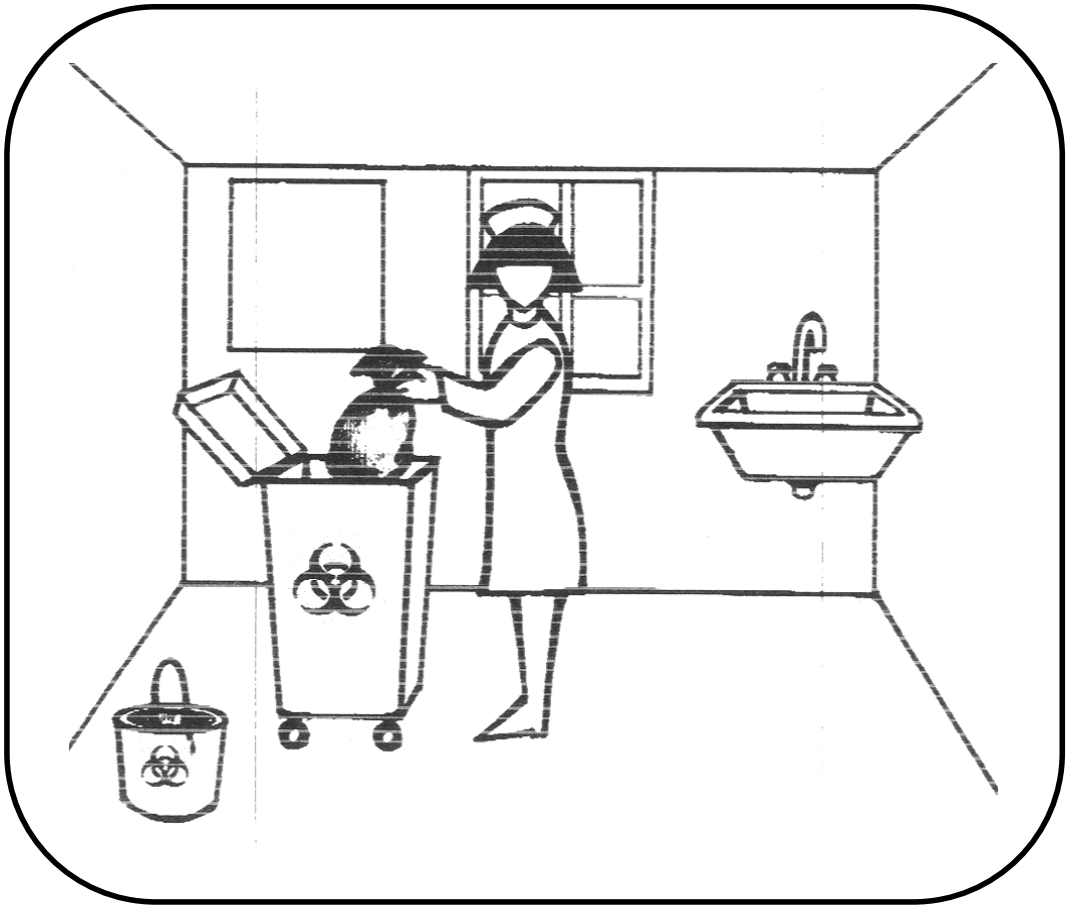
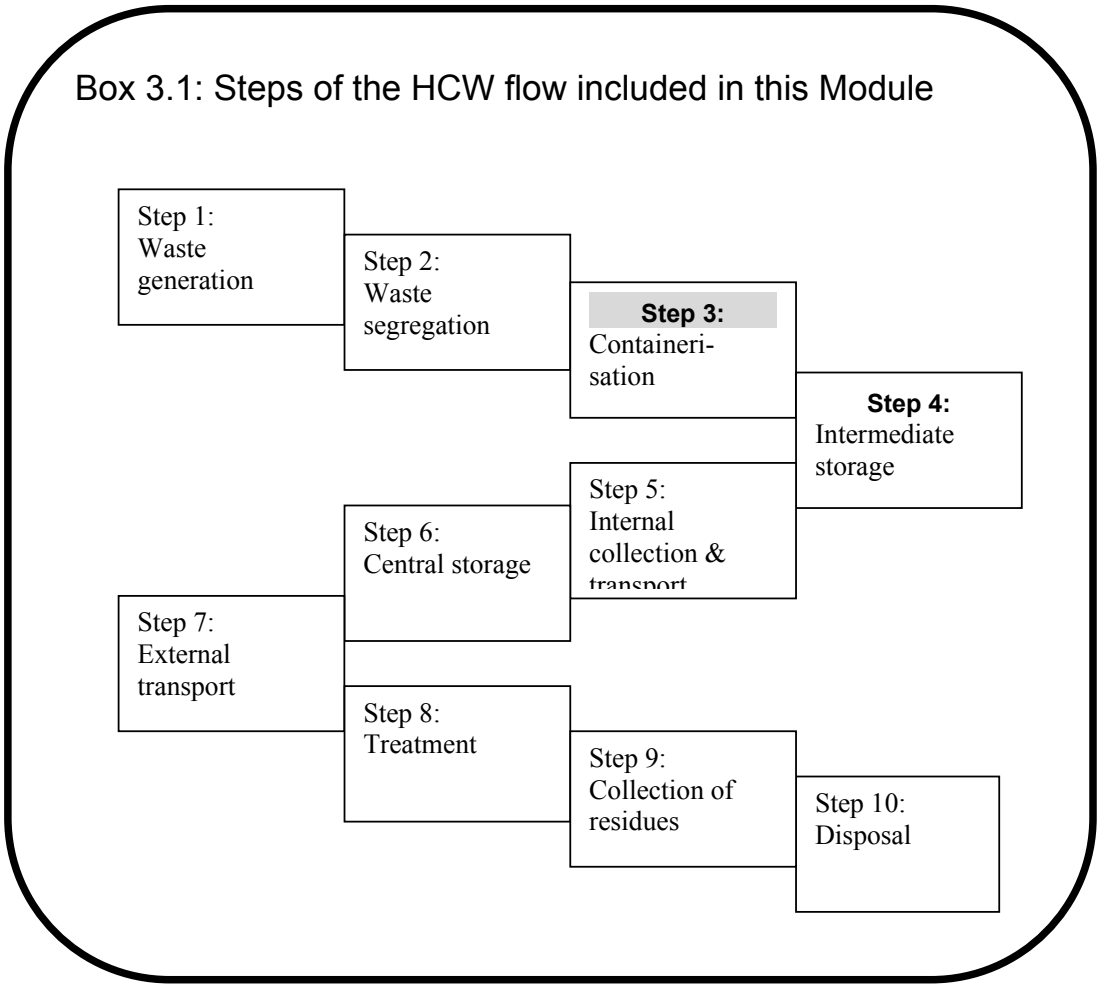
Guidelines
on Sustainable Health Care Waste Management in Gauteng

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



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:

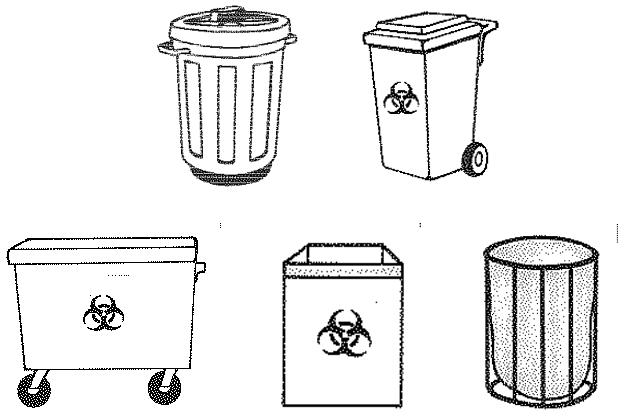
Design criteria for containers:
The amount, density and categories of HCW generated between collection rounds;
A maximum allowable mass of 15 kg is to be adhered to where HCW containers are to be handled manually. Manual handling and lifting as well as the number of transfers is therefore to be minimised 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.

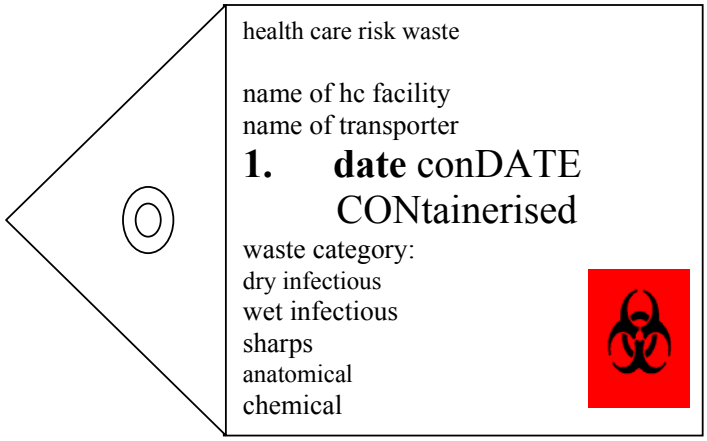
Box 3.8: Principles for labelling of HCRW containers

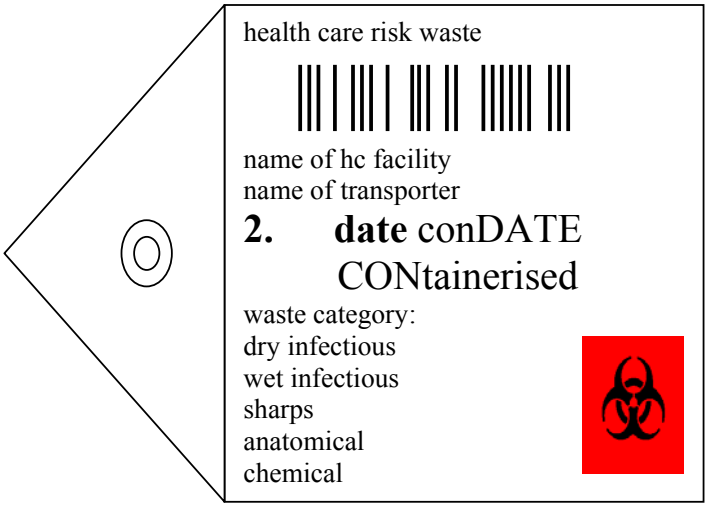
All containers shall be labelled in such a way that the following information is clearly visible:
Waste category
Preferably the following additional information should also appear on the label:
Date;
Name of health care facility;
Department identification (if applicable).

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

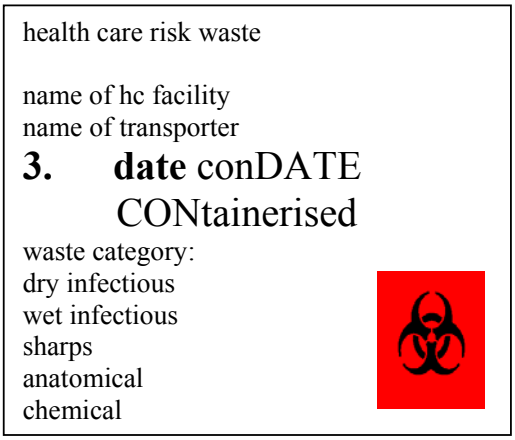
Manual recording – a

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.

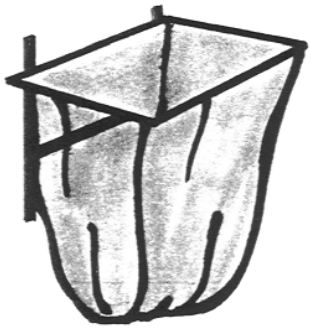
Based on the above considerations, there is a wide range of alternative containers on the market that will ensure that the general infectious HCRW is managed in a safe and healthy manner. A number of these containers are presented in Box 3.12.

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);

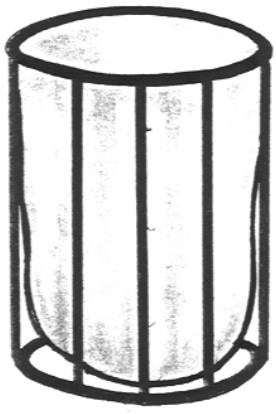
Pictures of selected containers are shown in Box 3.13.

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.

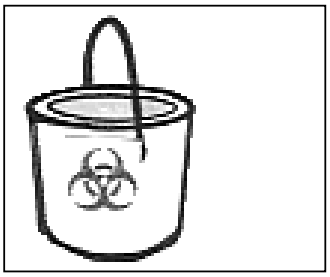
Having considered the criteria to be used in selecting appropriate pathological waste containers, the options available in the market is presented in Box 3.15.

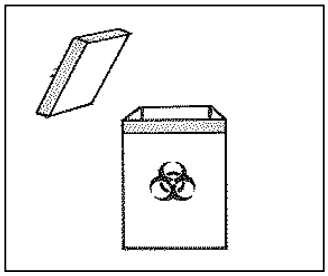
Box 3.15: The following options are available for pathological containers:

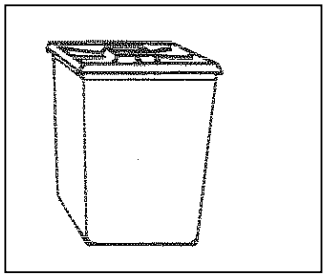
Disposable cardboard boxes with liners for pathological waste;
Disposable cardboard boxes with plastic lamination for pathological waste that is packaged in a disposable leak-proof inner container/bag;
Disposable puncture proof plastic containers for non sharp waste;
Reusable plastic containers for pathological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

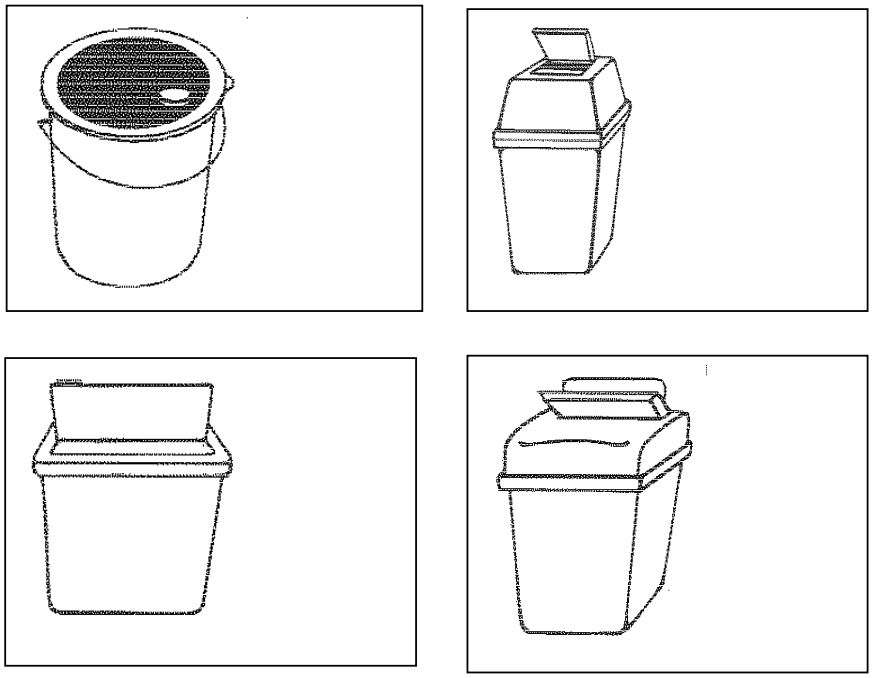
The alternative options available for sharps containers are presented in Box 3.19.

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).

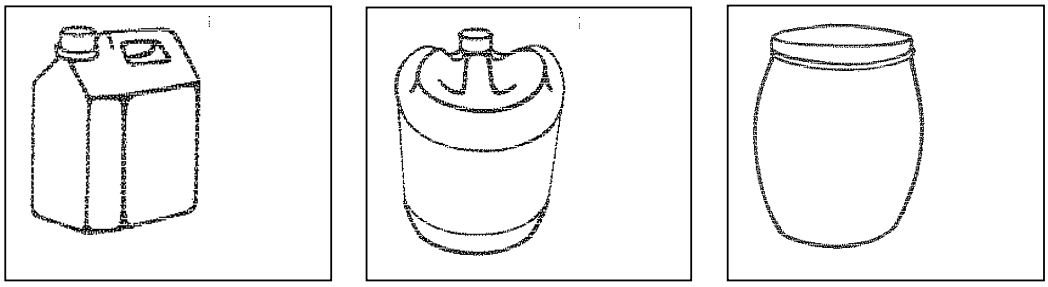
Based on the above, the following options are available for containerisation of chemical / pharmaceutical HCRW:

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	2002-09-27	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

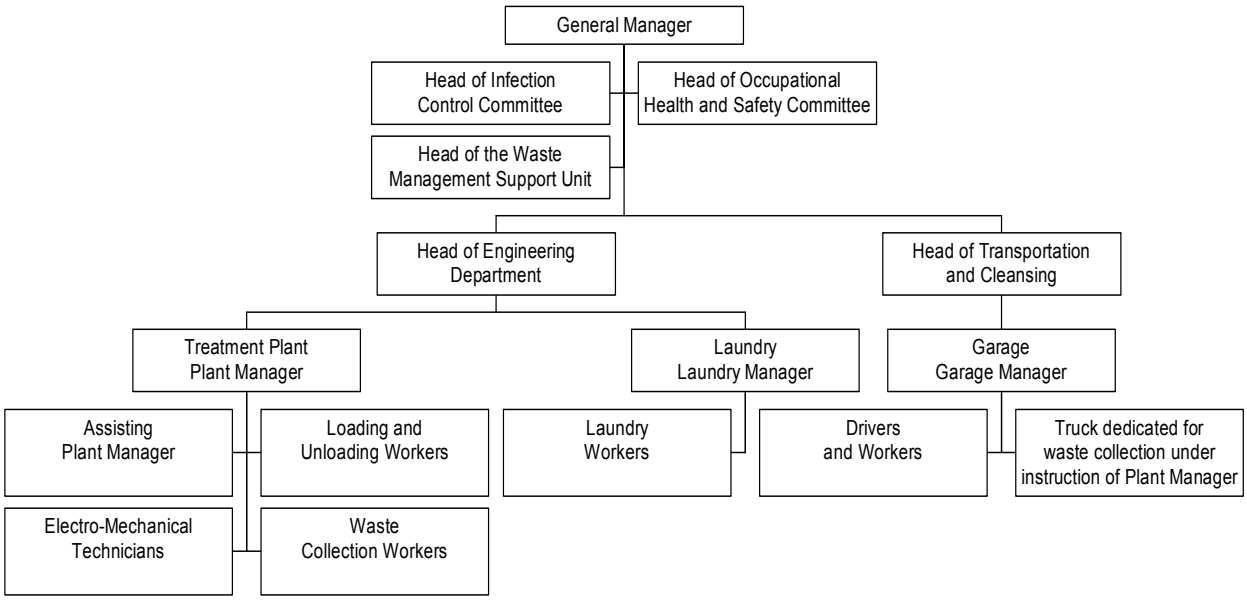
The following staff must hold a copy of the COP:

- 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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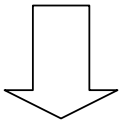
3.14 Annexure 3.3: Example of a poster illustrating waste segregation

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



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