NIGERIA IN SEARCH OF SUSTAINABLE HEALTHCARE WASTES MANAGEMENT STRATEGIES: ANY LEGAL AND INSTITUTIONAL PROSPECTS?[*]

Abstract

Wastes are materials of solid or semi-solid character that possessor no longer considers of sufficient value to retain. They are also substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provision of national law. Healthcare is the services of providing medical care. Waste is also any substance or material which needs to be disposed of, as being broken, worn out, contaminated or otherwise spoiled. Management on the other hand is getting things done through and with people to achieve organizational objective. It is also the act of running and controlling a business or similar organization. Healthcare waste management system therefore is the care and management of wastes in the organization in a way that will not be harmful to the people and environment for sustainability. It is imperative for there to be proper management of medical waste in order to maintain healthier environment and human beings. Developed nations like United Kingdom and United States of America have researched and developed institutional mechanisms to treat and control its harmful effects, most countries of the developing world like Nigeria have no knowledge of the dangers associated with the generation, collection, transportation and especially disposal of these health care wastes. It is how to make these developing countries to be aware, conscious and knowledgeable by having institutional, judicial and legislative frameworks that prompted research in this area, hence, this paper. The paper concluded by recommending measures to improve the Healthcare waste management practices in Nigeria.

Keywords: Sustainability, Nigeria, Healthcare wastes, management, strategies legal and institutional prospects.

1. Introduction

The sustainable management of Healthcare waste (HCW) has continued to generate increasing public interest due to the health problems associated with exposure of human beings to potentially hazardous wastes, arising from healthcare.[1] Presently, considerable gap exist with regard to the assessment of healthcare waste management practices particularly in Nigeria and in several other countries in sub-Saharan Africa. The nature and quality of healthcare waste generated as well as institutional practices with regards to sustainable methods of healthcare waste management including waste segregation and waste recycling are often poorly examined and documented in several countries of the world despite the health risks posed by the improper handling of HCW.[2] It is also a serious concern that the level of awareness particularly of health workers regarding healthcare waste has not been adequately documented. HCW are a special category of waste because they often contain materials that may be harmful and can cause ill health to those exposed to it. A number of studies have indicated that the inappropriate handling and disposal of healthcare waste poses health risks to health workers who may be directly exposed and to people near health facilities, particularly children and scavengers who may become exposed to infectious wastes and a higher risk of diseases like hepatitis and HIV/AIDS.[3] The World Health Organization estimates that each year there are about 8 – 16 million new cases of Hepatitis B virus HBV; 2.3 to 4.7 million cases of Hepatitis C Virus (HCV) and 80,000 to 160,000 cases of human immune deficiency virus (HIV) due to unsafe injections and mostly due to very poor waste management systems. In developing countries like Nigeria, where many health concerns are competing for limited resources, it is not surprising that the management of healthcare wastes has received less attention and the priority it deserves. Unfortunately, practical information on this important aspect of healthcare management is

[*]By**Livinus I. NWOKIKE**, **OND, HND, PGD, MBA, FNIM. LLB (Hons), BL, LLM, PhD (candidate),** Justice of Peace, Notary Public & Lecturer, Department of International Law and Jurisprudence, Faculty of Law, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria, Email: li.nwokike@unizik.edu.ng, tolerancefocus@gmail.com, website: http://www.geci.org.ng. Phone Number: 08033521034, 09073018015

[1] T L Tudar et al Healthcare waste management: A case study from the Cornwall NHS UK, Waste Management. (2005) 606-615 at 25

[2] M Farzadika et al 'Hospital waste management-status in Iran: A case study in the teaching hospitals of Iran University of Medical Sciences, Waste Manage. Res. (2009) 384-389 at 27; I A Oke 'Management of Immunization Solid Waste in Kano State, Nigeria' (Kano, Waste.manage,2008) 2512-2521 at 28

[3] M A Adegbita et al 'Assessment of Dumpsite Rehabilitation Potential using the integrated Risk Based Approach: A case study of Eneka, Nigeria, World Appl. Sci J 8(4) (2010) 486-442; A O Coker et al 'Characterization and Management of Solid hospital wastes in Ibadan, Nigeria in Integrated development for water supply and sanitation: proceedings of the 25th Annual Conference of Water Engineering and Development Centre (WEDC), edited by John Pickford, UK, November, 1999 Addis Ababa, Ethiopia (1999) 331-334. World Health Organization (WHO) 'Unsafe Injection Practices and transmission of blood borne pathogens, Bull and Health Organization (1999) 787-819 at 77; WK Townend et al 'Guidelines for the evaluation and assessment of the sustainable use of resources and of wastes management at healthcare facilities, waste manage. Res. (2006) 398-408 at 23

inadequate management of healthcare, and insufficient research on the public health implications of inadequate management of healthcare wastes.[4]

Although reliable records of the quantity and nature of healthcare wastes and the management techniques to adequately dispose of these wastes has remained a challenge in many developing countries of the world, it is believed that several hundreds of tons of healthcare waste are deposited openly in waste dumps and surrounding environments, often alongside with non-hazardous solid waste. A near total absence of institutional arrangements for HCW in Nigeria has been reported by others.[5]Various methodologies have been used all over the world to assess and quantify HCW. They include the use of physical observation, questionnaire administration and quantification. Recent studies in Nigeria has estimated waste generation of between 0.562 to 0.670kg/bed/day and as high as 1.58kg/bed/day.[6]

The mismanagement of healthcare waste possesses health risks to people and the environment by contaminating the air, soil and water resources. Hospitals and healthcare unit are supposed to safeguard the health of the community. However, healthcare waste if not properly managed can pose an even greater threat than the original diseases themselves.[7] There are a responsible range of treatment technologies available for healthcare wastes that may be appropriate for third world countries, however, it is pertinent that before any of these options are adopted, hospitals and medicals facilities will need to assess the problem and put forward a management strategy that is suitable to their economic circumstances and that can be sustained based on local technology.

In fact, the aim of this study therefore is to identify the gaps in current practices of healthcare waste in Nigeria compared with international best practice and recommend ways of bridging the gap considering the current economic and technological realities in the country. This paper therefore set out to:

a. Assess the current waste management practices in terms of type of wastes and quantities of waste generated in the various units of a tertiary level healthcare facility and the waste handling and disposal practices.
b. Assess the level of awareness of health workers regarding HCW management.
c. Assess the level of compliance with recommended best practices for the sustainable management of healthcare wastes based on the United Nations Environmental Programme/World Health Organization (UNEP/WHO, 2005) and the Townend and Cheeseman (2005) guidelines.

2. Overall Responsibility for Managing Waste

Through face to face interview (key informant interview) of the hospital head of administration it was revealed that there was no focal person or waste manager responsible for HCW management, rather sanitation in the hospital is overseen by a committee. The hospital had thus retained the services of 2 environmental officers directly responsible for maintaining sanitation in the hospital. There were also a number of cleaners assigned to each ward and unit who are responsible for the day to day cleaning of the wards and emptying of waste bins. The overall responsibility for HCW management is not clearly defined.

Table 1: HCW management description and the indicators used in the assessment of waste management performance at the healthcare facility

	HCW Management Criteria	Indicators
1.	General management strategy	Hospital waste management policy or strategy Special budget for waste management Operative staff for management of waste Training on waste management Personal Protective Equipment worn by operative staff Type of receptacles/storage containers (uniform or specific,

[4] S O Abah et al 'Healthcare Waste Management in Nigeria: A case study of Journal of Public Health and Epidemiology, (2015) Vol 3(3), pp-110

[5]Baz Alagoz et al 'Treatment and disposal alternative for healthcare wastes in developing countries – A case study in Istanbul, Turkey Waste Manage Res. (2010) 769-777 at 28; Coker 'Medical waste management in Ibadan, Nigeria: Obstacles and Prospects, February 2009, *Waste Manag*. 29 (2) (2009) 804-811

[6] E O Longe et al 'A Preliminary study of medical waste management in Lagos Metropolis, Nigeria. A Project submitted to the Department of Civil and Environmental Engineering, University of Lagos, Lagos State, Nigeria

[7] PATH 'Achieving effective sharps waste management in GAVI host countries. A proposed approach with estimates of cost 2006 (2009) available at http://www.path.org/files/is-ach-swm.pdf accessed 27 July, 2009

		varying types, sizes etc) Colour coding of receptacles
2.	Waste Collection and Segregation	Number/adequacy of waste receptacles Are sharps or infectious materials collected separately? Is segregation regulated or controlled?
3.	Waste recycling	Is there any form of recycling? What is recycled? Are syringes reused? What else is re-used?
4.	Waste storage	Presence or absence of purpose built waste handling facility Waste dumped outside the hospital building? Open waste disposal?
5.	Waste treatment	None Autoclaving of lab wastes Crude incineration outside Encapsulation e.g. of sharps Waste burial within healthcare facility Chemical disinfection of body fluids Other advanced technology
6.	Offsite disposal	Waste disposal contracted out? How are wastes transported (open vehicle or Enclosed compaction vehicle?) What is the final destination of the waste (open dump, level 1 landfill, hazardous waste engineered landfill, shredded + some other technology?

3. HCW Management Manual and Instructive Posters

Interviews of key informants and observations by the researcher reveal that the hospital does not have a HCW management manual. It was also observed that instructive posters on waste segregation were not on display anywhere in the health facility.

Waste Collection, Segregation and Storage

Direct observation revealed that waste was collected in different types of receptacles. Out of 63 bins inspected, 41 (76.2%) did not have a lid. There was no form of color coding to indicate the type of waste to be deposited in a particular waste bin. There was no provision of weighing scales for measuring the weight of wastes generated at any of the wards or locations that waste were collected. As a result it is impossible to determine precisely the quantity of waste generated in the health facility. Sharp waste segregation was done in the wards. No other form of waste segregation occurs at any level and no strategy is in place for waste minimization. Temporal storage of waste occurs in the receiving receptacles or waste bins which are emptied daily or more frequently depending on the filling rate. Waste is collected daily by ward attendants and cleaners for dumping directly from storage receptacles or bins.

Waste re-cycling and re-use

Direct observations and face to face interviews of key informants revealed that no form of waste re-cycling or re-use exist or is planned for the near future at the health facility.

Table 2: Guidelines for the assessment of level of sustainable waste management practice

Sustainable Level of Practice	Operating Performance	Characteristic
Level 0	Operating in a totally unsustainable manner with reluctance to change	No waste management strategy, only limited segregation of wastes, storage containers are unspecific with no colour coding and waste likely to be dumped outside the hospital building. In addition waste is transported in open trucks, limited re-use of materials and no recycling at the facility; waste treatment is limited to the simplest technologies such as crude

		incineration while if off-site disposal exists it will be mainly to a dumpsite or level 1 landfill with the attendant environmental hazards.
Level 1	Generally operating in an unsustainable manner, although there is some evidence of awareness and willingness to change.	Although having no specific waste management strategy, will have separate collection of segregated wastes in enclosed vehicles, autoclave of infectious waste and use single cell incineration plant.
Level 2	Operating in a manner with some aspects that are considered sustainable and others that are considered unsustainable	Waste management policy in place, segregation of wastes and colour coding, specified waste storage containers, waste transported with enclosed compaction vehicles and separate vehicles for hazardous waste, some recycling at facility (paper, cardboard etc), use of multi chamber incinerator plants and alternative modern technologies (such as microwave) to treat waste and disposal in level 2 landfill.
Level 3	Generally operating in accordance with sustainable development, but some aspects not ideal	Local waste management policy and strategy in place, full colour coding, dangerous goods are stored in UN approved containers and packaging all waste in containers of approved standard and a dedicated waste handling facility. Re-use and re-cycling of materials (example, print cartridges, oil), incineration of hazardous materials to EU Directive emission standards plus use of alternative technology and offsite disposal at a level 3 engineered landfill site.
Level 4	Operating in a way that displays all the characteristics normally associated with sustainable development.	Waste management policy, full time waste manager, full segregation of materials, full colour coding, contracts with secondary raw materials industry, storage in UN approved containers, all wastes in containers or sacks to approved standard and a dedicated well secured waste facility. Waste is transported in enclosed compaction vehicles, Basel convention applied to waste transport. Recycling of paper, glass, plastic, metal, construction waste, food waste, textiles etc. incineration of hazardous materials to EU Directive emission standards plus use of alternative technology, hazardous waste to strictly controlled landfill sites and offsite disposal to level 4 engineered sanitary landfill.

Source: Modified from Townend and Cheeseman (2005).

Waste Treatment and Disposal

Waste is collected at a central open dumpsite and burnt periodically. Occasionally, the wastes are buried by covering with a layer of earth. No prior treatment takes place. Human body parts such as placenta and amputated limbs are either disposed with the general waste or returned to the patient for disposal. Used swabs and dressings as well as pharmaceutical wastes are disposed with general waste. Sharps are collected separately in sharp proof containers and disposed by burying.

Training, knowledge and practice of doctors and nurses

The proportion of respondents who had received specific training in management of HCW was 11.5% (6/52). The number who understood the importance of HCW management in the provision of safety to the public was 46% (24/52). Only 8% (4/52) responded that they had seen instructive posters on waste segregation. None of the respondents knew the focal person responsible for HCW management in their unit and the hospital strategy for managing HCW. About 69% (36/52) of the respondents reported that the waste generated in their unit of the hospital was disposed of by open burning or burying on facility site.

Management and Commitment

This study has revealed significant problems with HCW management at the tertiary facility studied. These include lack of management commitment, poor waste handling practice, inadequate training on HCW, non-existent segregation of HCW and risky disposal practices. Although some form of segregation of sharps (needle and syringes) takes place at the facility, which has reduced the incidence of needle prick injuries, the overall practice of HCW management is still problematic. HCW management is a management and technical issue (WHO, 1999) requiring urgent attention. Sustainable HCW management practice depends on the commitment of all healthcare facility staff, particularly commitment from the hospital leadership. The current management approach to HCW found in this study mirrors waste management at the national level in a number of ways. For instance, national legislation and policy specific to HCW management is yet to be implemented at any level despite the existence of Draft Nigeria National HCW (2007) and the fact that Nigeria is a signatory to several multilateral environmental agreements including the Basel convention, Vienna Convention and Kyoto Protocol to mention but a few; municipal waste management is ongoing problem in many states and the absence of functional landfills in the country has further compounded the problem. Other factors contributing to poor health care waste management in the country include the general situation of infrastructure such as poor roads, intermittent electricity, lack of health vehicles (thus making transportation of waste unsafe) and the absence of effective municipal waste disposal system. These constraints notwithstanding, it is possible to demonstrate management commitment in a number of other simple but effective ways such as training and creating awareness of the health risks from the inadequate management of medical waste, provision of simple institutional guidelines, provision of adequate personal protective equipment for waste workers and a focus on implementation of solutions that are currently affordable and available.

Table 3: Characteristics of HCW management at the study site

HCW Management Criteria	**Description of existing practice**
General management strategy	
Hospital waste management policy or strategy	No existing HCW management policy
Special budget for waste management	No special budget
Operative staff for management of waste	No dedicated HCW manager
Training on waste management	No records of special training for handlers of healthcare waste
Personal Protective Equipment worn by operative staff	Personal protective Equipment is limited to uniforms
Waste Collection and Segregation	
Type of receptacles/storage containers (uniform or specific, varying types, sizes etc)	Varying types and sizes of non-specific containers
Color coding of receptacles	No color coding
Number/adequacy of waste receptacles	Waste receptacles are small in size and require physical contact to open lid
Are sharps or infectious materials collected separately	Yes, sharps are collected in puncture proof containers
Is segregation regulated or controlled	Only sharps are segregated
Waste recycling	
Is there any form of recycling?	No form of recycling
What is recycled	Nothing
Are syringes reused?	No
What else is re-used?	Bed linings
Waste Storage	
Is there a purpose built waste treatment facility?	No
Area waste dumped outside the hospital building?	Yes
Open waste disposal?	Yes. Waste is dumped in a large pit outside the hospital building
Waste treatment	
Autoclaving of lab wastes	Autoclaving of theatre materials
Crude incineration outside	No
Encapsulation example, of sharps	No

Waste burial within healthcare facility	Yes
Chemical disinfection of body fluids	No
Other advanced technology	Nil
Offsite disposal	
Waste disposal contracted out?	No
How waste is transported (open vehicle? Enclosed compaction vehicle?	Open bins and vehicles, carried manually to waste dumps
What is the final destination of the waste (open dump, level 1 landfill, hazardous waste engineered landfill, shredded + some other technology?)	Open waste dump. Waste is burned in open fire or buried by covering with earth at healthcare facility

The findings from this study has shown clearly the critical need for management to provide institutional support and guidance aimed at ensuring that health workers follow a standard procedure in the management of HCW waste at the institutional level. Without a clear policy from management there is likely to be very little attempt at waste segregation, waste minimization and adequate treatment and disposal. Another major issue confronting the management of healthcare waste is perhaps the fact that it is generally viewed mainly from an environmental and less from a public health perspective. As a result gaps exist in visions and understanding, particularly as it relates to the much desired robust integration of the Environment ministry and the Health ministry at both the state and National levels of Governance. In Nigeria, liability for any pollution occurring as a result of unauthorized waste management activities rests with the waste generator in accordance with Article 20(1) of Decree No. 58/88. The Public Health Act 1958 and various state edicts on environmental sanitation also provide regulations on the management of solid waste, particularly non hazardous, general (municipal) waste. These laws however do not adequately address the important aspects of healthcare waste. A mechanism to regulate and enforce sustainable management of wastes generated from health cares as an integral part of the existing environmental protection framework should be considered.

The 1992 Earth Summit in Rio de Janeiro called for action to establish national policy, national guidelines and a training program for HCW management in all countries in the world.[8] In Nigeria, the Government response to the conference has yet to result in a national policy on HCW management. The current national action plans for waste management does not include participation from the health sector.[9] It is thus not surprising that healthcare waste management centers are generally lacking at any level of healthcare. The establishment of specific policies and strategic plans on HCW at the national level, particularly given the limited budget available to the health sector is a crucial initial step towards the achievement of a minimum level of HCW management practice in a developing economy like Nigeria.

Waste Generation, Segregation, Treatment and Disposal

Our study has shown that generally the quantity of waste generated in the out-patient units is less than that in the in-patient units. This may be because a large proportion of the wastes generated by patients in the in-patient wards are similar to general waste such as packaging and food waste, and thus there may be no real difference in the actual quantity of general waste. In-patients on the other hand are more likely to generate infectious wastes, pharmaceutical wastes and pathodological wastes. Good segregation practice will ensure a reduction in the quantity of medical waste which is more expensive to manage. The absence of waste segregation at the health facility imply that the estimates of the various categories of waste may not be precise, nonetheless it provides a useful guide for the assessment of the different waste streams generated many of which are hazardous in nature requiring special handling to avoid health consequences. The World Health Organization recommends the segregation of HCW waste preferably at the source of production and provides guidelines for the safe and sound management of medical waste in developing countries.[10] From this study, it is obvious that the WHO guidelines have not been followed in the HCW management of the hospital. The WHO recommends the following color coding of waste receptacles to facilitate the segregation of HCW at the source of generation (and to keep them separated from each other).Red for highly infectious waste, yellow for other infectious waste, yellow marked 'SHARPS' for sharp waste, brown for

[8] See UNCED, 1992

[9] See Daily Trust Newspapers of 17 September, 2008

[10] WHO 'Safe Management of Waste from healthcare activities, edited by A Pruss et al, World Health Organization, Geneva (1999) pp 1-230

pharmaceutical waste, lead box labeled with radioactive symbol for radioactive waste and black for general or non-infectious waste.[11]

Table 4: Summary result of the application of the Townend and Cheesman guidelines for the sustainable management of HCW at the studied healthcare facilities

Waste management criteria	Description of existing practice	Townend and Cheeseman criteria	Corresponding sustainable level of HCW management at study site
Waste Management Responsibility, Segregation, Storage and Packaging	No focal waste manager, No written waste management plan, only sharps are segregated, waste stored in unlabelled plastic bins, no color coding and 76% of bins have no lids; waste dumped outside building	No waste management strategy; Limited Segregation (sharps, only); storage containers not specific (no color coding); Waste dumped outside building	0
Waste transport	Waste collected in bins and manually transported to dumpsite outside the building	Municipal solid waste (MSW) collection and transport with open topped vehicles used for all wastes	0
Waste recycling and reuse	No form of waste recycling. Limited re-use of some theatre materials and beddings.	Some re-use of materials. No recycling at the HC facility	0
Waste treatment	Burning with open fire and burying at healthcare facility	Crude incineration on site of hazardous wastes. Environmental pollution and dangers to public health from crude incinerators. Some waste burying at HC facility in remote areas	0
Offsite disposal	No offsite disposal	Scavenging by animals and insects Causing environmental pollution Dangers to public health No site security	0

*0 = unsustainable level of HCW management

It must be emphasized that in addition to the color, special sharp proof containers are required for sharps wastes. Segregation of HCW serves many important public health functions: segregation reduces medical waste and thus reducing the health impacts on the general public (after dumping); reduction of medical waste impacts positively on the budget required for HCW disposal. Study of infectious wastes in a Saudi Arabian hospital has also reported the importance of providing instructive posters as tool to promote effective segregation of HCW. In this study, the lack of HCW management manual and hospital policy on HCW management are likely to be responsible for the low awareness of health workers on HCW management.[12] This finding is consistent with the outcome from other studies.[13] A lack of sufficient health budget means that waste management is probably not a priority issue amongst competing needs in the health facility and may be factor in the non provision of standard waste bins of desired size and make, such as bins with foot operated lid. To overcome these limitations the health facility should consider the

[11]A Pruss et al 'Teacher's guide management of wastes from healthcare activities, Lecture 5, World Health Organization, Geneva (1998) pp 1-74

[12] D L Hagen et al 'Infectious waste survey in a Saudi Arabian Hospital, An Important Quality Improvement Tool, AM.J. Infect. Control, 29 (2001) pp 189-202

[13] M Askarian et al 'Results of a hospital waste survey in private hospitals in Fars Province, IRAN j. *Waste Manag*; 24 (2004) p. 83-89

use of inexpensive locally available containers which can be modified to make them suitable and then inserting colored labels. This is can be used as a short term measure. A medium to long term measure will be the proper allocation of financial resources for the provision of appropriate storage bags and containers, construction of temporal storage facility, training of operational staff and other health workers and the investment in appropriate technology for waste treatment and disposal. The provision of instructive posters is also not expensive and can be achieved in the short term within available resources.

The current disposal method adopted by the health facility, which is dumping and open burning at the facility premises poses health risks to patients and people residing close to healthcare facilities (Kuroiwa et al., 2004). The HCW may also contain a large proportion of plastics. When burnt, dioxin is a major air pollutant of concern from chlorinated polymer as reported by the World Health Organization.[14] Hazardous healthcare Waste poses potential risk of injury or infection to all those exposed to it, including;

(i) Medical staff: doctors, nurses, sanitary staff and hospital maintenance personnel.
(ii) In- and out-patients receiving treatment in health-care facilities as well as their visitors.
(iii) Workers in support services linked to health-care facilities such as laundries, waste handling and transportation services.
(iv) Workers in waste disposal facilities, including scavengers.
(v) The general public and especially the children, who play with items scavenged from open waste dumps.

WHO estimates that over 20 million infections of Hepatitis B, C and HIV occur yearly due to unsafe injection practices (reuse of syringes and needles in the absence of sterilization). Improperly disposed hazardous HCW also poses indirect risks to humans through direct environmental effects by contaminating soils and ground water.[15] During open burning or incineration, air pollutants are released into the atmosphere causing respiratory illnesses to nearby populations. Immediate improvements in the waste disposal system can be achieved through a combination of waste segregation and a simple high temperature system. It is generally acknowledged that the items of waste corresponding to the category of 'non risk or general waste' constitute about 80 to 85% of HCW[16]. This can be disposed through the regular municipal waste disposal system. The hazardous component can be disinfected or autoclaved. Although incineration has the advantage of being able to handle most types of medical waste and of achieving volume reduction, it has a number of significant disadvantages. It is a relatively costly technology requiring frequent maintenance, and limited life span. In addition, environmental concerns arising from emissions of greenhouse gases and dioxins to the atmosphere and the impacts of the residual ash make incineration a less acceptable technology.[17] Advanced pollution control mechanisms for dioxin emission now exist in many developed countries and involve the injection of activated carbon and calcium hydroxide into the flue gases emerging from the furnace and collecting the resultant particulate in a fabric filter. It is however doubtful if many hospitals in developing countries can afford this expensive air pollution control equipment (APC).

4. Improving Present HCW Management Practices

Significant improvements in the current practice of HCW management can be achieved through a number of simple steps. A clear policy on medical waste management must be put in place both at the institutional and national levels. Health workers must then be trained to follow a simple but systematic procedure that is based on the policy. To achieve this, healthcare institutions must utilize the most practical options to achieve acceptable standards and practices for HCW management using available technologies. New technologies used in advanced economies, although desirable may not be appropriate on account, of cost, power requirements, maintenance capabilities and availability. The choice of waste treatment technology should be tailored to urban or rural health facility as well as the availability and affordability of the technology in the context of long term sustainability. Waste segregation is a critical beginning step to achieve waste minimization, cost reduction and sustainable waste management practice. It offers the health facility the ability to make more accurate assessment of their waste composition and also positions the facility for practical HCW management strategies.

[14] World Health Organization, WHO Country Cooperation Strategy: Federal Republic of Nigeria (2002-2007)
[15] WHO Ibid
[16] WHO Ibid
[17] M A Adegbita et al, 'Assessment of detal waste management in a Nigerian Waste hospital, waste management Res. 28, (2010) 761-777

5. Conclusion and Recommendations

There is no doubt that the present management practices for healthcare wastes generated at the health facility studied is unsustainable and should not be relied upon to protect human health and environmental integrity. There is no existing policy or plan and no systems in place for sustainable management of HCW. There is imperative need to take practical steps aimed at ensuring the 'duty of care' and safeguarding the environment for current and future generations. Although, the findings of the paper is important for the management of HCW in Nigeria and other developing countries, the widespread application of these findings may be limited because of the small sample size, the narrow scope of study and the short duration of the study. It will be useful to consider the waste management practices at lower levels of healthcare practice, such as Primary Health Care Centres, in future research.

We recommend the following as a modern and sustainable approach to healthcare waste management which we prefer should be adopted:

1. Management commitment to the sustainable management of HCW through:
   a) Formulation of hospital waste operational procedure (HCW Management plan).
   b) Allocation of appropriate resources.
   c) Adequate staff training and capacity building.
   d) Technology transfer.
   e) Information and awareness of HCW management plan to all hospital staff and their patients.

2. Formulation of appropriate institutional and national policies on HCW and initiating monitoring activities relating to HCW in Nigeria. Tertiary health institutions should apply the principle of 'waste to wealth'. Over 75% of HCW is general non hazardous waste. Materials such as paper, glass and plastics can be safely and easily re-cycled. Not only is the market readily available, the process can also be used as a powerful economic tool to improve the financial resources available to the hospital, given the current poor funding of health care in Nigeria.

3. The current levels of HCW management in tertiary health facilities need to be given more attention through improved funding and research to protect the health of the public and the environment.