



TRAINING MANUAL 2 ISWM TECHNOLOGY APPLICATION

Module 2-6: Healthcare Waste Management



Prepared by the International Consortium
GTZ-ERM-GKW



This Training Manual has been prepared for advice and assistance of the staff in ministries of health and healthcare institutions, particularly from those who are responsible for introducing better waste management practices in medical institutions so as to reduce infection risks and improve hygiene. The information provided is of a practical nature.



AIMS OF HEALTHCARE WASTE MANAGEMENT

Correct management of hospital waste must be based upon consideration of various aspects, including

- the health and safety of all persons within the hospital, (staff, patients and visitors), and
- the protection of the population outside the hospital from contagious diseases.

The specific biological, physical and chemical properties of the waste with regard to its potential for harming the environment, and the ethical and aesthetic issues that are involved, must also be considered.

Every healthcare establishment, no matter what size, is intended to be a place of healing. This is the fundamental purpose of a health care system. The ability of an institution to provide a good standard of health care is undermined if there is a poor standard of hygiene and a high risk of avoidable infection to patients and medical workers. Achieving a good standard of cleanliness in health care institutions is an important component in controlling infection.

Correct treatment of Special Healthcare Waste (SHW) must be based upon consideration of various aspects, including the health and safety of all persons within the healthcare establishments, (staff, patients and visitors), and the protection of the population outside from contagious diseases. The specific physical and/or chemical properties of the waste with regard to its potential for harming the environment, and the ethical and aesthetic issues that are involved must also be considered.



WHAT IS HEALTHCARE WASTE?

Healthcare waste is generated by large and small healthcare facilities, home healthcare as well as research and industrial operations and can be classified in three main categories:

- Reusable or recyclable material
- Common Waste similar to Solid Municipal Waste
- Special Healthcare Waste

Special Healthcare Waste (SHW) presents a high risk to human health and the environment because of the hazardous characteristics of some of its components.



The term "healthcare waste" is used to refer to all residues produced in healthcare establishments during implementation of their institutional functions; these residues can be more or less hazardous depending on their origin within the healthcare establishments.

Healthcare Waste similar to Solid Municipal Waste (SMW) includes all solid waste without infectious-contagious, chemical, cytotoxic or radioactive waste produced in healthcare establishments. Such Common Waste can be disposed of together with municipal waste for instance in a landfill, after removal of material for reuse or recycle took place.

Waste produced in medical departments is one of the sources of infection. Its potential to cause infection increases if it is not properly handled and removed regularly from each medical area. It is not the only source of infection but one that can be easily avoided with a little effort and forethought. It is thus surprising that health care institutions in many middle- and lower-income regions have few or no arrangements for the organized collection and disposal of the waste that they produce.



LEGAL REQUIREMENTS

One of the needs of an orderly healthcare waste management is to set up a legal structure which regulates and defines the following themes:

- Classification of healthcare wastes
- Internal management of waste in healthcare institutions
- External management of waste from healthcare institutions
- Permitted treatment and disposal methods
- Specifications for the selection of healthcare waste handling equipment and material
- Determination of responsibilities.



With reference to the legal and institutional situation, there is a need of legislative framework, by-laws and guidelines for the regular management of healthcare wastes, because SHW are internationally classified as hazardous wastes and therefore require more attention than ordinary domestic wastes.

The objective of each Health Ministry should be to set up a legal structure that will be maintained and updated by an official legislation unit and which should regulate and define the following themes:

Precise definition of all terms to describe the management of healthcare waste

Classification of healthcare wastes

Internal management of waste in healthcare institutions

External management of waste from healthcare institutions

Permitted treatment methods

Specifications for the selection of healthcare waste handling equipment and material

Determination of responsibilities

Fines and penalties for non-compliance.

According to the principles to avoid infectious disease transmission, general guidelines for the management of healthcare wastes have to be elaborated, taking into account the requirements for a safe, hygienic and environmentally sound healthcare waste management in the following sectors:

Segregation

Marking

Collection

Internal Transportation

Storage

External Transport

Treatment

Disposal.



CLASSIFICATION OF HEALTHCARE WASTE

From this, the necessity arises to classify the various types of waste into groups according to the management techniques which experience has shown are appropriate:

Waste similar to Solid Municipal Waste

Type A: Recyclable Waste

Type B: Common Waste

Special Healthcare Waste (SHW)

Type C: Infectious Waste

Type D: Anatomic Waste

Type E: Other Hazardous Waste



According to the World Health Organisation (WHO), HW consists of two main categories:

Waste similar to Solid Municipal Waste (SMW) and
Special Healthcare Waste (SHW).

Healthcare Waste similar to SMW includes all solid waste **without** infectious-contagious, chemical, cytotoxic or radioactive waste. Such HW similar to SMW can be disposed of together with municipal waste for instance in a landfill, after removal of material for reuse or recycle took place.

The SHW consists of several different subcategories. In the European Waste List SHW from **natal care, diagnosis, treatment or prevention of disease in humans** are defined by a six digit code as follows:

Code 18 01 03*: Waste whose collection and disposal is subject to special requirements in view of the prevention of infection

Code 18 01 06* : Chemicals consisting of or containing dangerous substances

Code 18 01 08*: Cytotoxic and cytostatic medicines

Code 18 01 10* : Amalgam waste from dental care

According to this list for instance used dressings, plaster casts, linen, disposable clothing, diapers as well as medicines other than those mentioned in 18 01 08 are considered waste whose collection and disposal is not subject to special requirements in view of the prevention of infection.

For the concerned healthcare personnel the necessity arises to classify the various types of waste into groups according to the management techniques which experience has shown are appropriate:

Waste similar to Solid Municipal Waste

Type A: Recyclable Waste

Type B: Common Waste

Special Healthcare Waste (SHW)

Type C: Infectious Waste

Type D: Anatomic Waste

Type E: Other Hazardous Waste



WASTE SIMILAR TO SOLID MUNICIPAL WASTE

The waste management process begins before wastes are produced with avoidance and source reduction. Waste avoidance means that priority is given to long-life or multi-use products and packaging instead of disposable articles.

Type A: Recyclable Waste

Waste recovery comprises all wastes reusable or recyclable generated within the healthcare centre by administration, kitchen, warehouses, workshops etc.

Type B: Common Waste

Waste similar to domestic waste whose collection and disposal is not subject to special requirements in view of the prevention of infection .



The guiding principle for HW management is the prevention of waste, and possibilities for reuse and recycling of waste should be investigated. A considerable reduction of waste can also be achieved if disposable products such as certain clothes, kitchenware, are banned in hospitals. Thus modification of purchasing procedures at hospitals is required to further prevent the generation of waste.

Waste avoidance also means that objects are reused for purposes which otherwise would require the acquisition of new products. One example for this is the reuse of empty plastic water-bottles or detergent-containers for the collection of needles and sharps, instead of buying special containers for this purpose.

Therefore the quantity of waste produced by a healthcare institution depends not only on the size, type and quantity of services offered but also on the willingness of the hospital administration, the education and training of the hospital personnel, the standard of services, the infrastructure of the hospital and the local traditions.

Unfortunately, most healthcare authorities and hospital administrations have not planned or initiated special measures in terms of waste recycling or waste avoidance. If there are particular recovery activities, they are private initiatives. Therefore, there is a strong need for campaigns to develop and raise the awareness of the necessity of waste avoidance and waste recycling.

Waste **Type A** recovery comprises all **wastes reusable or recyclable** generated within the healthcare centre by administration, kitchen, warehouses, workshops etc.

The other type of waste, **Type B**, is healthcare **waste similar to Solid Municipal Waste**. It is the biggest fraction within HW and can be disposed of together with municipal waste for instance in a landfill, after removal of material for reuse or recycle.



CLASSIFICATION OF SHW

Type C: Infectious Waste



Potentially infectious-contagious waste that requires special management inside and outside the healthcare establishments, corresponding to EU Code 18 01 03:

- All waste from isolation wards
- Wastes from clinical laboratories for micro-biological and infectious-serological investigations
- Wastes which constitute a real risk of infection when being disposed of, such as used needles and sharp objects
- Waste from dialysis stations with risk patients
- Bacteria and virus retaining air filters.

A more detailed description of the SHW **Type C, infectious-contagious waste**, can be given as follows:

: Discarded materials from health-care activities on humans or animals which have the potential of transmitting infectious agents to humans. Such material can result from diagnosis, treatment, or prevention of disease, which have been in contact with blood and its derivatives, tissues, tissue fluids or excreta. Wastes from infection isolation wards shall be completely included in this group. Sharps, whether contaminated or not, should be considered as subgroup of infectious healthcare waste. It includes syringe needles, scalpels, infusion sets, knives, blades, contaminated broken glass.

CLASSIFICATION OF SHW



Type D: Anatomic Waste

This waste type requires special treatment, not only to prevent infections, but also for ethical reasons. This group comprises:

- Recognisable parts of human bodies generated in operating theatre, delivery room, morgue, autopsies, etc.
- Corps of infected animals used for micro-biological experimentation
- Blood and blood containers and other body fluids from infected patients

Waste **Type D, anatomic waste**, consists of recognisable body parts. This waste type requires special treatment, not primarily in order to prevent infections, but rather for ethical reasons. This group comprises recognisable parts of human bodies generated in operating theatres, delivery rooms, morgues, autopsies, etc. Examples are organic tissues, placentas and amputated limbs, etc.

It includes also blood and blood containers and other body fluids from infected patients as well as corps of infected animals used for micro-biological experimentation



CLASSIFICATION OF SHW

Type E: Other Hazardous Waste

This group covers waste types that, for legal reasons or because of their physical or chemical properties, require special management, such as:

- Radioactive wastes that can only be handled by authorised personnel
- Cytotoxic and cytostatic medicines
- Hazardous chemical wastes
- Amalgam waste from dental care
- other hazardous wastes



Other SHW , resumed in **Type E** , are:

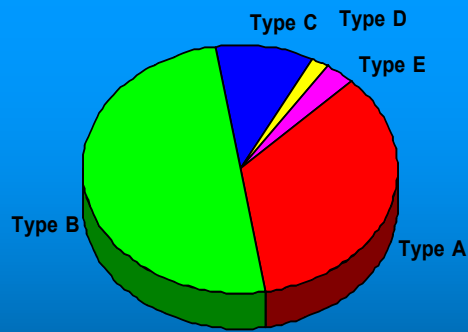
Cytotoxic and cytostatic medicines: Consisting of, or containing substances with genotoxic properties, including cytotoxic and cytostatic drugs, and genotoxic chemicals.

Chemical materials: Consisting of/or containing hazardous chemical substances. Examples are laboratory chemicals; film developer; disinfectants expired or no longer needed; solvents, cleaning agents.

Heavy metals: Consisting of both materials and equipment with heavy metals and derivatives. Examples are batteries, thermometers and amalgam waste from dental care.

Radioactive materials which include: liquids from radiotherapy or laboratory research; contaminated glassware, packages or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides.

ROUGH REPARTITION OF THE HEALTHCARE WASTE TYPES



Type A: Recyclable Waste
Type B: Common Waste

Type C: Infectious Waste
Type D: Anatomic Waste
Type E: Other Hazardous Waste



The figure shows the quantitative repartition of the healthcare waste types. The average quantities repartition is the result of measurements in hospitals in several countries with different standards like: Germany, Argentine, Colombia, Venezuela, China, Sierra Leone and Ghana.



REQUIREMENTS OF SHW MANAGEMENT



Based on this classification the training module will present the requirements for management of **Special Healthcare Waste (SHW)**, in particular :

- Segregation and collection with appropriate packaging and marking
- Transport and storage within the hospital
- Transport outside the Hospital
- Treatment methods
- Monitoring and Control
- Instruction and Training of Personnel.

An important tool for each healthcare establishment is a waste management plan, which is specific for each hospital. It addresses above topics and describes daily routines for collection, handling, separation and packaging of the different categories of waste. Facility managers should ensure that this plan is in place with adequate budget and personnel to implement it.

Poor standards of hygiene can be reduced significantly by adopting some straightforward steps to segregate the main types of waste, collect and store them properly, and remove them regularly from medical areas.

A waste management plan should be prepared before a new system is put into operation to ensure that the practical arrangements have been properly thought out and the necessary resources have been accurately estimated.

Some health care institutions are under considerable external pressure to improve their waste management since poorly handled, treated and deposited wastes are highly visible and likely to attract the attention of health authorities and the general public. In these cases the tendency is to start introducing improvements, using donated resources such as bins and bags, with only a minimum of forward planning.

Once a waste management system is in operation and is seen to be reasonably effective, the management of the institution may be more receptive to making a retrospective waste management plan, in order to define the resources required to sustain the system.

EXAMPLES OF UNHYGIENIC HEALTHCARE WASTE MANAGEMENT INSIDE A HOSPITAL



In a medical department where all health care waste is mixed together and perhaps also stored and removed in a haphazard and unsatisfactory way, an obvious potential for injury and infection exists. In many healthcare establishments the lack of standards, awareness, and proper allocation of resources subject both patients and hospital staff to avoidable risks. These take the form of:

Use of inappropriate receptacles without lids and without bags

Lack of hygiene, failure to wash and disinfect receptacles and internal transport devices

Placing of disposable syringes with attached needles and of sharps together with other blood covered objects loosely in the receptacles

Lack of appropriate one-way collection and packaging materials for waste transportation

The infectious and hazardous wastes are not identified by bags of different colour or with labels


Internal transport of waste under unhygienic and unsanitary conditions.

The pictures show some examples and speak for themselves. Waste bags should not be hand-carried around a hospital since this increases the risk of injury to the legs, arms and torso from incorrectly disposed of sharps or other items.



SEGREGATION AND COLLECTION OF SHW

Waste Types C, D and E should always be collected in disposable receptacles that meet the following requirements:

- Leak-resistant and sealable to prevent emission of micro-organisms
- Impervious to moisture and non-transparent
- Different colour and marked with the biohazard label 
- Of sufficient strength to prevent tearing or bursting under normal conditions of use and handling
- **The material must be appropriate for the treatment**

Plastic bags with a thickness of 100 microns and a size of approx. 60 x 100 cm fulfil these conditions.



Effective waste segregation is the obligation of hospital staff. The most appropriate way of identifying the categories of health-care waste is by sorting the waste into colour-coded plastic bags or containers. Generally all healthcare waste should be separated by the medical and cleaning staff into four categories with containers of different colour:

recyclable materials, type A, usually put into blue bags;

common waste, type B, usually put into black bags;

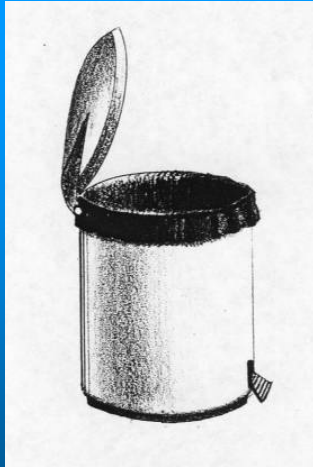
potentially infectious health care waste, type C, usually put into yellow or red bags with the label for “biohazard”;

used sharps, type C, put into rigid containers (if possible yellow or red too).

WHO recommends black for general waste and yellow for potentially infectious wastes. Ultimately all bags, containers, bag holders and trolleys should be either black or yellow to reinforce the separation of these two types of waste. Once separated, the two waste streams should be handled and disposed of separately and not recombined.

Current principles of waste management are supported through paying attention to procurement of products. If wastes are incinerated, particular aspects like replacing certain products made of PVC by other products, because of their property of generating hazardous gases during the burning process, should be considered. Thus modification of purchasing procedures at hospitals is required to further prevent the generation of secondary effects or to enable certain waste treatment processes.

SEGREGATION AND COLLECTION OF SHW



Metallic bag-holders with lid

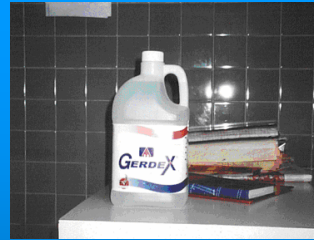
Every site within the hospital at which waste is generated must be equipped with a sufficient number of waste containers, and emphasis should be placed on the need to segregate "risk waste" from other waste and to use appropriate packaging and marking.

For potentially infectious wastes a possible transmission route is by airborne dispersal of pathogens released from body fluids contaminating the wastes. Therefore, the first simple measure to reduce the risk of airborne transmission is to cover all waste bins and avoid using open containers and wastebaskets.

Circular or rectangular metallic bag-holders with lid and the corresponding disposable bags placed within should be situated at strategic places of each department. To reinforce the use of a colour coding system, all bag holders, pedal bins and waste transporting trolleys should be either black or yellow. Where this is not possible, clear signs should be placed on the bag holders, bins and trolleys to indicate whether they should be used for general waste or infectious waste.

The top of the bag is folded outward over the rim in order to prevent its soiling. Sharp objects must be placed in puncture-resistant containers such as disposable plastic bottles or cardboard boxes, before being disposed of in the bags.

SEGREGATION AND COLLECTION OF SHW



Recycled container for sharps and needles



Mini containers for sharps and needles



Closing bag with wire sling

The most well known transmission route for infections from health care waste is from needle stick injuries caused by sharps contaminated with blood. This is why loose sharp items (e.g. needles and blades) should not be placed directly in plastic bags or similar containers that are easily punctured.

Sharps should all be collected together in special containers, regardless of whether or not they are contaminated. Sharps containers should be used to contain needle and syringe assemblies, small ampoules, razor blades, scalpel blades, infusion needles, lancets and broken glass.

Containers should be puncture-proof (usually made of high-density plastic) and fitted with covers. They should be rigid and impermeable so that they safely retain not only the sharps but also any residual liquids from syringes.

Where commercial plastic or metal containers are unavailable or too costly, containers made of dense cardboard or used emptied plastic bottles of liquids like detergents are recommended. To discourage abuse and to protect the environment, containers should be tightly closed and difficult to re-open or break.

The filled bags are closed off using a plastic strip or wire sling which, once fastened in place, cannot be re-opened. Then it is removed from the bag holder and placed at the transfer area for its removal by the collection service. Neither re-use of the disposable receptacles nor compression of the waste are permissible. No bag or sharps container should be more than three quarters full when it is replaced. It should preferably be replaced when it reaches two thirds full. The reason for this is to reduce the risk of plastic bags splitting open and of an injury from a protruding sharp item in



TRANSPORT OF SHW WITHIN THE HOSPITAL

The waste should be removed each day from the transfer areas in the wards and be taken to a central storage place.

This transport must be done with care in order to prevent the rupturing or opening of the bags, resulting in release of harmful pathogens into the environment.

Rubber-wheeled carts with a bin made of plastic or non-rusting metal or two-wheeled 240 litre standard container should be used for this.

These bins or containers should have a smooth surface for easy cleaning and disinfecting.



The transfer area on the wards for placing the filled bags should be set apart from other facilities and be sufficiently well ventilated. The waste should be removed each day from the transfer areas and taken to a storage place. This must be done with care in order to prevent the rupturing or opening of the bags, resulting in release of harmful pathogens into the environment.

There should be a fixed schedule for the collection of waste bags and containers from each medical department. This is to ensure the regular removal of waste from each location and to avoid misunderstandings between medical staff and cleaning or housekeeping staff. The minimum frequency of waste removal should be once a day, and preferably at least once per working shift. There should be separate schedules and separate collection times for black bags and yellow bags/sharps containers.

If waste bags are carried out of the building to a central storage area in trolleys touring different medical departments, separate trolleys should be used for general waste and potentially infectious waste. Yellow and black bags should not be carried mixed in the same trolley. If both types of bag are carried this increases the possibility of wastes becoming mixed and being transported along inappropriate disposal routes.

Solid waste bags of Types A and B can be deposited in the containers used for domestic refuse.

Waste of bags of Types C and D must be transported to a special storage room. The carts used for internal transport of the waste must be regularly cleaned and disinfected.

No waste of Types B, C or D may be transported by using dump chutes or pneumatic conductive pipelines. The chimney effect associated with dump chutes can lead to aerogenic spread of germs in the hospital through possible escape of pathological germs at the dumping point.



TRANSPORT AND STORAGE OF SHW WITHIN THE HOSPITAL



Rubber-wheeled cart with a bin made of non-rusting metal



Two-wheeled 240-litre container



The use of rigid containers such as a two-wheeled 240-litre container with a lid is recommended for temporary storage within or near to the waste generating areas. Sealed and labelled bags containing SHW are placed in this container and then removed at the scheduled collection times by cleaning or housekeeping staff. The use of a rigid container as a temporary storage point avoids filled waste bags being piled on the floor where they could be knocked and split open.

One temporary storage container should be available to each medical department for potentially infectious waste. Sometimes more than one medical department on the same floor can share this temporary storage point. The temporary storage point should be located away from patient areas, for example in a sluice room or housekeeping room.



STORAGE OF SHW WITHIN THE HOSPITAL

Waste of Types C, D and E must be transported to a special enclosed space to which only authorised personnel has access and that meet the following requirements:

- capacity to deposit waste generated within one week
- lockable door with the international sign for clinical waste
- floors and walls are smooth, waterproof, and easy to clean and disinfect
- air-conditioning with air-filters, temperature below 15°C
- protective covers for all openings in order to prevent insects, rodents, birds, etc. from entering



Wastes types A and B are transported to central storage points. These are locations in special areas or in the grounds of a hospital where larger containers, e.g. 1.1 m³ four-wheeled bins, are used to store waste until it goes for final disposal by the municipal collection service. To ensure that waste is kept separated, the central storage containers for common waste should be grey or black or at least clearly marked “for general waste only”.

Waste of Types C and D must be transported to a special storage room. This depot must be situated so as not to affect other facilities of the hospital, such as kitchen, laundry, wards, etc., in any way. It must take the form of an enclosed space to which only authorised personnel have access.

In hot, arid and tropical areas all waste should be disposed of within 24 hours in the hot season and a maximum of 48 hours in the cool season. These time periods assume that central storage points are not refrigerated. If the depot room for SHW is air conditioned with a temperature below 15° C the waste stored must be picked up at least once a week. The depot area must be washed out afterwards each time.

The central storage points for the two waste streams should be geographically separate at a hospital site. Waste from the central storage points for general waste and potentially infectious waste from the special storage room should go to different final disposal facilities.



TRANSPORT OF SHW OUTSIDE THE HOSPITAL

For this purpose specially designed vehicles with the following features are requested:

- The waste loading part should be completely closed,
- The vehicles should be without any compaction facilities,
- The driver's cabin should be separated from the loading space
- The internal surfaces of the loading space should be made of stainless material and be smooth with all corners covered for easy cleaning,
- The vehicle should have the international sign for "Biohazard"



Technical, economical and environmental studies proved, that central treatment plants have considerable advantages in comparison with individual treatment by each generator of waste. Consequently waste Types C and D should be treated or disposed in central plants to which the waste must be transported by special collection tours.

It is recommended that the infectious waste be transported in specially designed vehicles which do not compress the waste and which have equipment which prevents the bags or the containers from sliding around during transport. The interior of the vehicle must be easy to clean and the floor have raised edges to retain any liquids that may escape from the bags, and it must be adequately ventilated.

The waste bags or the containers should be loaded and unloaded one-by-one with maximum care. It is recommended that the inside height of the loading compartment be such that workers can stand up straight.

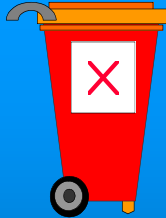


TRANSPORT OF SHW OUTSIDE THE HOSPITAL



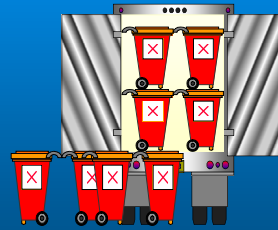
Transport vehicle for SHW with the logo for biohazard and a sufficient inside height of the loading compartment that workers can stand up straight.

TRANSPORT OF SHW OUTSIDE THE HOSPITAL



To reduce damage to the plastic bags during internal and external transport of SHW, transport can be carried out using returnable containers, for instance 240 litre standard waste containers of different colour and the sign for biohazard.

The filled containers should remain in the depot until they are transferred to the treatment plant or landfill cell and must be regularly cleaned and disinfected. The transport vehicles should be equipped with a system for raising and lowering the containers.



For storage and transport of SHW bags also returnable containers can be used. The slide shows the use of 240 litre standard containers with special colour and lockable lid.



TREATMENT METHODS FOR SHW

The waste types comprised in groups C, D and E, require special treatment which ensures elimination or isolation of their harmful properties.

- **Sterilisation** denotes killing of all living organisms in a material. When done thermally temperatures over 134°C are required.
- **Disinfection** or **decontamination** stands for the inactivation of potentially infectious agents. Thermally it will be effective at temperatures between 90 and 105°C.

The terms "sterilisation", "disinfection" and "decontamination" are used in discussions of medical waste. They need to be precisely defined in any regulation:

Sterilisation denotes killing of all living organism in a material. If it is done thermally, it needs temperatures over 134°C and is, in the opinion of experts, too restrictive for the treatment of all hospital waste materials.

Disinfection or decontamination stands for the inactivation of potentially infectious agents, but does not necessarily indicate that all organisms are killed. Thermally it is effective by temperatures between 90 and 105°C.

TREATMENT METHODS FOR SHW

Special Incineration

Incineration of SHW, both the infectious and the anatomic types, is a recognised and proven method of eliminating its hazardous properties.



Picture: Hoval Werke, Lichtenstein

Incineration of hospital waste, both the infectious and the anatomic types, is a recognised and proven method of eliminating its hazardous properties. This treatment method also has the advantages of a great reduction of the waste volume and the gaining of calorific energy which can be used for heating and steam production.

Various different technologies and patents for combustion are available on the market today, most of which are adequate. Basically, an incineration plant for hospital waste should satisfy the following requirements:

Combustion of the waste (dry, wet, organic or liquid) must be complete, in spite of the fact that their calorific values are very different. Glass, metals or materials with a very high calorific value such as plastics and alcohol, etc., contained in the waste, should not impair the function of the plant in any way.

The combustion process should be automated and exhaust gases must be within the limits established by the national emission standards or internationally recommended standards. The plant must be equipped with the measuring instruments necessary for operation and control

personnel from coming into contact with the combustion chamber.

It should have an automatically closing charging sluice to prevent operating



TREATMENT METHODS FOR SHW

Sterilisation by heat

This type of waste treatment is generally performed in autoclaves and recommended for microbiological cultures from laboratories.

Disinfection by steam

The application of heat by steam at about 100°C, thus transforming infectious wastes into common residues.

Microwave disinfection

Heating of SHW by microwave energy in stationary or mobile plants. Process requires shredding of the waste, a problematic practice.

Chemical disinfection

There are many techniques for disinfection by chemical means, but none of them has been proven to be effective for treatment of hospital waste.



Sterilisation by heat

This type of waste treatment is generally performed in autoclaves by steam treatment at high temperatures. It is recommended for microbiological cultures from clinical or research laboratories, which should not leave the investigation area without treatment. It is not adequate for the large total volume of hospital waste.

Disinfection by steam

Another type of thermal treatment used for pathological waste is the application of heat by steam at about 100°C, thus transforming infectious wastes into harmless residues. Two different systems are on the market:

Fractioned vacuum-process, the waste is collected in bags consisting of several layers of paper, with the inside reinforced by a layer of plastic. These bags are placed in a hermetically sealed chamber, into which steam is pressed, in order to inactivate the pathogens. To ensure that the steam penetrates to all parts of the charge of waste, the air in the chamber is first evacuated to create a vacuum prior to admitting the pressurised steam. This process is repeated several times following a set pattern lasting approximately 25 minutes. Once this treatment has been completed, the waste can be handled as common waste and disposed of in sanitary landfills for domestic waste.

Steam-flow-process, the waste is supplied in disposable containers or bags and disintegrated continuously by cutting devices to a defined particle size to render it accessible to the steam. The shredded solid waste is filled by a screw feeder into a vessel, where it is heated to the physically predefined temperature by steam. The entire process is controlled by a process control system such that the temperature, once it reaches the predefined level, is kept constant for the prescribed period of time. The steam flow process requires shredding of the waste, a procedure which may be problematic considering that the content of the waste containers can not be controlled before.

Microwave disinfection

Another method used to disinfect clinical waste in stationary or mobile plants is heating it by microwave energy. The waste material to be treated by microwaves must first be broken up and shredded to a certain size. As the microwave-process only works in the presence of water, and as clinical wastes are generally rather dry, the shredded waste mixture must be moistened beforehand by adding water and steam. In a pipe-shaped screw conveyor, the shredded and wetted material is continuously transported under microwave generators to be heated by irradiation. The screw conveyor speed is regulated by the waste temperature to guarantee the temperature-time schedule of decontamination. This process requires also shredding of the waste, a problematic practice as described before.

Chemical disinfection

There are many techniques for disinfection by chemical means, but none of them has been proven to be effective for treatment of hospital waste. Equipment is available for shredding or granulating and then disinfecting waste by means of disinfectant liquids; however, its use is generally quite problematic, and there is no guarantee that the disinfectant liquid used will penetrate to all parts of the batch of waste undergoing treatment. In addition, chemical liquids impose an additional burden on the environment as chemical disinfectants themselves are inherently hazardous chemicals. Therefore, the use of chemical disinfectants may actually increase personal and environmental risks associated with the management of hospital wastes.



TREATMENT METHODS FOR SHW

Controlled disposal in sanitary landfills

Studies have demonstrated the rapid death of selected human pathogens after burial in a sanitary landfill. The advantages of a controlled disposal of the infectious SHW in a sanitary landfill are obvious for the following reasons:

- It is the most economic method
- It is a recognised and proven method of disposing this waste fraction
- The technology is applicable to all infectious wastes and doesn't require pre-processing of the waste
- The control is easy and evident.



Human pathogens live and grow best in an environment that most closely resembles the conditions prevailing in the human body. Conditions in the exterior environment are, for the most part, not conducive to the survival and growth of human pathogens. Studies have demonstrated the rapid death of selected human pathogens after burial in a sanitary landfill and indicate that land filling can be a satisfactory mechanism for the treatment and disposal of hospital wastes.

For this reason, infectious hospital waste of Type C can be buried in sanitary landfills if certain precautions are taken.

DISPOSAL ON LANDFILL CELL

In situations where high technology treatment like incineration is impossible or not recommendable infectious waste can be disposed of in a special lot of sanitary landfill, which is constructed and used only for infectious SHW



The picture shows the disposing of SHW in a special cell of a sanitary landfill, where only SHW are disposed of and daily covered. The workers wear protective clothing and one can observe the transport containers in the transport vehicles.



TREATMENT METHODS FOR SHW

Burial in cemetery

Anatomic wastes Type D, human body parts and placentas, can be buried in certain areas of cemeteries.

Chemical-physical treatment

Type E wastes are not limited to healthcare establishments and its management is generally regulated by legislation covering industrial hazardous wastes.

Radioactive waste

Radioactive waste of healthcare establishments possesses generally a very low-level radioactivity and has a short half-life. Radioactive sealed sources must be returned to the manufacturer.



Burial in cemetery

In many countries burning of anatomic wastes Type D, human body parts, is not practiced for religious reasons. This type of SHW can be buried in certain areas of cemeteries or in the family grave by the relatives.

Chemical-physical treatment

Type E wastes will not be discussed in here as these wastes are not limited to hospitals and its management is generally regulated by legislation covering industrial hazardous wastes.

Radioactive waste

Radioactive waste produced in healthcare establishments possesses generally a very low-level radioactivity and has a short half-life. Low-level radioactive infectious waste (e.g. swabs, syringes for diagnostic or therapeutic use) should be collected separately from other waste and be stored safely until their radioactivity has decayed to the point that they are no longer considered radioactive and then be disposed of according to their other characteristics (e.g. chemical, infectious or general) and in conformity with national regulations.

The uniquely defined portion of radioactive material used in hospitals are the so-called radioactive sealed sources. Due to their limited life span, radioactive sealed sources used in radiation therapy need to be regularly removed from hospitals. Radioactive sealed sources are kept in an inventory at the manufacturer, so they are tracked over their life span. Additionally, they should be inventoried at the hospital to guarantee that they are returned to the manufacturer and their functionality is secured. The manufacturer is responsible for the final disposal of sealed sources at suitable repositories for radioactive waste.



INSTRUCTION AND TRAINING OF PERSONNEL

Awareness and training related to a safe management of SHW should cover the following aspects:

- Awareness raising of all staff about risks
- Training of personnel regarding separation practices
- Selection of appropriate equipment and materials
- Training regarding safe handling, storage and operation and maintenance of treatment technologies
- Display of written instructions for personnel



Good management of health care waste in hospitals means the effective segregation of waste and the separate handling and disposal of each segregated waste category. This cannot be achieved without the commitment of senior directors and the motivation of medical and support staff.

Improvements in medical areas can only be made if there is a commitment by the directors of a healthcare institution to deal decisively with the challenge posed by healthcare wastes. It is essential that they designate staff to be responsible for improving waste management and that they make available modest extra resources to ensure that these improvements can be maintained. Motivating medical staff, especially nurses and cleaners, is the key to setting up a new waste management system in each medical area.

The technological advances which have been made in health care call for control of microbiological contamination and hospital infections to be interdisciplinary, in other words involving

not only the physicians, as in the past, but instead spanning an entire group of professionals with different specialised tasks. Only this way is it possible to prevent infections stemming from poor handling of waste, an aspect which ought to be of great concern to all persons working in the field of medicine since it superimposes additional problems onto the basic task of treating patients in order to restore their health. For example doctors, nurses, cleaning and administrative hospital personnel should know how to separate infectious and other hazardous waste and how to handle it.

Preparation of manuals and audio-visual aids would be helpful. Personnel from all hospitals should be invited to courses and workshops. Furthermore research activities, for example through the university, should be encouraged.

Training for solid waste personnel should also be aimed at municipal collection and disposal services or their contracted private companies. Solid waste personnel on collection trucks or at disposal sites must be able to differentiate wastes by colour or other codes in order to handle each type properly. Programmes should include the following topics:

Categories of hospital waste and rapid assessment

Storage and collection methods and equipment

Treatment and disposal methods.

Consulting and advice should also be given to municipal and governmental officials in planning, operating and financing a hospital waste management programme with consideration of private alternatives.



SUPERVISION AND CONTROL

The control of the correct and hygienic management should be organised on two levels:

- 1. Level: Responsible self-control** by a qualified member of the own staff.
- 2. Level: Official control** by inspectors of the concerned Ministries, mostly:
 - Ministry of Health inside the hospitals
 - Ministry of Environment outside the healthcare establishments



Legislation alone is a useless instrument without an official organ to monitor its compliance and with the power to enforce it by punishing non-compliance. Therefore, together with an appropriate legislation regulating SHW management inside and outside the healthcare institutions, an effective control system must be established.

1. Level: Responsible self-control of the executing institutions by a qualified member of their own staff, both of the hospital for the internal sanitary handling, as well as of the municipal services for the management outside the hospital.
2. Level: Official control with the power of caution and sanction over all healthcare institutions by inspectors of the concerned Ministry.

Ideally, a health care institution should have a working infection control committee with delegated powers to impose changes. The enforcement of better practices in maintaining good hygiene is then exercised by specialist infection control staff, typically highly experienced senior nurses and other medical personnel. Where no formal system for infection control exists, the success of improving health care waste schemes is largely a matter of the determination of the head nurse in each medical department. There are many examples of where this has succeeded, but it is a less reliable approach than is normally achieved through the internal enforcement of infection control by specialist staff.



**Health is not everything,
but without health,
everything is nothing.**

German aphorism



Thank you for your attention!



This module aims to contribute to raise the hygienic standard in hospitals. Nobody should be afraid to go into a hospital with one disease and come back with two.

Thank you for your attention!