have on the HCGW;
Vehicles used for transport of HCGW should meet both the national transport legislation as well as the bylaws from the local authorities in which area the vehicles are operating;
All vehicles are to be equipped with the necessary safety equipment that will include equipment appropriate for clearing any spillage of HCGW;
Records of waste removal recording are only required in terms of the billing system that is to be implemented;
Staff appointed to collect and transport HCGW are to be properly trained and equipped to execute their duties;
All inoculation programmes should be in place and all treatment be documented for staff that may come in contact with HCW;
Training programmes are to be developed against the background of the OHS Act, to ensure compliance with the relevant legislation;
The training as well as the inoculation programmes should apply to permanent as well as temporary staff used for HCW management.

The options available for implementation of an external transport system is presented in Box 5.3.

Box 5.3: Options available for external transport of HCW

Health Care Risk Waste:
The size of vehicle used to transport HCRW could be selected for light loads (e.g. <1000 kg payload), medium loads (e.g. 1000< payload < 3000 kg) or heavy load vehicles (e.g. > 3000 kg payload);
The HCRW vehicle design could allow for a single level loading bay or double level loading bay, with or without dedicated lifting mechanisms as required by the number of loading bay levels as well as the type of containers being used;
The logistics for daily collection of HCRW could be in single shifts or multiple shifts;
Cleansing of HCRW collection vehicle with an anti-septic could be done on a daily or less frequent basis, depending on the exposure to potentially infectious pollutants;
Billing for HCRW collection and transport could be according to the number of HCRW containers collected (volume billing), according to the total mass of HCRW collected (mass billing), or as a combination of volume and mass billing.

Health Care General Waste:
HCGW can be collected in a compacted or uncompacted state, depending on the rate of generation as well as the availability of storage space at the premises;
Uncompacted HCGW collection can be done by means of black plastic bags loaded into a Rear-end-Loader compactor truck, 240-litre wheelie bins loaded into a Rear-end-Loader compactor truck, 5 to 6,5 m^3 skips loaded into a Rear-end-Loader compactor truck or collected with a loadlugger truck, 20 to 30 m^3 roll-on roll-off containers, collected with a roll-on roll-off truck;
Frequency of HCGW collection will be determined by the rate of generation, the temperature conditions that can result in the generation of odours, as well as the storage space available;
Kitchen waste may be collected separately when used as pigswill; MEETING WILL BE SET UP WITH VETS TO DISCUSS WHETHER FOODSTUFF FROM HOSPITALS CAN BE USED AS PIGSWILL.
Recyclable materials that were separated before there was any risk of contamination, may be collected separately.

Figure 5.1 below presents examples on different types of vehicles for external transport of HCW.

Figure 5.1: Examples on vehicles for external transport of HCW

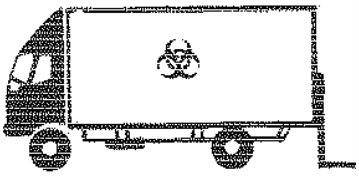
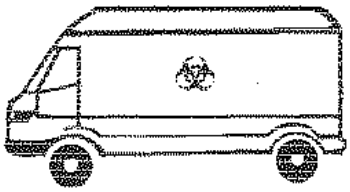
	Large truck Large truck with a back loader for loading with both trolleys, wheelie bins etc.
	Smaller truck Smaller truck primarily for manual loading of smaller wheelie bins and cardboard reusable or disposable boxes.

Figure 5.4 displays the biohazard sign to be used for labelling HCRW containers and marking HCRW transport vehicles.

Figure 5.2: Bio hazard sign, indicating the presence of Health Care Risk Waste

5.6 How to Load and Transport HCRW Residues

Transport of residues from HCRW treatment facilities is the movement of treated HCRW by means of suitable designed containers and vehicles. This activity takes place from the point of treatment, to the point of final disposal at an appropriately permitted, designed, constructed and operated waste disposal facility. Due to the strong similarity in many respects between the transport of residues and that of untreated HCRW, it is considered appropriate to combine the aforesaid activities into one module.

A number of recommendations related to the loading and transport of HCRW residues are described in Box 5.4.

Box 5.4: Recommendations on the loading and transport of HCRW residues:

Volume reduction during treatment, resulting in an increased density of residues, results in more cost effective transport between the treatment- and disposal facility;
Low density residues could be transported more cost effectively by using compaction equipment to increase the material density;
The equipment required for containerising HCRW residues is appropriate receptacles (containers) to be used for the collection of the residues, which is determined by the state of the treated residues;
Residues are transported with vehicles that are appropriate for the type of containers being used, to a waste disposal site that meets the requirements for disposal of that particularly waste classification;
Similar to HCRW collection vehicles, these vehicles are once again to meet the standards laid down by the National Road Traffic Act (Act 93 of 1996).
Manual loading of HCRW residues should be discouraged;
Irrespective of the treatment process, is it recommended that the residues from any HCRW treatment process be managed as if it is potentially infectious;
The fine dust particles from incinerator ash could contain heavy metals, thus requiring effective dust suppression as well as the use of appropriate personal protective equipment (PPE) and emergency equipment, if required;
In addition to the occupational health and safety risks, there is also an environmental risk of pollution through heavy metals present in some treated residues;
Suitable covers are to be provided over containerised residues that will prevent the infiltration of water, as well as the scattering of residues through wind action;
People responsible for the handling of residues are to be capacitated in the environmentally sound, yet healthy and safe ways for handling of HCRW residues.

Box 5.5 provides various options for handling of residues, the equipment required for residue handling as well as the ways in which the payload of residues can be improved during transport thereof.

Box 5.5: Options for transport of residues.

- Residues can be loaded manually (although not recommended), mechanically or by means of automation;
- The vehicles used for the transport of residues could be a loadlugger for transporting skips with high density residues, a roll-on roll-off truck with 20-m^3 to 30-m^3 containers for transport of low density residues; a rear-end-loader (REL) compactor truck for transport of low density residues or a static compactor with roll-on-roll-off containers for transporting of low-density residues;
- An improved payload can be achieved by means of increased volume for bulk transport of low-density material, by means of increased density through shredding of low-density material or by means of increased density through compaction of low-density material.

5.7 Importance of Cooperation

The importance of cooperation in this module is focussed around the need for HCRW transport contractors to interact with the HCRW management staff from the health care facilities on the one end, and with the staff from the HCRW treatment facility on the other end. The contractor responsible for transport of residues will in turn interact with the staff from the treatment facility on the one end, and

with the staff at the waste disposal site on the other end. Significant delays and other irregularities can be averted through close cooperation and interaction on any matters that may have a negative impact on the operations of the respective parties.

Damaged containers, overloading of containers or storing of containers that are unprotected against the elements, are aspects over which the staff at the health care facility do have control and which will make the waste collection much more effective if addressed timely. Other important aspects to consider are for instance the provision of easy and unobstructed access, limiting the number of collection points per facility, limiting the transport distance between the central storage area and the loading bay, etc. Probably one of the more important aspects around this will be the efficiency with which the HCRW is containerised, as that will ultimately have a significant impact on the cost effectiveness of the transport operation, should the billing system be based on mass rather than volume, or even where the mass is to some extent incorporated in the billing system

Cooperation with the treatment facility operator on the other end will not only improve the effectiveness with which the transport contractor can undertake his work, but it will also be beneficial to the treatment facility operator if the mass recording is done effectively and the HCRW containers are stacked in the correct area and in the correct manner.

For the transport of residues it is important that the bulk containers are ready and available when called upon to collect it, once again with easy and unobstructed access. Easy access and limited disruption at the waste disposal site will be the important aspects to consider during disposal.

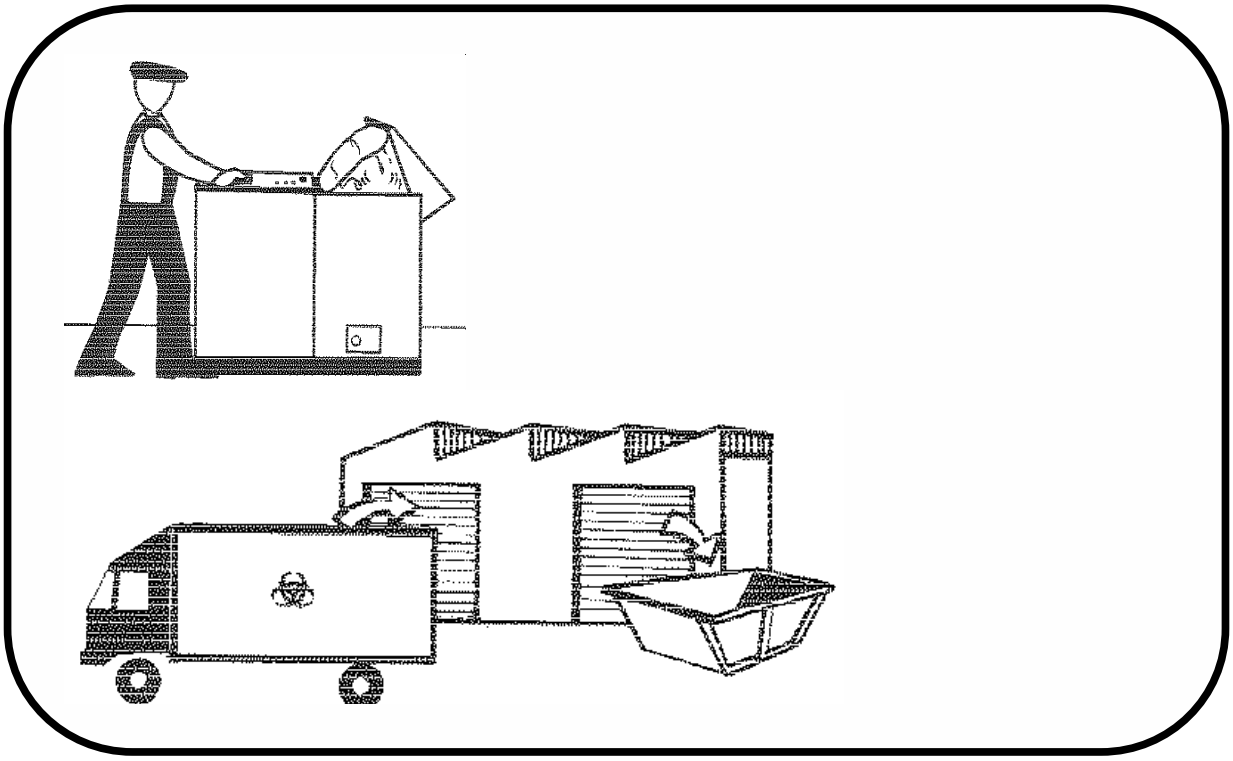
5.8 Annexure 5.1: Proposals for posters and other info materials

(TO BE FINALISED AND INSERTED ON COMPLETION OF THE PILOT PROJECTS)

Guidelines on Sustainable Health Care Waste Management in Gauteng

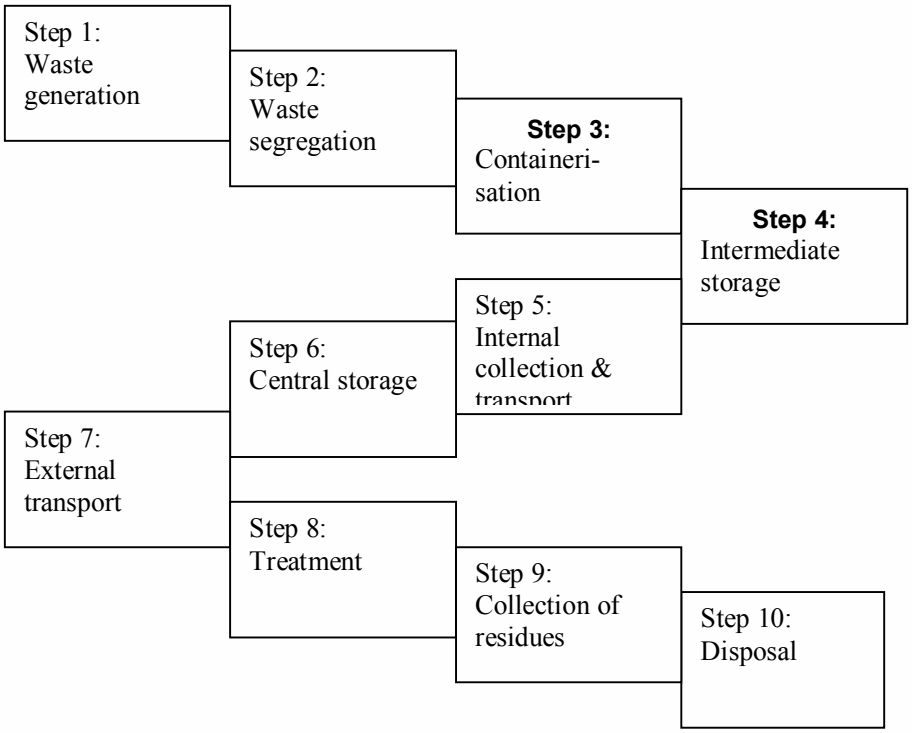
MODULE 6: Treatment of Health Care risk Waste:

- Health Care Waste Information System
- Presentation of different treatment technologies
- Advantages & disadvantages
- Examples on treatment technologies
- Environmental standards



6. Module 6: Treatment of HCRW – Principles for Operation

Box 6.1: Steps of the HCW flow included in this Module



6.1 Objectives of Module 6

The two main HCRW treatment technology categories are thermal and non-thermal treatment processes. The objective of Module 6 is to present recommendations on various options available for HCRW treatment, which is aimed at eliminating the infectious organisms and other hazardous materials in the HCW. Reducing the environmental as well as the occupational health and safety risks by elimination of such infectious organisms can in turn be considered to be the ultimate objective of integrated HCW management.

HCRW treatment can therefore be described to be any method, technique or process used for altering the biological, chemical or physical characteristics of HCRW in order to reduce the hazards it presents, to facilitate its ultimate disposal and reduce the costs of disposal. The basic treatment objectives include disinfection, neutralisation, volume reduction or other changes to reduce hazards.

6.2 Target Group

Module 6 of the Guidelines primarily targets senior and middle management of the HCRW treatment facilities. It does however also provide concrete information used during the decision making process for senior management at health care facilities, who are in terms of the Duty of Care Principle responsible for the treatment and safe disposal of HCRW. Environmental officers, environmental health officers and other professionals responsible for HCW management may furthermore benefit from this Module.

Management at health care facilities is inter alia to decide whether treatment of HCRW is from an environmental, health, safety and finally financial point of view more effective undertaken by operating an on-site treatment facility or whether such services are to be outsourced to service providers using regional off-site treatment facilities.

Since each particular treatment technologies have its own special operational requirements, these Guidelines will focus on generic matters that are considered to be relevant to all or most of the treatment technologies used in South Africa.

6.3 Scope of Module 6

The responsibility for environmentally sound treatment and final disposal of the HCRW is transferred from the generator to the transporter, and then to the HCRW treatment facility owner every time the HCRW is handed over to the next party involved in the HCW management process. However, the duty-of-care principle requires from each party to ensure that the HCRW and responsibility for its sound management is handed over to a competent organisation that will apply approved and permitted methods and systems only.

The Guideline therefore focuses on peripheral activities that are generic for most treatment options, for instance data recording on delivery, HCRW storage requirements, safe handling and onsite transport of HCRW during treatment and finally the management of residues.

6.4 Reference to Other Modules/Documents

The information in this Module is to be read in conjunction with Module 1, which is the Module designed to address all the cross cutting issues identified in the process of integrated HCW management. Readers of Module 6 are also encouraged to read Module 6 on transportation of HCRW and residues from treatment for a better understanding of the interfacing of transport with treatment, as well as Module 8 that deals with the sound disposal of residues.

6.5 How to record HCWIS Data

DACEL is in the process of developing, enacting and prescribing a record keeping and data reporting structure to be used by all HCRW treatment facilities; the Health Care Waste Information System (HCWIS).

The major objective of the HCWIS is to support management in undertaking strategic planning on HCRW management in Gauteng. Its second objective is to generate sufficient data for reporting on the State of Environment or systems.

The HCWIS is therefore intended to:

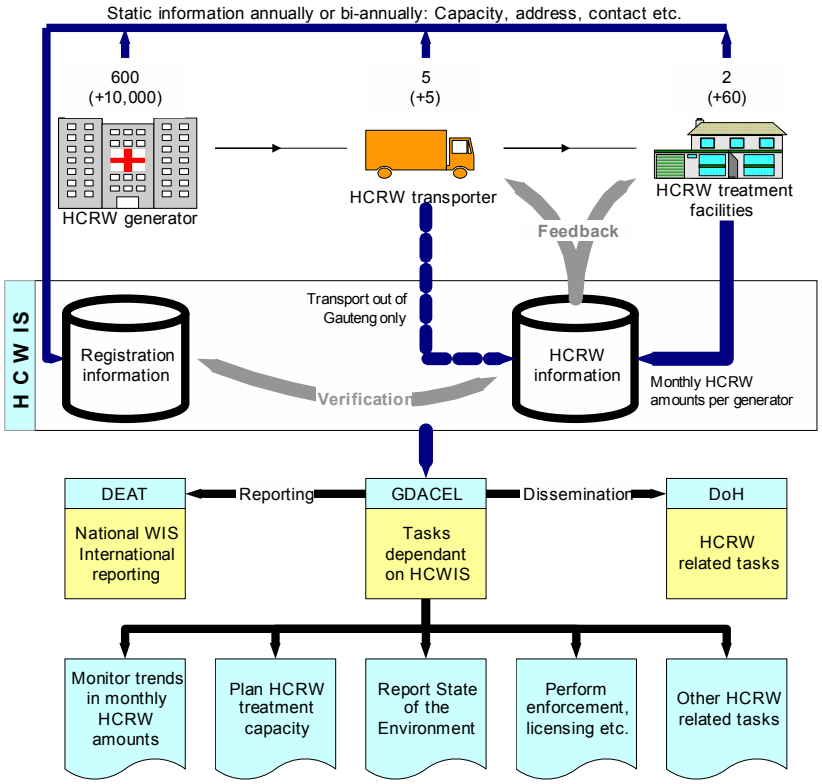
Periodically monitor trends in the amount of HCRW transported and treated within the Province, and Assess the availability of HCRW treatment capacity within the province against the amount of HCRW being generated to plan for future HCRW treatment needs.

Further issues to be addressed by the HCWIS, include:

To promote the recording of waste generation data for individual health care facilities;
To develop a data base on HCRW generators, transporters and treatment facilities;
To appropriately report on information gathered for the HCWIS for amongst others the Provincial as well as National State of Environment Reporting (SoER);
To identify priorities for HCRW management and at source separation training;
To monitor waste minimization programmes and the success of training for improved waste segregation;
Identify unit generation data, i.e. typical waste tonnages produced for different generator types.

Information for the HCWIS will be collected, processed and disseminated as illustrated in Figure 6.1 below. The main principle of the system is that each piece of information is collected only once, validated close to the source of information for correctness, and disseminated to the relevant bodies.

Figure 7.1: Overall principles of HCW information system



The HCWIS was designed to handle dynamic as well as static information regarding HCRW generators, transporters and treatment facilities. The information required for the HCWIS will include:

Basic information on HCRW generators;
Basic information on HCRW transporters;
Basic information on HCRW treatment plants (private and public);
From treatment plants (including onsite at hospitals and clinics) information will be obtained on the monthly amount of HCRW treated per generator as reported per transporters;
From transporters information will be obtained on monthly amounts HCRW transported out of the Province for treatment at approved HCRW treatment facilities in neighbouring provinces.

6.5.1 Registration

All HCRW generators, transporters and treatment facilities will be required to register with Gauteng DACEL. Initially only medium and large generators of HCRW (> 1kg per day) will be required to register and will be issued with a unique registration number. Small generators of HCRW, for example GP's may be accommodated by means of central collection points for which the Local Authority is responsible, in which case the Local Authority would register as a HCRW generator. There are an estimated 227 large generators (> 10 kg per day), 343 medium generators (1-10 kg per day) and approximately 9700 minor generators (< 1kg per day) within the Province (HCRW Status Quo Report, 2000)

In registering with DACEL, certain basic static information is required, such as the company name, postal address, telephone number, e-mail, contact person, permit status and coordinates. Furthermore, for treatment facilities, information on treatment capacity would be required, while for generators, information on number of beds and/or outpatients, occupancy and expected ranges in HCRW generated would be requested.

The unique identifier issued to generators, transporters and treatment facilities is required to distinguish between different companies submitting data to the HCWIS.

HCRW treatment facilities, and to a lesser degree HCRW transporters, will be the sources of information for the HCWIS. Static data will be collected on registration and thereafter updated annually or bi-annually. Dynamic data will initially be collected monthly and later during the process perhaps quarterly. In terms of the HCWIS, it will be required that all HCRW be weighed and that the amounts are reported in kilograms (kg).

The method used to weigh the HCRW either by the transporter or treatment facility is not prescribed. Similarly the means of capturing generator information is not prescribed, whether it is labels, bar codes or transponder systems. The only stipulation with regards to labelling is that each and every container be clearly marked with the generator's name and unique number.

6.5.2 Reporting

Data submission to DACEL can (in order or priority) be done by means of i) online reporting using the internet, or ii) reporting in computer file on diskette or via e-mail, or in exceptional cases iii) submission of data in paper format.
Reporting by either a treatment facility or transporter must contain the following:

Identification of reporter;
Month and year;
Amount of HCRW (kg);
HCRW category;
Generator registration number;
Transporter registration number;
Treatment facility registration number.

The reports for both the treatment facility and transporters are the same. The report allows for the capture of information on the Reporter, the generator producing the waste, the transporter delivering waste to the treatment facility (inside or outside of Gauteng), and the treatment facility receiving the waste.

For HCRW removed from Gauteng to another province, only the province name is listed under *Treatment facility*, since these treatment facilities will not be registered with Gauteng DACEL, and as such will not have a registered unique identifier. Similarly for waste received for treatment in Gauteng from neighbouring provinces, only the province name is listed under the *Generator* field. DACEL will however require more details on such treatment facilities and generators, to ensure that the same standards set for Gauteng, are met by outside parties becoming involved in HCW management for Gauteng.

6.6 Storage of HCRW at Treatment Facilities

Having collected and externally transported the HCRW from the various generators (e.g. health care facilities) where no HCRW treatment is done onsite, the HCRW is to be delivered to the storage areas at regional facilities where the HCRW treatment is to be undertaken. Such storage should consist of a suitable location at or near the HCRW treatment plant, but within the outer perimeter of the facility, with the intention of near future removal for treatment and disposal.

Some of the most important requirements with which HCRW storage areas at the treatment facilities are to comply, are presented in Box 6.2.

Box 6.2: Requirements for HCRW storage areas at treatment facilities.

The onsite storage area is to provide effective lockable access control that will make it inaccessible for humans, animals, birds and insects, ensure its isolation from the elements, provide protection against rodents and vectors as well as protection against environmental and health impacts;
The HCRW storage area door should have a signboard that clearly indicate the contents of the room, the contact details of the responsible person as well as contact details for use in the event of an emergency;
HCRW storage areas should be equipped with any monitoring facilities that may be required (e.g. monitoring for radioactivity, etc.);
The storage area should be easily accessible for the waste management personnel collecting HCRW as well as for waste collection vehicles delivering HCRW to the facility;
The HCRW storage area should be equipped with good lighting and at least passive ventilation;
The storage room should have an impermeable, hard-standing floor with a floor drain and water supply as part of a wash facility;
The HCRW storage room should be easy to clean and disinfect. For this purpose walls with smooth surfaces that can be readily disinfected are preferred;
A supply of cleaning equipment, protective clothing and waste bags or containers should be located conveniently close to the storage area;
The floor of the storage facility should at all times be free from damp and moisture, not only to prevent it from being slippery, but also to protect the containers, particularly where cardboard boxes are used for HCRW storage;
There should be no sources of open fires in close proximity of the HCRW storage areas that can result in the outbreak of a accidental fire;
The room temperature should be kept down by protecting it from temperature rises resulting from direct sunlight and un-insulated corrugated iron walls/roofs;
As most HCRW contains biodegradable materials, the packaging should be sealed and the storage time limited, particularly when considering the fact that the HCRW has already for some time been stored at the point of generation. Although it is preferred to have all incoming HCRW treated in daily cycles, the following time limits for non-cooled storage of HCRW should be followed in Gauteng to avoid odour problems and the breeding of vectors:
Maximum 72 hours in moderate climates;
Maximum 72 hours in hot climates.
Depending on the quality of the packaging and the robustness of seals anatomical waste may have be stored for shorter periods and treated as a priority to avoid unacceptable odour and esthetical problems.
Where required by abnormal high temperatures or long storage periods, refrigerated facilities are to be provided as part of the storage facilities;
The storage area is to be used for all potential categories of HCRW that is to be treated at that particular treatment facility, with some clearly demarcated area for HCRW that cannot be treated and that is to be removed for treatment at an appropriate facility somewhere else (e.g. pathological HCRW at non-burn treatment facilities);
If radioactive waste is detected, such waste should normally be of relative low radioactivity level and of very modest quantities and must therefore be handled and placed separately for further treatment/disposal in accordance with the level of radioactivity and risk associated with its presence;
Multiple box units are not to be stacked higher than 1.7 meters if handled manually and only if this is safe to handle and unlikely to result in boxes falling or collapsing;

Wheelie bins are not to be stacked at all;
Smaller units such as sharps containers and specicans should not be stacked and stored loosely but preferably contained in larger containers to limit the number of units to be handled and to safeguard against spills;
The stacking height for high density waste like for instance liquids in specicans, are to be limited to two layers of containers, that will reduce the risk of contamination of the storage area in the event of possible overturning of sealed containers;
The size of the HCRW storage area should be sufficient to cater for the HCRW storage equivalent to the maximum treatment capacity for a period of 3 days;
Pre-arranged contingency plans must be established to allow for transfer of waste for treatment at another treatment plant that will allow for planned or unplanned unavailability of the treatment facility.

The training required for the operators at the treatment plant shall go hand-in-hand with the training of the transport staff, which is likely to be responsible for the placing of containers inside the storage area at the HCRW treatment facility. Training is furthermore to include all safety and emergency response measures that are to be implemented and adhered to for the HCRW storage area.

6.7 Handling and Onsite Transport of HCRW

Details on the requirements for onsite handling and transport of HCRW are described in Box 6.3.

Box 6.3: Details on onsite handling and transport of HCRW.

Manual transport of HCW should be avoided wherever practical, with heavy or awkward lifts and manipulations not being permitted under any circumstances.
Only in exceptional cases should manual lifting be allowed and only for units weighing less than 15 kilograms and that are designed for easy handling;
Dedicated waste management staff should carry out collection of HCRW from onsite storage areas;
Where manual transport of HCRW is for logistical reasons the only viable option, it should be assured that the workers doing this are appropriately informed about the risks of infection as well as the associated occupational health and safety aspects;
Workers are to be informed on the safe way in which HCRW containers are to be handled; like avoiding the carrying of HCRW bags directly against the body and limiting the number of containers carried to the maximum lifting load of 15 kg;
Workers are to be equipped with the required Personal Protective Equipment (PPE) like dust masks, aprons, gloves and safety shoes;
No HCRW shall be handled unless containerised and no form of segregation shall be undertaken at the HCRW treatment facility;
Where container collapse or spillage occurred, the prescribed emergency procedures should be followed for re-containerisation of the HCRW and disinfection of the affected area;
Removal of HCRW spills are to be undertaken by staff that are suitable trained and equipped with the necessary Personal Protective Equipment (PPE);
Onsite transport of HCRW at the treatment facility can be by means suitable designed trolleys or other wheeled systems;
The rate of HCRW treatment, the types of containers used, the distance between the onsite storage area and the treatment facility as well as the accessibility for different types of trolleys to both the storage area and the treatment plant will inter alia determine the onsite transport system to be used;
The types and sizes of containers to be transported onsite will determine the more precise trolley dimensions.

The design criteria for carts, trolleys or other vehicles for transport of HCRW between the onsite storage area and the treatment plant as indicated in Box 6.4 are important to consider.

Box 6.4: Design criteria for carts, trolleys or other vehicles for onsite transport of HCRW.

Equipment used for transport of HCW are to ensure safe transport thereof, avoiding spills and preventing unauthorised persons from getting in contact with the HCW. Trolleys, when loaded, shall not be left unattended;
The transport equipment used shall be easy to load and unload, whilst securing the HCW containers during transport;
HCRW containers shall not be loaded higher than the design level and no unsecured containers that may drop from trolleys shall be loaded onto the trolleys;
Transport equipment should be easy to move and manoeuvre and should be able to get easy access to both the HCRW storage area as well as the HCRW treatment plant;
The equipment used should be durable with low maintenance requirements. It should further be easy to clean and disinfect.

The required training for workers responsible for onsite transport of HCRW is detailed in Box 6.5.

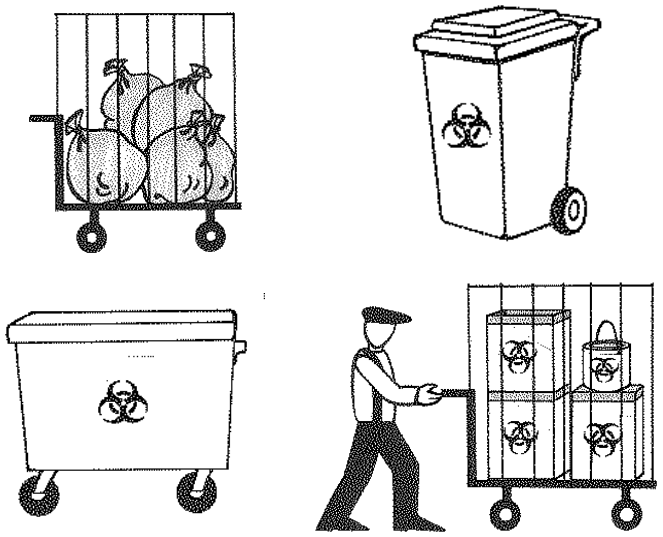
Box 6.5: Training Requirements for onsite HCRW transport.

Procedures for safe handling and loading of various HCW containers;
Emergency procedures in the event of an accident or HCW spillage;
Occupational Health and Safety requirements;
The correct use of PPE.

Certain standard procedures related to the safe onsite management of HCRW at the treatment facilities are to be compiled and distributed to all affected members of staff. In addition to this, the information is also to be conveyed by means of graphic illustrations like for instance posters, particularly as many of the persons involved in this activity may be illiterate, thus not being able to read written procedures and manuals.

Figure 6.2 below presents some different types of trolleys for onsite transport of HCRW.

Figure 6.2: Examples of trolleys used for onsite transport of HCRW.



In Table 6.1 below examples on technical specifications and typical prices of equipment for onsite transport of HCRW are shown.

Table 6.1: Guiding specifications and prices of waste collection and transport equipment

Item	Technical specification	Approximate price in Rand / piece
Bar fence trolley (refer to Figure 6.2.)	Painted steel	1000-2000
Bar fence trolley (refer to Box 6.2)	Stainless steel	3000-5000
600-800 litre wheelie bin	Xx	2000-2400
1100-1500 litre wheelie bin	xxx	2500-3000
Tractor unit	xxx	xx
Trucks for the tractor unit	xxx	xxx

6.8 Treatment of HCRW

This section on HCRW treatment includes both thermal (e.g. incineration) as well as non-thermal (e.g. sterilisation/inactivation) treatment technologies. Treatment plants can be located on-site at the source of the HCRW, for example at larger hospitals, or off-site for combined use by a larger group of HCRW generators on a regional basis.

Currently there are a number of HCRW treatment technologies available. Box 6.6 below gives an overview of such technologies, divided into two categories, i.e. "proven technology" and "technology under development".

Box 6.6: Alternative technologies for treatment of health care risk waste.

Thermal Treatment (followed by off-site disposal of residues):
Incineration (excess air, controlled air, rotary kiln or fluidised bed) (#);
Pyrolyse/plasma (high temperature gasification) (*).

Non burn technologies: Sterilisation (followed by off-site disposal/treatment of residues):
Steam sterilisation (autoclaves or retorts) (#);
Microwave sterilisation (#);
Chemical sterilisation (chlorine, iodophor, alcohol, formaldehyde, glutaraldehyde, etc.) (¤);
Gas sterilisation (ethylene oxides, formaldehyde, etc.) (¤);
Hot air/dry heat sterilisation (#);
Electro-thermal deactivation (high voltage at radio frequency) (#);
Irradiation sterilisation (*):
Cobolt-60 gamma rays sterilisation (*);
Electron beam sterilisation (*).

Notes:
(*): Experimental technologies or with limited commercial application today;
(#): Widely used HCRW treatment technologies;
(¤): Limited application for specific certain types of waste only.

Brief descriptions of the widely used technologies are presented in the following section, indicating advantages and disadvantages of the individual technologies.

6.8.1 Incineration

A typical HCRW flow for an incinerator plant is shown in Figure 6.3 below. Although some form of a heat exchanger/cooling system may be required, particularly where fabric filters are used as part of the flow gas cleaning system, it is unlikely that the generation of warm water will be financially viable in South Africa.

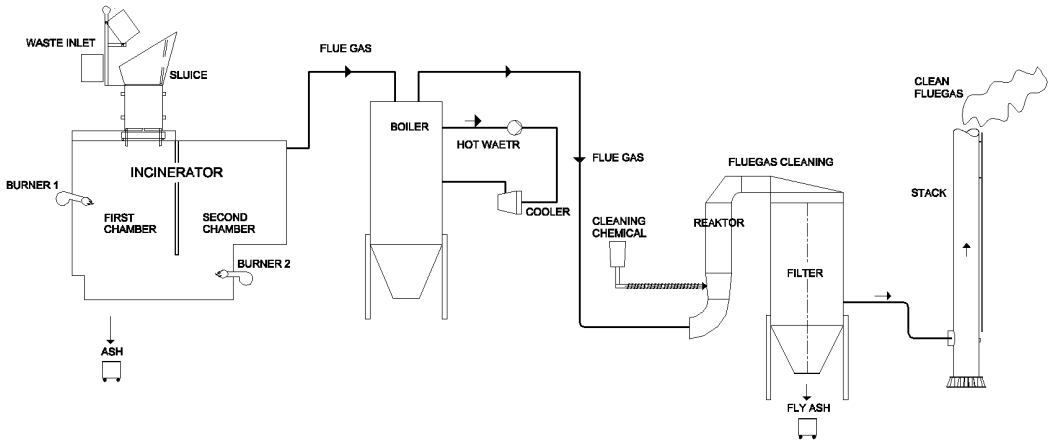


Figure 6.3: Flow chart for a typical incinerator plant with flue gas cleaning system.

Box 6.7 below shows a simplified material flow chart of the diagram in Figure 6.3. As indicated, the first step is the feeding of the containerised

HCRW into the incinerator, or more specifically into the primary combustion chamber, through a feeding system.

In the primary combustion chamber the newly loaded HCRW is either ignited through its contact with burning waste that may already be present in the chamber, or alternatively it is ignited by support burners (diesel oil or gas). The combustion temperature in the primary chamber should reach 850 ºC to ensure that all organic materials and micro-organisms are converted into Gas.

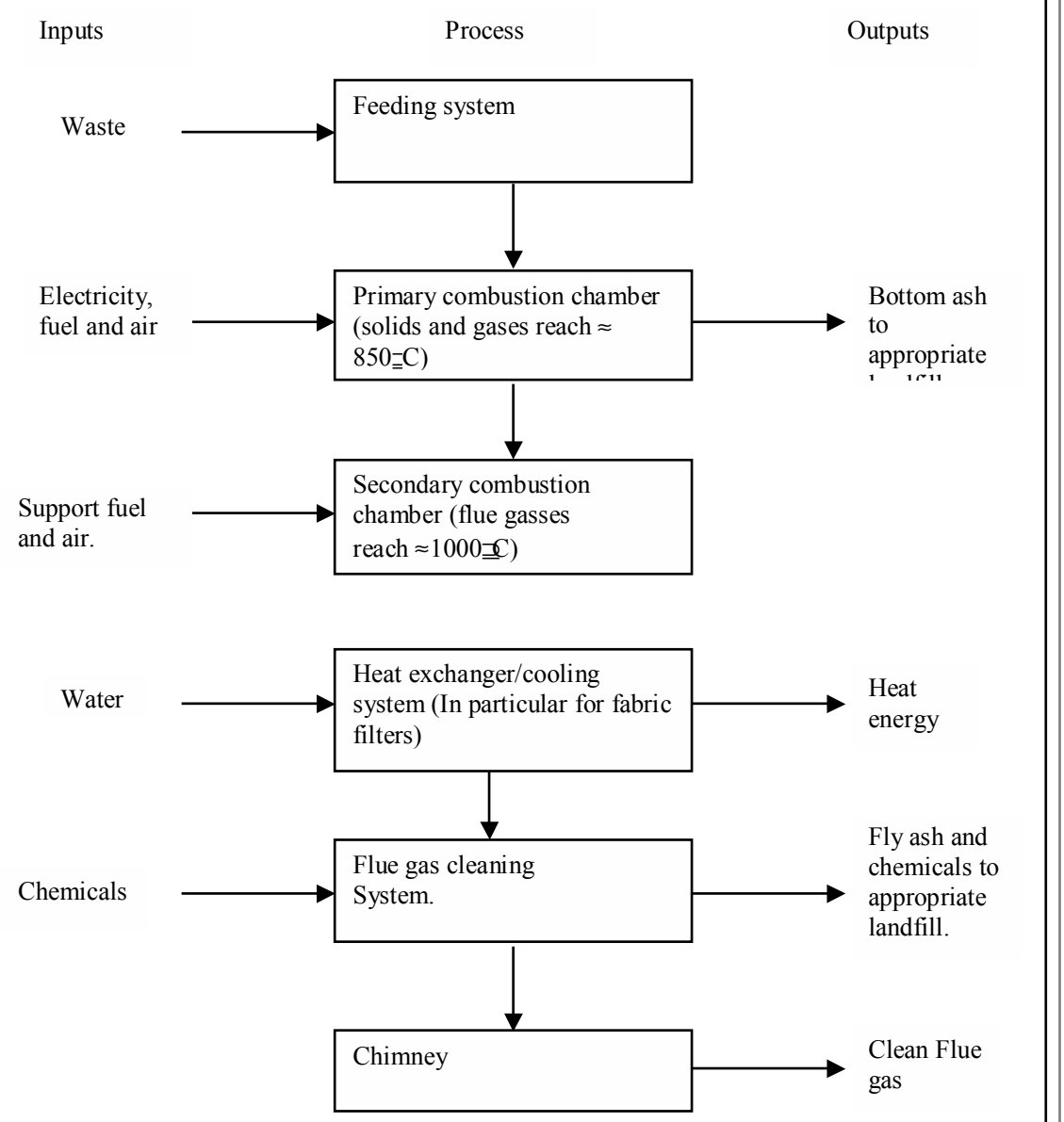
There are two kinds of residuals from the primary chamber; ash and flue gas. The ash is recovered at certain intervals and cooled down for collection, treatment (if required), transport and disposal to a landfill. The flue gas in turn is passed on to a secondary combustion chamber where the gases are heated to more than 1000 ºC to ensure that some of the hazardous substances in the gases, e.g. dioxins, are converted into less hazardous substances.

From the secondary combustion chamber the flue gas is led through a heat exchanger that either works as a boiler where the heat is utilised (if financially viable), or as a cooling system. In both instances the temperature of the flue gas is reduced.

From there the flue gas is directed to the flue gas cleaning system that recovers some of the pollutants from the flue gas, e.g. acidic gases and particulates. Compliance with the DEAT Emission Guidelines requires that as a minimum, acid gases, dioxins and dust be removed from the flue gas. There are a number of different cleaning technologies, e.g. dosing of dry neutralising agents e.g. lime or sodium bicarbonate, often mixed with minor quantitative of activated carbon or use of wet or semi dry scrubbers followed by bag filters, ceramic filters or electrostatic precipitators.

The cleaned flue gas is then led to the stack, which is designed to ensure suitable dispersion based on local topography, distance to neighbouring buildings, height and dimension of neighbouring buildings and prevailing climatic conditions.

Box 6.7: Flow diagram for a typical incinerator plant



The amount of PVC plastics and other materials that can generate acid gases should be minimised. Acid gases corrode the incinerator plant, increase the risk of dioxin formation and, if not efficiently scrubbed from the gas emissions, can lead to a significant impact on the environment. Other plastics such as Polyethylene (PE) and Polypropylene (PP) do not pose the same environmental risks but they contribute significantly to the calorific value when incinerated. Please refer to Module 4 for possible substitution of PVC products.

Incineration is internationally the most widely applied HCRW treatment method, but the size, capacity, design, environmental and technical performance standards as well as the organisational set-up vary significantly from country to country. Non-burn technologies are increasingly taking over the market for dedicated HCRW treatment plants due to increasing costs of flue gas cleaning and public concern over incineration in general.

In Box 6.8 below the perceived advantages and disadvantages of incineration in relation to other treatment technologies are summarised.

Box 6.8: Advantages and disadvantages of incineration

Advantages of incineration	Disadvantages of incineration
Safe elimination of all infectious organisms in the HCRW; Can also treat most chemicals / pharmaceuticals in addition to infectious HCRW. (Chemical waste cannot be treated by any other HCRW treatment technologies.); Non-recognisable residues; Reduction of the volume by approximately 95%; Well proven technology; No pre-shredding required; No special requirements to packaging of HCRW; Full disinfection can be determined visually by observing the slag / bottom ash.	High* investment costs for incinerator and flue gas cleaning; Emissions to the air; By-products have to be handled as special waste; Chimneys are necessary, which can be perceived negatively by the community; PVC and heavy metals in the HCRW stream should be avoided as much as possible, e.g., by substitution of PVC by other plastic types and at source separation of batteries etc. * For SA, this is to a large extent influenced by the local content, due to the exchange rate of the Rand.

Figure 6.4 below shows a dual chamber incineration plant with advanced flue gas cleaning. Existing single chambered incinerators and other older incinerators based on around pre-1990 designs, are unlikely to meet the present flue gas cleaning standards. It is however to be emphasised that in terms of the HCW Management Policy for Gauteng, all HCRW treatment facilities (including existing facilities) are required to meet the DEAT Emission Standards by 1 January 2004.

All HCRW incinerators used in Gauteng should therefore be equipped with flue gas cleaning in the form of dry or wet scrubbers and filters for compliance with the DEAT Emission Guidelines.

Figure 6.4: Example of a dual chamber incineration plant for health care risk waste with flue gas cleaning

Incineration plant manufactured by Envikraft A/S, Denmark, including dual

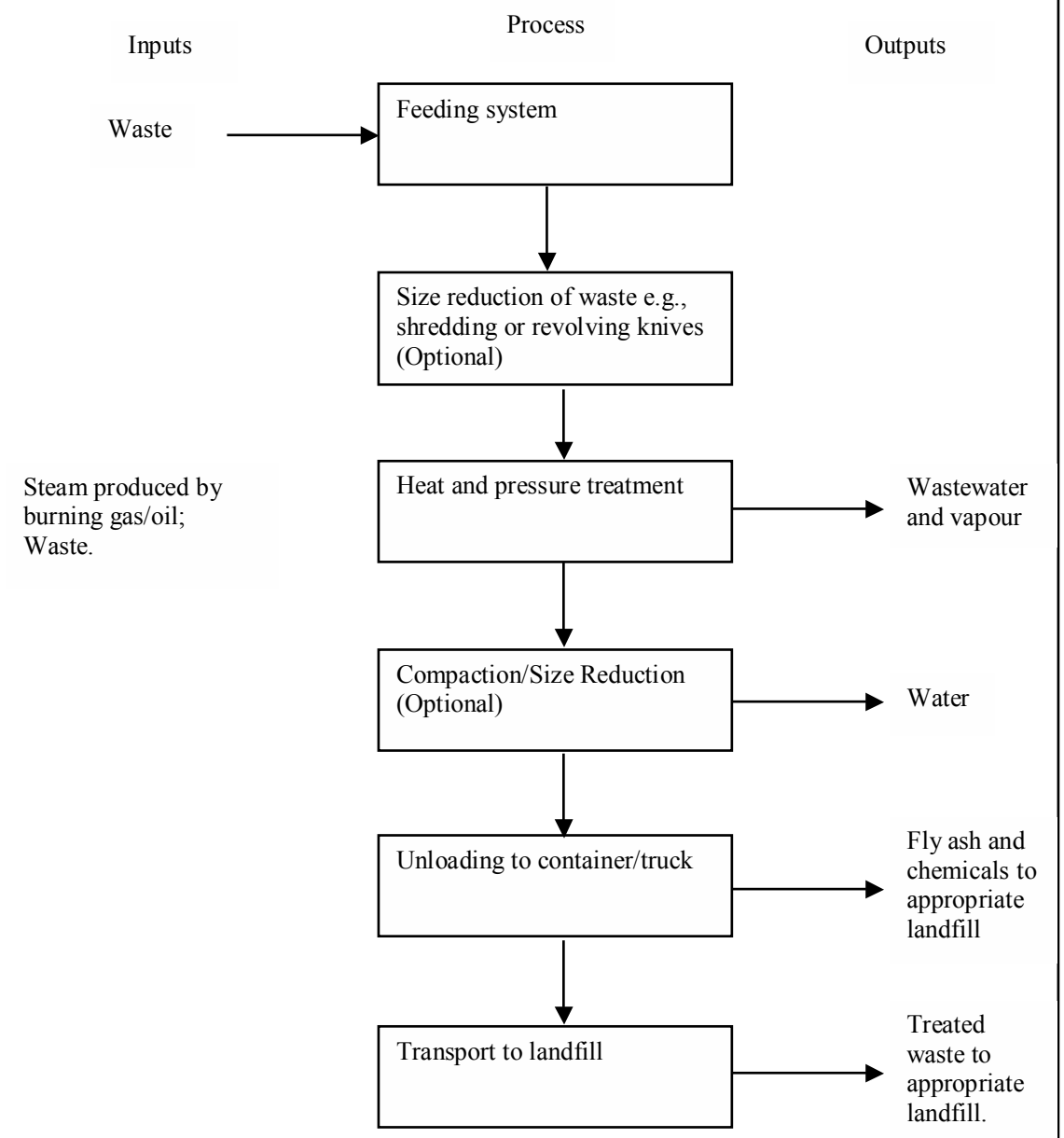
ight

Internationally and also in South Africa, there are manufacturers of HCRW incinerators that will be able to comply with the DEAT Emission Standards.

6.8.2 Steam Sterilisation

The second most popular HCRW treatment technology applied internationally is steam sterilisation/autoclaving. Box 6.9 below shows a typical material flow of a steam sterilisation plant.

Box 6.9: Material flow chart of a steam sterilisation plant



A typical sterilisation plant primarily consists of a reactor, which is a closed container where majority of the necessary processes takes place.

The first process in a sterilisation plant is usually a size reduction through crushing / shredding of the incoming HCRW, for instance by means of a shredder. In addition to the volume reduction that is achieved, the purpose is to reduce the size of the waste so that the steam can readily penetrate the waste and to make the waste less readily recognisable for aesthetic purposes.

The next step is the actual sterilisation, which is the heating of the HCRW. The heating can take place in many different ways, but steam is often used at high temperatures and pressures (steam sterilisation). The steam is led into the chamber, where the HCRW is heated to approximately 130^{o} C

and for an adequate time period, usually 15 to 40 minutes, that ensures that all infectious micro-organisms are killed.

In some cases the sterilisation plant includes a compactor where the treated HCRW is compressed or in some cases, it is first mixed with some stabilising materials, e.g. cement, before it is formed into blocks.

Finally the treated HCRW is containerised and transported to an appropriately designed, constructed and operated landfill, for which the classification will depend on the classification of the HCRW residues. As the waste may still contain hazardous substances, it has to be handled with the necessary care.

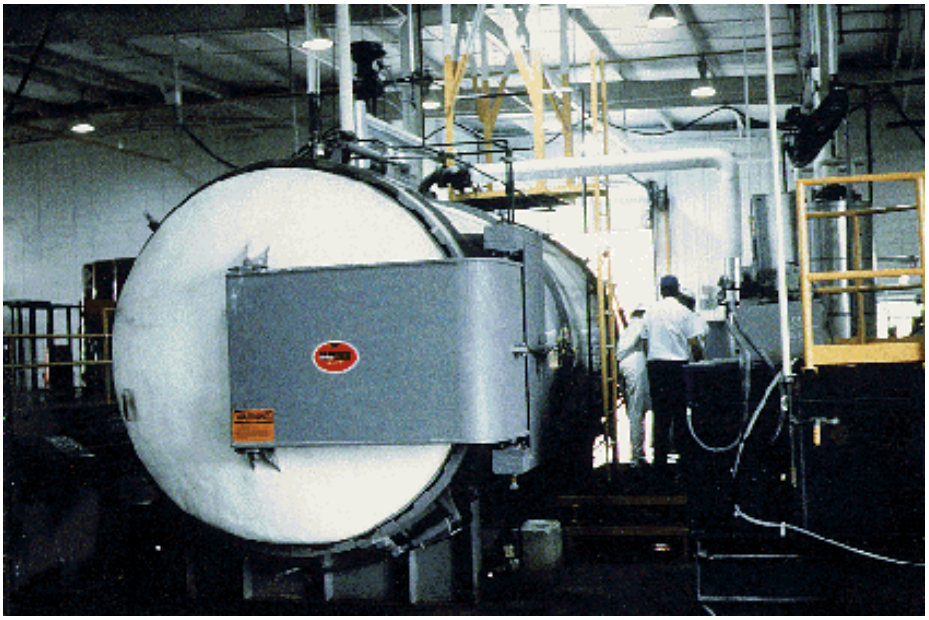
In Box 6.10 below, the perceived advantages and disadvantages of steam sterilisation are summarised.

Box 6.10: Advantages and disadvantages of steam sterilisation

Advantages of steam sterilisation	Disadvantages of steam sterilisation
Low environmental impacts (low emissions); Moderate* investment costs; Low operation costs; High disinfection level; Proven technology; Easy to monitor by the Authorities; Flexible capacity. * For SA, this is to a large extent influenced by the local content, due to the exchange rate of the Rand.	Difficult to repair shredder in the event of blockages or breakdowns; HCRW must be well-segregated; Cannot treat hazardous chemicals; It is not possible to visually determine that HCRW has been sterilised; The total amount of HCRW must after treatment be transported to the landfill; A well operated landfill with daily coverage and no open burning is required for residue disposal; Air filter is required; Minimum temperature and pressure must be guaranteed; It cannot eliminate Creutz-Jacobs disease.

Figure 6.5 A and B below show photos of steam sterilisation plants, one stationary (A) and one mobile plant (B).

Box 6.5 A: Example of a stationary steam sterilisation plant (autoclave plant)



Box 6.5 B: Example of a mobile steam sterilisation plant (autoclave plant)

6.8.3 Microwave Sterilisation

The third most popular HCRW treatment method used internationally is microwave sterilisation. Microwaves are used instead of steam to heat the moisture contained in and around micro-organisms / pathogens. Similar to steam sterilisation it is important that the microwave energy penetrates the entire HCRW matrix, and that all HCRW is sufficiently exposed to the radiation. The principle of this technology is that all moisture containing matter can be heated by being exposed to microwaves;

provided an adequate temperature is reached and for sufficient time, sterilisation of the waste is obtained.

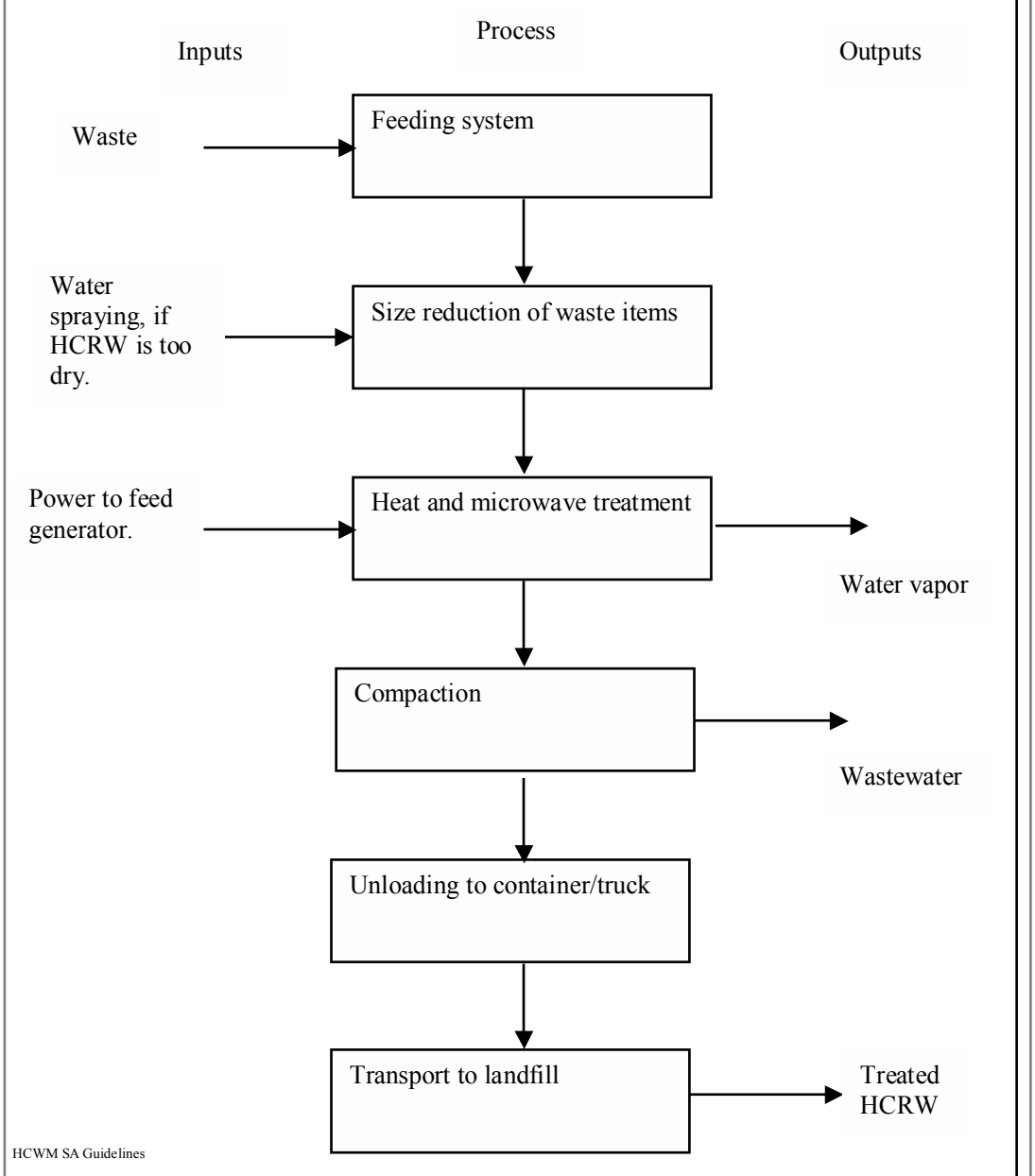
Large-scale microwave HCRW treatment is currently mostly applied in the USA, whereas smaller scale treatment units for laboratories and similar small-scale HCRW producers are applied worldwide.

It is important that there is sufficient moisture contained within the HCRW and it may be necessary to add moisture to secure adequate treatment. It is also to be noted that large quantities of metals, metal containers or similar will reduce the effectiveness of the microwaves penetration the HCRW.

Microwave treatment systems are available from very small to large scale. It is possible to purchase systems approximately the size of a dishwasher that can be installed in a sluice room or other suitable area. It is further possible to purchase mobile units mounted on vehicles as well as large stationary units capable of treating HCRW from several hospitals and other health care facilities on a regional basis.

A typical material flow for a microwave sterilisation plant is shown in Box 6.11 below.

Box 6.11: Flow diagram for a typical microwave sterilisation plant



The principles of a microwave sterilisation plant are in many ways similar to a steam sterilisation plant, except that the sterilisation of HCRW is done by microwaves instead of steam.

The sterilisation process works by microwaves heating the water within the HCRW, thereby destroying the pathological micro-organisms. In some cases water is to be added to the HCRW in order to ensure a high enough moisture level.

Microwave sterilisation plants are usually smaller than steam sterilisation plants.

In Box 6.12 below the perceived advantages and disadvantages for microwave sterilisation are summarised.

Box 6.12: Advantages and disadvantages of microwave sterilisation.

Advantages of microwave sterilisation	Disadvantages of microwave sterilisation
Low environmental impacts (low emissions); Units with small capacity are available for small HCRW generators.	High electricity consumption; Difficult repairs of the shredder in case of blocking or breakdowns; Some uprising of the HCRW mass HCRW to be segregated very well; Unsuited for high quantities of infected metal (e.g. needles); Cannot treat hazardous chemicals; Low disinfection temperature; Low maximum capacity; Limited application world-wide; It is not possible to visually determine that HCRW has been sterilised; The full amount of HCRW is after treatment to be transported to the landfill; Requires a well operated landfill with daily coverage and no open burning; It cannot eliminate Creutz-Jacobs Disease or other prion diseases.

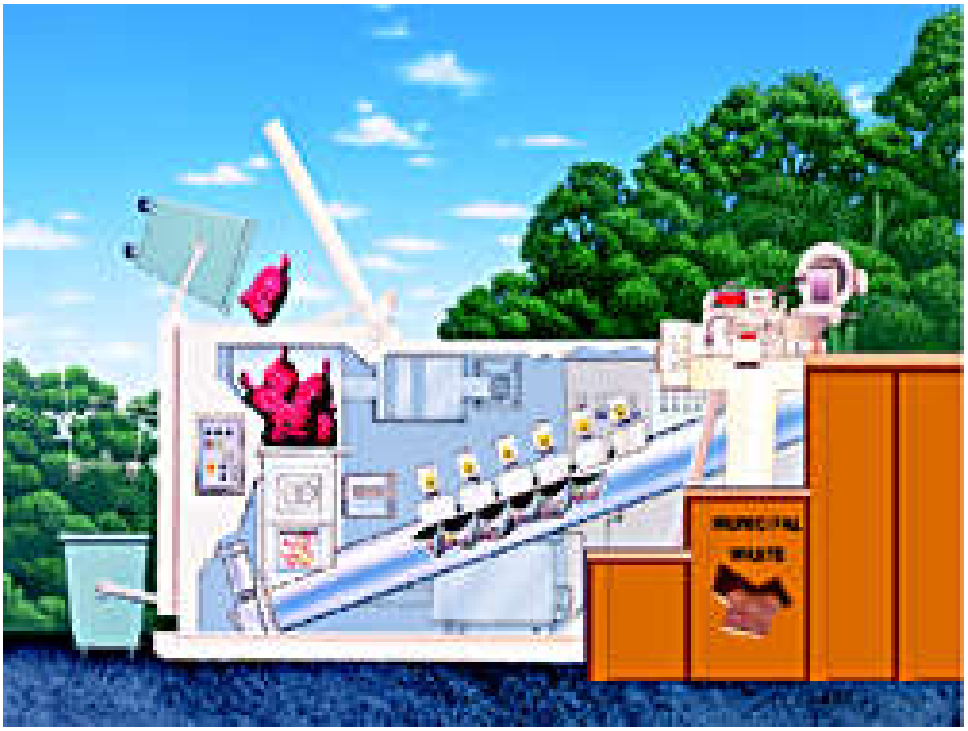
Microwave treatment of HCRW is, compared to thermal treatment process and steam sterilisation, a slightly newer technology. Microwave treatment is in principal similar to steam sterilisation.

As microwave treatment and steam sterilisation cannot treat hazardous chemicals, e.g. cytotoxic chemicals from laboratories and similar chemical wastes, some types of HCRW will continue to have hazardous properties after being sterilised. Health care facilities generating such hazardous chemical waste should ensure, as far as possible, that good separation of these wastes is obtained at source prior to treatment. General waste landfills can accept sterilised waste that contains limited amounts of chemical hazardous waste, but disposal to a hazardous waste landfill may be required, depending on the final classification of residues. Figure 6.6 A and B shows pictures of stationary and mobile microwave sterilisation plants.

Figure 6.6 A: Example of a stationary microwave sterilisation plant.

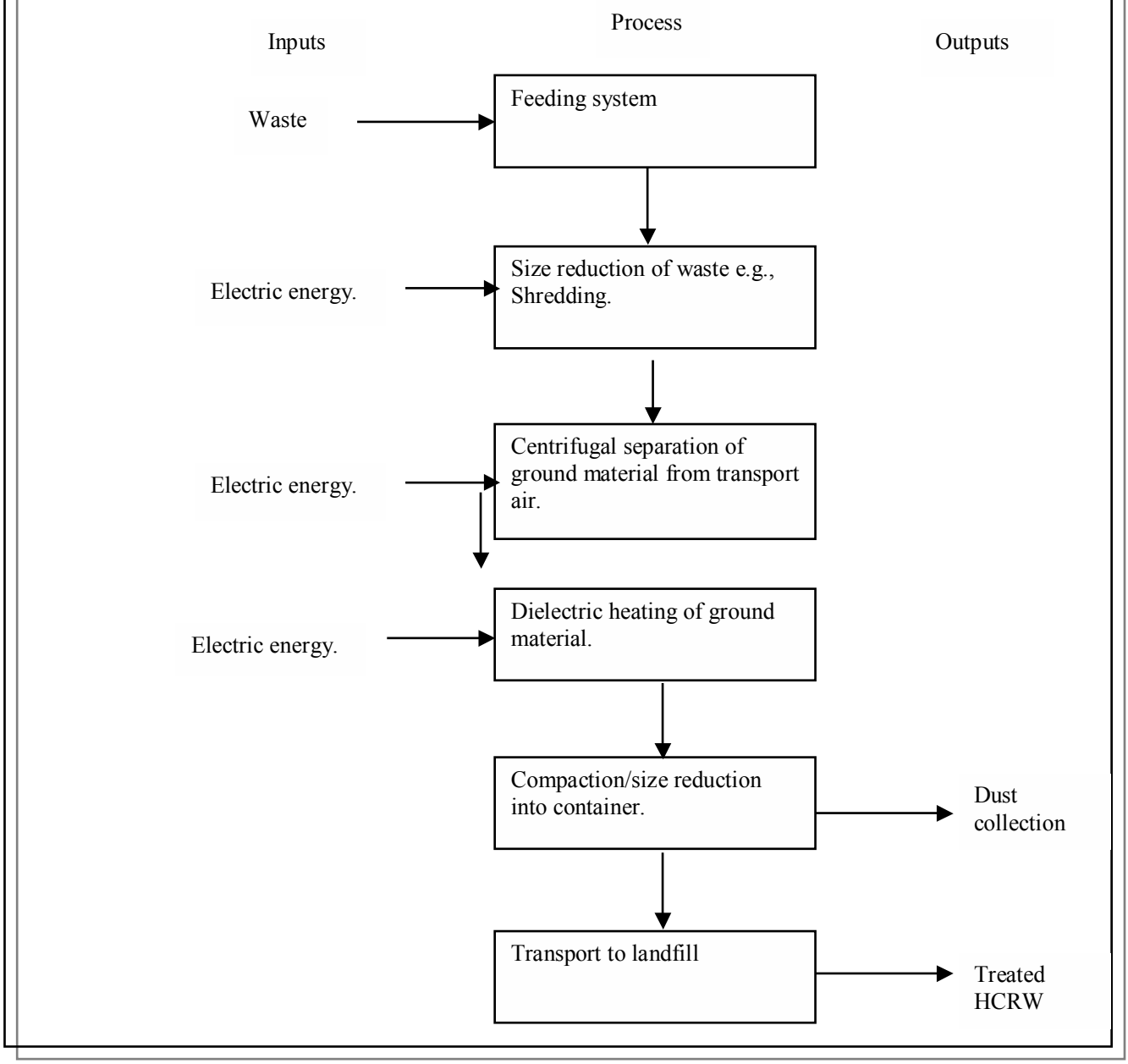
6.8.4 Electro Thermal Deactivation (ETD)

Figure 6.6 B: Example of a mobile microwawe sterilisation plant.



A further HCRW treatment technology applied internationally is electro thermal deactivation (ETD). Box 6.13 below illustrates the flow of HCRW from the point where it enters the electro thermal deactivation plant, to the point where the treated HCRW is finally disposed of on an appropriately permitted, developed and operated landfill

Box 6.13: Material flow chart of an electro thermal deactivation plant



The first phase in the process of electro thermal deactivation is size reduction through crushing / shredding of the incoming HCRW, for instance by means of a shredder. In addition to the volume reduction that is achieved, the purpose of this process is to ensure that the deactivation process is undertaken more effectively by creating unobstructed access to all parts of the HCRW that is to be treated.

The size reduction occurs under negative air pressure (vacuum) provided by the process fan. The ground material is then transferred via high velocity airflow in sealed ducts to the low energy cyclone,

where the material is separated from the transport air by means of the centrifugal force. The material is then transported on a sealed transfer conveyor. A high-energy cyclone removes any small dust particles that may have remained in the transport air. Such dust particles are then also deposited on the transport conveyor.

The next step is the actual deactivation, which is accomplished by the selective absorption of energy at differential rates (due to their organic nature) by the cells of the microbe. The cell membrane weakens under the imposed high voltage field and ruptures. With cell rupture, the cell cannot reproduce and dies. This phenomena takes place at atmospheric conditions at temperatures less than the boiling point of water. There is no liquid emission due to the recycling water system.

In some cases the electro thermal deactivation plant includes a compactor where the treated HCRW is compressed. Thereafter the treated HCRW is unloaded, irrespective of whether it is in the form of loose waste or whether it is compressed.

Finally the treated HCRW is transported to an appropriately designed, constructed and operated landfill, for which the classification will depend on the classification of the HCRW residues. As the treated HCRW may still have an extremely low infection risk and may contain chemical and hazardous substances, it should be handled with the necessary care.

In Box 6.14 below, the perceived advantages and disadvantages of electro thermal deactivation are summarised.

Box 6.14: Advantages and disadvantages of electro thermal deactivation

Advantages of electro thermal deactivation	Disadvantages of electro thermal deactivation
Low environmental impacts (low emissions);	High* capital investment costs;
High disinfection level;	Difficult to repair shredder in the event of blockages or breakdowns;
Proven technology;	HCRW must be well-segregated;
Flexible capacity.	Cannot treat hazardous chemicals;
	It is not possible to visually determine that HCRW has been sterilised;
	The total amount of HCRW must after treatment be transported to the landfill;
	A well operated landfill with daily coverage and no open burning is required for residue disposal;
	Air filter is required;
	It cannot eliminate Creutz-Jacobs disease.
	* For SA, this is to a large extent influenced by the local content, due to the exchange rate of the Rand.

Figure 6.7 below shows a photo of an electro thermal deactivation plant.

Figure 6.7: Example of an electro thermal deactivation plant

Photo to be added.

6.8.5 Other HCRW Treatment Methods

Besides the HCRW treatment technologies described above, several other HCRW treatment technologies exist. However, none of these appear to have the same potential for large-scale treatment of HCRW due to various constraints inherent to these technologies.

Some technologies such as: i) chemical sterilisation, ii) gas sterilisation, and iii) ultra violet treatment can currently only treat limited types and amounts of HCRW. Other technologies such as dry heat sterilisation is increasingly being applied with success in for example the UK.

Cobalt-60 gamma rays and electron beam sterilisation are mostly at an experimental stage and are not widely yet used on a commercially. Some of these technologies may also require particular skills and expertise by the operators that are not readily available on-site at health care facilities or in the HCRW management industry.

6.9 Operational Requirements

6.9.1 Operational Requirements for Thermal Treatment Facilities

In the absence of suitable South African flue gas emission standards, Gauteng will enforce the Emission Guidelines as published by DEAT.

It is expected that National Government will revise the current lenient air pollution prevention legislation of the "Atmospheric Pollution Prevention Act, 1965" (Act 45 1965) as it does not set any measurable limits in the form of maximum allowable concentrations of selected pollutants per standard volume of flue gas.

In Table 6.1 below the threshold limit values for HCRW incinerators in SA, EU and USA are presented in comparison.

Table 6.1: Threshold limit values for incinerator plants

Schedule 2, Process 39 Atmospheric Pollution Prevention Act 1965 *Guidelines(DEAT)*		**EU**	**US**
		Dec. 2000	Sept. 1997
Type			S/M/L*
Units	mg/Nm^3	mg/Nm^3	mg/Nm^3
PM/dust	180	10	53/26/26
CO	-	50	36
TOC	-	10	-
Dioxin/furan (nanogram) TEQ	0.2	0.1	1.76/0.46/0.46
l	30	10	17
HF	-	1	-
SO_2	25	50	112
NO_x	-	200	366
NH_3	-	10	-
Pb, (same for Cr, Be, Ar, As, Sb, Ba, Ag, Co, Cu, Mn, Sn, V, Ni)	0.5	0.05	0.92/0.05/0.05
Cd (same for Tl)	0.05	0.05	0.12/0.03/0.03
Hg	0.05	0.05	0.42

Note: *) S/M/L: Small (<200lb/h)/Medium/Large facilities (>500lb/h). Limits recalculated to same standard conditions
Ref. Cond.: 11% O_2, 273 Kelvin, 101.3 kPa

In principle, the environmental as well as the health and safety impact of any HCRW treatment facility shall be of such nature that the facility could be erected anywhere, without creating a risk to the environment or the surrounding communities. However, siting requirements shall take into account any nuisances to the public, neighbouring areas etc. (cf. the EIA procedures) and preferably such facilities shall be placed on or near already compromised land, industrial areas and similar areas.

6.9.2 Operational Requirements for Non-burn Treatment Facilities

Suitable measures shall be taken to prevent emission of any pathogens via exhausts or similar. Such measures shall include a requirement for filter materials as well as for the maintenance and replacement of filters to be documented.

As far as microbial inactivation is concerned, Gauteng DACEL requires microbial inactivation based on the Technical Assistance Manual: State Regulatory Oversight of Medical Waste Treatment Technologies, April 1994, issued by the State and Territorial Association of the USA. Hence, for demonstration and investigation monitoring the following is required (in brief):

Vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites and mycobacteria: *?6 Log_{10} reduction;*
B. stearothermophilus spores or B. subtilis spores: *?4 Log_{10} reduction;*
Representative biological indicators, as described in the *Technical Assistance Manual of the State Regulatory Oversight of Medical Waste Treatment Technologies*, or their equivalents that area available in South Africa, shall be used.

For routine monitoring the use of B.subtilis spores is normally specified.

6.10 Alternative Considerations when selecting a HCRW Treatment Process

In order to take a decision on the most appropriate HCRW treatment process, all of the alternative options available for HCRW treatment, as presented in Box 6.15, should be taken into consideration.

Box 6.15: Overall considerations when selecting a HCRW treatment process:

The use of on-site HCRW treatment facilities versus the use of off-site (regional) facilities;
HCRW treatment service for public facilities rendered by health care facility staff, provincial staff from other Departments (Public Works), or by a private contractor;
Refrigeration provided for pathological HCRW only or for all HCRW stored at treatment facility;
The options for inclusion or exclusion of certain radioactive, chemical, and pathological HCRW in the treatment process will depend on the treatment technology selected;
Options for thermal HCRW treatment technologies are:
- Multiple chamber incinerators
- Rotary kiln
- Fluidised bed

Options for non-thermal sterilisation (inactivation) HCRW treatment technologies are:
- Autoclave / steam sterilisation
- Microwave
- Electro Thermal Deactivation (ETD)

- Chemical / heat disinfection

Optional encapsulation of HCRW treatment technologies include:

- Encapsulation in impermeable media

The HCRW treatment facility loading mechanism for could allow for the use of disposable containers like plastic bags or cardboard boxes, or reusable containers like plastic boxes or wheelie bins of different capacities;
Electricity, diesel or oil fuel used as energy source for HCRW treatment facility;
Wet scrubber, bag filter or ceramic filter used as flue gas cleaning system for thermal HCRW treatment facility.

6.11 On-site Management of HCRW Treatment Residues

The state of the HCRW residues will be dependant on the type of treatment technology used, and in particular whether it is a burn or non-burn technology. Incinerators will result in the generation of ash with a significant reduction in volume, whereas non-burn technologies will produce a residue that will, even though significantly transformed from its original state, not have the same reduction in volume. In some instances the non-burn technologies are therefore supplied with a compactor and/or solidifier unit that encapsulates the residues e.g. in cement.

The need for shredding of HCRW for non-thermal treatment processes to be effective, will result in a reduction of volume (although not as much as for thermal treatment process), whilst the addition or removal of moisture during the respective treatment processes could in turn result in a significant change in mass. Whilst these aspects will to a great extent determine the physical process requirements for onsite storage, containerisation, transport and disposal of the residues, aspects such as the chemical composition and the remaining risk of infection must also be considered.

When evaluating the impact of the various HCRW treatment technologies on the state of the residues, it is to be recognised that the way in which residues are managed thereafter, will have a further impact on this. Table 6.2 provides some details on the expected impact that the respective treatment technologies will have on the volume and mass of the residues.

Table 6.2: Impact of alternative treatment technologies on the volume and mass of HCRW residues. TO BE COMPLETED

Treatment process	Effect on Volume	Effect on Mass
Incineration Autoclaving Microwaving Electro Thermal Deactivation	…….. …….. ……	….

Box 6.16 provides information on important considerations when managing HCRW residues.

Box 6.16: Important considerations in managing of HCRW residues.

The higher the residue density (and proportionally lower the volume), the more effective the payload that can be achieved during transport of residues;
For residues with low density and high volume, increased payloads can be achieved by compacting the residues, either with a static onsite compactor, or by making use of rear-end-loader (REL) compactor trucks for collection and transport of residues;
The residues should, from both an environmental as well as an occupational health and safety point of view, not be handled in any way that will create a risk of residues being scattered through wind or rain action;
Should it from a logistical point of view not be possible to store the residues in an enclosed environment, provision is to be made for containerised residues to be

protected against the elements by means of suitable covers such as plastic sheets;
It is important to recognise that even though the HCRW may have been treated, there is, in addition to the risk of sharp objects, always a risk of infection where the treatment process may not have been fully successful. All residues are therefore to be handled with the same care and caution, as was the case before it was treated.

6.12 Treatment of Waste containing Radioactive Substances

The treatment and disposal of low-level radioactive waste uses somewhat different management principles to those used for infectious or chemical wastes. Radioactive wastes cannot be destroyed, they can only be contained or stored, e.g. in a landfill, and allowed to degrade without causing harm to humans and the environment, or they can be dispersed into the environment in such a way that they become so diluted that they no longer pose any danger. The discharge to sewer or the thermal treatment process of selected low level radioactive wastes with the infectious waste stream lead to significant dilution. An example is the incineration of C^{14} containing low level waste; the C^{14} burns to give $C^{14}O_2$ (C-14 carbon dioxide), which is diluted with the enormous quantities of carbon dioxide generated by the burning of the infectious waste and any fuel used to maintain the high temperatures required.

The Department of Health, Directorate of Health Technology controls the incineration of low-level radioactive waste and an *incinerator operator must have an authorisation from the Directorate to accept such waste*. Regular monitoring of the radioactivity levels of incinerator ash will be required. For radioactive waste under their control, the holder of an authority must at all times ensure that:

(a) Disposal of radioactive waste to the infectious waste incinerators is restricted to suitable waste, which includes flammable solid waste (excluding sealed sources), animal carcasses, vials containing organic solvents and bulk solvent;
(b) G1ass vials with closed metal caps are not disposed of 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. However, glass vials with plastic caps can usually be safely disposed of in limited numbers. Plastic vials containing organic solvents are perfectly acceptable provided the smoke emitted from the incinerator stack does not contravene the standards laid down by air pollution control legislation applicable to the area.
(c) The activity per waste package of 74Bq/g and the total activity disposed of per month do not exceed authorised limits;
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;
Accurate records are kept of the nuclides and total activity disposed of per month to the incinerator;
When disposing of radioactive waste at an incinerator, the holder of the authority or his agent shall liase 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 carries 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),
Note: that an incinerator designed for infectious waste treatment cannot normally accept some of the waste listed above, such as bulk solvents.

The discharge of low-level liquid radioactive wastes, i.e. for an authorised medical facility is limited to $10ALI_{min}$ per month. For discharge to sewer of the low-level radioactive waste under her/his control, the holder of an authority must at all times ensure that:

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;
The activity per release and the total activity per month do not exceed the limits specified in the code.
Accurate records are kept of the nuclides and total activity disposed of per month via the sewer;
Release of radioactive waste is confined to one release point for each laboratory;
At each release point there shall be a visible sign stating that radioactive waste may be released into the sewage system;

Water to dilute the discharge is flushed before and for at least one minute after the discharge;
Plumbing personnel are warned of the possible hazard prior to performing maintenance;
Liquid scintillation counting vials containing chemically toxic organic compounds (e.g. toluene, xylene, etc.) are not disposed of via the sewer.

6.13 Importance of Cooperation

With the HCRW treatment process being the most important component of the disinfection process, it is important that this be linked to all processes, starting from generation and containerisation, all the way through to delivery of HCRW for treatment at the treatment facility. Box 6.17 below presents examples on how earlier processes in the waste flow will impact on HCRW treatment.

Box 6.17: Examples of the way in which earlier processes will impact on HCRW treatment:

Poor procurement procedures on the materials that will form part of the HCRW stream will impact on the HCRW treatment process, for instance by the amount of PVC present in the HCRW to be incinerated (PVC creates acidic gases that increasing the corrosion of the metal parts of the plant);
Poor segregation could lead to radio-active waste being dispose of in the treatable HCRW stream, or pathological waste being disposed of in the non-thermal treatment HCRW stream;
The use of containers that are not compatible with HCRW loading system of the treatment plant;
The delivery of HCRW at times that is not compatible with the treatment plant operations, will result in a build-up of HCRW.

Based on the above, it is evident that operators of HCRW treatment facilities should consult, either directly of indirectly, with all parties that may have an impact on the treatment process.

The efficiency of the treatment will have a direct impact on the risk of pollution, as well as infection, of all parties associated with the containerisation, transport and disposal of HCRW residues.

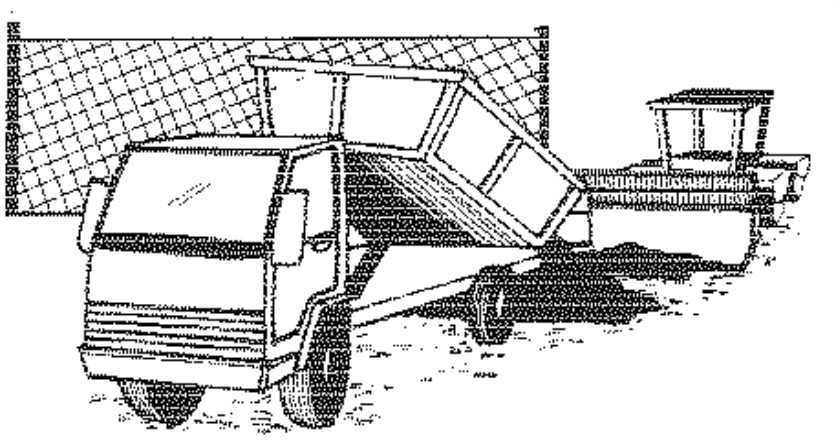
6.14 Annexure 6.1: Proposals for posters and other info materials

(TO BE FINALISED AND INSERTED ON COMPLETION OF THE PILOT PROJECTS)

Guidelines
on Sustainable Health Care Waste Management in Gauteng

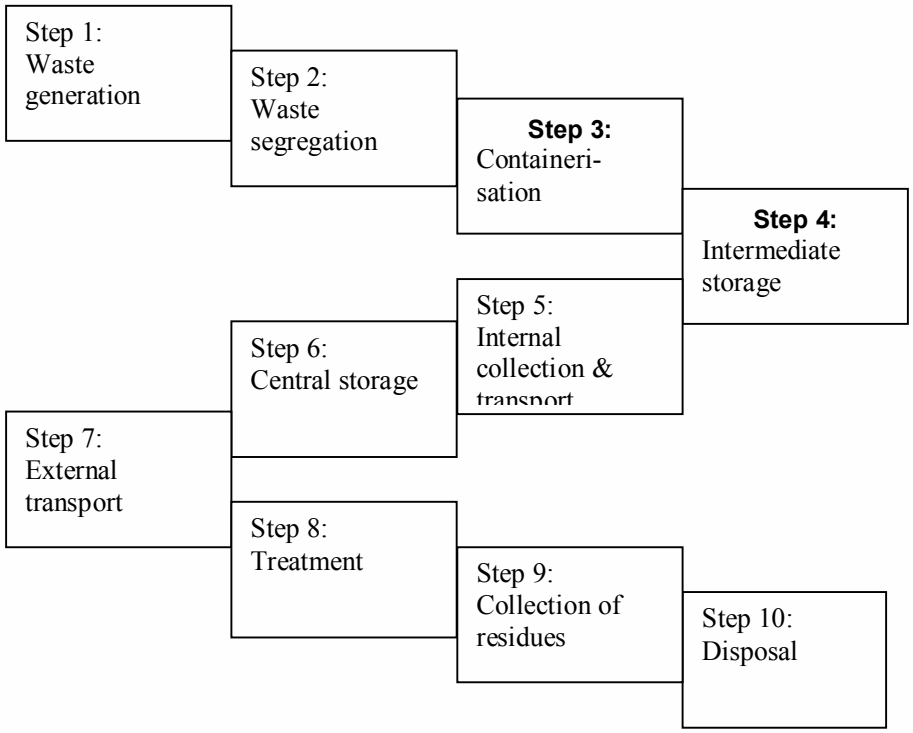
MODULE 7: Disposal of HCRW Residues:

- Environmental risks of landfilling
- What can be disposed of
- Landfilling of treated Health Care Risk Waste residues



7. Module 7: Disposal of HCRW Residues

Box 7.1: Steps of the HCW flow included in this Module



7.1 Objectives of Module 7

The objective of Module 7 of the Guidelines is to provide information on the safe disposal of treated HCRW residues, as supporting information to the "Minimum Requirements for Waste Disposal by Landfill", published by the Department of Water Affairs and Forestry in 1998 (ref. xx). This Module is not intended to present the contents of the aforesaid documents, but merely to provide information specifically related to disposal of treated HCRW that is presently not addressed.

There are primarily two HCW streams to be considered, i.e. that of untreated HCRW (illegal disposal) and that of appropriately treated HCRW (legal disposal). This Module is intended to shed more light on various aspects that should be considered when opting to dispose of treated HCRW, whilst pointing out certain risks associated with the disposal of untreated HCRW.

7.2 Target Group

Module 7 of the Guidelines will be targeting the general workers and landfill operators that are present on the workface where the waste loads are disposed of. It is expected that such persons will be in the best possible position to evaluate the contents of the waste loads being delivered, without actually undertaking investigations that could put their health or safety at risk. In addition to the people responsible for organising the workface, it is also aimed at persons responsible for looking after the occupational health and safety of those that may be exposed to untreated HCRW.

As some of the HCRW landfill workers and operators may not be familiar with the terminology used in these Guidelines, it is in fact intended for this Module to be directed at the senior and middle management who are responsible to supervise and overlook the daily activities of the workers and operators.

7.3 Scope of Module 7

After having collected and transported the treated HCRW residues from the HCRW treatment facility to the disposal site, it is the responsibility of the waste disposal site operators to ensure that the treated HCRW residues are disposed of in an environmentally sound and safe manner. This is however against the background of the principle of duty of care, which does not relief the generator of the HCRW from its responsibility to ensure that the process through which the HCRW is taken from generation to final disposal, will be environmentally sound, whilst being occupationally healthy and safe.

In order not to duplicate the information presented in the Department of Water Affairs and Forestry's Minimum Requirements and merely to provide additional information that may not have been addressed in sufficient detail, Module 7 will address the following topics:

Landfilling of treated HCRW residues;
Special precautions when dealing with treated HCRW residues;
Risks resulting from landfilling of untreated HCRW;
What is allowed and what is not allowed for disposal on general waste landfills?
Importance of cooperation.

7.4 Reference to Other Modules/Documents

The information in this Module is to be read in conjunction with Module 1, which is the Module designed to address all the cross cutting issues identified in the process of integrated HCW management.

To get a better understanding on the interfacing that needs to take place in terms of external transport of treated HCRW residues from the treatment facility to the waste disposal site, readers are referred to Module 6 for more information.

7.5 Landfilling of treated HCRW Residues

Once the HCRW residues are delivered to a waste disposal site, the residues are to be disposed of in accordance with DWAF's *Minimum Requirements for Waste Disposal by Landfill*. Disposal of residues can be defined as the intentional burial or deposit of residues from HCRW treatment processes at an appropriately permitted, developed and operated waste disposal facility.

In addition to DWAF's Minimum Requirements, and as a more operational measure, the Gauteng DACEL will require that the standards, as descried in Box 7.2, be met for residues from burn and non-burn treatment facilities.

Box 7.2: Standards set for landfilling of treated HCRW residues.

General standards for all treatment technologies:
HCRW treatment residues is to be classified in accordance with DWAF's *Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste* to determine whether the residues are to be disposed of on general waste disposal sites, or on hazardous waste disposal sites;
Although ash from incinerators is in general considered to be hazardous due to its concentrated heavy metal content, shredded HCRW from sterilisation processes can in most instances be co-disposed with general municipal waste, subject to it meeting the required classification;

For both burn and non-burn HCRW treatment technology groups, the permit holder must report cases of non-compliance immediately to DACEL with a report containing the reason for non-compliance and the plan for avoiding future non-compliance;
If permitted disposal facilities cannot be used according to the DWAF's Minimum Requirements under those circumstances, operations at the HCRW treatment facility must be stopped and backup treatment measures introduced until such time that compliance can be achieved.

Incinerator bottom ash/fly ash:
Maximum allowable percentage of non-combustible matter will be based on the ignition loss not exceeding 5 % by mass;
Maximum contents of heavy metals for incinerator residues, with a view to forcing optimisation of the combustion efficiency and segregation of heavy metal containing components from the waste stream, will in the absence of national standards, be limited as set out in the EU Directive 2000/76/EC of 4 December 2000;
If detected that there is a problem with the treatment process resulting in it not being fully efficient, the HCRW treatment process is to be discontinued until such time that the problem has been addressed. Any residue loads that may not have been disposed of, is to be disposed of under supervision, and at hazardous waste disposal sites only;
It is important for the permit holder of the treatment facility to document compliance by using a combination of independent emission testing as will be prescribed by DACEL.
A standard frequency of tests shall be carried out. However, in case of three successive previous tests demonstrating compliance, the frequency can be reduced to a prescribed minimum frequency (cf. *State Regulatory Oversight of Medical Waste Treatment Technologies, April 1994)*.

Residues from non-burn technologies:
Microbial inactivation achieved to be documented in accordance with the report "Technical Assistance Manual of the State Regulatory Oversight of Medical Waste Treatment Technologies, April 1994" of the State and Territorial Association/USEPA;
Maximum contents of heavy metals for non-burn technology residues, with a view to forcing optimisation of the combustion efficiency and segregation of heavy metal containing components from the waste stream, will in the absence of national standards, be limited as set out in the EU Directive 2000/76/EC of 4 December 2000;
If detected that there is a problem with the treatment process resulting in it not being fully efficient, the HCRW treatment process is to be discontinued until such time that the problem has been addressed. Any residue loads that may not have been disposed of, is to be disposed of under supervision, and at hazardous waste disposal sites only;
A standard frequency of tests shall be carried out. However, in case of three successive previous tests demonstrating compliance, the frequency can be reduced to a prescribed minimum frequency (cf. *State Regulatory Oversight of Medical Waste Treatment Technologies, April 1994)*.

Certain precautions, as detailed in Box 7.3, needs to be taken when dealing with the residues from treated HCRW, in order to reduce the risk of infection or injuries.

Box 7.3: Special precautions when dealing with treated HCRW residues:

The precautionary principle should in all cases apply, which will require that residues from HCRW treatment processes always be considered to be infectious, even when treated, since:

Even though the HCRW may have been treated to the extent that it is not considered to be infectious any longer, direct human contact without any protective equipment should be avoided, as testing done on the effectiveness of the various HCRW treatment processes are from a practical point of view only done on random samples;
Even though some HCRW treatment processes may make use of high temperatures whilst others will make use of shredders for the destruction of sharp objects, some remaining sharps objects could still create a risk of injuries to humans as well as animals.

Box 7.4 presents a summary on some of the options for the disposal of HCRW residues, which includes possible waste minimisation measures, as well as disposal options for different waste categories.

Box 7.4: Options for disposal of treated HCRW residues.

Disposal of all residues from the HCRW treatment process without minimisation activities, or alternatively by recovering of reusable (e.g. possible use of incinerator ash for road construction) or recyclable (e.g. plastic and glass from sterilisation processes, etc.) materials;
Disposal of non-hazardous residues at general waste disposal sites at reduced cost, by de-listing certain waste categories, or alternatively disposal of hazardous residues at hazardous waste disposal sites at increased cost, without any de-listing of waste categories.

7.6 Risks resulting from Landfilling of Untreated HCRW

Landfilling of waste containing organic waste results in aerobic or anaerobic digestion by microorganisms using the waste's organic material and water. This digestion may take place over decades depending on temperatures and availability of water and air.

Landfilling of especially untreated HCRW poses a threat of pollution of the environment as well as a health and safety risk due to the possible spreading of infections/pathogens to landfill workers, reclaimers and rodents/birds. Infectious waste remains infectious for very long periods, as many bacteria, viruses and other microorganisms do not degrade rapidly in landfills, especially when landfills are not operated to the prescribed procedures and standards.

Landfilling of untreated HCRW is for those reasons not recommended, which is also the approach taken by the Department of Water Affairs and Forestry.

For some remote rural areas, viable long haul systems are to be developed that will meet the technical as well as the environmental requirements for HCW management. Gauteng is however in the unique situation that even the most remote areas are within reach of regional HCRW treatment facilities.

Table 7.5 below summarises some of the perceived advantages versus risks associated with landfilling of untreated HCRW.

Table 7.5: Advantages and disadvantages of landfilling of untreated health care risk waste

Perceived advantages associated with landfilling of untreated HCRW	Risks associated with landfilling of untreated HCRW
Low capital investment costs; Very low operational costs; • Flexibility in terms of capacity.	High risk of pollution of surface water and ground water; No disinfection of HCRW resulting in high risk of spreading of infections; High risk of injuries by sharps; High risk of anatomical waste being stolen for use by traditional healers; High risk of expired pharmaceutical HCRW being stolen for reuse; No volume reduction.

7.7 What is allowed for Disposal on General Waste Landfills

The need for sound and effective segregation of HCW has two sides to it: (1) by disposing of HCRW in the HCGW stream, it is creating the risk of putting the health and safety of waste management workers and even informal waste reclaimers at the landfills at risk, whilst (2) the disposal of HCGW in the HCRW steam leads to increased HCW management costs.

There is often a perception amongst members of the public as well as officials from local authorities responsible for the management of waste disposal facilities, that all waste items generated in health care facilities should be managed, treated and disposed of as HCRW. This would for instance require that items that did not necessarily come in contact with potentially infected areas of patients, also be classified and treated as HCRW, for which the cost is significantly higher than if such uninfected materials were separated at source and disposed of as part of the HCGW stream.

In the most extreme case, common health care packaging material may be considered to be infectious, and should such materials be detected in an untreated form on general waste disposal sites, action is often taken against the transporters of such waste. This results in HCGW being classified as HCRW, which is of course the safer option. Should it not be possible for HCW generators to make the required distinction, the emphasis should remain on the health and safety of all parties that may be affected, rather than on the financial savings that could be achieved.

The other side of the coin is also true, i.e. that some scrupulous waste management companies is prepared to put the health and safety of people at risk, by illegally disposing of untreated HCRW on general waste disposal sites. For the sake of identifying and tracing such people, it is important for landfill operating staff to be able to identify HCRW that is not to be disposed of on general waste landfills. They should further be informed about the actions required to safely containerise such waste for transport to a HCRW treatment facility, or alternatively for safe disposal on the landfill.

The descriptions provided in Table 7.1can be used as broad guidelines to landfill operators for identification of HCW that are not to be disposed of on general waste landfills.

Table 7.1: Some prominent HCW items that *should* and *should not* be dispose of on general waste disposal sites.

Items that are *allowed* to be disposed of on general waste landfills:	Description:	Illustration:
Health care packaging materials.	Any cardboard, paper or plastic used for the packaging of medical equipment.	Illustration
Drip bags.	Plastic bags used for supply and dosing of ……	Illustration.
Syringes without needles	Plastic tubes of varying sizes used for injections.	Illustration.
Etc.	Etc.	Etc.
Items that are *not to be disposed* of on general waste landfills:	Description:	Illustration:
Blood bags.	Plastic bags used for the storage and dosing of blood	Illustration
Used or unused needles.	Sharp objects used with syringes to inject patients.	Illustration
Etc.	Etc.	Etc.

The landfill operating staff should at regular intervals be informed about the items that are allowed to be disposed of and those that are not allowed to be disposed of on general waste disposal site. The correct procedures on dealing with possible illegal dumping of HCRW should form part of the ongoing information campaign.

7.8 Importance of Cooperation

The cooperation should in the first instance be with registered HCRW transport companies, in order to identify and eliminate unauthorised collection and disposal of untreated HCRW by scrupulous waste management companies.

The next area of cooperation should be with the HCRW treatment facilities that are making use of any particular waste disposal site. It is first of all to be communicated to the landfill operator that the residues are classified for disposal on that particular class of landfill, and secondly there should be sufficient and effective lines of communication to warn landfill operators in the event of any process failure on the HCRW treatment facility.

7.9 Annexure 7.1: Proposals for info materials for landfill operators

(to be inserted).