Health-Care Waste Practices in Selected Health-Care Facilities in Maseru

M. Majara
Graduate Student
University of Cape Town
&
R.C. Leduka
Associate Professor and Director
Institute of Southern African Studies
National University of Lesotho
Roma

Abstract
Although constituting a relatively small proportion of waste matter, the waste produced during medical treatment and routine dispensing of medical care is potentially the most infectious and environmentally hazardous. Health-Care Facilities (HCF) are, therefore, duty-bound to effectively manage the waste that they produce in order to avert environmental pollution and risks to people's health. This paper reports on the findings of a recent study of current medical or Health-Care Waste (HCW) management practices in four purposively selected Health-Care Facilities (HCFs) in the district of Maseru, focusing on generation, segregation, treatment and disposal practices. These management practices are reported from a social science perspective, with no pretensions to expert medical or biological knowledge of the issues raised. The primary purpose of the paper is to raise public awareness and sensitivity to this serious but generally neglected environmental and public health issue. Evidence is adduced in the paper to show that the HCW management practices in the four HCFs are unhygienic and dangerously unsafe and that the HCW from these HCFs is an environmental and public health hazard. Most disturbingly, perhaps, is that Lesotho has neither a HCW management policy nor guidelines, and there are no indications that such policy will be in place in the foreseeable future.

Introduction
Although constituting a relatively small proportion of municipal waste stream, the waste produced during medical treatment and routine dispensing of medical care is potentially

the most infectious and environmentally hazardous. In fact, Plianbangchang (2006: 3) reminds us that the United Nations considers "healthcare waste as the second most hazardous, after nuclear waste [and that in] accordance with the 'polluter pays' principle, it is the waste generator who should be responsible for safer management of its discards". Health-Care Facilities (HCFs) are, therefore, duty-bound to effectively manage the waste that they produce in order to avert environmental pollution and risks to people's health. This paper reports on the findings of a recent study of Health-Care Waste (HCW) management practices in four purposively selected Health-Care Facilities (HCFs) in the district of Maseru, focusing on generation, collection, segregation, treatment and disposal practices. These are: the Queen Elizabeth II hospital, the Maseru Private Hospital, the St Joseph's Hospital and the National University of Lesotho's Health Centre. The paper reports on the HCW management practices in these HFCs from a social scientific perspective, with no pretensions to expert medical or biological knowledge of the issues raised. The primary purpose of the paper is to raise public awareness and sensitivity to this serious but generally neglected environmental and public health issue.

Following this introduction, the paper provides an overview of globally accepted principles and good practices of HCW management and highlights the most salient environmental impacts of HCW. A brief review of the HCW policy and management practices in Lesotho is then presented, followed by the research methodology and choice of case study HCFs. The management of HCW in the four selected HCFs are then discussed, with the last section summarising and concluding the paper.

Accepted Principles of Good Practices of HCW Management: A Global Overview

This section provides an overview of HCW practices, highlighting globally accepted principles of good practice. It discusses issues relating to the classification, generation, collection, transportation, treatment and disposal of HCW. The

section ends by briefly highlighting the environmental and public health impacts of HCW.

Classification of HCW

Health-care waste (HCW) is defined as "all waste generated by health-care establishments, research facilities and laboratories [as well as] waste originating from 'minor' or 'scattered' sources – such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc)" (Prüss, Giroult and Rushbrook 1999: 12). Similary, Klangsin and Harding (1998: 517) consider HCW as any waste that is generated in the diagnosis, treatment, immunization of human beings or animals, in research thereto or in the production or testing of biologicals (see also WHO 2005: 7). The major concern regarding HCW is that it comprises of hazardous and non-hazardous material, which makes management difficult. One way of classifying HCW is by source and potential hazards or risks (Table 1).

Table 1: Classification of HCW

Waste Category	Description and examples
Hazardous waste	
I. Clinical Waste	Body fluids, drainage bags, blood collection tubes, vials, culture dishes, syringes, contaminated broken/unbroken glassware, gauze, bandages, pathological waste (organs, body parts and tissues).
II. Laboratory Waste	Chemicals used in pathological laboratories, microbial cultures and clinical specimens, slides, culture dishes, needles, syringes and other radioactive waste.
Non-Hazardous/Non-risk waste	
III. Non-clinical Waste	Wrapping paper, office paper and uncontaminated plastics.
IV. Kitchen Waste	Food waste, wash and waste water. Although non-risk, but is a potential source of pests and vermin, such as cockroaches, mice and rats which are transmitters of pathogens.

Source: Compiled from Akter, N. (2000:3; see also Akter, 1998) *Medical Waste Management:AReview.* http://www.eng.consult.com/BEN/papers/paper-anasima.PDF.

Generation and Collection

Shaner and McRae (1999: 1) point out that hospital waste generated in the Third World countries is expectedly less than the volume produced in high-income countries. For example, the United States of America is said to produce about 3.5 billion kg of HCW per year (Kaiser, Patrick and Shaner, 2001). Middle-income countries, such as Brazil, Argentina, South Africa respectively produce about 110, 33 and 32 million kg of HCW (Prüss et al., 1999). In contrast, Botswana (a middle-income but low population country) produces approximately 2.5 million kg per year (Simon and Phatswe, 1999) and Lesotho 1.5 million kg per year (Ministry of Health and Social Welfare [MHSW], 2004). However, a more useful and easily comprehensible indicator of waste production is the per capita index (Prüss, et al, 1999).

According to Table 2, the amount of HCW produced per capita is clearly highest in high-income countries of the north compared to middle- and low-income countries of the south. The annual per capita production of HCW in high-income countries is nearly twice that in middle-income countries, and four times that produced in the low-income countries. Waste production of also varies significantly between countries within each income group, as well as within individual countries, depending on the hospital sizes, bed occupancy rates, in-and-out patient ratios, location and so forth (Prüss et al., 1999; Klangsin and Harding, 1998).

Table 2: Per Capita Generation of HCW

National Income Level	Annual Waste Generation (kg/head of population)
High-income countries:-	
All health-care waste	1.1-12.0
Hazardous health-care waste	0.4-5.5
Middle-income countries	
All health-care waste	0.8-6.0
hazardous health-care waste	0.3-0.4
Low-income countries:	
All health-care waste	0.5-3.0

Source: Prüss et al., (1999) *Safe Management of Wastes from health-care facilities*. Geneva: WHO.

Treatment and Disposal

Shaner and McRae (1999) suggest that hospital waste should not be addressed simplistically as just another waste, but rather focus should be on separating the *infectious* and *hazardous* from *non-infectious* waste. Therefore, waste segregation is a basic but vital requirement for appropriate management of HCW (WHO, 2005; Shaner and McRae, 1999). It is defined as a process that separates the different waste streams based on their hazardous properties, treatment and disposal requirements. Segregation, therefore, results in cleaner waste streams, with approximately 90 percent of HCW being capable of easy, safe and cost-effective management through conventional recycling, compositing and land filling (Shaner and McRae, 1999).

To facilitate management, HCW must also be appropriately *identified and labelled*. The most highly recommended way of identifying health-care waste is through sorting waste into *colour-coded* and appropriately *labelled* bags or containers (WHO, 2005: 14). The aim of the *colour-coding* is to ensure immediate and easy identification of hazards associated with each type of HCW stream. Therefore, the colour-coding system should remain simple and uniform throughout the country. In Sub-Saharan Africa, the colour-coding and labelling scheme developed by the WHO is most often used, namely *black, yellow* and *brown. Black* containers are often used for non-risk HCW; y*ellow containers* are used for special waste (for example, human anatomical waste, sharps, cytotoxic pharmaceutical waste and blood and body fluids), infectious and highly infectious waste, such as microbiological cultures and blood from patients infected with HIV and Hepatitis B, as well as radioactive waste. *Brown containers* are used for potentially hazardous pharmaceutical waste, chemicals and heavy metals (WHO, 2005: 13). *Labelling* involves assignment of names and/or *biohazard symbols* to specific categories of HCW to facilitate identification (WHO, 2005: 14).

In order to realise the full benefits of segregation and labelling, HCFs must have secure *internal and external collection and transportation systems*. There are specific requirements in relation to the collection and transportation of medical health-care waste. WHO (2005:12) recommends that in order to avoid accumulation of waste, collection must be regular and storage centralised within the HCF prior to treatment or removal from the facility. For instance, the WHO insists that toxic waste must not be stored in the premises of the HCF for more than 24 (WHO, 2005: 13). The transportation of waste must also follow specified routes through the HCF in order to reduce the passage of loaded carts through wards and other clean area.

Once segregated into hazardous and non-hazardous streams, HCW can then be treated to reach infection and toxicity levels that ensure that they meet acceptable public health and environmental standards and can be accepted into municipal

systems of waste management. Several technologies exist to treat or dispose off health-care waste, such as:

- *Autoclaving* - the exposure of waste to steam under pressure in an enclosed container
- *microwave irradiation* - the use of a high energy electromagnetic field that rapidly heats up the waste in a container, thus causing the destruction of the infectious components.
- *chemical disinfection* - use of chemicals to kill microorganisms on medical equipment and liquid waste such as blood, urine and hospital sewage.
- *Encapsulation* - burying waste in concrete.
- *incineration* - controlled burning of all types of HCW in high temperature incinerators.

Most of these technologies are beyond the reach of most HCFs in developing countries because they are expensive (see WHO, 2005: 48-50; Pruss, et al., 1999; Johannessen, et al., 2000).

According to WHO (2005: 15) infectious *HCW* may be treated on and/or off-site. *On-site treatment* is the treatment that occurs within the HCF compound. The advantage associated with on-site treatment is that it minimises public health and environmental risks by confining hazardous waste within the boundaries of the HCF. *Off-site treatment* is when waste is treated in another healthcare facility or in a plant specifically constructed for the purpose (WHO 2005: 15). Several methods of disposing medical waste are possible depending on the priorities of healthcare authorities. These are product re-use, material recycling, incineration and sanitary land-filling (Kaiser et al, 2001; WHO, 2005; Enger and Smith, 2004; Miller, 2004; Johannessen, Dijkman, Bartone, Hanrahan, Boyer and Chadra, 2000).

Some Environmental and Public Impacts of Health Care Waste

Environmental and health risks associated with HCW are too numerous to comprehensively list. Only the most salient risks are discussed here. It is nevertheless, fitting to mention that although all people are potentially at risk of injury or infection

from HCW, certain groups face even higher levels of risk because they are directly exposed to such waste. The main groups of people at risk are:

> *Medical doctors, nurses, health-care auxiliaries, and hospital maintenance personnel; patients in health-care establishments or receiving home care; visitors to health-care establishments; workers in support services allied to health-care establishment, such as laundries, waste handling, and transportation; and, workers in waste disposal facilities, such as landfills or incinerators, as well as scavengers [and domestic animals] in waste disposal sites. (Prüss et al., 1999: 20)*

It is widely accepted that sharps, especially infected hypodermic needles, represent one of the most problematic and hazardous type of waste generated by healthcare facilities. Infections occurring as a result of injuries from puncture or cuts from sharps include human immunodeficiency virus (HIV) and hepatitis B and C, which can all lead to life-threatening illnesses. For instance, in all Asian countries, prick injuries from contaminated sharps account for approximately 20 000 cases of Hepatitis B (compared to 56-96 infections in the USA); 85 000 of Hepatitis C and 30 000 of HIV/AIDS (compared to 8 and 39 in France and the USA respectively) infections every year (Plianbangchang 2006: 4). Infection rates are thought to be probably much higher in low-income countries. For instance, evidence from Uganda shows that 57 percent of nurses and midwives experience at least one needle stick injury per year (Nsubuga and Jaakkola, 2005).

In terms of environmental pollution, mention could be made of potential for soil and groundwater contamination from chemical and pharmaceutical waste that is not properly stored, including poisoning through eating contaminated food or drinking water. Some chemical wastes that are directly disposed off into municipal sewerage systems prior to appropriate treatment can lead to inefficient functioning of waste water treatment plants and consequently the pollution of water resources in areas that receive the final effluent (Prüss, et al. 1999).

Prüss et al (1999) also register concerns about the survival of pathogenic micro-organisms in the environment, in particular the Hepatitis B virus, which can survive for several weeks in dry air and is also resistant to boiling water. They note with concern that research from the Japanese Association for Research on Medical Waste has confirmed that "an infective dose of hepatitis B or C virus can survive for up to a week in a blood droplet trapped inside a hypodermic needle" (Pruss, et al, 1999: 28).

Concern with the resilience of pathogens applies equally to their environmental spread by vectors such as rodents, flies and cockroaches, which all feed on the HCW. If improperly managed, both within and outside the boundaries of the HCF, vectors are likely to multiply and to passively transmit the microbial pathogens to the unsuspecting public. Environmental pollution from HCW is unlikely to be localised and as such it requires concerted management efforts. Significant concerns relate to the combustion or incineration of hazardous waste, arguably the most popularly used HCW treatment technology, especially in low-income countries (Krueger, 2001; Smith, 2000: Mccally, Orris, Thornton and Weinberg, 1996). Cormier, Lomnicki, Backes and Dellinger (2006: 813) argue that "combustion of hazardous waste results in pollution that exists in a gaseous, liquid, and/or solid particle state suspended in air". There is now ample evidence that the incineration of HCW releases dangerous toxins into the atmosphere, especially dioxins and furans, which result from the combustion of plastic material, often making 20 percent of HCW matter (Krueger, 2001; Smith, 2000: McCally et al., 1996; Comier et al., 2006). There are three aspects of the environmental behaviour of dioxins that make them particularly troublesome. First, they are extraordinarily persistent, capable of resisting physical, chemical and biological degradation for decades. Second, they can be transported over long distances through the air. Third, dioxins are oil but not water soluble, which enables them to accumulate in fatty tissues and become magnified in concentration as they move up the food chain, especially in dairy foods, meat and fish. The danger with dioxins is that they are known to be animal carcinogenic and that they could also

possibly be human carcinogenic (Mccally et al., 1996; Akter, 2000).

Besides dioxins and furans, incinerator ash, which is made up of both *fly* and *bottom* ash, often contains dangerously high levels of heavy metals and acid gases. The irony with incineration, as Akter (2000:12) notes, is that "as the air pollution equipment becomes more effective in removing the particulate matter, the toxicity of the fly ash increases". The disposal of incinerator *bottom* ash in ordinary or unsanitary landfills can also contaminate soil and groundwater. Acid gases produced from incineration processes can lead to eye irritation and respiratory illnesses, contribute to acid rain and enhance the toxicity of heavy metals.

The Management of HCW in Lesotho Policy Context

Lesotho has no explicit policy on the management of hazardous waste besides a number of often disparate and often generalised regulations on various environmental issues, but none specific to the management of healthcare waste. These include, for example, the Constitution of Lesotho, the Public Health Order of 1970, the Environment Act of 2001, the Local Government Act of 1997, the Sanitary Services and Refuse Removal Regulations of 1972, the Labour Code (chemical safety) Regulations of 2003. There are also international conventions that Lesotho has ratified, such as the Stockholm Convention on Persistent Organic Pollutants and the Basil Convention on the Control of Transboundary Movement of Hazardous Waste and their Disposal. These are briefly discussed below.

The Lesotho Constitution

Section 36 of the Lesotho Constitution provides a framework for elaborate policies and legislation on environmental management and protection. The section provides that:

> *Lesotho shall adopt policies to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations and shall endeavour to assure all its citizens a sound and safe environment adequate for their health and well being.*

However, these constitutional provisions are yet to be met through development and effective implementation of appropriate environmental policies (Mhlanga and Gulitat, 1997).

Environment Act 2001

This Act deals with environmental issues and the management of natural resources. However, there is no section in the Act that addresses HCW directly, except those that address general solid and hazardous waste. Section 45 of this Act prohibits the discharge of hazardous substances, chemicals and materials into the environment and stipulates procedures for the acquisition of effluent discharge, pollution and ionizing radiation licences, all of which most hospitals country-wide are supposed to have (MHSW, 2005: 25). However, the Act was never brought into force and a new Environment Bill is being debated in parliament.

Local Government Act 1997

This Act establishes Local Authorities for purpose of decentralisation. Except reference to general matters of public health as the responsibility of local authorities, the Act also makes no reference to HCW management.

Public Health Order of 1970 and Sanitary Services and Refuse Removal Regulations of 1972

This order also addresses public health issues which are binding to health institutions in Lesotho, including hospitals, clinics and pharmacies. Regulation 14 of the Sanitary Services & Refuse Removal Regulations of 1972, which derive from this Order refer directly to HCW, albeit in very general form. The regulation provides that no waste should be deposited, kept or stored in public view in such a manner that it becomes a nuisance or injurious and dangerous to health. Nevertheless, the Order and Regulations are terribly out of date.

The Labour Code (Chemical Safety) Regulations of 2003

Although meant to regulate industrial pollutants and worker safety, these regulations contain clauses that are relevant to the

management of HCW. These, amongst others, include requirements for labelling and packaging, identification and classification of chemicals, workplace and health surveillance, as well as personal protection (MHSW, 2005: 26).

International Conventions

As indicated earlier, Lesotho has endorsed a number of international conventions, such as the Stockholm Convention on Persistent Organic Pollutants and the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal. The Stockholm convention aims to limit the emission of persistent pollutants such as dioxins and furans, especially from the incineration of medical waste (Enger & Smith, 2004: 449). The Basel convention aims to minimize the generation of hazardous waste and to control and reduce their movement across boundaries. The convention makes explicit reference to the control of HCW, such as sharps, pathological infectious waste, as well as hazardous chemical and pharmaceutical waste.

Current HCW Management Practices and Problems

There are three significant studies on the management of healthcare waste (HCW) in Lesotho. The first is the National Health Care Waste Management Plan by the Ministry of Health and Social Welfare (MHSW) (2005), which, for all intends and purposes, is a consultancy report notwithstanding its title. The second is a study by Murye and Mohale (2005) of the status of HCW management system in the district of Maseru. The third is a master's degree thesis by Ramabitsa-Siimane (2006), which aimed to identify appropriate technologies and approaches for effective management of healthcare waste in Lesotho.

Both these studies focus on segregation, storage, treatment, disposal, training and awareness and conclude that HCW is grossly mismanaged and that awareness of the hazards of HCW amongst healthcare staff and the general population is extremely low. In particular, Murye and Mohale are concerned about "the presence of identifiable healthcare waste at disposal sites [in addition to] the lack of protective clothing and training of health care waste handlers" (2005: 124). With reference to the

Queen Elizabeth II hospital, the main referral facility in the Lesotho, the MHSW's report/plan makes rather damning observations, that: HCW management was not assigned any specific authority; all medical staff did not segregate HCW; HCW handlers were not provided with appropriate equipment; staff was not trained in HCW management; HCW was not accorded effective treatment prior to disposal; hospital grounds were not maintained in a manner deserving of a health care facility of QE II standing (MHSW, 2005: 94; also Murye and Mohale, 2005; Ramabitsa-Siimane, 2006). Below we provide an overview of HCW issues in Lesotho as gleaned from these and other studies.

Generation and Collection of HCW

According to Mhlanga and Gulilat (1997: 28), the census report of 1996 shows the annual production of household waste as 26,556,300kgs, and other categories of solid waste as 802,389,500kgs. For the city of Maseru alone, the Maseru Environmental Profile (2007) indicates that 245 000 000kgs of waste is produced per annum, 33 000 000kgs of this being household waste, 206 000 000kgs being industrial and commercial waste and 130 000kgs being healthcare waste. Country-wide extrapolations based on measurements made at the Queen Elizabeth II hospital in 2004 indicate that a national total of 1 500 000kgs of HCW waste was produced per year, with nearly 23 percent of this classified as hazardous (MHSW, 2005)[1].

The collection of medical waste from wards, theatres, laboratory, maternity wards and other points of generation is predominantly by untrained cleaners or housekeepers. The transportation system is either by trolleys or hand to the storage or disposal area. The most common method of general waste storage is either in cardboard boxes or black refuse bags. Except for sharps and anatomical waste, which "were religiously separated from the rest" and stored in 20 litre plastic containers or, in limited cases, cardboard boxes, all other waste, including

[1] Computations based on estimated daily waste production of 1.44kg per bed per day, with 25 percent of this considered as hazardous.

surgical gloves, swaps and so forth, are mixed, often in ordinary dustbins or black plastic bags. The dustbins, cardboard boxes and plastic bags are often neither labelled nor colour-coded and no record is kept of waste movement from one point to another (MHSW, 2005; Murye and Mohale, 2005).

Following collection, waste is either taken to the storage area on the health-care premises for later disposal or directly to the disposal facility, depending on circumstances of each individual health-care facility. However, most health-care facilities have no appropriate storage facilities for keeping waste before treatment/disposal and it is not unusual in some healthcare facilities for waste, especially sharps, to be stored for over one month prior to final disposal (MHSW, 2005). Transportation to final disposal is either by hand, wheelbarrows or unmarked vehicles (Murye and Mohale, 2005).

Treatment and Disposal of HCW

Some HCFs treat infectious wastes and sharps through incineration, which is able to reach temperatures as high as 1 300^{o} Celsius when operating under ideal conditions. This seems to be the only form of treatment of medical waste. Therefore, incineration is used as both a means of treatment and disposal of medical waste. However, with the exception of Mafeteng and Maluti hospitals, whose incinerators were in fair working condition, not a single incinerator in the healthcare facilities that were surveyed in 2004 was in a serviceable condition, including that for the Queen Elizabeth II hospital. Other healthcare facilities have either constructed simple brick furnaces where waste is manually burnt or used open-air burning (MHSW, 2005: 36). Murye and Mohale (2005: 120) observe that brick furnaces and open-air burning do not generate sufficiently high temperatures to detoxify cytotoxic drugs.

Besides incineration, another method of disposal is land filling. In the Maseru city, waste disposal is the responsibility of the Maseru Municipal Council (MMC), which disposes waste from the healthcare facilities together with other municipal waste at the Ha Tśosane Municipal dumpsite. This is not a sanitary landfill, but a disused quarry with open access to scavengers (people and animals). Most urban and peri-urban

clinics and surgeries transport their waste sharps to the nearest hospital for incineration. For clinics located in rural areas the most predominant system of disposal is burial of medical waste with or without prior burning (MHSW. 2005: 37). Murye and Mohale (2005) note that the final disposal of HCW is risky in that there is often recognisable HCW at disposal sites, including dressings, vials/ampoules and sharps.

Management of Medical Waste in the Selected Healthcare Facilities

In this section, we present data that was obtained through interviews that were conducted in the selected HCFs corroborated at various points in the section by similar findings from previous studies. These were Queen Elizabeth II Hospital, St Joseph Hospital, Maseru Private Hospital and the National University's Health Centre. We first present the methodology used in the research. We then present a general overview of management of HCW in the case study HCFs, highlighting, where secondary data was available, the quantities of waste produced, and the collection, treatment and disposal of HCW. We close the paper by indicating possible areas for policy intervention.

Methodological Issues

This paper draws from a 2007 qualitative study of health-care waste management in selected HCF in Maseru. Preliminary investigations revealed serious dearth of social research on the management of health-care waste in Lesotho, which led to the study being considered as exploratory and, therefore, amenable to qualitative methodologies. As Murphy, et al, (1998) argue, qualitative methodologies are more commonly suited to exploratory research (see also Berg 1998; Feagin and Orüm 2003). The basic approach that was adopted was the case study method, which was complemented with observations.

Four health-care facilities were selected as case studies, namely, Queen Elizabeth II hospital, Maseru Private Hospital, St Joseph's Hospital and the National University of Lesotho's Clinic. These health-care facilities were selected on the basis of ownership, hoping that this would influence their waste management strategies. Therefore, the selected facilities were a

state-owned hospital, a private hospital, a church-owned hospital and university-run clinic, respectively. Another reason for choosing these four health-care facilities was that they were proximate to the NUL, which facilitated regular follow-up visits by the investigators.

A semi-structured interview using interview guides was the principal data collection instrument. The guide questions were arranged in the form of an interview schedule consisting of closed, but predominantly open-ended questions. Basically, the reasoning behind using guide questions was because the researchers were unfamiliar with the issues being researched, especially the terminology. Open-ended questions, therefore, allowed the respondents to elaborate on important aspects, especially those that the researchers had not included in the guide. The semi-structured interviews were complemented by extended observations and photographing.

Armed with the above methodologies, frequent visits spanning a period of two months were made to the selected health-care facilities in order to find out how solid HCW waste was generated, stored, collected and disposed off. Interviews with key informants, such as the incinerator operator, infection control sister, the matron, waste collection workers were carried out to establish how they collected, stored and disposed off waste material. In addition, the Department of Health and Environment of the Maseru Municipal Council (MMC) was consulted.

The above data collection strategy and instrument were chosen because they had proven to be useful in similar studies in Zimbabwe (see Kuvarego and Taru, 2005: 154), the United States of America (see for example Klangsin and Harding, 1998) and Lesotho (Ministry of Health and Social Welfare, 2005; Murye and Mohale, 2005). The information obtained was analysed through a thematic approach, which involved searching and identifying themes through careful reading and re-reading of the information collected

Expectedly, problems were encountered during data collection. At St Joseph's Hospital the administrative staff was not comfortable with the photographing of their waste disposal facility, arguing that they felt embarrassed because they did not

have an incinerator. The second problem was the reluctance of the NUL's Healthcare Center staff to respond to questions. At Queen Elizabeth II Hospital, interviewing the domestic service personnel was difficult, as they all claimed that they were in no position to answer the questions. At the end, some of the questions that were specifically meant for the domestic service staff were responded to by the incinerator operator.

Generation of HCW

Secondary data from the MHSW (2005) indicates the following health-care waste generation amounts in three of the case study areas: at Queen Elizabeth II Hospital it was 236,223kg; St Joseph Hospital produced 73,492kg and Maseru Private Hospital produced 16,789 kg per year. As indicated earlier, 25 percent of HCW from these and other facilities is considered as hazardous. No similar data existed for the NUL's Health Center, but the general feeling by respondents from all HCFs was that the amount of waste that was produced was of moderate quantity.

HCW Storage and Collection

Several observers (see Zerbock 2003, Akter, 1998; 2000; Pruss et al, 1999) note that collection practices in most developing countries are problematic due to lack of policies that regulate waste collection and disposal. Waste collection from hospital wards in the four healthcare facilities was undertaken by untrained general purpose cleaning staff, who either carried waste in plastics on their person and/or on trolleys. This form of waste collection is extremely dangerous as it exposes cleaning personnel to injuries by sharps and other surgical instruments. None of the HCFs had proper storage facilities. Plate 1 shows typical storage of HCW at the Queen Elizabeth's II, while Plate 2 shows typical storage at the Maseru Private Hospital.

Plate 1: Storage of HCW at Queen II Hospital

Source: Majara (2007) Medical Waste Management Study. Unpublished BA (URP) Dissertation. Department of Geography, NUL.

Plate 2: Storage of HCW at Maseru Private Hospital

Source: Majara (2007) Medical Waste Management Study. Unpublished BA (URP) Dissertation. Department of Geography, NUL.

As alluded to earlier, the storage of HCW at the Queen II is unsatisfactory for a referral facility. In both cases, waste is stored where it is openly accessible and is unprotected from rodents and animals and people, especially at Queen II. It is also a constant public eyesore, which confirms the discontent expressed by Murye and Mohale (2005). The collection of waste to the Maseru city land fill was by the MMC for the QE II and Maseru Private Hospitals, where in the former, waste was collected once in two weeks and in the latter waste was collected daily. Collection of waste from the NUL's Health Center was by a private cleaning contractor and own cleaning staff for the St Joseph's hospital. The WHO (2005: 12) urges HCFs to avoid waste accumulation, a guideline that the Queen Elizabeth II Hospital appears not comply with. Mccally et al (1996) argue that accumulation of medical waste attract rats (a common sight in the premises of the Queen II hospital) and other disease vectors, thereby adversely impacting on public health, the environment and the food chain.

Waste was also transported to final disposal sites by unmarked vehicles from the premises of all the four HCFs. For transporting HCW the WHO (2005) encourages the use of dedicated and marked vehicles, another simple guideline that was clearly not complied with by all cases of HCFs. For example, because the Maseru Private Hospital has no incinerator, it transported anatomical waste for incineration at the Queen II hospital in an unmarked small passenger car. Unfortunately, alternative uses of this car are unknown to us.

Treatment and Disposal

As indicated earlier, segregation consists of separating different waste streams based on their hazardous properties, and the type of treatment and disposal practices applied. In all the healthcare facilities studied, health-care waste was religiously segregated into three waste streams, namely, general health-care waste, infectious and highly infectious waste and biomedical waste or waste requiring special attention, such as anatomical waste. In all the four healthcare facilities, general waste was placed in black plastic bags and biomedical waste in red plastic bags. However, data collected showed that it was not in all cases

where biomedical waste was placed in red plastic bags. Sometimes it was placed in black plastic bags as a means of reducing expenses, as reported by the Queen II and St Joseph's hospitals. In all the healthcare facilities studied, sharps, which are classified as highly infectious waste, were kept in a covered plastic container (Plate 3).

Plate 3: A Sharps Container

Source: Majara (2007) Medical Waste Management Study. Unpublished BA (URP) Dissertation. Department of Geography, NUL.

The method of segregation that was used in these four healthcare facilities to a certain degree complies with the WHO Guidelines (2005), which, amongst others, recommend that sharps should be placed in puncher-proof sharps containers. These containers were found in all the four healthcare facilities studied. The next step after segregation was treatment and disposal.

Nearly all the HCFs that were investigated had on-site treatment of medical waste, with the exception of Maseru Private Hospital, which transported anatomical waste to the incinerator at the Queen Elizabeth II hospital. On-site treatment involved incineration in the case of Queen II hospital (Plates 4 & 5), brick furnace with the NUL's Health Center (Plate 6) and open-air burning at the St Joseph's hospital. Incineration and simple burning of waste was undertaken on a daily basis or once a week, depending on the amount of waste generated. The problem with low-or moderate temperature treatment or

incomplete combustion, such as incomplete incineration, brick furnace or open-air burning, is that it produces more toxic by-products than complete incineration (Cormier et al., 2006: 810).

General or non-risk HCW from Queen E II and Maseru Private Hospital is disposed off at the municipal landfill at Ha Tsosane. The NUL Health Center non-risk waste is disposed off at the NUL's waste facility (Plate 4). At St Joseph's hospital, both risk and non-risk waste were disposed off (burned) in the purpose-made concrete enclosure.

Plate 4: Queen II Hospital Incinerator

Source: Majara (2007) Medical Waste Management Study. Unpublished BA (URP) Dissertation. Department of Geography, NUL.

Plate 5: NUL Health Centre Brick Kiln

Source: Majara (2007) Medical Waste Management Study. Unpublished BA (URP) Dissertation. Department of Geography, NUL

Respondents in all case study HCFs, especially at Queen II hospital were acutely aware of the environmental hazards associated with the incineration of medical waste in the hospital premises. Air and smell pollution were mentioned as major adverse environmental impacts of incineration. It was observed that at the Queen Elizabeth II Hospital the incinerator was mounted only a few meters away from the Tuberculosis Isolation ward, and around this ward was a stench of smog that hanged there all day even when the incinerator was not in operation. It also emerged from the Queen II incinerator operator that the incinerator was not operating automatically, which inevitably implied higher smoke emissions rates as smoke was not reprocessed before it was released into the atmosphere. Frequent equipment failure was also reported, either due to broken burners or sometimes due to the lack of diesel. In the case of St Joseph Hospital, waste was burned openly inside a concrete enclosure.

Summary and Some Policy Recommendations

The paper reports on the findings of a study on medical or Health-Care Waste (HCW) management practices in four purposively selected Health-Care Facilities (HCFs) in the

district of Maseru, focusing on generation, segregation, treatment and disposal practices. The primary purpose of the paper is to raise public awareness and sensitivity to this serious but generally neglected environmental and public health issue. Evidence adduced in the paper points to a desperate situation where the HCW infrastructure is grossly inadequate, a problem that besets both state and non-state-owned facilities, as well as the municipal authority in Maseru.

Although all HCFs observed the basic requirement for waste segregation, handling, storage, treatment, transportation and final disposal practices were inadequate and risky, findings that clearly confirm what earlier studies have already shown. That there is neither policy nor legal framework to regulate the management of HCW leads us to conclude authorities do not consider HCW as a serious environmental and public health problem, notwithstanding evidence to the contrary. This sombre conclusion leads us to recommend as follows:

- That policies meant to regulate medical waste should be put in place, with penalties prescribed for non-compliance with prescribed standards. We urge for enforcement of strict liability or the 'polluter pays principle'.
- With regard to medical waste management in the city, we note with concern that the city authority is only involved in the collection of non-risk health care waste and the responsibility of treating other categories of health care waste is left to the healthcare facilities. Our recommendation is that the city authority should be involved at all stages of HCW management processes in order to reduce HCW dangers associated with final disposal in municipal waste facilities.
- That housekeeping staff within healthcare facilities should be trained in handling medical waste and be provided with appropriate protective clothing.
- Alternative, cost-effective and less hazardous HCW management technologies should be considered. Together with such technologies, a 'green purchasing' approach should be considered. 'Green purchasing

> involves the procurement of material that does not produce hazardous substances during disposal. In order for this to happen, a holistic approach that embraces the direct link between product selection, product use, product disposal and environmental and public health is required. "Without this holistic approach, the industry charged with health and healing contributes to environmental problems, which in turn adversely impact human health" (Kaiser, et al., 2001: 206; see also Ramabitsa-Siimane, 2006).

We wish to end this paper by noting that the HCW problem is only microcosm of a much wider social and environmental problem of waste management in Lesotho, which has so far not received much priority in terms of policy intervention and notwithstanding the noble ideas espoused in Lesotho's Vision 2020.

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