

5

Health-care waste management planning

5.1 The need for planning

Formulation of objectives and planning for their achievement are important for improving health-care waste management at the national, regional, and local level. Planning requires the definition of a strategy that will facilitate careful implementation of the necessary measures and the appropriate allocation of resources according to the identified priorities. This is important for the motivation of authorities, health-care workers, and the public, and for defining further actions that may be needed.

Surveys on the generation of waste will be the basis for identifying opportunities—and setting targets—for waste minimization, reuse and recycling, and cost reduction.

A national programme of sound health-care waste management is achievable through an action plan (see section 5.3).

5.2 International recommendations for waste management

The United Nations Conference on the Environment and Development (UNCED) in 1992 led to the adoption of Agenda 21, which recommends a set of measures for waste management. The recommendations may be summarized as follows:

- Prevent and minimize waste production.
- Reuse or recycle the waste to the extent possible.
- Treat waste by safe and environmentally sound methods.
- Dispose of the final residues by landfill in confined and carefully designed sites.

Agenda 21 also stresses that any waste producer is responsible for the treatment and final disposal of its own waste; where possible, each community should dispose of its waste within its own boundaries.

The European Union has elaborated a common “European Community Strategy on Waste Management”; other regional groupings of countries may set up similar policies in the future.

5.3 National plans for health-care waste management

5.3.1 *Purpose of a national management plan*

A national management plan will permit health-care waste management options to be optimized on a national scale. A national survey of health-care waste will provide the relevant agency with a basis for identifying

actions on a district, regional, and national basis, taking into account conditions, needs, and possibilities at each level. An appropriate, safe, and cost-effective strategy will be concerned principally with treatment, recycling, transport, and disposal options.

5.3.2 Action plan for the development of a national programme

A national programme of sound health-care waste management can be developed through a seven-step action plan. The seven steps and their suggested time frame are shown in Fig. 5.1 and described in more detail in the following paragraphs.

Step 1. Establish policy commitment and responsibility for health-care waste management

Before an action plan is implemented there must be commitment to the development of a national policy, and responsibility must be delegated to the appropriate government authority. The ministry of health or the ministry of environment will usually serve as the principal authority, and should work closely with other relevant ministries. The designated authority will cooperate with other ministries, the private sector, non-governmental organizations (NGOs), and professional organizations, as necessary, to ensure implementation of the action plan.

Policy commitment should be reflected in appropriate budgetary allocations at different government levels. Guidance from central government should lead to maximum efficiency in the use of available resources from health-care establishments.

Step 2. Conduct a national survey of health-care waste practices

The national agency responsible for the disposal of health-care waste should be fully aware of current levels of waste production and of national waste management practices. A comprehensive survey is essential for planning an effective waste management programme. It is suggested that a wide-ranging questionnaire be completed for all health-care establishments in order to establish the following:

- number of hospital beds and bed occupancy rate for each health-care establishment;
- types and quantities of waste generated;
- personnel involved in the management of health-care waste;
- current health-care waste disposal practices, including segregation, collection, transportation, storage, and disposal methods.

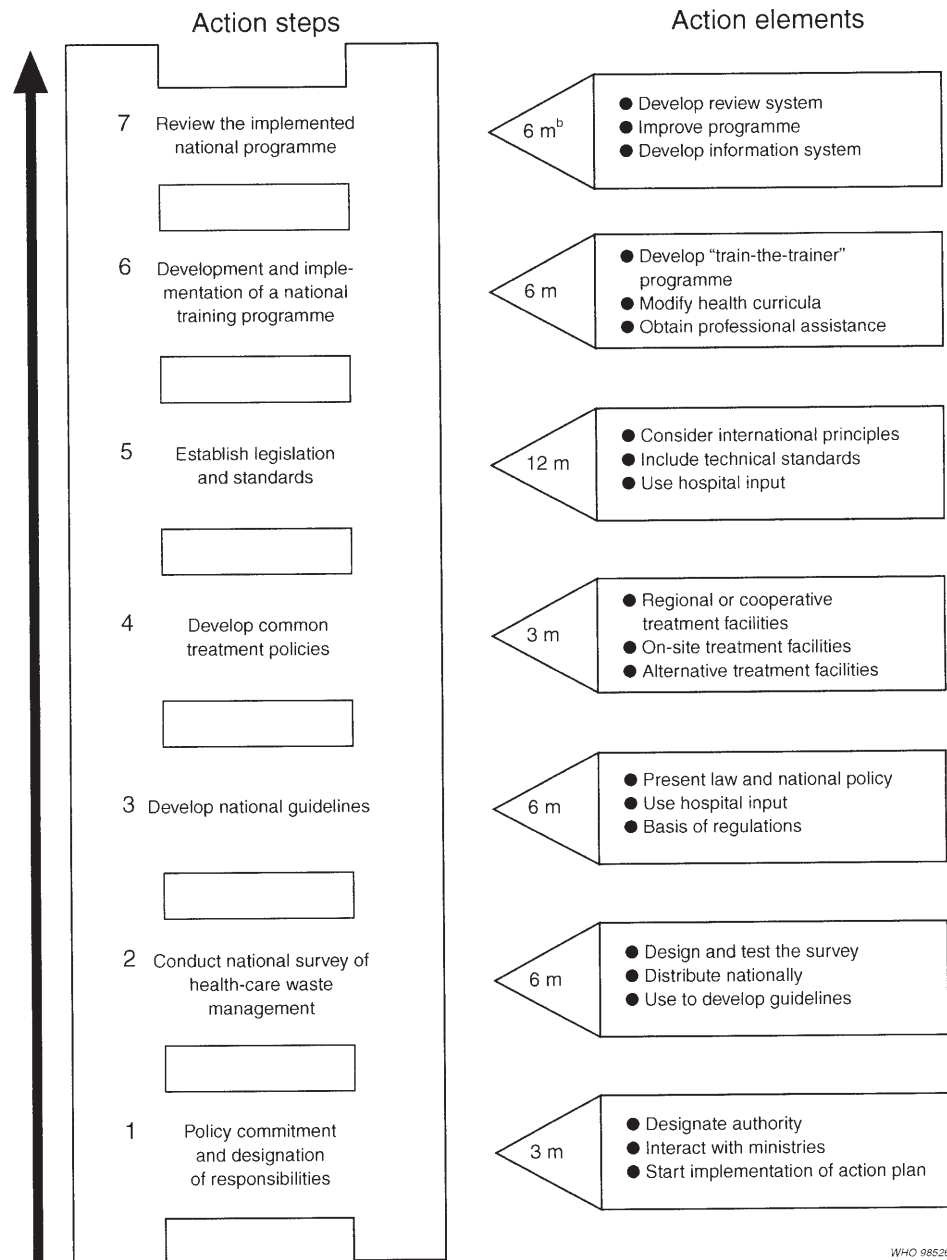
The survey should also include site observations and interviews with health or support workers (waste workers, cleaners, etc.) at different levels. The information collected will provide a basis for formulating strategy for district, regional, and national levels.

A typical survey questionnaire is reproduced on pages 37 to 42; it has been used in a survey of hospitals in WHO's South-East Asia Region to identify issues that require interventions.

Step 3. Develop national guidelines

The foundation for a national programme for health-care waste management is the technical guidelines—plus the legal framework that supports them. Step 3 thus consists of the formulation of a national policy document and technical guidelines based on the results of the national

Fig. 5.1 Action plan for national programme of sound health-care waste management^a



WHO 98526

^aSource: WHO (1997).

^bTime (months) to complete action.

survey; the two may be brought together in one comprehensive document. Their content, outlined in section 4.3, should provide the technical foundation on which health-care establishments can build their individual management programmes.

Survey questionnaire for hospital waste management¹

QUESTIONNAIRE

Hospital (name, location): _____

- Type of hospital (tick one):
- Specialist
 - General
 - University (training/provincial)
 - Regional
 - District
 - Sub-district

No. of inpatients: _____ /day

No. of outpatients: _____ /day

No. of beds (total): _____ /day

including _____ in _____ ward
(no.) (type of ward)

_____ in _____ ward
(no.) (type of ward)

_____ in _____ ward
(no.) (type of ward)

_____ in _____ ward
(no.) (type of ward)

¹ With minor editorial changes, as used by the WHO Regional Office for South-East Asia.

Survey questionnaire for hospital waste management (continued)

Type of solid waste produced and estimated quantity
(Consult classification and mark X where waste is produced.)

Sources	Waste category								Est. quantity (kg/day)	
	General	Pathological	Radioactive	Chemical	Infectious	Sharps	Pharmaceutical	Pressurized containers		
<i>Patient services</i> Medical Surgical Operating theatre Recovery/intensive care Isolation ward Dialysis unit Oncology unit Emergency Outpatient clinic Autopsy room Radiology										
<i>Laboratories</i> Biochemistry Microbiology Haematology Research Pathology Nuclear medicine										
<i>Support services</i> Blood bank Pharmacy Central sterile supply Laundry Kitchen Engineering Administration Public areas Long-term health care										

Survey questionnaire for hospital waste management *(continued)*

Waste segregation, collection, storage, and handling

Describe briefly what happens between segregation (if any) and final disposal of:

Sharps _____

Pathological waste _____

Infectious waste _____

Radioactive waste _____

Chemical waste _____

Pharmaceutical waste _____

Pressurized containers _____

Survey questionnaire for hospital waste management (continued)

Waste segregation, collection, labelling, transport, and disposal

Handling of segregated waste	Sharps	Pathological waste	Infectious waste	Radioactive waste	Chemical waste	Pharmaceutical waste	Pressurized containers
Indicate by X the type of waste (if any) that is segregated from general waste stream.							
Where is the segregation taking place (i.e. operating room, laboratory, etc.)?							
What type of containers/bags (primary containment vessels) are used to segregate waste (bags, cardboard boxes, plastic containers, metal containers, etc.)? Describe accurately.							
What type of labelling, colour-coding (if any) is used for marking segregated waste? Describe.							
1. Who handles (removes) the segregated waste (designation of the hospital staff member)? 2. Is the waste handler using any protective clothing (gloves, etc.) during waste handling? Yes/No.							
What type of containers (plastic bins, bags, cardboard boxes, trolleys, wheelbarrows, etc.) are used for collection and internal transport of the waste? Describe.							
Where is the segregated waste stored while awaiting removal from the hospital or disposal? Describe.							
Describe briefly the final disposal of segregated waste (taken to municipal landfill, buried on hospital grounds, incinerated, open burned, etc.).							

Survey questionnaire for hospital waste management (continued)

Personnel involved in the management of hospital solid waste

1. (a) Designation of person(s) responsible for organization and management of waste collection, handling, storage, and disposal at the hospital administration level.

(b) General qualification and level of education of designated person.

(c) Has he/she received any training on hospital waste management? Yes No
If yes, what type of training and of what duration?

2. Indicate the number of persons involved in the collection, handling, and storage of hospital waste, their designation, their training in solid waste handling and management, and the number of years of experience of this type of work.

Number	Designation	Training	Experience

3. Do the waste management staff have job descriptions detailing their tasks? Yes No

4. Are instructions/training given to newly hired waste management staff? Yes No

Hospital waste management policy

1. Are you aware of any legislation application to hospital waste management? Yes No
If yes, please list the legislative Acts:

Survey questionnaire for hospital waste management (continued)

2. Are you aware of a document outlining the hospital waste management policy? Yes No
If yes, give title of document (and attach a copy if possible):

3. Is there a manual or guideline document on management of hospital wastes available:
(a) In the Ministry of Health? Yes No
If yes, give title of document:

(b) In your hospital? Yes No
If yes, give title of document:

4. (a) Does your hospital have a Waste Management Plan? Yes No
If yes, please attach a copy.

(b) Does your hospital have a Waste Management Team (or Teams)? Yes No
If yes, please list the members by designation:

	<i>Designation</i>	<i>No.</i>
Team leader	_____	_____
Team members:	_____	_____
Waste handling staff:	_____	_____

5. Are there clearly defined procedures for collection and handling of wastes from specified units in the hospital? Yes No

6. Are there waste management responsibilities included in the job descriptions of hospital supervisory staff (Head of Hospital, Department Heads, Matron/Senior Nursing Officer, Hospital Engineer, Infection Control Officer, Pharmacist, Laboratory Supervisor, etc.)? Yes No
If yes, provide sample copies.

7. How are the present waste collection, handling, and disposal responsibilities defined in the job descriptions of the staff involved? (Cite appropriate statement or provide copies.)

Step 4. Develop a policy on regional and cooperative methods of health-care waste treatment

The designated government agency should identify resources that will ensure a national network of disposal facilities for health-care waste, accessible by hospitals and other health-care facilities. The national (or regional) policy should also include technical specifications for the processes and equipment involved in acceptable treatment options.

There are three basic options for managing the treatment of health-care waste:

- Option 1: an on-site treatment facility in each health-care establishment.
- Option 2: regional or cooperative health-care waste treatment facilities, supplemented by individual facilities for outlying hospitals.
- Option 3: treatment of health-care waste in existing industrial or municipal treatment facilities (e.g. municipal incinerators), where these exist.

Each option has advantages and disadvantages. The national or regional planning policy will depend on local circumstances such as the administrative mechanisms for verifying proper waste management procedures, the number, location, size, and type of health-care establishments, quality of road network, and financial and technical resources.

On-site health-care waste treatment facility

The advantages of providing each health-care establishment with on-site treatment facilities include the following:

- convenience;
- minimization of risks to public health and the environment by confinement of hazardous wastes to the health-care premises.

On-site treatment facilities are particularly appropriate in areas where hospitals are situated far from each other and the road system is poor. They must be managed by the hospitals where they are located and may accept health-care waste collected from scattered small sources in the surrounding areas.

The drawbacks of on-site disposal include the following:

- Costs may be high if there are many hospitals.
- Overall, more technical staff may be required to operate and maintain the facilities.
- It may be difficult for the relevant authorities to monitor the performance of many small facilities; this may result in poor compliance with operating standards, depending on the type of facilities, and increased environmental pollution.

Regional and cooperative treatment facilities

On-site waste disposal methods, which may be desirable for large health-care establishments, may not be practicable or cost-effective for smaller institutions, for which regional or cooperative disposal may be the better option. Such systems are in use in several countries, operating on either a voluntary or a statutory basis. For example, a group of hospitals may cooperate to set up a regional health-care waste treatment facility (e.g. a high-capacity incinerator) at one hospital which will then receive wastes

from others within the group. In other cases, the local authority or a private waste disposal contractor may establish a centralized plant to receive waste from health-care facilities within its region.

Centralized regional facilities could provide the following advantages:

- greater cost-effectiveness for larger units, through economies of scale;
- spare capacity can be provided more economically;
- future modifications or expansions (relating to flue-gas cleaning systems of incinerators, for example) are likely to be less expensive;
- where privatization of facilities is seen as a desirable option, this can be achieved more easily on a regional basis than for numerous small units; in addition, it will be easier for the relevant government agencies to supervise and monitor the facilities;
- efficient operation can be more easily ensured in one centralized facility than in several plants where skilled workers may not be readily available;
- air pollution may be more easily kept to a minimum at a centralized plant (costs of monitoring and surveillance and of flue-gas cleaning, for example, will be reduced);
- hospitals will not have to devote time and personnel to managing their own installations.

The location of regional facilities for the treatment of health-care waste should be carefully chosen. Catchment areas should be defined on the basis of estimated waste production by the health-care establishments involved, and the location of the treatment plant within each catchment area should then be based on the following considerations:

- accessibility for the hospitals and health-care facilities to be served (road conditions, distances, and transportation times);
- quantities of health-care waste expected from the various establishments within the identified catchment area;
- whether or not transfer stations are needed (daily transfer of waste direct from hospitals to the regional facility, with no need for transfer stations, would be optimal, avoiding double handling of waste);
- likely changes in the capacity or function of each hospital and hence in the quantity or nature of its waste;
- preliminary environmental considerations, based on a detailed environmental and health impact assessment (the assessed impact may be lower if the facility is located inside an industrial “park” designed specifically for hazardous industries);
- adequacy of the land area for the facility at a proposed site;
- public attitude towards the treatment method.

Minimizing total times for transportation of health-care wastes to the regional facility should be an important factor in the choice of site and in determining appropriate transportation routes. Allotting adequate numbers of collection vehicles to the various routes in the region will ensure regular collection of waste and contribute to overall cost-effectiveness.

Step 5. Legislation: regulations and standards for health-care waste management

Once developed, the policy and guidelines should be supported by legislation that regulates their application. This law is usually based on

international agreements and underlying principles of sound waste management as outlined in Chapter 4.

Step 6. Institute a national training programme

In order to achieve acceptable practices in health-care waste management and compliance with regulations, it is essential for all managers and other personnel involved to receive appropriate training. To this end, the central government should assist in preparation of “train the trainer” activities, and competent institutions or centres for the trainers’ programme should be identified. Details on training programmes are provided in Chapter 14.

Step 7. Review the national health-care waste management programme after implementation

The national programme for management of health-care waste should be viewed as a continuous process with periodic monitoring and assessment by the responsible national government agency. In addition, the recommendations on treatment methods should be regularly updated to keep pace with new developments.

The national agency will base its assessment primarily on reports from the health-care establishments on their success in implementing waste management plans. It should review annual reports submitted by the heads of the establishments and make random visits to carry out audits of the waste management systems. Any deficiencies in the waste management system should be pointed out to the head of the establishment in writing, together with recommendations for remedial measures. The time limit for implementation of remedial measures should be specified and the head of the establishment should be informed of the follow-up date.

In the case of off-site waste treatment facilities, incinerator operators, road haulage contractors, and landfill operators should also be audited. Periodic review of waste management practices by both the national government agency and the health-care establishments should result both in improved protection of occupational and public health and in enhanced cost-effectiveness of waste disposal.

5.4 Waste management plan for a health-care establishment

5.4.1 Assignment of responsibilities

The proper management of health-care waste depends largely on good administration and organization but also requires adequate legislation and financing, as well as active participation by trained and informed staff.

The head of the hospital should form a waste management team to develop a waste management plan. The team should have the following members:

- Head of Hospital (as chairperson)
- Heads of Hospital Departments
- Infection Control Officer
- Chief Pharmacist
- Radiation Officer

- Matron (or Senior Nursing Officer)
- Hospital Manager
- Hospital Engineer
- Financial Controller
- Waste Management Officer (if already designated).

In certain establishments, the structure may include a Hospital Hygienist, in addition to or instead of the Infection Control Officer, to address specific problems relating to hospital hygiene. In such cases, some or all of the duties of the Infection Control Officer specified below will be carried out by the Hospital Hygienist.

The Head of Hospital should formally appoint the members of the waste management team in writing, informing each of them of their duties and responsibilities as outlined in the following sections. (In an institution that is not directly involved in patient care, such as a medical research institution, the head of the establishment should use his discretion to appoint members of the waste management team from among the relevant staff.) He or she should appoint a Waste Management Officer with overall responsibilities for the development of the hospital waste management plan and for the subsequent day-to-day operation and monitoring of the waste disposal system. Depending on availability of relevant staff, this post may be assigned to the Hospital Engineer, to the Hospital Manager, or to any other appropriate staff member at the discretion of the Head of Hospital.

5.4.2 Management structure, liaison paths, and duties

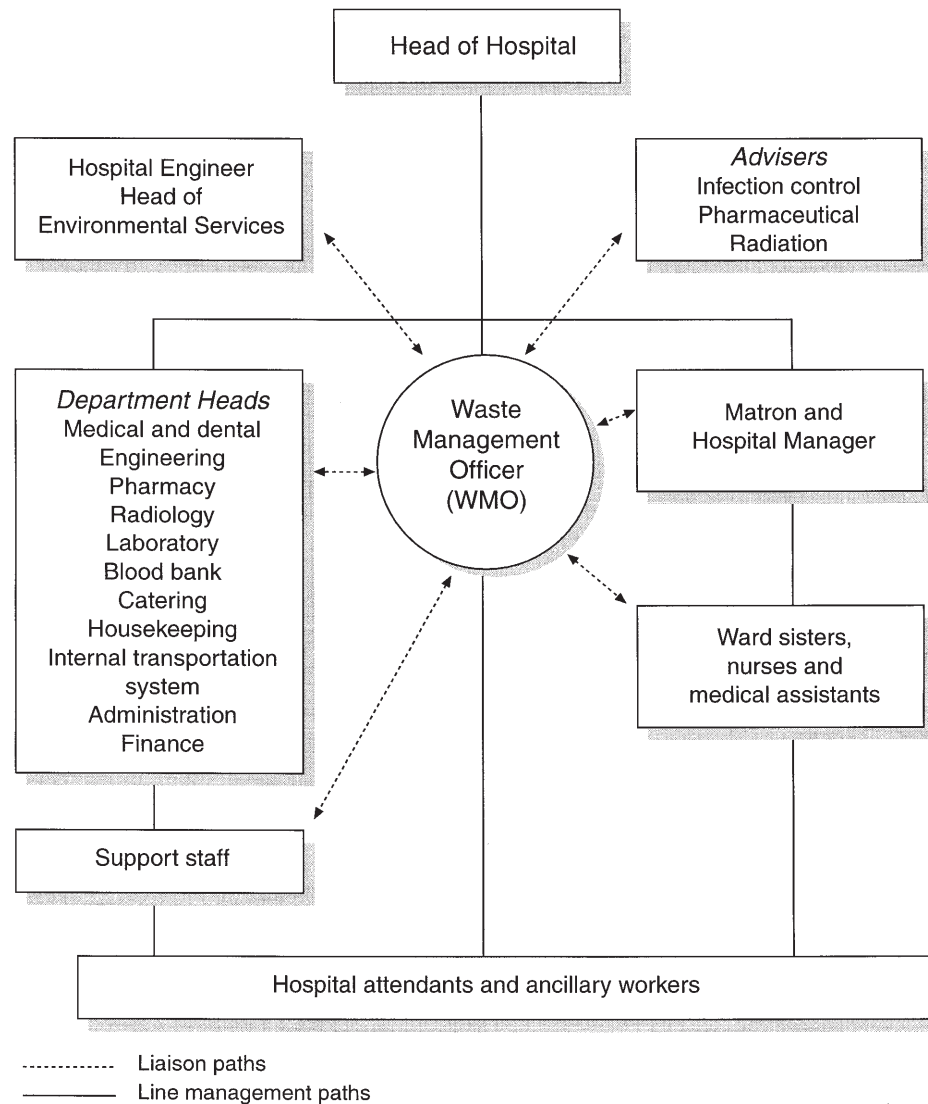
A typical hospital waste management structure is shown in Fig. 5.2, with line management responsibilities and liaison paths between key personnel involved in the handling of health-care waste. This structure may be adjusted to the particular needs of each hospital. The sharing of duties of key personnel in large hospitals is described in the following paragraphs; in smaller hospitals, one individual may fulfil two or more sets of responsibilities, but the same principles will apply.

Head of Hospital

The Head of Hospital is responsible for the following tasks:

- Forming a waste management team to develop a written waste management plan for the hospital. The plan should clearly define the duties and responsibilities of all members of staff, both clinical and non-clinical, in respect of the handling of health-care waste, and establish lines of accountability.
- Designating a Waste Management Officer (WMO) to supervise and coordinate the waste management plan. The Head of Hospital retains overall responsibility for ensuring that health-care and other wastes are disposed of in accordance with national guidelines.
- Keeping the management plan up to date.
- Allocating sufficient financial and personnel resources to ensure efficient operation of the plan. For example, sufficient staff should be assigned to the Waste Management Officer to ensure efficient operation of the waste management plan.
- Ensuring that monitoring procedures are incorporated in the plan. The efficiency and effectiveness of the disposal system should be monitored so that the system can be updated and improved when necessary.

Fig. 5.2 Hospital waste management structure^a



WHO 98527

^aAdapted from a 1994 draft document, *Regional guidelines for healthcare waste management in developing countries*, produced by the World Health Organization Western Pacific Regional Environmental Health Centre, Kuala Lumpur.

- Immediately appointing a successor in the event of personnel leaving key positions in the waste management team (or temporarily assigning responsibility to another staff member until a successor can be appointed).
- Ensuring adequate training for key staff members and designating the staff responsible for coordinating and implementing training courses.

Waste Management Officer (WMO)

The WMO is responsible for the day-to-day operation and monitoring of the waste management system. It is therefore essential that he or she has direct access to all members of the hospital staff (see Fig. 5.2). The

WMO is directly responsible to the Head of Hospital. He or she should liaise with the Infection Control Officer, the Chief Pharmacist, and the Radiation Officer in order to become familiar with the correct procedures for handling and disposing of pathological, pharmaceutical, chemical, and radioactive wastes.

In the area of waste collection, the WMO should:

- control internal collection of waste containers and their transport to the central waste storage facility of the hospital on a daily basis;
- liaise with the Supplies Department to ensure that an appropriate range of bags and containers for health-care waste, protective clothing, and collection trolleys are available at all times;
- ensure that hospital attendants and ancillary staff immediately replace used bags and containers with the correct new bags or containers;
- directly supervise hospital attendants and ancillary workers assigned to collect and transport health-care waste.

Concerning waste storage, the WMO should:

- ensure the correct use of the central storage facility for health-care waste, which should be kept locked but should always be accessible to authorized hospital staff;
- prevent all unsupervised dumping of waste containers on the hospital grounds.

To supervise collection and disposal of the waste, the WMO should:

- coordinate and monitor all waste disposal operations;
- monitor methods of transportation of wastes both on- and off-site and ensure that wastes collected from the hospital are transported by an appropriate vehicle to the designated treatment and disposal site;
- ensure that waste is not stored for longer than specified in the guidelines and that the transport organization (which may be the local authority or a private contractor) collects the waste with the required frequency.

For staff training and information, the WMO should:

- liaise with the Matron (or Senior Nursing Officer) and the Hospital Manager to ensure that the nursing staff and medical assistants are aware of their own responsibilities for segregation and storage of waste and that the responsibilities of hospital attendants and ancillary staff are limited to the handling and transport of sealed waste bags and containers;
- liaise with Department Heads to ensure that all doctors and other qualified clinical staff are aware of their own responsibilities regarding segregation and storage of waste and that the responsibilities of hospital attendants and ancillary staff are limited to the handling and transport of sealed bags and containers;
- ensure that hospital attendants and ancillary staff are not involved in waste segregation and that they handle only waste bags and containers that have been sealed in the correct manner.

For incident management and control the WMO should:

- ensure that written emergency procedures are available, that they are in place at all times, and that personnel are aware of the action to be taken in the event of an emergency;
- investigate and review any reported incidents concerning the handling of health-care waste.

In addition, the WMO should continuously monitor certain parameters, which are listed in Box 5.1.

Department Heads

Department Heads are responsible for the segregation, storage, and disposal of waste generated in their departments. They should

- ensure that all doctors, nurses, and clinical and non-clinical professional staff in their departments are aware of the segregation and storage procedures and that all personnel comply with the highest standards;
- continuously liaise with the WMO to monitor working practices for failures or mistakes;
- ensure that key staff members in their departments are given training in waste segregation and disposal procedures;
- encourage medical and nursing staff to be vigilant so as to ensure that hospital attendants and ancillary staff follow correct procedures at all times.

Matron and Hospital Manager

The Matron (or Senior Nursing Officer) and the Hospital Manager are responsible for training nursing staff, medical assistants, hospital attendants, and ancillary staff in the correct procedures for segregation, storage, transport, and disposal of waste. They should therefore:

Box 5.1 Parameters to be monitored by the waste management officer

Waste generated each month, by waste category:

- in each department;
- treatment and disposal methods.

Financial aspects of health-care waste management:

- direct costs of supplies and materials used for collection, transport, storage, treatment, disposal, decontamination, and cleaning;
- training costs (labour and material);
- costs of operation and maintenance of on-site treatment facilities;
- costs for contractor services.

Public health aspects:

- Incidents resulting in injury, “near misses”, or failures in the handling, separation, storage, transport, or disposal system, which should also be reported to the Infection Control Officer; this will be the basis for preventive measures to prevent recurrences.

- liaise with the WMO and the advisers (Infection Control Officer, Chief Pharmacist, and Radiation Officer) to maintain the highest standards;
- participate in staff introduction to, and continuous training in, the handling and disposal of health-care waste;
- liaise with Department Heads to ensure coordination of training activities, other waste management issues specific to particular departments, etc.

Infection Control Officer

The Infection Control Officer should liaise with the WMO on a continuous basis and provide advice concerning the control of infection and the standards of the waste disposal system. His or her duties are to:

- identify training requirements according to staff grade and occupation;
- organize and supervise staff training courses on safe waste management;
- liaise with the Department Heads, the Matron, and the Hospital Manager to coordinate the training.

The Infection Control Officer also has overall responsibility for chemical disinfection, sound management of chemical stores, and chemical waste minimization.

Chief Pharmacist

The Chief Pharmacist is responsible for the sound management of pharmaceutical stores and for pharmaceutical waste minimization. His or her duties are to:

- liaise with Department Heads, the WMO, the Matron, and the Hospital Manager, giving advice, in accordance with the national policy and guidelines, on the appropriate procedures for pharmaceutical waste disposal;
- coordinate continuous monitoring of procedures for the disposal of pharmaceutical waste;
- ensure that personnel involved in pharmaceutical waste handling and disposal receive adequate training.

The Chief Pharmacist also has the special responsibility of ensuring the safe utilization of genotoxic products and the safe management of genotoxic waste.

Radiation Officer

The duties and responsibilities of the Radiation Officer are the same as those of the Pharmaceutical Officer but relate to radioactive waste.

Supply Officer

The Supply Officer should liaise with the WMO to ensure a continuous supply of the items required for waste management (plastic bags and containers of the right quality, spare parts for on-site health-care waste treatment equipment, etc.). These items should be ordered in good time to ensure that they are always available, but accumulation of excessive stores should be avoided. The Supply Officer should also investigate the possibility of purchasing environmentally friendly products (e.g. PVC-free plastic items).

Hospital Engineer

The Hospital Engineer is responsible for installing and maintaining waste storage facilities and handling equipment that comply with the specifications of the national guidelines. She or he is also accountable for the adequate operation and maintenance of any on-site waste treatment equipment and is responsible for the staff involved in waste treatment, ensuring that:

- staff receive training in the principles of waste disposal and are aware of their responsibilities under the hospital waste management plan;
- staff operating on-site waste treatment facilities are trained in their operation and maintenance.

5.4.3 Assessment of waste generation

In order to develop a waste management plan, the waste management team needs to make an assessment of all waste generated in the hospital. The WMO should be responsible for coordinating such a survey and for analysing the results.

The waste should be categorized according to the classification system specified in the national guidelines (or as described in this handbook if no such guidelines are available). The survey should determine the average daily quantity of waste in each category generated by each hospital department. Special care should be taken to assess the likelihood of peak production—the occasional generation of extraordinary quantities of wastes. For example, the impact of epidemics and other emergencies that affect the quantities of waste generated should be estimated. Account should also be taken of potential slack periods or other unusual circumstances that may cause significant variations in waste quantities. Survey results should include an assessment of any future changes in hospital designation, departmental growth, or the establishment of new departments. Table 5.1 shows a sample sheet for the daily assessment of waste, by waste category, for each waste collection point.

Data from the waste production survey should form the basis on which an appropriate waste management plan can be developed.

5.4.4 Development of a waste management plan

During development of the waste management plan, every member of the waste management team (WMT) should carry out a review of existing waste management arrangements in his or her area of responsibility. Existing practices should then be evaluated in the light of the national guidelines and recommendations made to the WMO on how the guidelines can be implemented in each area. On the basis of the waste generation survey and these recommendations, the WMO should prepare a draft discussion document for the WMT. This discussion document should include details of the new waste management system as outlined in Box 5.2. It should be divided into sections addressing the following issues:

- present situation (waste management practices, personnel and equipment involved)
- quantities of waste generated
- possibilities for waste minimization, reuse, and recycling
- waste segregation

Table 5.1 *Sample sheet for assessment of waste generation^a*

Name of the health-care facility: Week:

Waste collection point: department/location	Waste category ^b (specify)	Quantity of waste generated per day (weight and volume)													
		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
		kg	litre	kg	litre	kg	litre	kg	litre	kg	litre	kg	litre	kg	litre

^aAdapted from Christen (1996), with permission.

^bInfectious waste, pathological waste, sharps, pharmaceutical waste, cytotoxic waste, waste with high heavy-metal content, radioactive waste.

- on-site handling, transport, and storage practices
- identification and evaluation of waste treatment and disposal options (on- and off-site)
- identification and evaluation of the options, and associated costs
- record-keeping
- training
- estimation of costs relating to waste management (actual situation and proposed options)
- strategy for implementation of the plan.

The draft discussion document should be prepared in consultation with all members of the WMT and their staff. Officials from the local authority and from the national government agency responsible for the disposal of health-care wastes should be invited to assist in the development of the waste management plan (WMP). The WMP should be based on the discussion document and should be presented to a meeting of the WMT for approval. The WMO should amend the draft discussion document in the light of comments made by the WMT. When full agreement has been reached, the document should be designated as the hospital WMP.

The WMO should now complete the WMP with a diagram that outlines the line management structure and the liaison paths, and a list of names and telephone numbers of responsible personnel to be notified in the event of an emergency.

Box 5.2 Details for inclusion in the waste management plan

Location and organization of collection and storage facilities

1. Drawings of the establishment showing designated bag-holder sites for every ward and department in the hospital; each bag site shall be appropriately designated for health-care waste or other waste.
2. Drawings showing the central storage site for health-care waste and the separate site for other waste. Details of the type of containers, security equipment, and arrangements for washing and disinfecting waste-collection trolleys (or other transport devices) should be specified. The document should also address eventual needs for refrigerated storage facilities.
3. Drawings showing the paths of waste-collection trolleys through the hospital, with clearly marked individual collection routes.
4. A collection timetable for each trolley route, the type of waste to be collected, the number of wards and departments to be visited on one round. The central storage point in the establishment for that particular waste should be identified.

Design specifications

5. Drawings showing the type of bag holder to be used in the wards and departments.
6. Drawings showing the type of trolley or wheeled container to be used for bag collection.
7. Drawings of sharps containers, with their specification.

Required material and human resources

8. An estimate of the number and cost of bag holders and collection trolleys.
9. An estimate of the number of sharps containers and health-care waste drum containers required annually, categorized into different sizes if appropriate.
10. An estimate of the number and cost of yellow and black plastic bags to be used annually.
11. An estimate of the number of personnel required for waste collection.

Responsibilities

12. Definitions of responsibilities, duties, and codes of practice for each of the different categories of personnel of the hospital who, through their daily work, will generate waste and be involved in the segregation, storage, and handling of the waste.
13. A definition of the responsibilities of hospital attendants and ancillary staff in collecting and handling wastes, for each ward and department; where special practices are required, e.g. for radioactive waste or hazardous chemical waste, the stage at which attendants or ancillary staff become involved in waste handling shall be clearly defined.

Procedures and practices

14. Simple diagram (flow chart) showing procedure for waste segregation.
15. The procedures for segregation, storage, and handling of wastes requiring special arrangements, such as autoclaving.
16. Outline of monitoring procedures for waste categories and their destination.
17. Contingency plans, containing instructions on storage or evacuation of health-care waste in case of breakdown of the treatment unit or during closure down for planned maintenance.
18. Emergency procedures.

Training

19. Training courses and programmes.

5.4.5 Implementation of the waste management plan

Implementation of the WMP is the responsibility of the Head of Hospital. It involves the following steps:

1. Interim measures, to be introduced as a precursor to complete implementation of the new waste management system, should be developed by the WMO, in collaboration with the WMT, and be appended to the plan. A bar chart should also be added, showing dates of implementation of each part of the new system.
2. Provision for future expansion—of the hospital or of waste storage facilities—should be made.
3. The Head of Hospital appoints personnel to the posts with responsibility for waste management. Notices of these appointments should be widely circulated and updates should be issued when changes occur.
4. The Infection Control Officer should organize and supervise training programmes for all staff, in collaboration with the WMO and other members of the WMT. Initial training sessions should be attended by key staff members, including medical staff, who should be urged to be vigilant in monitoring the performance of waste disposal duties by non-medical staff. The Infection Control Officer should choose the speakers for training sessions and determine the content and type of training given to each category of personnel.
5. As soon as the actions in 1–4 have been completed and necessary equipment for waste management is available, the operations described in the WMP can be put into practice.
6. The WMT should review the WMP annually and initiate changes necessary to upgrade the system. Interim revisions may also be made as and when necessary.
7. The Head of Hospital should prepare an annual report to the national government agency responsible for the disposal of health-care wastes, providing data on waste generation and disposal, personnel and equipment requirements, and costs.

Failures in the waste handling, segregation, storage, transport, or disposal system, or waste management incidents that result in injury should be reported as soon as possible to the Infection Control Officer.

5.5 Management of health-care waste from scattered small sources

5.5.1 Basic principles

Improvement in health-care waste management should start in large hospitals, then extend to smaller health-care establishments, and finally to the diverse sources of small quantities of waste.

The heads of health-care establishments are responsible for health protection and safety at the workplace and bear legal responsibility for the safe disposal of health-care waste generated in their establishments. They should therefore take all reasonable measures to:

- prevent health-care waste from causing environmental pollution or adverse effects on human health;
- ensure that health-care waste is adequately segregated (as outlined in section 7.1) and safely packed, especially in the case of sharps which should be packed in puncture-proof containers;

- ensure that bags or containers of health-care waste are handled only by those officially licensed to transport and/or dispose of such waste;
- ensure that a transfer note describing the waste is handed to the recipient when waste is transferred;
- check that the driver of the collection vehicle is aware of the rules governing transport of hazardous goods.

The options for safe collection and disposal of health-care waste from small sources, which do usually not treat their own waste, include the following:

- the local authority or an authorized private contractor collects the waste for treatment at a local hospital incinerator or other facility;
- an authorized private contractor collects and treats the waste at the contractor's treatment facility;
- the local authority or an authorized private contractor collects the waste for treatment at a municipal waste incinerator or for treatment by another disinfection or confinement process.

All waste should be clearly marked with self-adhesive or tie-on labels indicating point of production (hospital and department), content, and—in the case of transport off-site—certain additional information (see also sections 7.2 and 7.3). Any contract for collection by a private registered health-care waste carrier should identify the disposal or treatment facility to be used. The carrier should, whenever possible, use dedicated vehicles for the collection of infectious waste. Collection of health-care wastes from their source should be regular and frequent. Any storage of waste before destruction or collection for off-site disposal should be in a secure location designated for the purpose.

Private practitioners, health-care research establishments, haemodialysis centres, veterinary practices, and nursing homes should establish infection control policies. All employees should be able to understand the policy, which should contain details of the procedures to follow in case of a needle-stick injury or exposure to infected blood.

5.5.2 Private medical or dental practitioners

Private medical and dental practitioners represent numerous, scattered sources of health-care waste, including contaminated sharps. They should establish certain rules for dealing with health-care waste:

- Arrangements should be made for waste segregation (see section 7.1) and collection; specific containers for sharps and infectious waste will usually be needed.
- When an injection is carried out at a patient's home, the practitioner is responsible for disposing of syringes, needles, and all other items used.
- Practitioners' employees should be informed of policy and procedures of health-care waste disposal, including any special arrangements with hospitals, clinics, or local authorities, and should be appropriately trained.

5.5.3 Research activities

Waste produced in research areas can range from small items such as culture dishes to large animal carcasses, and may also include soiled

beddings and sharps. The waste is often infectious or even highly infectious. Heads of research units are responsible for the training of personnel and for ensuring correct segregation of waste. Because of the nature of the waste generated in research establishments, the following precautions should be taken:

- Highly infectious waste should be autoclaved or incinerated on site whenever possible and should be handled only by trained and authorized staff.
- If on-site treatment is impossible or uneconomical, cooled storage facilities should be provided and there should be a regular collection by a contractor who has suitable incineration facilities.
- Animal carcasses that cannot be destroyed immediately after experimentation should be stored at a temperature below -20°C .

Any contractual arrangement for research by workers outside the establishment should include adequate provisions for the safe handling and disposal of any waste.

Biotechnology laboratories may generate waste that presents special hazards (such as genetically modified material) and that should in no circumstances be released into the environment. Management of such waste needs additional precautions that are beyond the scope of this handbook.

5.5.4 Nursing homes

Waste from nursing homes will consist mainly of swabs, soiled dressings, sharps, stoma bags, and incontinence pads. Suitable containers will be required for infectious waste and sharps. The head of each establishment is responsible for the training of all personnel and for implementing segregation practices.

5.5.5 Home treatment

The amount of health-care waste produced at an individual patient's home will be very small. Most of it will be handled by the patient or by his or her family. It will mainly consist of items contaminated with blood (e.g. from haemodialysis patients equipped with machines), incontinence pads, dressings, or syringes and hypodermic needles (e.g. from diabetics).

Sharps may be packed in small puncture-proof containers and then disposed of with the general refuse. Diabetics should be provided with such containers or boxes for hypodermic needles and should return them, when full, to the physician in charge of treatment. Health-care waste other than sharps should be double-packed in plastic bags and then disposed of with household refuse. Health-care waste produced by chemotherapy treatments at home, such as needles from infusion sets or syringes, and protective gloves, contaminated with cytotoxic drugs, should be packaged safely and transferred to the treating physician. In some countries, separate collection services are provided for health-care waste produced at home or in hotels.

5.5.6 Ambulance services

Ambulance services and the hospitals they serve should have a policy for the safe disposal of health-care waste. Ambulances should be equipped

with puncture-proof containers of appropriate size, mainly for infectious waste and sharps. The sealed yellow bags and containers should be deposited at the hospital emergency department on arrival and can then be dealt with by that department. Ambulance staff should be trained in the safe handling of health-care waste.

5.5.7 Veterinary centres

Waste from health-care research activities involving animals should be handled in the same way as waste arising from human health-care. Waste from veterinary health-care activities is not addressed in this handbook.

References and suggested further reading

- Christen J (1996). *Dar es Salaam Urban Health Project. Health-care waste management in district health facilities: situational analysis and system development*. St Gallen, Switzerland, Swiss Centre for Development Cooperation in Technology and Management (SKAT).
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- WHO/CEPIS (1994). *Guía para el manejo interno de residuos sólidos hospitalarios. [Guide to the internal management of solid hospital waste.]* Lima, World Health Organization/Pan American Sanitary Engineering and Environmental Sciences Center.