

GREEN HOSPITALS

CONCEPT MANUAL FOR IMPROVING INFRASTRUCTURE

SECTION 4

Best Practice: Healthcare Waste Services

Additional sections available - go to [EPOS' Green Hospitals](#) page to view all:

Section 1: Best Practice – Basic Planning Principles

Section 2: Best Practice – Building and Building Services Maintenance

Section 3: Best Practice – Water Supply and Wastewater for Health Facilities

Section 4: Best Practice – Healthcare Waste Services

Section 5: Best Practice – Environmental Cleaning Services

www.epos.de



www.etlog-health.com



www.giz.de



Developed as part of the 'Greening Hospitals Integrated Infrastructure Competence Project' in Tajikistan, co-funded by EPOS, ETLog and GIZ • December 2013 - October 2015

For further information contact:

EPOS Health Management • eposhq@epos.de • +49 (0)6172-930-370



This Concept Manual has been prepared in five sections within the framework of the 'Greening Hospitals — Integrated Infrastructure Competence Project' in Tajikistan, by the development partnership of EPOS Health Management and ETLog Health GmbH, as part of the part of the develoPPP.de programme that Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is implementing on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

The five sections are as follows:

- SECTION 1 — Best Practice: Basic Planning Principles
- SECTION 2 — Best Practice: Building & Building Services Maintenance
- SECTION 3 — Best Practice: Water Supply for Health Facilities
- SECTION 4 — Best Practice: Healthcare Waste Services
- SECTION 5 — Best Practice: Environmental Cleaning Services



Table of Contents

Introduction — Importance of Providing Healthcare Waste Management Services	5
Organization & Management of Services	7
• Roles & Responsibilities	9
• Human Resource Management	11
• Budgeting	13
Providing Healthcare Waste Management Services	15
• Waste Classification & Segregation	17
• Healthcare Waste Segregation Point	29
• Logistics of Healthcare Waste Management	38
• Disposal & Treatment of Healthcare Waste	44
Quality Management of Healthcare Waste Services	49
Further Reading	55

List of Figures

Fig. 1 Example Waste Segregation Point/ ETlog	30
Fig. 2 Example Waste Segregation Layout/ ETlog	31
Fig. 3 Sharps Bucket	32
Fig. 4 Sharps Bin	32
Fig. 5 Waste Bag Holder	32
Fig. 6 Multi-coloured Waste Bags	32

Fig. 7 Waste Segregation Posters	34
Fig. 8 Example Healthcare Waste Labelling/ ETlog.....	36
Fig. 9 Overview of Healthcare Waste Logistical System.....	38
Fig. 10 Example Hazardous Healthcare Waste Disposal Scheme Vietnam/ ETlog	45
Fig. 11 Decision Making Path for the Treatment of Infectious Waste ...	46

List of Tables

Table 1 International Waste Colour Coding Chart	35
Table 2 Best Practice Waste Streams	39

Introduction—

Importance of Providing Healthcare Waste Services

The adequate management of Healthcare Waste (HCW) is still a new subject in Central Asia. There are hardly any existing integrated waste management concepts. The transmission of disease from healthcare waste occurs mainly through injuries from contaminated sharps and through inhalation of bio-aerosols. Besides Tuberculosis (TB), blood borne diseases - such as Hepatitis B (HBV), Hepatitis C (HCV), and the Human Immunodeficiency virus (HIV) - are infections of particular concern. Toxic risks arise among others from reagents (particularly laboratory reagents), drugs and mercury thermometers.

The different categories of waste normally generated from a healthcare setting are non-risk/non-hazardous solid waste (domestic waste), as well as risk/hazardous waste (healthcare waste), such as infectious waste, sharps, pharmaceuticals, chemicals and other potential dangerous waste streams. Included in domestic waste is also 'green waste' from grounds maintenance and construction and demolition waste from building activities.

The personnel responsible for healthcare waste management, i.e. for waste minimization, collection, transport, storage, treatment and disposal, will require access to relevant professional advice and the implementation of a sound management system adequate for the purpose. Risk assessment is required in the context of the staff and the environmental protection.

Due to the changes in healthcare processes, the volume of waste generated is steadily increasing. Those responsible for healthcare waste are increasingly challenged to investigate further the management of this waste. The aim,

where possible, should be to substantially reduce the volume of waste. Special consideration should be given to hazardous waste, because of the higher risks posed and the cost intensive nature of its specialist treatment and disposal. In particular, sound and practical systems of segregation are required.

Improvement of Healthcare Waste Management is linked and will require also overall improvement of healthcare facility management like planning and logistics, housekeeping and cleansing standards.

Organization & Management of Services

Roles & Responsibilities

Healthcare waste management, as other environmental infection control services, is a cross-cutting service, touching all areas of a hospital or healthcare facility. It must be remembered that it is not only the waste management team who is responsible for the safe and environmentally sound management of waste – everybody within the health care facility must be aware of the “Golden Rule”:

All medical and non-medical staff (including senior physicians) are responsible for the correct segregation of the generated waste at source.

The Director

The director of the healthcare facility has overall responsibility for hazardous health care waste management - from generation to final disposal. In this regard he or she is also the final liable and responsible body for damages caused by the management of the waste against the outside.

Healthcare Waste Officer (HWO)

A responsible person should be appointed for the day-to-day operation and monitoring of the waste management system. This person is directly responsible and must report to the Director of the Healthcare Facility or their Deputy . The HWO must liaise with the other members of the waste management group.

Waste Operators

The waste operators must be trained in proper and environmentally sound waste management procedures by the HWO. Additionally, they should be trained to train other operational staff, who come into contact with waste. The waste operators inform the HWO in case of improper processes or accidents.

The operational staff inside a healthcare facility may be divided into:

Generators (e.g. doctors, nurses, etc.) - should know what kind of waste they are producing. They are responsible for the correct segregation of waste in the correct bins and bags. After filling the bags, they are responsible for correct closing of bags.

Providers (e.g. Cleaning personal, housekeeping) - are responsible to provide generators with the necessary bins and bags. They are responsible to ensure that the different waste bins have sufficient capacity until their removal, the right colour coding and correct labelling. They may also be responsible for collecting waste within a defined area and placing it ready for transportation.

Carriers (e.g. waste operators, etc.) - are responsible for the correct transportation and interim storage of waste until final disposal.

The specific tasks of the Director of the healthcare facility, the Healthcare Waste Officer and the individual members of the waste management team should be noted in the waste management plan, as well as in the standard operating procedures.

Human Resource Management

The operation and management of an adequate healthcare waste management system will require that the following functions to be fulfilled:

- * Operational management of the healthcare waste/ waste collection system;
- * Operation of the interim storages and treatment plant, including supporting activities;

A training program to enable staff to carry out these functions should be provided. The management of the healthcare facility is responsible for ensuring that the following roles are introduced and the job descriptions are provided to the staff:

The **Foreman** of the waste management unit (Healthcare Waste Officer) will be the person responsible for the waste management system. From the waste collection at the department until final disposal.

Waste Management Operator: The waste management operator is responsible to collect hazardous and non-hazardous waste from defined waste collection points and to transport it to the interim waste storage. The duty may include the registration of the waste, the treatment of the waste or the placing

ready of the waste for external pick-up and disposal.

The **Infection Control Person** provides independent auditing, and advice on healthcare waste management together with reviews and witness/validation of processes. He/she shall be also designated to carry out regular inspections of the storage places and the waste treatment facility.

The Maintenance Person is designated to carry out maintenance and periodic testing on equipment used for healthcare waste management such as trolleys or waste treatment equipment and shall be from the technical department.

Quality Controller: The quality controller is defined as a person designated by the management to be responsible for quality control of the hospital waste management system with the authority to establish, verify and implement all quality control and quality assurance procedures.

Infection Control Committee: the Infection Control Committee is responsible for monitoring waste collection and waste treatment issues as part of the ongoing improvement against standards set in the various frameworks

Budgeting

Like other secondary sectors such as laundry, kitchen, etc., healthcare waste management needs a separate budget line. The budget shall be either included in the budget for housekeeping and cleaning services or shall be a separate budget line. The set up of a cost centre for healthcare waste activities is recommended. Financing of external services (such as household waste disposal) should also be considered in the budget.

For capital costs, the following items must be considered:

- * Waste treatment equipment: incinerator, sterilizer, etc.
- * Support equipment: dosing equipment, water treatment systems, etc.
- * (Medical) furniture: storage equipment for chemicals, chairs, cupboards, etc.

For recurrent costs, the following items must be considered:

- * Consumables for waste management: fuel for incinerator, plastic bags, sharp containers, monitoring equipment, etc.
- * Minor equipment: bins, trolleys, etc.
- * Services: Waste pick up cost, cost for disposal of non-hazardous waste, etc.

Providing Healthcare Waste Management Services

Waste Classification & Segregation

Independent of the kind of waste, the segregation of waste in different waste streams (classes) has to be carried out at the point of generation. Based on the kind of waste, the waste might be later on reused, recycled, treated or disposed of. The segregation of waste is the duty of every waste generator, independent of the position in the healthcare system. Waste has to be segregated directly after generation. In the following, a sample segregation system is provided. This system has to be adapted to the specific regulation in the country.

A) Sharp Waste (Sharps)

Sharps are all objects and materials which pose a potential risk of physical injury (needlestick, cuts, etc.). Typical items are needles, blades, broken glass and vials, infusion sets with butterflies and so on.

Specification	All sharp items, whether contaminated with infectious material or not.	
Colour Code	Yellow	
Packaging:	Water tight, puncture proofed, sealable and strong cardboard or plastic containers. A sharps container should, once assembled, have a lid which cannot be removed, have a handle (not part of the closure device) and a lid so designed as to enable items to be dropped in by one hand. Should be resistant to penetration and leakage.	
Symbol / Marking	International biohazard symbol in black / yellow and wording: "Danger! Contaminated Sharps"	
Recommended Labelling	<p>The container should bear a horizontal line together with the words 'WARNING - DO NOT FILL ABOVE THE LINE'.</p> <p>Name of the generator (department, ward)</p> <p>Waste class, date of generation</p> <p>Waste volume and waste destination</p>	

B) Infectious Waste

Infectious waste consists of discarded materials that are contaminated with communicable pathogens with the potential to transmit infectious agents to humans.

This waste includes: waste from isolation wards, tissues (such as swabs), waste contaminated with potentially infectious excreta, body fluids and blood, infectious waste from the laboratory (as long this waste is not considered as highly infectious waste), waste from the pathology department and from the dialysis (yellow dialysis), waste from the operation theatre.

Specification	Healthcare waste contaminated with pathogens which are known or clinically assessed to have the potential of transmitting infectious diseases to humans or animals.	
Colour Code	Yellow	
Packaging:	Strong PP or PE plastic bags of good quality and sufficient capacity. Should be placed in a container, such as a pedal bin, or suspended from a bag holder with a lid.	
Symbol / Marking	International bio-hazard symbol in black / yellow and wording: "Danger! Bio-hazardous medial waste"	
Labelling	Name of the generator (department, ward) Waste class, date of generation Special remarks Waste volume and waste destination	

C) Highly Infectious Waste

Highly infectious waste includes all viable biological and pathological agents artificially cultivated in cultures or stocks. It also includes items used for the transfer, inoculation and mixing or cultures of infectious agents. Place of origin of highly infectious waste is normally the laboratory, but may also be in other locations, such as quarantine or isolation wards. Highly infectious waste must be treated close to the place of generation. For example, only after autoclaving, should highly infectious waste be disposed of in “normal” infectious waste bags (double security).

Specification	Media and cultures from the microbiological laboratory.	
Colour Code	Yellow	
Packaging:	Autoclavable (e.g. made from PP), strong, leak proof bags. If bags shall be autoclaved, they should not be hermetically	
Symbol / Marking	International bio-hazard symbol in black / yellow and wording: “Danger! Bio-hazardous medial waste”	
Recommended Labelling	Name of the generator (department, ward) Waste class, date of generation Recommended is a chemical indicator which indicates if the waste was successfully sterilized Waste volume and waste destination	

D) Pathological and Anatomical Waste

Pathological and anatomical waste includes all waste made up of human body parts and placentas. Anatomical waste is not necessarily infectious, but needs a special requirement due to ethical and religious reasons.

Specification	Anatomical, pathological waste as body parts.
Colour Code	Yellow
Packaging:	Water tight and sealable strong plastic bags, containers or other collection items
Symbol / Marking	None – Recommended wording: “Pathological waste - Handle with care”
Recommended Labelling	Name of the generator (department, ward) Waste class, date of generation Special remarks Waste volume and waste destination

E) Hazardous Pharmaceutical Waste

Pharmaceutical waste includes expired, unused, unwanted, spilled and contaminated pharmaceutical products, drugs and vaccines. It also includes all sera and bottles, boxes and vials used to contain pharmaceuticals, which are no longer required. It does not include packaging materials for pharmaceuticals, which should be disposed of as non-medical waste or non-risk pharmaceuticals like vitamins, sugars, amino acid and certain salts.

Specification	Hazardous pharmaceutical waste
Colour Code	Red
Packaging:	To be packed in specific cardboard boxes, containers or other safe packaging, depending on the specific characteristics and hazards.
Symbol / Marking	<p>Depend on the type of the waste, such as: toxic, noxious, corrosive, oxides, flammable, mixed hazards, environmental polluting materials etc.</p>  <p>The wording: "Danger! Hazardous pharmaceutical waste"</p>
Recommended Labelling	<p>Name of the generator (department, ward)</p> <p>Waste class, date of generation</p> <p>Special remarks</p> <p>Waste volume and waste destination</p>

F) Hazardous Chemical Waste

All discarded solid, liquid and gaseous chemicals, for example from diagnostic and experimental work and cleaning, housekeeping and disinfecting procedures posing a wide variety of dangers and different procedures.

Special care must be taken during segregation and collection since materials can be highly toxic, irritant, corrosive, ignitable, harmful, explosive or carcinogenic. Used packaging must be designed for specific chemical waste. In the absence of special packaging, the waste should be collected in the original packaging. Different kinds of chemicals should only be collected together if they will not react with each other. If possible, chemical waste should be given back to the supplier for final disposal. Chemical waste should only be handled with Personal Protection Equipment (PPE).

Specification	Chemical waste; Formaldehyde, Oxide ethylene, X-Ray fixing and developing solutions, Solvents, Chemical mixtures.
Colour Code	Red
Packaging:	Sealable, robust containers, appropriately for their content and for normal conditions of handling and transportation. Different types of hazardous waste should not be mixed to eliminate undesirable reactions.
Symbol	<p>Depend on the type of the waste, such as: oxides, corrosive, mixed hazards, environmental polluting materials etc.</p> 
Additional Labelling	<p>Name of the Producer, if applicable: department Waste class, date of production Special remarks Waste volume and waste destination</p>

G) Cytotoxic Waste

A highly hazardous subcategory of pharmaceutical waste is cytotoxic waste. Cytotoxics are pharmaceuticals used for cancer treatment and can be mutagenic, carcinogenic and teratogenic. Cytotoxic waste—also known as genotoxic waste - is potentially highly hazardous if not carefully handled. For this reason it is considered as a separate waste category.

Specification	Waste from the reconstitution of cytotoxic pharmaceuticals	
Colour Code	Purple	
Packaging:	Sealable, robust containers, appropriately for their content and for normal conditions of handling and transportation. Different kind of hazardous waste should not be packed together to elimi-	
Symbol / Marking	Health hazard - cancer, Wording: "Cytotoxic waste"	
Recommended Labelling	Name of the generator (department, ward) Waste class, date of generation Special remarks Waste volume and waste destination	

H) Waste with High Heavy Metal Content

Waste with high heavy metal content is potentially highly toxic and represents a subcategory of hazardous chemical waste, but needs special consideration during treatment. Cadmium is used in batteries and mercury in thermometers or manometers. Mercury is also present in small quantities in mercury vapour lamps. Lead is still used in radiation proofing of X-ray and diagnostic departments.

Specification	Waste with heavy metal content	
Colour Code	Red	
Packaging:	Sealable, robust containers, appropriately for their content and for normal conditions of handling and transportation. Different kind of hazardous waste should not be packed together to eliminate undesirable reactions.	
Symbol / Marking	Skull and crossbones, Wording: "Heavy Metal Waste" containing XXX (Mercury or Cadmium....)	
Recommended Labelling	Name of the generator (department, ward) Waste class, date of generation Special remarks Waste volume and waste destination	

I) Radioactive Waste

In tertiary health facilities, radioactive waste is generated during diagnostic, therapy and research processes. Radioactive waste has to be handled in accordance to the national regulations.

Specification	Waste with radio-nuclides whose ionizing radiation has genotoxic effects e.g. Cr-51, Ga – 67, I-125, I-131, In-111, P-32, Rb-86, RD – 222, S-35, Tc-99m	
Colour Code	No special colour	
Packaging:	Sealable, robust containers, appropriately for their content and	
Symbol / Marking	International radiation symbol and wording: “Caution! Radioactive Waste”	
Required Labelling	Name of the generator (department, ward) Kind or radionuclide Radiation on given date (start storage time) Period of storage time required Further safety remarks (e.g.: Danger! Contains Bio-hazardous materials) Waste volume and waste destination	

J) Pressurized Containers

Gases such as compressed air, liquids and powdered materials are often stored in pressurized cylinders, cartridges and aerosol cans. Filled pressurized containers must be stored in an upright position. Most of these containers are reusable and should go back to the supplier. Whether containing inert or potentially harmful materials, containers may explode if incinerated or accidentally punctured and should be collected separately and handled with care.

Specification	Container under pressure, e.g. oxygen bottles, etc.	
Colour Code	No special colour	
Packaging:	Original container, no re-packing	
Symbol / Marking	"Pressurized Container – handle with care"	
	<p>Recyclables: The international recycling sign should be placed on the bins/bags. Wording: "Non-contaminated XXX (kind of waste), to be recycled" is recommended.</p>	
Labelling	<p>Dependent on the contents of the container – e.g. hazardous symbols for ethylene oxide</p> <p>Name of the generator (department, ward)</p> <p>Waste class, date of generation</p> <p>Special remarks</p> <p>Waste volume and waste destination</p>	

5) Non-medical Waste

Non-medical or domestic waste is comparable to waste generated by households. This waste class is graded as non-hazardous.

Examples of this kind of waste are:

- * Kitchen waste, packing materials, waste from the administration, left over food and fruit pellets, etc.
- * Other non-risk waste: Garden waste, Construction Waste

Recyclable waste, such as glass, paper, cardboard, aluminium, scrap metal or certain plastics are considered as a subcategory of the non-medical waste.

Specification	Healthcare waste with similar composition to household and municipal waste	
Colour Code	Black (Green for recycling)	
Packaging:	Black PP or PE plastic bags of good quality and sufficient capacity.	
Symbol / Marking	Household like waste: "Domestic Waste"	
	Recyclables: The international recycling sign should be placed on the bins/bags. Wording: "Non-contaminated XXX (kind of waste), to be recycled" is recommended.	
Labelling	During normal operation not necessary, only during times of research (e.g. waste audits: Name of the Producer, department, etc.)	

Healthcare Waste Segregation Point

A waste segregation point refers to any dedicated place in a health facility where the first level of separation of waste occurs and waste is put into dedicated containers for collection. As there different waste streams exist in health facilities, segregation points may include receptacles for one or more types of waste. Normally, each room in a hospital has at least one segregation point.

Typical waste streams found at segregation points include:

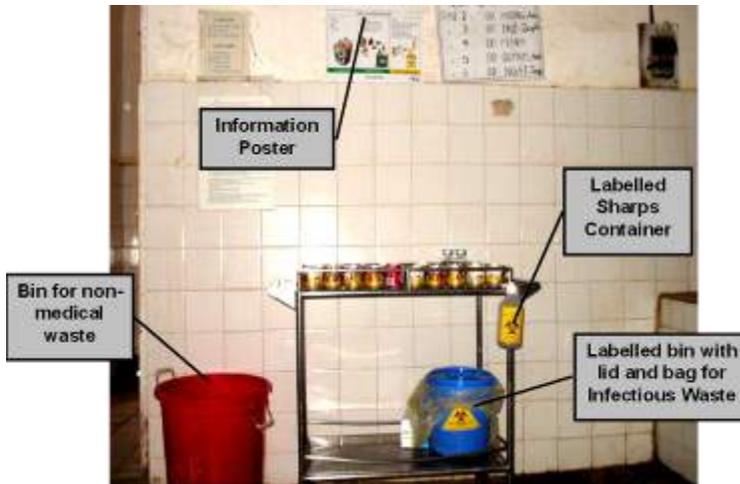
- * Non-risk waste (municipal or household like waste)
- * Recyclables (Paper/cardboard, glass, plastic)
- * Infectious waste and sharps
- * Pharmaceuticals (minor points)

Segregation points normally consist out of:

- * Waste bins or bag-holders
- * Packing material for the waste (e.g. sharp box or plastic liner)
- * Necessary IEC material to inform the waste generator what kind of waste shall be collected at the point (e.g. poster or labels on bins).

Segregation points for other waste streams (chemical waste, radioactive waste) will only be set up at the locations where this waste is generated.

Fig. 1—Example of Waste Segregation Point/ ETlog



To enable a systematic segregation and collection of healthcare waste, it is highly advisable to plan the location of segregation points. To be effective this planning must consider the existing areas of a facility: buildings, departments, wards, sub-departments etc. Each room within these defined areas will be analysed for:

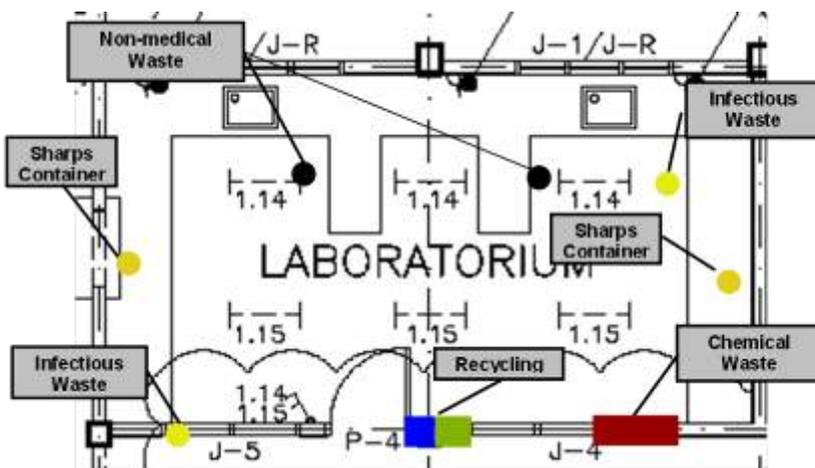
- * Nature of waste to be generated in the room
- * Expected amount of waste to be generated per day
- * Frequency of the waste collection
- * Needed segregation equipment
- * Available space for location of containers, bins, bags

Based on the analysis, the kind and quantity of segregation points can be estimated for each room and for the entire area. In this way the total amount of equipment required (type and size of bins) can be identified. For each area, a segregation plan shall be developed which contains the exact location of required segregation points in each room and a list of required equipment.

Issues to be considered during the planning of segregation:

- * Segregation should be carried out as close as possible to the point of waste generation (proximity principle).
- * Segregation points shall be easy accessible for the user.
- * Non-risk and hazardous waste should be separated.
- * Segregation points for hazardous waste must be out of reach of patients, visitors and strangers and only accessible by trained staff.
- * Hazardous waste segregation points should be clearly marked and equipped with easy to understand instructions.

Fig. 2—Example of Waste Segregation Layout/ ETlog



Once established, the staff must be informed about the nature of waste to be collected at each segregation point.

Packaging of Healthcare Waste

Different kinds of waste need different packaging due to the different risks created. The chemical characteristics of the waste must be considered, since certain chemicals may dissolve plastic bags and must be packed in metal containers or glass bottles. When choosing packaging material, the specific hazards created by the waste must be contained (e.g. puncture proof containers for sharps, lead shielded containers for radioactive waste).

Fig. 3—Sharps Bucket



Fig. 4—Sharps Bin



Plastic bags for infectious waste should be made of good quality strong material to avoid tears and spillage. The use of bag holder with lid or bins with lids are recommended to prevent air contamination.

Fig. 5—Waste Bag Holder



Fig. 6—Multi-coloured Waste Bags



Hazardous waste packaging must be labelled prior to collection to enable easy identification of waste type and source. For the identification of the potential hazards, the United Nations hazard symbols should be used.

<http://www.unece.org/trans/danger/publi/ghs/pictograms.html>

IEC Materials for Healthcare Waste Segregation Points

To inform staff what kind of waste is to be collected in which bin, information posters can be used. To ease the identification of bins, strict adherence to a colour coding system is recommended. If bins and containers are not available in the right colour, alternative methods can be used e.g. coloured plastic bags, coloured paint or markings in the side of bins, coloured sticker. In particular, bins for hazardous waste should information indicating the kind of waste may be placed in the bins.

Fig. 7—Examples: Waste Segregation Posters



Table 1 — International Waste Colour Coding Chart

Colour	Description
 Yellow	Waste which requires disposal by incineration Indicative treatment/disposal required is incineration in a suitably permitted or licensed facility.
 Orange	Waste which may be "treated" Indicative treatment/disposal required is to be "rendered safe" in a suitably permitted or licensed facility, usually alternative treatment plants (ATPs). However this waste may also be disposed of by incineration.
 Purple	Cytotoxic and cytostatic waste Indicative treatment/disposal required is incineration in a suitably permitted or licensed facility.
 Yellow/black	Offensive/hygiene waste* Indicative treatment/disposal required is landfill or municipal incineration/energy from waste at a suitably permitted or licensed facility.
 Red	Anatomical waste for incineration* Indicative treatment/disposal required is incineration in a suitably permitted facility.
 Black	Domestic (municipal) waste Minimum treatment/disposal required is landfill , municipal incineration/energy from waste or other municipal waste treatment process at a suitably permitted or licensed facility. Recyclable components should be removed through segregation. Clear/opaque receptacles may also be used for domestic waste.
 Blue	Medicinal waste for incineration¹ Indicative treatment/disposal required is incineration in a suitably permitted facility.
 white	Amalgam waste For recovery

* The use of yellow/black for offensive/hygiene waste was chosen as these colours have historically been universally used for the sanitary/offensive/hygiene waste stream.

1. The colours "red" and "blue" are new to the colour-coding system in this edition. Care should be taken when ordering red containers to ensure that they can be clearly differentiated from orange. The colour-coding could be agreed as part of a contract specification.

Operation of Waste Segregation Points

Two main principles for the successful use of segregation points are:

- * The correct segregation is the clear responsibility of every waste generator, independent of their position („duty of care“ principle).
- * In case of doubts, the „precautionary“ principle must be followed (classification of the waste in the highest potential risk group).

Waste segregation points need maintenance!

Stickers or markings on bins must be replaced as necessary and the bins must be regularly cleaned. Locations must be inspected frequently. It is highly recommended to establish a maintenance schedule for segregation points. Waste segregation point planning should be reviewed annually in cooperation with the department or sector. A complaints system should be introduced to monitor and improve and maintain standards.

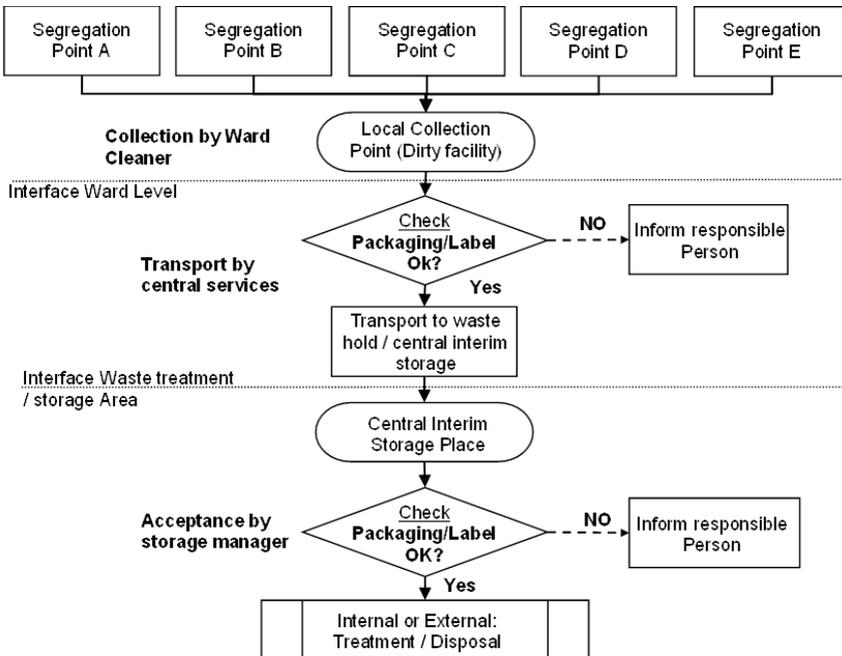
Logistics of Healthcare Waste

Internal and External Healthcare Waste Logistics

The internal operational system for the disposal of healthcare waste comprises the collection of segregated waste, transportation and storage. In some healthcare facilities the treatment and the disposal of specific wastes such as sharps, placentas or incinerator ash maybe part of the internal procedure.

Below, an overview of a typical internal processes and the relevant interfaces and responsibilities is shown.

Fig. 9—Overview of Healthcare Waste Logistical System



The transportation of waste can be divided into:

Direct:

Direct transportation of waste from the segregation point to the central interim storage area (normally used in smaller healthcare facilities). Local collection points are not considered for direct transportation.

Two-step system:

First step: transportation of waste from segregation point to local collection point (by the staff of the respective department or ward);

Second step: collection of waste from local collection point and transport to the central interim storage area (by housekeeping staff).

Considering hygiene, ease and economical aspects, following systems different waste streams should be introduced:

Table 2 — Best Practice Waste Streams

General Waste:	Regular collection, direct transportation for small hospitals, two step transportation for larger hospitals.
Recyclables:	Regular collection, direct transportation for small hospitals, two step transportation for larger hospitals.
Highly Infectious Waste:	Regular collection, to be collected together with infectious waste after disinfection.
Infectious Waste:	Regular collection, direct transportation if no dirty utility rooms or disposal holds are available, two step transportation if dirty rooms are available (recommended).
Sharps:	Regular collection, to be collected together with infectious waste.
Pharmaceuticals:	Direct transportation, on demand collection (Note: normally carried out by staff of the respective department).

Chemical Waste:	Chemical Waste: Two step transportation (usage of local collection points in laboratory, pathology or radiology department), collection on demand.
Radioactive Waste:	Direct transportation, on demand.
Pressurised Container:	Direct transportation, on demand (collection by supplier).
Heavy Metal Waste:	Direct transportation, on demand.

Collection of Healthcare Waste

Segregated waste shall be collected by the ward/department cleaner and shall be taken to the local collection point. Containers for the collection of waste shall be made from solid, relatively light, stainless and waterproof materials. Containers for the collection of infectious and cytotoxic solid medical waste shall be cleaned and disinfected before reuse. Plastic bags must not be reused.

Infectious waste, pathological waste and general waste must be collected regularly. The waste should be collected, but as soon as the bins are 2/3 full. Other types of waste (e.g. sharps) can be collected with a lower frequency (when containers are 2/3 full). Pharmaceutical waste and chemical waste shall be collected on demand and after giving notice to the responsible person.

Internal transport of healthcare waste

Hazardous and non-hazardous waste shall be collected from the local collection points and transported to the interim storage area by designated staff and not by ward/department cleaners. For the transport, appropriate transport equipment is required. The personnel in charge of the

transportation of waste shall be equipped and wear the necessary personal protection equipment (PPE), such as gloves, mask and overalls.

Hazardous and non-hazardous waste must be transported separately. For the transport of general waste, infectious waste, sharps and pathological waste, only specially designed, closed and easy to be disinfected trolleys shall be used. These trolleys shall not be used for any other purpose. If other hazardous materials such as chemicals or pharmaceuticals shall be transported, it must be packed in a way that no risk during transportation will be created.

Central Interim Storage for healthcare waste

Each healthcare facility has the duty to establish and operate at least a basic central interim storage point. The central interim storage point shall act as waste service area and it should be possible to carry out the following tasks at this area:

- Maintenance (cleaning) and repair area for waste transportation equipment (water supply and drainage outlet);
- Interim storage and transfer area (interface) for domestic waste;
- Post-sorting and storage area for valuable materials (waste for recycling), if recycling is carried out (a simple shed or room);
- Documentation and record keeping of the waste streams;
- Storage area in case that the waste will be treated in a central facility – e.g. district hospital.

Healthcare waste, wherever it arises, should be disposed of as soon as it is practicable to do so, but within 24 hours after storage. This requires that waste for disposal has to be picked up at least 3 times per week.

In all instances, storage arrangements should:

- be robust and secure;
- allow safe handling of waste containers exclusively for healthcare waste. Any clean unused containers must be distinctly separate from used/full containers;
- allow clear distinctions to be maintained between wastes intended for

- different disposal methods;
- allow storage of wastes in designated and delineated areas, in a safe environment without offensive odour;
- be provided with safety instructions (e.g. spillage procedures and blood and body fluids precautions);
- be of sufficient size to allow for delays in the onward transportation of the waste.

The location, size and type of construction of the storage area will depend upon specific circumstances: what is required in a tertiary level hospital and in a primary level clinic will be very different. In all cases, it should be secure from unauthorised entry, animals, birds or other infestation.

Storage areas for hazardous waste should be located near to any on-site treatment facility, sited on well drained impervious hard standing, and provided with wash down facilities, adequate lighting, ventilation and clear warning signs. The local circumstances and the nature and volume of the waste to be stored should be taken into account when determining storage conditions.

External Transportation of Healthcare Waste

It will be the duty of each healthcare facility, independent of its size, to establish an external transport and disposal arrangement at least for domestic waste. Arrangements for the collection and transport of healthcare waste should:

- be compatible with the arrangements made for storage of the waste;
- be made, in the context of the duty of care under any local, regional and national legislation or regulation in force in relation to Healthcare Waste Management to permit prompt delivery to the location of treatment or disposal that has been agreed;
- comply with legislation and good practice, especially regarding the health and safety of patients, healthcare and waste management personnel and others, and protection of the environment.

Arrangements for the storage, collection and transport of waste may involve the personnel of different healthcare employers, of waste collection and disposal authorities and of waste contractors. In the interests of smooth

operation, and to ensure compliance with local legal requirements, there should be arrangements for monitoring the 'duty of care' at regular intervals, to include operational performance and liaison with all designated points of contact.

Arrangements for transport by road, rail or sea must ensure that:

- medical solid waste shall be stored in strong, closed containers before transferred to transport vehicle;
- the waste carrier is registered under any relevant local, regional or national legislation regulations concerning healthcare waste management;
- medical solid waste containers shall be secure and out of reach of people or animals;
- transport personnel shall wear necessary PPE, consisting of: Helm, masker, eye protector, overall, apron for industry, foot protector/boots, and special gloves.

The vehicles used to transport healthcare waste should:

- permit the safe and easy loading, securing and unloading of waste;
- contain any leakage from damaged containers;
- be constructed to avoid entrapment of particles of waste and refuge for insects or vermin;
- permit, where appropriate, the use of secondary containment of the waste;
- allow ready disinfection or steam cleaning;
- be subject to regular inspection for cleanliness and a programme of cleaning appropriate to the extent and nature of usage.

Where a vehicle is not used solely for the transport of waste (for example, where waste is carried in general purpose vans or, in small quantities, in cars), particular care should be taken to avoid contamination of personnel, of the vehicle itself or of subsequent loads. That care may involve special arrangements for extra containment and for regular examination of the vehicle and cleaning as required.

Disposal and Treatment of Healthcare Waste

The overriding rule for the treatment and disposal of waste shall be the duty of care and the polluter pays principle. Each waste generator shall be fully responsible for the safe treatment and disposal of the waste they generate.

Disposal of Domestic Waste:

Each healthcare facility, independent of its size and location shall be responsible to organize the external transport and disposal of generated domestic waste. The onsite burning or burying of domestic waste shall not be permitted. If no general waste disposal service is offered by the municipality, arrangements shall be made with local transport companies for the disposal of the waste in the nearest dump.

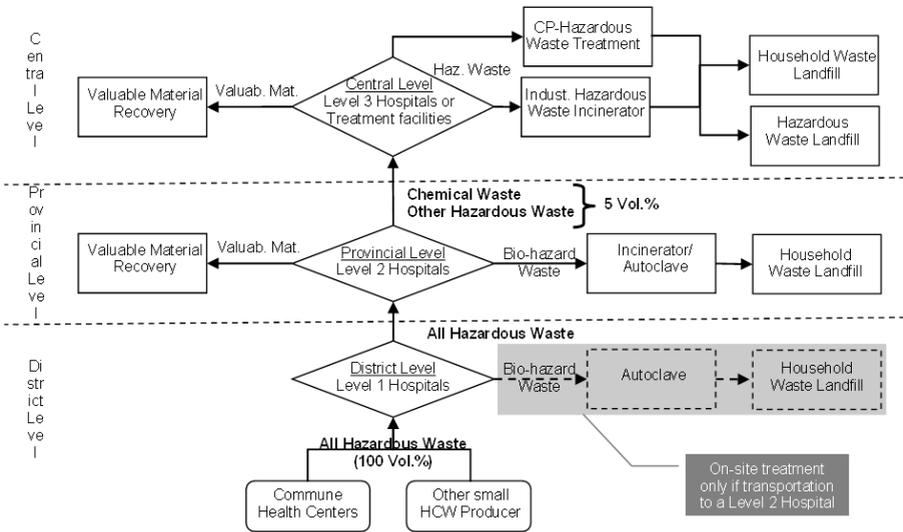
Treatment of Hazardous Waste:

The treatment of hazardous waste is a complicated and often costly process. If possible, it only should be carried out at district hospital level and above. Pharmaceutical waste, chemical waste and other hazardous waste shall only be collected, stored and regularly transported for final treatment to facilities at provincial or regional level (depending on in-country structures).

Infectious waste and sharps may be treated at district level hospitals. No regular treatment of hazardous waste shall be carried out at lower level healthcare facilities with the exception of the disinfection of infectious waste generated, which must be decided on a case by case basis.

In the following, a sample system for the treatment of hazardous healthcare waste is displayed.

Fig. 10—Example: Hazardous Healthcare Waste Disposal Scheme Vietnam/ETlog



Treatment of Infectious Waste and Sharps

In general, healthcare facilities at district level and below should avoid treating waste by themselves, but should hand-over the waste for treatment to more specialized institutions. Considering the environmental impact of different treatment solutions, public health and occupational health risks, the following hierarchy of treatment systems is recommended:

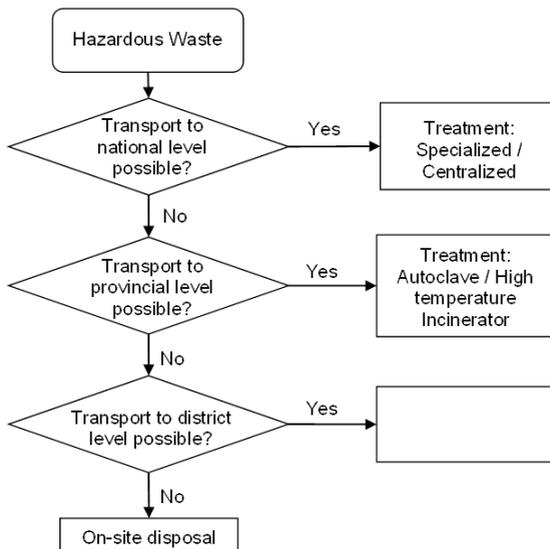
1. Co-Incineration or large scale steam treatment (autoclaving)
2. High thermal, medium-scale oil fired incinerator
3. Steam treatment (autoclaving)
4. Controlled sanitary landfilling without treatment but with at least daily coverage of the waste (only in rural, mountainous areas)

The burning of infectious waste in primitive incinerators or barrels shall only allowed in exceptional, temporary circumstances with the written approval of the local environmental control officers and the district health offices . The disposal of infectious waste and sharps together with the domestic waste shall be in not be permitted.

Compared with steam treatment, co-incineration also offers a solution for other hazardous waste streams such as pharmaceuticals or chemicals. For economic and technical reasons it is only feasible if large amounts of waste are to be treated.

Based on the previously mentioned considerations, the path for decision making on the treatment of bio-hazardous waste indicated below shall be followed.

Fig. 10—Decision Making Path for the Treatment of Infectious Waste



Treatment of Infectious Waste and Sharps by Incineration:

Traditional incineration has been the most commonly used treatment method for healthcare waste. Due to current concerns about the environmental impact of emissions from incineration (flue gas, bottom ash, contaminated fly ash and waste water from the flue gas treatment), small and medium scale incinerators have come under strong criticism. From a practical point of view, the high fuel consumption of medium scale incinerators (about 0,3 – 1 l fuel per kg of waste) is often a significant problem.

During incineration hospital waste and the pathogen agents are oxidized. State of the art incinerators have dual chamber systems, equipped with a wet or dry flue gas treatment system and a continuous emission monitoring (CEM) system. The gasification of waste takes place in the first chamber and in the second chamber the produced gas is combusted at a temperature of 800 – 1200°C and pathogens are destructed. One problem of the incineration of hospital waste is the high content of PVC. The incineration of PVC often produces HCl, which may will result in hazardous and cancer causing gases such as dioxin and furan.

This type of treatment of waste also creates the problem of how to dispose of ash generated by incineration. This incinerator ash is often be classified as potentially toxic, due to high contents of heavy metals, etc. Therefore incinerator ash should not disposed of in an unsecured landfill without prior inertization and stabilization.

Treatment of Infectious Waste and Sharps by Steam Treatment:

Different kinds of thermal treatment systems are available today, all of which have one thing in common — the use of steam in the treatment of waste. As heat is applied to water, its temperature rises until it reaches its boiling point or saturation temperature at which point water is turned into steam. At atmospheric pressure the saturation temperature of water is 100° C. At higher pressures (e.g. in the pressure vessel of an autoclave), the saturation temperature is higher. For example, at a pressure of 3.2 bar, water boils at 134°C.

Steam based systems inactivate micro organisms using heat (coagulation of the proteins). The inactivation process however combines the effects of

moisture, heat and pressure. If steam treatment is chosen for the treatment of waste, the parameters set out by the government legislation must be followed.

Note: The sterilization of infectious waste and sharps using chemicals or hot air is not recommended. All treatment and disposal facilities require a licence or authorisation from the relevant responsible authority and these will be subject to stringent conditions.

Treatment of Other Kinds of Hazardous Waste

Highly infectious waste, if generated in district hospitals, shall be treated by thermal (steam) treatment methods close to the place of generation or directly in the laboratory. After treatment, the waste shall be handled as infectious waste.

Fixing baths used in photographic processes of radiology must be de-silvered (recovery of silver) prior to disposal. The recovery shall either be carried out on the premises or the fixing bath must be sold to specialized companies.

Liquid hazardous waste must be neutralized prior to being disposed of via the waste water system. Liquid hazardous waste which cannot be neutralized, such as solvents or halogenated liquids must be stored and transported to more specialized treatment facilities.

Non-infectious hazardous waste, such as heavy metal, pharmaceutical or chemical waste shall be stored in the hazardous waste store of the health facility and must be transported to the next level for further treatment.

Quality Management of Healthcare Waste Services

Quality Management

Testing & Monitoring

Regular testing of waste treatment systems and continuous monitoring of the performance of the waste generators and the waste operators are a must in healthcare waste management.

For example steam decontamination is more and more used by hospitals for their biohazardous waste treatment. Many such facilities are periodically monitoring the efficacy of their decontamination process with Biological Indicators. In Vietnam, the Ministry of health has set up regulations requiring the periodic monitoring of such decontamination cycles.

Next to the by law required testing and monitoring, also internal monitoring is an important tool for a sustainable waste management system. To get a good idea about current healthcare waste situations, it is today recommended to carry out regularly so called “healthcare waste audits”.

The HCW Audit is the first step for the implementation of an economical and ecological waste management system. Before actions towards a modern waste management can be done, a detailed picture of the current situation of the existing waste management must be available.

The objective of a HCW Audit is to conduct a survey of the waste streams in a hospital and to check where, what kind, how, how much and why the waste is generated. This has to be carried out under consideration of the different sectors and sub-sectors of a hospital. A HCW Audit can be carried out in the entire hospital or for selected or single departments. The gained data and information are the basis for setting up the waste management concept and strategy and to develop strategies for pollution prevention and waste minimization. The data will be of special relevance to determine which actions will be most beneficial and to identify potential areas for improvement of the current waste management. Additional, these data might be the base to control the efficiency and the developments of the waste management in the future.

Standard Operation Practices

The primary purpose of Standard Operating Procedures (SOPs) for HCW is to guide and standardize risk working procedures in order to ensure a safe and efficient work result. It is therefore crucial that staff read and follows the SOPs and it becomes very important for the staff to train them on these SOPs so that they are actually aware of why and how SOPs can play an important role in fulfilling regulatory requirements and how they can help to protect their health.

The general rule for SOPs is: “Write down what you do, do what is written down”.

Writing SOPs is not an easy process. It is very time-consuming and involves analysis of processes. However, it pays big dividends when complete. The responsible person should be very clear on the objectives of the SOPs while writing them and should explain in an easy and accurate way each of the working steps necessary for the to be standardized procedure. The typical contents of a SOP should include:

- A descriptive title
 - In some contexts the purpose of the SOP
 - Date when the SOP became operative
 - The edition number and a statement that this edition replaces an earlier edition from an earlier date
 - The exact distribution of SOPs
 - The signature of the person responsible for writing the SOP
- The signature of the person responsible for authorising the SOP

SOPs for hazardous healthcare waste should additionally include:

- * Examples of the hazards and the international symbol
- * Safety standards and general handling
- * Emergencies and spillages [Contact Tel.]
- * First Aid [Contact Tel.]
- * Waste Disposal [Contact Tel.]
- * Address and Contact number of the responsible HWO
- * Description of the disposal possibilities

Because SOPs include the who, what, where, how and why of hospital operations, it is important for the staff to become familiar with the SOPs and to integrate them into the training program. In Annex, sample SOPs related to waste management can be found.

Useful Forms

Dealing with healthcare waste and hazardous substances require certain administrative proceedings and different forms might be used for the operation of a healthcare waste system.

- Hazard and safety symbols
- Sample poster for Segregation points
- Sample for infectious waste labels
- HCW system user complain form
- HCW work schedule
- HCW Disposal request form
- Hazardous HCW storage forms
- HCW maintenance schedule
- Job description – HCW officer
- Sample SOP
- Selected proceedings for emergencies

Further Reading

Options for further reading are indicated below:

- Safe management of wastes from health-care activities (Second Edition), WHO:
http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf
- Fundamentals of health-care waste management, WHO/UN Environment Programme:
http://www.who.int/water_sanitation_health/medicalwaste/en/guidancemanual1.pdf
- WHO Fact sheet N°231 Revised October 2006—Injection Safety:
http://www.wiredhealthresources.net/resources/NA/WHO-FS_InjectionSafety.pdf
- WHO Health-care waste management Fact sheet N°281 - October 2011:
<http://www.who.int/mediacentre/factsheets/fs281/en/index.html>
- Technical Guidelines on the Environmentally Sound Management of Bio-medical and Healthcare Wastes, September 2003, Secretariat of the Basel Convention
<http://archive.basel.int/pub/techguid/tech-biomedical.pdf>
- Compendium of Technologies for Treatment/Destruction of Healthcare Waste, United Nations Environment Programme, 2012
<http://www.unep.org/ietc/InformationResources/NewsArchives/HealthcareWasteCompendiumpublication/tabid/106569/Default.aspx>