

## Chapter 8

### Waste management at medical centres

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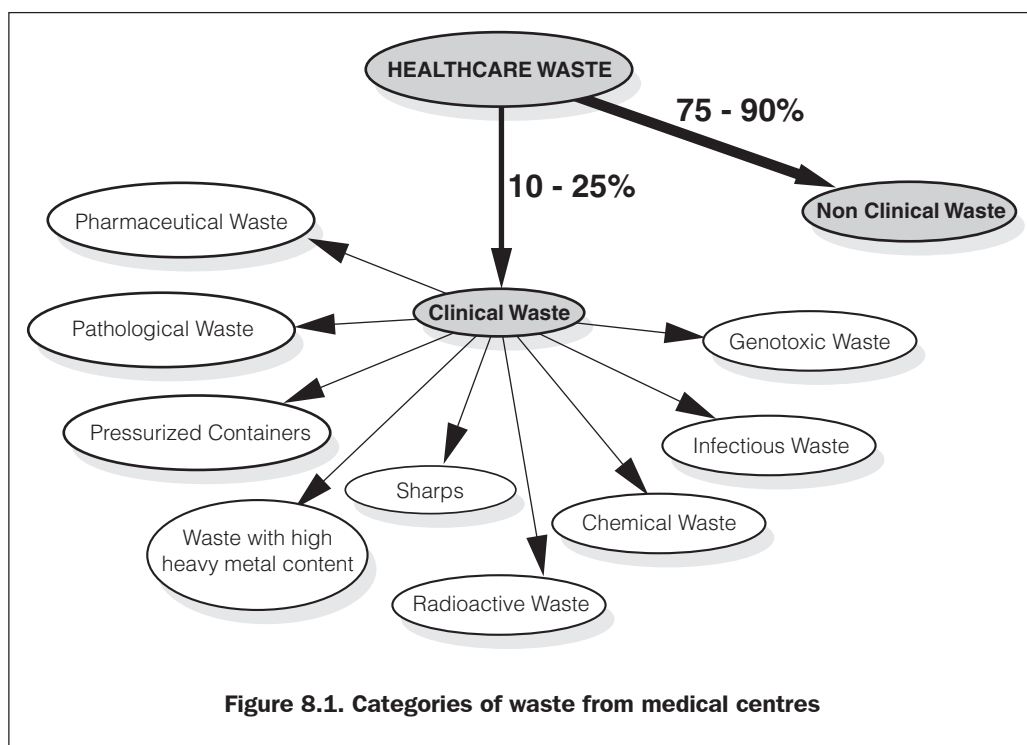
The term ‘medical centre’ can be used to refer to field hospitals, outpatient clinics and any other location where medical consultation, diagnosis or treatment is conducted. Some wastes from medical centres pose specific and sometimes severe health hazards; for this reason it is important that medical centre waste is managed separately from general solid waste and that management systems are more strictly controlled. The disposal of dead bodies is dealt with in Chapter 9.

#### 8.1 Types and sources of medical waste

The waste generated in a medical centre can be divided into two main categories:

- general (or non-clinical) waste; and
- medical (or clinical) waste.

General or non-clinical waste usually constitutes between 75 and 90 per cent of the total waste generated at medical centres; this includes office and kitchen waste (WHO, 1988 quoted by Appleton and Ali, 2000). The remaining 10 to 25 per cent of waste can be classed as medical waste which presents the greatest health risk to humans (Figure 8.1).



Medical waste can be further divided into the following categories:

- Infectious waste (lab cultures, wastes from isolation wards, tissues, used dressings)
- Pathological waste (body parts, human foetuses, placentas, blood, other body fluids)
- Pharmaceutical waste (unwanted drugs, expired drugs)
- Chemical waste (chemicals from diagnostic work, cleaning materials)
- Sharps (needles, blades and broken glass)
- Radioactive waste (radioactive substances from radiotherapy and lab work)
- Pressurised containers (gas cylinders, cartridges and aerosol cans)
- High heavy metal content (batteries, broken thermometers, blood pressure gauges)

In most emergency situations the predominant types of medical waste are infectious waste, pathological waste and sharps. These may be used as categories for segregation, but this will depend on the technologies selected for the final disposal of different waste types (see 8.5).

## 8.2 Associated risks

General, non-clinical, waste poses the same hazards as general solid waste (Chapter 7), but medical or clinical waste poses significantly increased hazards. The most obvious of these is the transmission of infectious diseases (e.g. Hepatitis B and HIV) through direct contact with infected waste items such as used needles, discarded dressings and human tissues or fluids.

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Non-direct risks include disease transmission by vectors and pollution of water sources and the environment. Less common potential risks include the risk of cancer, burns and skin irritation from radioactive waste or toxic chemicals.

### 8.2.1 Transmission pathways

The first step in waste management is to identify the potential routes for disease transmission. Possible pathways between medical waste and the population include:

- Direct contact
- Contact through vectors
- Airborne transmission
- Pollution of water sources
- Pollution of the environment

In order to minimise risks it is essential to attempt to break potential pathways. Table 8.1 summarises the risks, pathways and hazards of medical waste.

Table 8.1. Risks, pathways and hazards of medical waste (after Appleton and Ali, 2000)		
<i>Risk</i>	<i>Pathway</i>	<i>Hazard</i>
Contraction of disease/infection	Direct or indirect contact through a carrier	Pathological wastes and infectious wastes may transmit disease and infection through direct contact or via vectors
Cuts	Direct contact	Sharp waste including needles, glass and scalpels may cause cuts which provide entry into the body for infection
Ineffective medical care	Direct	Consumption of expired pharmaceuticals possible through inappropriate prescription by unscrupulous medical practitioners
Cancer	Direct or indirect contact, or proximity to waste	Radioactive waste
Burns and skin irritation	Direct or indirect contact, or proximity to waste	Toxic chemicals Radioactive waste
Injury from explosion	Being within the vicinity when explosion occurs	Pressurised containers
Pollution of groundwater, surface water and the air	Direct or indirect contact with polluted water or release to atmosphere	Toxic chemical wastes Pharmaceuticals Waste with heavy metal content

### 8.2.2 Who is at risk from medical waste?

Those most at risk from medical waste are:

- Medical staff
- Medical waste workers
- Waste-pickers
- Children (playing near disposal sites)
- Drug addicts (who scavenge for used needles and disposed medicines)
- Medical centre visitors and patients

Specific groups who come directly into contact with medical waste should be targeted for appropriate education and training. This aspect should be given at least equal priority to the provision of appropriate waste management facilities.

## 8.3 Minimising risks

### 8.3.1 Key measures to reduce hazards

Actual hazards resulting from medical waste can be reduced by:

- segregating general waste from medical waste;
- efficiently separating different categories of medical waste at the point of generation;
- labelling hazardous wastes;
- disinfecting before disposal (where possible);
- disposing of different categories of medical waste into appropriate disposal systems; and
- incinerating to destroy hazards (note that ineffective incineration may not remove all hazards and may cause air pollution).

### 8.3.2 Key measures to cut transmission pathways

Direct contact between people and hazardous waste can be prevented by:

- providing personal protective clothing and equipment (e.g. heavy duty gloves, safety glasses, overalls, etc.);
- designing systems to minimise contact (e.g. good storage facilities, more effective transportation, lack of double-handling, etc.);
- restricting access to medical waste pits or landfill sites; and
- improving education about dangers of medical waste.

Indirect contact between people and hazardous waste can be reduced by:

- applying vector control methods (e.g. covering waste);
- protecting water sources from contamination;
- implementing good hygiene practices when dealing with waste (e.g. handwashing); and
- implementing final disposal by effective sanitary landfill.

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**8.3.3 Key measures to protect the population**

Increased protection to those most at risk can be provided by:

- improving education, training and awareness raising (concerning safety and risk recognition) for medical staff, medical waste workers and others who are likely to come into contact with medical waste;
- immunising those in contact with medical waste against certain diseases, e.g. Hepatitis B and tetanus; and
- providing better access to healthcare for those in contact with waste.

**8.4 Segregation, storage and transportation**

Prior to final disposal, all wastes must be stored safely and transported to respective disposal sites. It is important that different types of waste are stored separately in order to prevent contamination of 'clean' waste by infectious or pathological wastes, and to allow easy transportation.

**8.4.1 Segregation**

The first step is to determine how waste should be separated or segregated. This will depend on the composition and quantities of waste generated, and how they are to be disposed of. The fact that this may change over time should be considered and on-going monitoring should occur.

In general, the segregation categories and disposal regimes in Table 8.2 are recommended for emergency situations.

In general, it is recommended that each treatment, diagnosis and consultation area of the medical centre (including wards, laboratories and immunisation points) has a set of three segregated containers: the first for general waste; the second for infectious and pathological waste; and the third for sharps. If pathological wastes such as placentas are to be disposed of separately from infectious waste, for example in a placenta pit, then a fourth type of container should be provided for this and disposal should take place immediately.

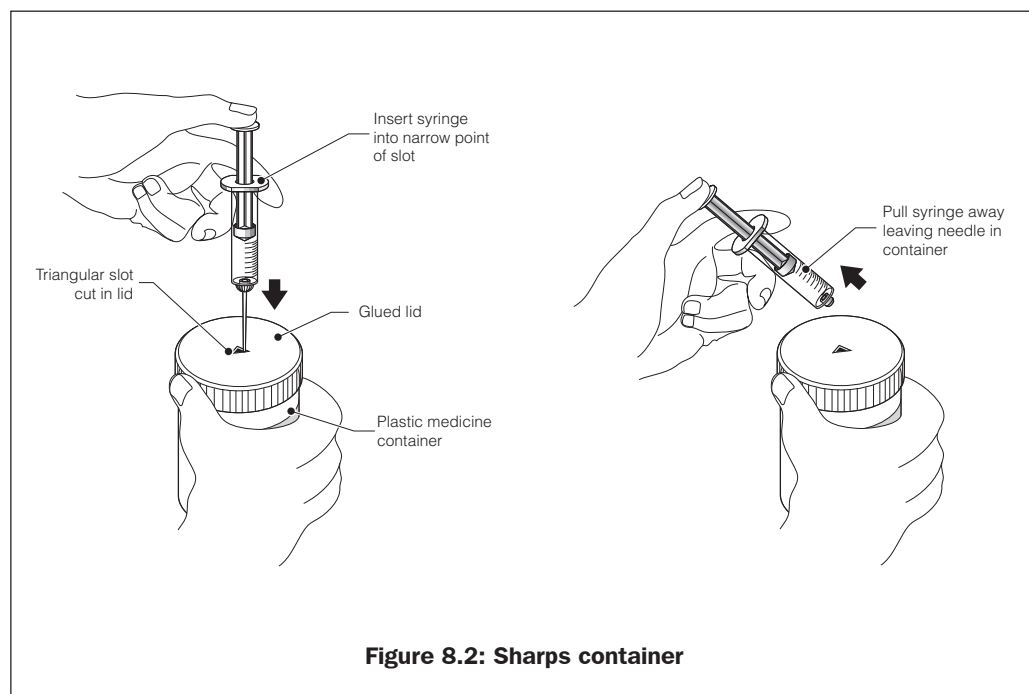
**Table 8.2. Segregation categories**

<i>Category of waste</i>	<i>Description</i>	<i>Disposal methods</i>
1. General waste	Kitchen waste, paper and packaging waste, etc.	On-site pit disposal Burning Sanitary landfilling
2. Pathological and infectious waste	Lab cultures, wastes from isolation wards, tissues, body parts, blood and other body fluids, etc.	Incineration Burning and burial Placenta pit
3. Sharps	Needles, blades, scalpels, glassware, infusion sets, etc.	Incineration at sufficient temperature (>1000°C) Sharps pit

### 8.4.2 Storage

All containers should have lids and should be water-tight in order to hold liquids. Open cardboard boxes are not recommended since these can easily be tipped over and they disintegrate easily. The size of container will depend on the volume of waste generated in each location but should be easy to handle and transport. It is recommended that containers of uniform colour are provided for each type of waste throughout the medical centre. This facilitates ease of identification and helps to avoid confusion. In addition, containers may be labelled, especially when containing infectious waste or sharps.

It is recommended that needles are stored in specially designed sharps containers. These containers should be disposed of together with their contents to eliminate further handling of potentially hazardous needles. Simple sharps containers can be made from empty pharmaceutical or medicine containers. The lid of the plastic container is glued or taped shut and a small triangular slot is cut in the lid. Following an injection the user inserts the needle and syringe in the slot, slides it to the narrow point of the slot and pulls the syringe away leaving the needle safely in the container (Figure 8.2). This prevents any handling of the used needle.



### 8.4.3 Disinfection

In general, the disinfection of solid waste using chemical disinfectants is only effective if such waste has been shredded beforehand. It is also inadequate for pharmaceutical, chemical and some types of infectious waste (Appleton and Ali, 2000). Disinfectants may themselves be hazardous and their use is not recommended in most emergency situations, unless treating liquid waste or sewage.

### 8.4.4 Transportation

Segregated storage containers should be designed so that they can be carried directly to the final disposal point. Containers must therefore be easy to carry, preferably with handles and a tight-fitting but easy-to-remove lid. Where waste is disposed of in an incinerator or pit this should be designed so that it is relatively easy to empty the container contents without spillage.

## 8.5 Disposal technology choices

Possible options for the disposal of different waste types are given below.

### 8.5.1 General solid waste pits

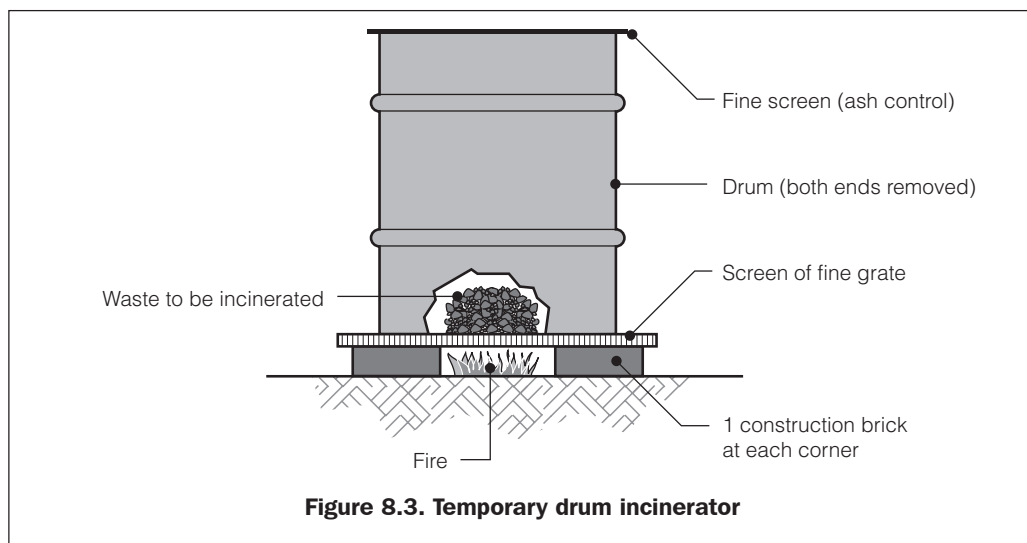
The disposal options for general solid waste are the same as those in Chapter 7. Where an off-site disposal system is in place, general waste from medical centres can be incorporated into that system. Alternatively, if solid waste is disposed of on-site it is likely to be appropriate to excavate a pit for general waste in the vicinity of the medical centre. This should be approximately 100m from the nearest habitable building.

### 8.5.2 Incineration

Incineration is an efficient and effective way to reduce organic and combustible waste to inorganic matter. Appropriate wastes should be at least 60 per cent combustible with a moisture content of not more than 30 per cent. A medical waste incinerator is designed to disinfect and render hazardous waste safe. It may be suitable for pathological, infectious or sharp wastes but should not be used for general solid waste, since this is an inefficient use of energy. Incinerators vary greatly from the sophisticated to the basic, and consequently performance, and therefore safety, varies greatly. Additional fuel is usually required if they are to operate correctly.

Figure 8.3 shows a temporary incinerator constructed from a disused oil drum. This is simple, cheap and quick to construct and ideal for the early stages of an emergency, but its efficiency is generally poor. The drum can be fitted with a chimney which should be at least 1m taller than surrounding structures, and this should help to remove smoke and reduce the effects of pollution. The incinerator can be built directly above a sealed pit so that the ash can be emptied from the base of the drum and deposited directly into the pit below. Alternatively the ash can be removed and buried nearby.

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Strictly speaking this is not an incinerator but a burner since it is unlikely to reduce all waste to ashes. Basic incinerators such as this often cause serious problems with emissions and should always be positioned at least 100m from the medical centre and other habitable buildings, to minimise the effects of smoke pollution. However, it is important that this is accompanied by appropriate containers for transportation and protective clothing. Sharp wastes such as needles will not be incinerated completely and therefore should be disposed of elsewhere if possible.

**Advantages:** Incinerators are cheap and quick to construct; and destroy infectious waste.

**Constraints:** There are smoke and odour hazards; and it is ineffective for the disposal of sharps.

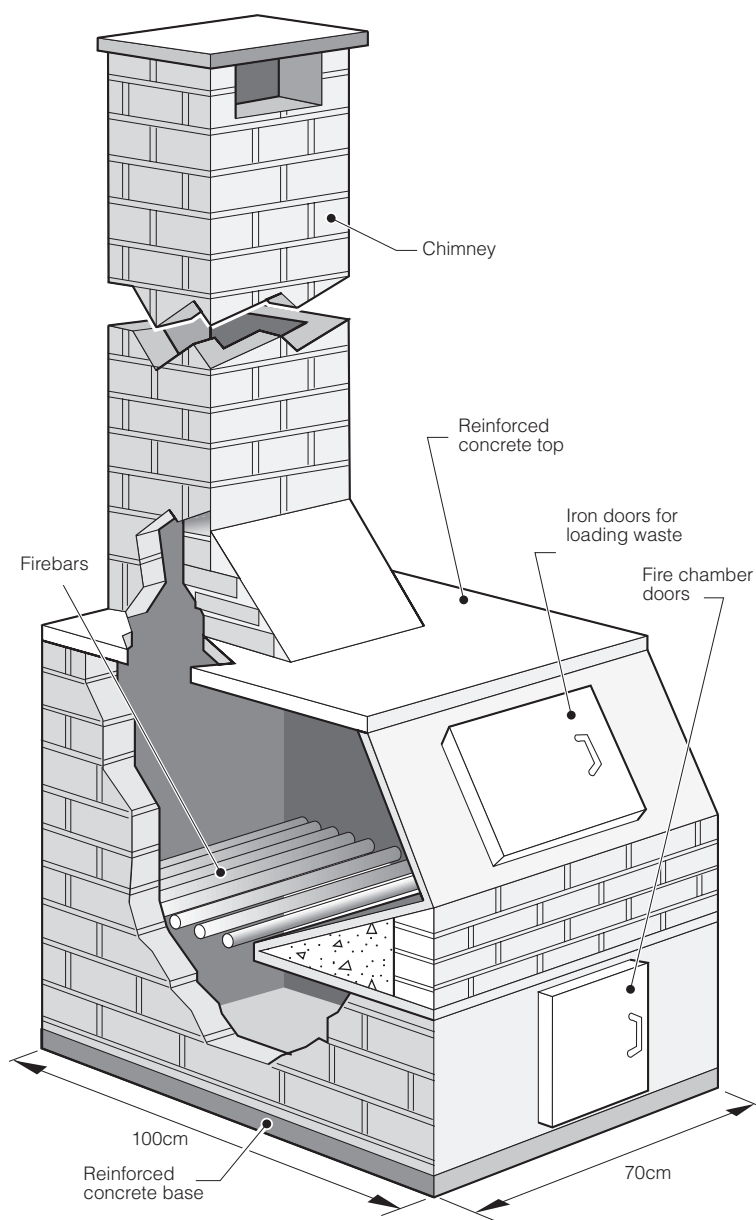


**Oil drum burner, Zambia**



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A more suitable long-term intervention is a properly designed incinerator (Figure 8.4). This is designed to operate at temperatures of 1000°C and above, and will reduce even metallic waste to a fine uniform ash.



**Figure 8.4. Permanent incinerator**

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A permanent incinerator may be constructed from brick and concrete with iron or metal doors. An incinerator of this chamber size (approximately 1.0m x 0.5m base) will be able to combust about 100kg of waste per hour (Médecins Sans Frontières, 1994).

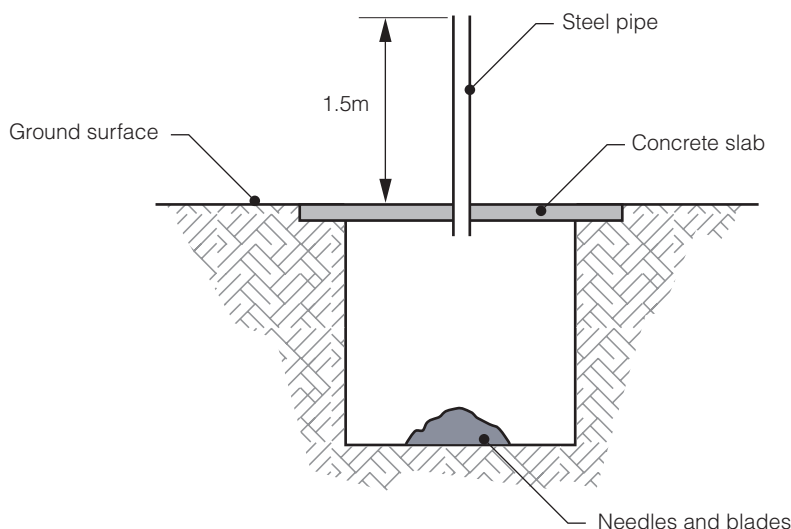
**Advantages:** Highly effective at disposing of sharps, and infectious and pathological waste.

**Constraints:** Expensive and time-consuming to construct; and difficult to operate at the appropriate temperature.

### 8.5.3 Sharps pits

Where it is not possible or appropriate to construct a proper incinerator, sharps should be disposed of in a specially built and sealed sharps pit (Figure 8.5). This option is preferable to disposal in an inefficient temporary burner in most situations.

A sharps pit can be a lined or unlined pit in the ground (see 6.8.7 for information on pit linings) with a sealed cover. The cover is normally constructed from reinforced concrete and has a small hole left in the middle. A tube or pipe rises vertically from the hole. This can be made from steel, asbestos or uPVC pipe and should be approximately 200mm in diameter (depending on the size of sharps containers). This is designed to prevent anyone from reaching inside the pit. Sharps containers (such as that in Figure 8.2) can be dropped down the tube into the pit below. Once the pit is full lime can be poured over the waste and the aperture should be sealed; a replacement pit should then be constructed.



**Figure 8.5: Sharps pit**

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**Advantages:** The pit is cheap and easy to construct; simple to understand; and easy to replace.

**Constraints:** Sharps containers may be attractive for alternative uses; and staff must be properly trained.



**Sealed sharps pit, Zambia**

### 8.5.4 Placenta burial pits

Where appropriate, covered pits can be provided for the disposal of placentas and other pathological wastes. In some cultures, it is normal practice for the family of the newborn to take the placenta home, whilst in other cultures the family prefer to bury it themselves. Where the latter is the case a designated area for burial should be provided where access by animals is prevented. In all cases the mother and her family should be consulted and their wishes respected.

## 8.6 Intervention levels

The risks posed by medical waste are so significant that in general intervention options are identical for immediate, short-term and long-term. However, basic immediate measures concerning segregation, transportation and disposal can gradually be improved and upgraded in later stages of an emergency. Table 8.3 gives recommended interventions for different emergency scenarios.

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**Table 8.3. Recommended interventions for different scenarios**

<i>Scenarios and recommended interventions</i>	<i>The affected population go through a transit camp immediately after a disaster</i>	<i>The affected population remain in a temporary location for up to six months</i>	<i>The affected population stay in the affected area immediately after a disaster</i>	<i>The affected population move to a new area and are likely to remain for more than a year</i>
Immediate action	<ul style="list-style-type: none"> <li>■ Clearing of scattered waste</li> <li>■ Burning and burial of waste on site</li> <li>■ Temporary pit for general waste and ashes</li> <li>■ Temporary containers for segregated waste</li> <li>■ Temporary sharps pit</li> <li>■ Temporary burner</li> </ul>			
Short-term measure	<ul style="list-style-type: none"> <li>■ Sealed containers for segregated waste</li> <li>■ Pit for general waste</li> <li>■ Off-site disposal for general waste</li> <li>■ Temporary incinerator/burner</li> <li>■ Sealed sharps pit</li> </ul>			
Long-term measure			<ul style="list-style-type: none"> <li>■ Sealed containers for segregated waste</li> <li>■ Pit for general waste</li> <li>■ Off-site disposal for general waste</li> <li>■ Permanent incinerator</li> <li>■ Sealed sharps pit</li> <li>■ On-site sanitary landfill</li> </ul>	

## 8.7 Education and training

A key aspect of the management of waste from medical centres is appropriate education of all those who may come into contact with waste and training of all those who are responsible for handling waste. Segregation, storage and transportation procedures should be well known among all medical and related staff. Signs and colour-coding should be used extensively within all medical facilities. A senior member of medical or sanitation staff should be given overall responsibility for the management of the system and the following groups should undergo appropriate training in waste management:

- Doctors
- Nurses

- Laboratory staff
- Cleaners
- Hygiene promoters
- Medical support staff

## 8.8 Key recommendations for waste management

The following key recommendations for waste management at medical centres were identified by Appleton and Ali (2000):

- Improve practices at all stages of the waste stream and do not focus on one stage only, for example final treatment.
- Separate the different types of waste at source: in particular keep infectious waste, pathological waste, sharps and chemical waste from being mixed with non-hazardous material.
- The separation and sale of reusable but non-hazardous materials such as paper, plastic and glass can successfully take place under controlled conditions if the waste is separated at source.
- Be prepared to improve the systems incrementally rather than look to ‘once and for all’ solutions such as incineration of all waste from the outset. Small steps can have significant impacts.
- Establish a distinct management responsibility for dealing with the waste generated.
- Create a dedicated budget for waste management.
- Provide all staff with training on handling waste.
- Work out detailed procedures for storage, handling, transfer and disposal of waste according to its characteristics and potential risks.

## References and further reading

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