Healthcare Wastes Management

A Handbook for Developing Countries

Editors:
M.K.C. Sridhar
W.B. Wahab
S.B. Agbola
Alione Badiane

Healthcare Wastes Management – A Handbook for Developing Countries

Editors:

M.K.C. Sridhar,
W.B. Wahab,
S.B. Agbola,
Alione Badiane

IBADAN UNIVERSITY PRESS
2009

Ibadan University Press
Publishing House
University of Ibadan
Ibadan

First Published 2009

ISBN: 978 – 978 – 8414 – 01 - 8

Printed by: Malijoe Soft Print, Ibadan. 08035798918.

TABLE OF CONTENTS

Foreword

Amongst the comity of wastes generated by humans, none is more insidious than biomedical (now known or called healthcare) wastes. While most developed nations have researched and developed institutional mechanisms to treat and control its harmful effects, most countries of the developing world have no knowledge of the many dangers associated with the generation, collection, transportation and especially the disposal of these health care wastes. Yet, it is in these countries of the world that this knowledge is critical as a result of the continuing rapid urbanization of their population. As these countries urbanize, more hospitals, maternities, dispensaries and other healthcare facilities proliferate thus adding to and exert abating health care wastes management processes.

It was this realization that prompted the African Regional Office of the Urban Management Programme (UMP) under my leadership as Director to initiate research into all aspects of healthcare waste in Africa using Ibadan, Nigeria as a case study. The research, conducted by the Institute for Human Settlement and Environment (IHSE), an international NGO based in Ibadan was UMP's contribution to the understanding and management of healthcare wastes in Africa.

As a means of adding value to this novel research, the research results have been turned into a healthcare waste handbook which will be handy to all nations, agencies, and institutions of learning and available to practitioners of healthcare wastes in particular. The main motivations for this book are to:

- Point to the near total absence of attention to this category of waste;
- Document the processes of health care waste management;
- Focus attention on the causes, consequences and impact of the many harmful effects of this waste;
- Suggest healthcare waste management strategies and;
- Call on the legislators and politicians in various countries of Africa in particular and the world in general on the need to evolve actionable policies to effectively handle this comparatively small but deadly category of wastes.

6

Handling of Biomedical Wastes

W.B. Wahab and M.K.C. Sridhar

This chapter deals with generation, segregation, collection, storage, and transportation of healthcare wastes. Health institutions generally generate a wide variety of wastes, some of them are similar in many respects to those produced by recreational facilities, hotels, and restaurants. Such wastes include paper, rags, food remnants, glass, plastics, metals and containers from food preparation activities. Others are paper, office waste, and other miscellaneous wastes from different maintenance activities. In view of the variety involved and the hazardous and infectious nature, appropriate handling practices and colour coding are required.

6.1 Generation Rate

Generation of healthcare wastes varies from country to country and depends also on the type of facility. Healthcare waste is usually expressed in terms of "kg/bed/day" or "kg/patient/day". This waste generation rate is then used to obtain the total weight of waste generated at a specific healthcare facility. Although the aim is to arrive at a single rate for healthcare waste generation, it should be stressed that there are inherent day-to-day variations in such values even at the level of each facility, which may not discard the same amount of waste every day. The volume of healthcare waste generated in some selected countries is given in Table 6.1.

Table 6.1: Healthcare Wastes Generation in Selected Countries

Country/Region	Kg/bed/day
East Asia (middle income)	1.8-2.2
Turkey (Mersin)	0.80
Nigeria (One study by the authors)	0.60
A National survey involving 48 facilities*	
- North Central region	0.59
- North East	0.70
- South South	0.32
- South East	0.43
- South West	0.37
- North West	0.48
Chile (Santiago)	0.65
Turkey (Adana)	0.70
Eastern Europe	1.4-2.0
Middle East	1.3-3.0
East Asia (high income)	2.5-4.0
Spain	0.4-0. 5
Sierra Leone	0.20
Cambodia (Phnom Penh)	0.26
Bangladesh (Dhaka)	0.30
Tanzania	0.41
Botswana (in primary hospitals)	0.50 (excluding sharps wastes)
Western Europe	3.0-6.0
Latin America	3.0 (0.60 in another study) - 20% (of total waste stream)
North America	7.0-10.0

Source: Pruss and Townend 1998.
* Federal Ministry of Environment (2004)

The daily production of solid wastes by rural hospitals in sub-Saharan Africa ranges between 0.3 kg and 1.5 kg/bed, of which a mere 2 to 10% are estimated to be hazardous. Typical figures for industrialized countries amount to 3 to 6 kg/bed/day, with 5 to 20% hazardous waste (WHO 1992, cited in Halbwachs 1994). Pakistan generates around 250,000 tonnes of medical wastes annually from various healthcare facilities in the country. According to a report, 15 tonnes of waste is produced daily in Punjab. The rate of generation is 1.8 kg per day per bed. The province houses 250 hospitals with a total capacity of 41,000 beds (Prusss and Townend 1998).

Healthcare wastes generation depends on numerous factors, such as established waste management methods, type of healthcare establishments, the proportion of patients treated and the level of complexity and degree of specialization of the healthcare facility. Hence, the teaching hospitals generate larger quantities of waste per unit than other facilities. For effective planning, healthcare facilities should make estimates of their own wastes production. In deriving unit generation values, the following hospitals/institutional parameters need to be considered:

- number of hospital beds;
- number of in-patients and out-patients (humans or animals);
- range of services provided; and
- any other activity that leads to the generation of healthcare wastes.

6.2 Waste Segregation

Segregation occurs when wastes or materials are separated or kept separate according to radiological, chemical, and biological or physical properties, so as to facilitate waste handling, treatment, and disposal. Segregation of different categories of wastes (Box 6.1), especially potentially infectious wastes, regular trash, hazardous waste, and low-level radioactive waste, where they are produced, may be necessary to prevent the mixing of incompatible wastes. Segregation enhances the disposal of the wastes to specialist outlets. Segregation should always be the responsibility of the waste producer. For successful implementation of wastes segregation, personnel of various institutions need to be well educated on the definition and classification of healthcare wastes. Staff must also be aware of the rationale for segregation as well as colour code for containers and bags used for different types of wastes. The workers should also be aware of the locations and uses of each segregated waste container (WHO 1999 and Cookey 2005).

Box 6.1: Composition of a Typical Health Care Waste

- Non-infectious regular waste- 80 - 85%.
- Sharps waste - 1%.
- Potential infectious waste and Pathological waste - 10-15%.
- Chemical or pharmaceutical waste - 3%
- Pressurized cylinders, broken thermo-meters, radioactive wastes, etc. < 1%.

Plans and policies should be laid down for waste segregation (Fig. 6.1). Imposing segregation practices within hospitals to separate biological and chemical hazardous wastes will result in a clean solid waste stream, which can be recycled easily. If proper segregation is achieved through training, clear standards, and tough enforcement, then resources can be turned to the management of the small portion of the waste stream needing special treatment.

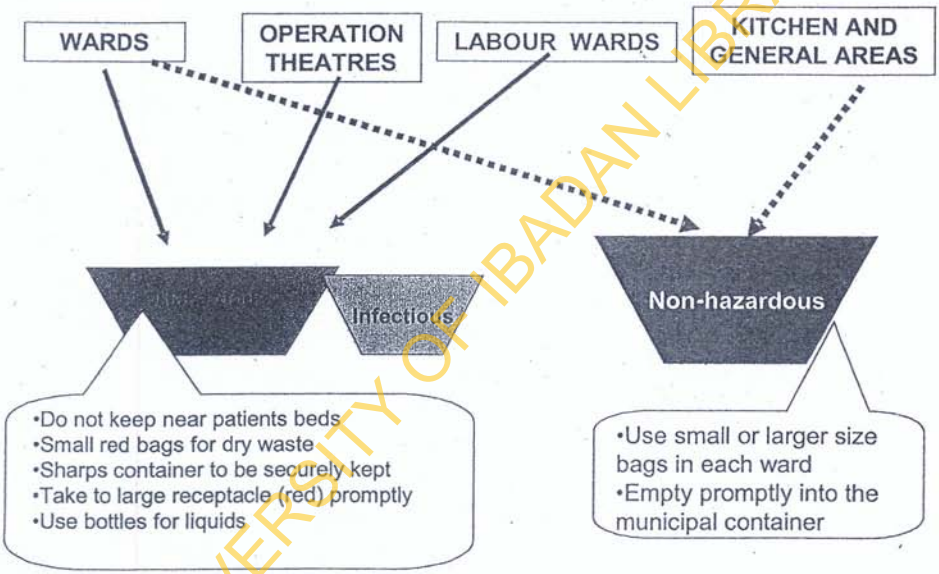

Fig. 6.1: Flowchart of waste segregation

Some of the guidelines for effective segregation are as follows:

(1) Normal, infectious, and hazardous wastes should be segregated at source, e.g. ward bedside, operation theatre, laboratory, or any other room in the hospital where the waste is generated by the doctor, nurse, or other person generating the waste.

(2) All disposal of medical equipment and supplies (excluding syringes and needles), plastic bottles, drips and infusion bags should be cut

or broken and rendered non-reusable at the point of use by the person using the same, or by any other person who comes in contact with such.

(3) All hazardous and infectious wastes other than sharps, large quantities of pharmaceuticals, or chemicals, waste with a high content of mercury or cadmium such as broken thermometers or used batteries, or radioactive waste should be placed in a suitable container made of metal or tough plastic, with a pedal type or swing lid, lined with a strong yellow plastic bag. The bags should be removed when it is not more than three quarters full and sealed, preferably with self-locking plastic sealing tags and not by stapling. Each bag should be labelled, indicating date, point of production or ward or hospital, quantity and description of waste, and it should prominently display the biohazard symbol. The bag removed should be immediately replaced with a new one of the same type.

(4) Sharps, including the cut or broken syringes and needles should be placed in metal or high-density plastic containers resistant to penetration and leakage, designed in such a way that items dropped in, using one hand, cannot be removed. The containers should be coloured yellow and marked "DANGER! CONTAMINATED SHARPS". The sharps container should be closed when three quarters full. If the sharp container is to be incinerated, it should be placed in the yellow plastic bag with the other risk wastes. At the moment, in Nigeria, many development partners are supplying cardboard sharp containers (usually white colour with biohazard symbol). Such should be used and disposed of as recommended.

(5) Large quantities of pharmaceutical waste (unused drugs, etc.) should be returned to the suppliers. Small quantities should be placed in a yellow plastic bag, preferably after being crushed—where this can be done safely.

(6) Large quantities of chemical wastes and wastes with a high content of toxic materials such as mercury or cadmium should not be incinerated but placed in chemical resistant containers and sent to specialized treatment facilities.

(7) Radioactive waste which has to be stored to allow decay to background level should be placed in a plastic bag, in a large yellow container or drum. The container or drum should be labelled, showing the radiochemical's activity on a given date, and the period of storage required, and marked "RADIOACTIVE WASTE" with the radiation symbol. Non-infectious radioactive waste which has decayed to background level should be placed in black plastic bags. Infectious radioactive waste which has decayed to background level should be placed in yellow plastic bags. High

level and relatively long half-life radionuclides should be packaged and stored in accordance with instructions of the original supplier—under supervision of the radiology officer—and sent back to the supplier for disposal.

(8) Non-hazardous waste should be placed in a suitable container lined with a black plastic bag. Adequate numbers of non-risk waste containers should be placed in all areas of the hospital and notices affixed to encourage visitors to use them.

6.3 Waste Collection

Healthcare waste collection practices should be designed to achieve an efficient movement of waste from points of generation to storage or treatment, while minimizing the risk to personnel. Generally, carts are used to transport waste within a facility and are expected to be shut during transport to prevent spillage, offensive sights, and odours. Containment, labelling, and storage specifications for containers should comply with applicable regulations within the country or Occupational Safety and Health Association's blood-borne pathogen rules (Healthcare Without Harm 2001). Collection of healthcare wastes require the following guidelines:

- Normal wastes should be collected in black polyethylene bags of minimum 200 micron gauge; those that are to be recycled should be labelled as "Non-contaminated plastic/glassware (be specific) to be recycled".
- All hazardous healthcare wastes should be placed in yellow polyethylene bags of minimum 300 micron gauge marked "Danger! Hazardous Medical Waste" and indicated with international biohazard symbol.
- Collect ward wastes daily.
- Waste bags should be sealed or tightly closed when ¾ full (with twine or plastic sealing tag but not by stapling).
- All containers and bags should be labelled.
- Full containers should be immediately replaced with empty containers or bags.
- The full containers should be properly and immediately stored until they are disposed of.

Containers for waste collection should meet the following requirements:

- non-transparent,
- impervious to moisture,
- sufficient strength to prevent easy damage during handling or use,
- leak proof,
- close fitted lids,
- fitted with handles for easy manipulation,
- light weight and convenient,
- designed to minimize physical contact, and
- cost effective.

Healthcare waste should be collected in accordance with the schedules specified in the waste management plan of the facility. There should be separate schedules and separate collection times for black bags and yellow bags in order to avoid the risk of mix up. Sanitary staff, sweepers, and other waste handlers should, when handling waste, wear personal protective equipment (PPE) such as face masks, industrial aprons, leg protectors, industrial boots, and disposable or heavy duty gloves, as required at all times. Sanitary staff and sweepers should ensure that:

(a) waste is collected at least daily, but more often if necessary;
(b) all bags are labelled before removal, indicating the point of production, ward, and hospital, and contents;
(c) bags and containers which are removed are immediately replaced with new ones of the same type and colour; and
(d) where a waste bag is removed from a container, the container is properly cleaned before a new bag is fitted in; in case of severe infection, the container should also be discarded.

6.4 Waste storage

Storage is the placement of waste where isolation, environmental protection, and human control are provided with the intent of retrieving the waste for processing and disposal at a later time. It is also the time lapse between the production of the waste until collection for final disposal. Storage areas should be made inaccessible to animals, insects, and birds and protected from direct sunlight. Storage areas should have passive ventilation and should not be located close to food storage or food preparation areas. A spill kit and personal protective equipment, such as gloves, protective footwear, gowns, and masks; extra yellow plastic bags should be

made available in a storage area. If an on-site storage container of biomedical waste leaks, the contaminated surfaces must be cleaned with germicidal agent.

Storage may be internal storage and external storage. Internal storage is the temporary placement of waste at the point of generation before transfer to external storage points and this should not exceed 24 hours. External storage refers to the period and transit point where waste is stored after removal from internal storage to the time it is collected and transported for treatment and final disposal. In both cases, consideration for storage must be based on the classification (Box 6.2) or type of waste being dealt with and the potential risk of infection to healthcare workers and waste disposal staff. Labels on containers should be permanent and legible for the entire storage period. The external storage is usually within the healthcare facility, while treatment and disposal sites could be on-site or outside the facility. The frequency of removal of waste stored depends on the volume and nature of waste generated (Federal Ministry of Environment 2004). Waste storage time should be very short and multiple daily removals are recommended when the quantity is large. For example, in temperate climate, the storage time should not exceed 72 hours in winter or 48 hours in summer. Similarly, in warm climate, storage time should not exceed 24 hours during hot season or 48 hours during cool season (WHO 1999). Some countries require refrigeration of regulated medical waste if storage time exceeds a specified time limit. Some of the storage containers used include buckets with lids, plastic bags, sharp boxes, and bottles (Planco Consulting GMBH 1994) and these vary from country to country (Fig. 6.2).

Box 6.2: UN Substance Classification

Source: WHO, 1999

Class 5.1: Oxidizing substances
Class 6.1: Toxic substances
Class 6.2: Infectious substances
Class 7: Radioactive material
Class 8: Corrosive substances

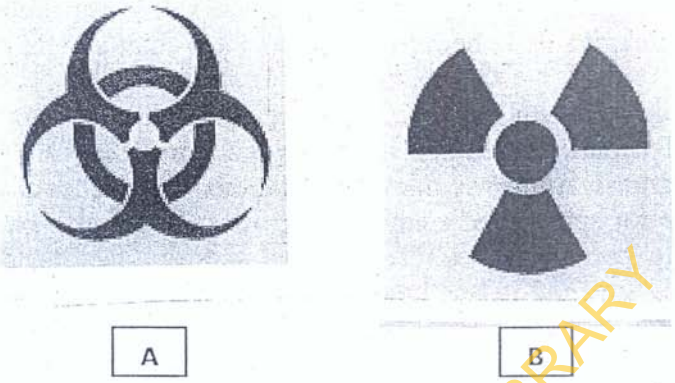

Fig. 6.2: The Biohazard (A) and Radioactive (B) Symbols

(The symbol 'A' is fluorescent orange or orange-red; the background may be any colour that provides sufficient contrast for the symbol to be defined).

A separate central storage facility should be provided for yellow-bagged waste, with a sign prominently displaying the biohazard symbol and clearly mentioning that the facility stores risk waste. The designated central storage facility should:

(a) be located within the hospital premises close to the incinerator, if installed, but away from food storage or food preparation areas or water supply points;
(b) be large enough to contain all the risk wastes produced by the hospital, with spare capacity to cater for collection or incinerator breakdowns;
(c) be easy to clean and disinfect, with an impermeable hard base, plentiful water supply and good drainage, lighting and ventilation;
(d) have adequate cleaning equipment, Personal Protective Equipment (PPE) and waste bags and containers located nearby;
(e) be easily accessible to collection vehicles and authorized staff, but totally enclosed and secure from unauthorized access, and especially inaccessible to animals, insects, and birds;
(f) receive no materials other than yellow-bagged waste; and

(g) not store waste for more than 24 hours: and when an emergency infectious waste is to be stored for more than 24 hours, it should be refrigerated at a low temperature of $<10^0$C.

Containers with radioactive waste should be stored in a specifically marked area in a lead-shielded storage room with proper fencing and warning symbols. Containers with chemical wastes which are for specialized treatment facilities should also be stored in a separate room or area. The central storage facility should be thoroughly cleaned in accordance with procedures stipulated in the waste management plan of the facility.

In addition, the following general measures should be taken to ensure the safe disposal of the wastes:

- Facilities for external storage should be removed from kitchen, laundry, ward etc. but should be within the precincts of the facility and easily accessible to collection vehicles.
- The facility should be enclosed and surrounded by an impervious wall of appropriate height and provided with a gate and lock.
- The walls and floors should be smooth, without cracks, impervious, easy to clean and disinfect.
- Site should be spacious and well ventilated and may accept waste from other healthcare facilities if space would allow.
- All loading and unloading of waste should take place within the designated collection area around the storage point.
- Larger volume waste bins—240 litres and above—should be available at the external storage facility to receive waste containers from the internal storage points. These bins should be marked for ease of identification of content and the markings must correspond with the colour code used for polythene bags in internal storage.
- Healthcare waste should not be compressed during collection.
- Waste water from the storage area must be drained into septic tanks and soakaways and must not be allowed to drain off into storm water drainage or streams.
- Adequate spill kits and protective clothing such as disposable gloves, overall, nose mask, etc., must be provided at the storage sites. The kit must include absorbent materials,

disinfectant, buckets, shovels, etc. for staff to clean up spills and must be easily accessible.

- Provision should be made for washroom facilities for those who handle these wastes e.g. basins, shower, water and soap/detergents etc.
- External storage facilities must meet certain basic standards for the type of waste stored e.g. the temperature of refrigeration of body parts must be such that will prevent further decomposition or multiplication of pathogens.
- Biohazard marks and other warning signs should be conspicuously posted on the door to prevent people from unnecessarily gaining access to the area.
- Only authorized people should have access to external storage area.

6.5 Waste Transportation

Collection and transportation of wastes from healthcare facilities should closely follow the general waste management plan of the state government in the country. Where the facility is not equipped to carry out on-site treatment and disposal of healthcare waste, the institution should appoint a waste management contractor licensed by, in the case of Nigeria, the State Ministry of Environment or any designated agency to collect and transport its wastes to a designated site for treatment and disposal. Before commissioning a healthcare waste contractor, the officer-in-charge (waste control manager) on behalf of the institution should verify particulars of the contractor for the following:

- whether licensed by the state government/State Environmental Protection Agency (SEPA) or State Ministry of Environment;
- type of license, e.g. whether for collection, transportation and/or disposal;
- type of waste that can be handled by the contractor (scope of contract);
- times for renewal of the license, which should be done annually;
- contractor's capacity, e.g. fleet size, work-force, creditworthiness, etc.;

- knowledge/experience in handling healthcare wastes; and
- any other points of interest, such as contractor's responsibilities and liabilities.

Transportation of healthcare wastes, whether internal or external, should follow the following guidelines:

(1) The process of internal waste transportation from medical wards to storage areas should be done by the use of a rigid two-wheeled container, properly labelled, colour-coded with respect to waste bags they will hold and equipped with a top lid.

(2) For on-site transportation, the waste collection trolley should be free of sharp edges, easy to load and unload and to clean, and preferably a stable three or four-wheeled design with high sides. The trolley should not be used for any other purpose. The trolley should be cleaned regularly, and especially before any maintenance work is performed on it.

(3) The sealed plastic bags should be carefully loaded by hand onto the trolley, to minimize the risks of punctures or tears.

(4) Yellow-bagged infectious waste and black-bagged non-hazardous waste should be collected on separate trolleys which should be painted or marked in the corresponding colours.

(5) The collection route should be the most direct one from the final collection point to the central storage facility designated in the waste management plan. The collected waste should not be left even temporarily anywhere other than at the designated central storage facility.

(6) Transportation to off-site should, unless otherwise agreed, be the responsibility of the local government or council or county, or an approved waste collector which should ensure that:

- all yellow-bagged waste is collected at least once daily;
- all staff members handling yellow-bagged waste wear PPE;
- yellow-bagged waste is transported separately from all other waste;

- vehicles or skips used for the carriage of yellow-bagged waste are not used for any other purpose, are free of sharp edges, easy to load and unload by hand, easy to clean/disinfect, and fully enclosed, preferably with hinged and lockable shutters or lids, to prevent any spillage in the hospital premises or on the highway during transportation;
- all concerned staff members are properly trained in the handling, loading and unloading, transportation and disposal of yellow-bagged waste, and are fully aware of emergency procedures for dealing with accidents and spillages;
- all vehicles carry adequate supply of plastic bags, protective clothing, cleaning tools and disinfectants to clean and disinfect any spillage promptly;
- the transportation of waste is properly documented, and all vehicles carry a consignment note (Fig.6.3) from the point of collection to the incinerator or landfill or other final disposal facility and also a return note to the waste producer;
- all vehicles are cleaned and disinfected immediately after use; and
- all vehicles used for healthcare waste carry the biohazard mark on all sides and are appropriately designed to prevent scattering of wastes, odour nuisance and leakage.

Any vehicle used to transport healthcare waste should fulfill the following design criteria (WHO1999):

- The body of the vehicle should be of a suitable size commensurate with the design of the vehicle, with an internal body height of 2.2 metres.
- There should be a bulkhead between the driver's cabin and the vehicle body, which is designed to retain the load if the vehicle is involved in a collision.
- There should be a suitable system for securing the load during transport.
- Empty plastic bags, suitable protective clothing, cleaning equipment, tools, and disinfectant, together with special kits for dealing with liquid spills, should be carried in a separate compartment in the vehicle.

- The internal finish of the vehicle should allow it to be steam-cleaned, and the internal angles should be rounded. The vehicle should be marked with the name and address of the waste carrier.
- The international hazard sign should be displayed on the vehicle or container, as well as an emergency telephone number.

6.6 Labelling and Colour Coding

Labelling of waste containers into various categories is crucial for easy identification, pretreatment, and disposal. The label should clearly indicate the contents, date of production, place of production (e.g. ward/establishment), waste quantity, waste category, waste destination in case of off-site disposal, and UN packaging symbol and substance class. This information may be written directly on the containers or on the pre-printed labels which are to be securely pasted on the containers. Some of the advantages of labelling are:

- it facilitates easy tracing of the origin of the wastes;
- it serves as a warning to waste generators, handlers, and the general public of the hazardous nature of the waste; and
- the nature of hazard posed by the waste in case of accident.

The WHO recommended colour-coding scheme are:

Black for non-hazardous general waste (e.g. kitchen waste, paper cardboard, sweeping etc.).
Yellow for infectious waste (e.g. patient waste, human/animal tissue and cultures/specimens); sharps, however are to be kept in puncture-resistant containers, either cardboard or plastic (if plastic are used, use yellow colour code).
Red or Brown for non-infectious hazardous waste (e.g. expired drugs, vaccines, chemicals, etc.).

Table 6.2 shows the colour coding for the storage and transportation of healthcare waste. It should always be noted that colour coding for the plastic bags should always correspond with or match the waste containers both at the internal and external storage sites. The classification of various categories of healthcare wastes in Nigeria is given in Box 6.3.

Table 6.2: Colour Coding for Storage and Transportation

Waste Type	Description of Waste	Colour code
1	General Waste	▪ Black plastic bag of appropriate size
2	**Infectious Waste**	
	(a) Sharps	▪ Puncture-resistant containers and yellow plastic bags marked "sharps"; cardboard boxes may be used but have no colour code
	(b) Patient waste	▪ Yellow plastic bags and containers
	(c) Culture/Specimen	▪ Yellow plastic bags and containers
	(d) Pathological/Organic Human tissues	▪ Yellow plastic bags
3	**Hazardous Waste**	
	(a) Pharmaceutical waste	▪ Red/Brown plastic bags and containers
	(b) Photographic chemical waste	
	- Photographic developer	▪ Red / Brown plastic containers
	- Fixer solution	▪ To be recycled/reused
	- X-ray photographic film	▪ To be neutralized
	(c) Radioactive Waste	▪ Yellow containers with radioactive symbol (usually with lead liners)
	- Solid combustible/compactable	- Durable plastic bags which can be sealed.
	- Noncombustible/noncompactable	- Puncture-resistant containers (metal), thick walled polythene bottles or organic glass containers but should have secondary container to prevent them from breaking.
	- Liquid-aqueous spent sealed sources	- Container in which the source was originally received.
	(d) Laboratory Waste	▪ Red/Brown containers with appropriate labels
	• Acids	- Acid label
	• Alkalis	- Alkali label
	• Solvents	- Solvent label
	• Organic substances	- Organic substances label
	• Heavy metal (e.g. mercury)	- Heavy metal label
	(e) Incinerator Ash Sludge	▪ Yellow metal containers labelled "Ash" ▪ Yellow metal containers labelled "Sludge"

Source: Federal Ministry of Environment 2007

Box 6.3: Nigerian Classification and Description

Class 1: Non-Risk General Waste - Similar to normal household municipal waste and can be managed by the municipal waste services (NON-HAZARDOUS).

Class 2: Infectious Waste (Hazardous) - Generated by both inpatients/outpatients or animals, this waste is known or likely to contain pathogenic micro-organisms and can be dangerous or infectious to both patients, healthcare workers and the public. It, therefore, requires special management both inside and outside the hospital.

Class 3 (Highly Hazardous): Sharps - These are sharp-edged wastes that can cause cuts or puncture wounds (e.g. needle stick injuries). They are hazardous whether or not they are contaminated with blood. They must be segregated, packaged, and handled with specific procedures within the health facility.

Class 4: Pathological/Anatomical - Includes amputations and other body tissues resulting from surgical operations, autopsy (post-mortem), or delivery. Requires special treatment for ethical and aesthetic reasons.

Class 5: Chemical, Pharmaceutical, Genotoxic Waste - Wastes, including expired products, generated from the pharmacy, radiology and from chemotherapy.

Class 6: Highly Infectious - These highly infectious wastes require immediate treatment by chemical disinfectants or autoclaving before joining the hazardous HCW stream.

Class 7: Radioactive Waste - Any solid, liquid, or pathological waste contaminated with radioactive isotopes of any kind.

Colour Coding (4 colours for secondary and tertiary facilities but only Black and Yellow for Primary HC facilities)

Black: Non-risk waste of category (Class 1)
Yellow: Infectious waste (Class 2), sharps collected in yellow, puncture-proof containers (Class 3)
Red: Highly infectious waste (Class 6)
Brown: Pharmaceutical waste, some chemical waste, heavy metal wastes (Class 5)

Source: Federal Ministry of Environment (2007)

Name of waste regulation authority Address and telephone number of waste regulation authority	Serial No: Originator's reference
CONSIGNMENT NOTE FOR THE CARRIAGE AND DISPOSAL OF HAZARDOUS WASTE	
Producer's Certificate **A**	(1) The material described in B is to be collected from: .... And (2) taken to: ..... Signed ..... Name ..... On behalf of ..... Position ..... Address: ..... Telephone No. .... Date .... Estimated date of collection .....
Description of the Waste **B**	1) General description and physical nature of waste 2) Relevant chemical and biological components and maximum concentrations 3) Quantity of waste and size, type and number of containers 4) Process(es) from which waste originated
Carrier's Collection Certificate **C**	I certify that I collected the consignment of waste and that the information given in A (1) and (2) and B (1) and (3) is correct, subject to any amendment listed in this space. I collected this consignment on ..... at ..... hours Signed ..... Name ..... Date ..... On behalf of ..... Vehicle reg. No. ..... Address ..... Telephone No. ....
Producer's Collection Certificate **D**	I certify that the information given in B and C is correct and that the carrier was advised of appropriate precautionary measures. Signed ..... Name ..... Date..... Telephone No .....
Disposer's Certificate **E**	I certify that waste disposal licence No ..... issued by ..... [Name of issuing body], authorized the treatment/disposal of this facility of the waste described in B (and as amended where necessary at C). This waste was delivered in vehicle ..... (reg. No) at ..... hours on ..... (date) and the carrier gave his name as ..... Proper instructions were given that the waste should be taken to ..... Signed ..... Position ..... Date ..... on behalf of .....
For use by Producer / Carrier / Disposer	

Fig. 6.3: A sample consignment note from UK
Source: Pruss and Townend (1998)

References

Cookey, Peter (2005) *A functional approach to waste management, business and environment and sustainable development. Practitioner's Series*, Earthwatch, Port-Harcourt.

Federal Ministry of Environment (2004) *Draft of national healthcare waste management plan in Nigeria*, pp.1-46.

Federal Ministry of Environment (2007) *National healthcare waste management guideline.,* Prepared by the healthcare waste management technical working group, draft 2007-04-04

Halbwachs, H. (1994) Solid Waste Disposal in District Health Facilities, *World Health Forum*, Vol.15, pp.363-367.

Healthcare without harm (2001) Non-incineration medical waste treatment technologies, 1755 S Street, Washington DC 20009, pp.1-106.

Pakistan Environmental Protection Council (2003) Draft hospital waste management rules, hospital waste management committee.

Planco Consulting GMBH (1994) *Medical waste management - experience from Nepal: A case study and lessons learned from Nepal*, Hamburg, Germany, pp1-23+ Annex.

Prüss, A. and Townend, W.K. (1998) *Teacher's guide-management of wastes from healthcare activities, Lecture 5*, World Health Organization, Geneva, pp.1-74

Sridhar, M.K.C. and Mbong, G.A. (2006) Healthcare waste management plan - A draft prepared for the World Bank for implementation of joint action plan of the roll back malaria partnership in Nigeria, pp.1-37.

WHO (1999) *Safe management of wastes from healthcare activities*, edited by A. Prusss, E. Giroult and P. Rushbrook, World Health Organization, Geneva, pp.1-230.