

Available online at www.sciencedirect.com**ScienceDirect**

APCBEE Procedia 9 (2014) 36 – 41

**Procedia
APCBEE**www.elsevier.com/locate/procedia

ICBEE 2013: September 14-15, New Delhi, India

Assessment of Environmental and Health Risks Associated with the Management of Medical Waste in Mauritius

C. Bokhoree*, Y. Beeharry, T. Makoondlall-Chadee, T. Doobah and N. Soomary

University of Technology, Mauritius, La Tour Koenig, Pointe aux Sables, Republic of Mauritius

Abstract

The management as well as the associated Environmental and health risks of medical waste are of global concern. There exist critical steps for safe and scientific management of medical waste which healthcare establishment can adopt. Medical waste may be disposed using different methods which many countries have adopted. However, the disposal of medical waste needs to be carried out in a way that neither the environment nor the health conditions of people are put at risk as they are hazardous. This paper focuses on the assessment of potential risks associated with medical waste management in Mauritius. Two medical institutions: one private and one public have been purposely chosen for proper analysis. Observations have been made on how they manage their medical waste through visits in those institutions. Results have demonstrated that both institutions manage their medical waste differently. Recommendations on how to improve the practices of these two medical institutions of Mauritius have also been made.

© 2014 C. Bokhoree. Published by Elsevier B.V.

Selection and peer review under responsibility of Asia-Pacific Chemical, Biological & Environmental Engineering Society

Keywords: ENVIRONMENTAL AND HEALTH RISK, MEDICAL WASTE MANAGEMENT, MAURITIUS.

1. Introduction

Resulting medical waste from healthcare settings in many countries has raised several concerns owing to the fact that there are inappropriate techniques for the management of those wastes [1]. With a rise in the population and the consumption patterns, there has been an increase in the generation of large volumes of different types of wastes [2]. Furthermore, during the past years, there have been rising concerns over solid

* Corresponding author.

E-mail address: sbokhoree@umail.utm.ac.mu

waste generated from healthcare services [3]. This is because these types of wastes are potentially dangerous to health and to the environment [4]. Although quantified as a relatively small amount of the total waste generated in a community, medical waste management is regarded as a critical issue throughout the world [5]. Huge amounts of infectious and hazardous waste are generated in hospitals and clinics around the world on a daily basis [6]. The amount of waste generated depends on factors such as waste management techniques, the type of health care institution, health care specializations, the quantities of reusable equipment available in the hospital/clinic and the number of patients treated daily [7]. Medical waste is 'special' as compared to other types of wastes because of its high potential of causing infection and injury [7]. Improper disposal such as open dumping or uncontrolled burning of medical wastes in hospitals and clinics may create a substantial health risk for medical personnel, patients, waste pickers and the surrounding environment because these wastes are infectious and hazardous [8]. Though healthcare services have for objective to mitigate health problems and avoid potential health risks, wastes that are generated from hospitals and clinics are potentially harmful to both human beings and to the environment [9]. Hence, this study pertained towards assessing the potential environmental and health risks associated with medical waste management in the health sector in Mauritius. Health services in Mauritius are dispensed in public hospitals as well as private clinics throughout the island. This paper aimed at assessing the potential environmental and health risks associated to medical waste management in the health sector in Mauritius. The objectives of the study were to gather information on the collection, treatment and disposal of medical wastes, to analyse and evaluate the actual status of medical waste management in Mauritius, to identify the potential impacts of medical wastes management on human and the environment and to make relevant recommendations in view to improve medical waste management system of Mauritius.

2. Health and safety risks associated with medical waste management

Medical waste may contain potential pathological organisms [10] which if improperly managed may be a risk to healthcare staffs and public [11]. In developing countries, medical solid waste has been placed together with the non-clinical waste which is now creating unavoidable health risks [12]. In the 1980s and 1990s, issues concerning exposure to HIV along with Hepatitis B Virus (HBV) led to rising concerns of potential risks evolving due to medical waste [8]. Therefore, waste generated from hospitals and clinics has become a focal point due to its several consequences as a threat to the health of patients, health care staff and outside the medical establishment [13]. Moreover, health care workers are not very much aware of the risks associated with medical waste [14]. Studies have shown personnel dealing with medical waste are by the biological, physical and chemical hazards such as needle sticks, cuts, falls, strains, sprains, burns, eye and back injuries. Several injuries such as hand cut due to handling broken glass occurred due to exposure to medical wastes inside and outside hospital premises [15]. The World Health Organization (WHO) confirms the risks associated to infectious waste and sharps that nurses are exposed to during healthcare delivery [10]. Other personnel are also exposed to such risks during the transportation of the medical wastes [6]. Furthermore, risks as a consequence of chemical and pharmaceutical wastes are associated with the characteristics of the chemical substance such as its toxicity and flammability. These wastes are generated when they are unwanted or have been expired and may cause poisoning if absorbed through the skin, inhalation or ingestion [6]. Similarly, the final disposal of hazardous waste that is incineration, involves health risks to which the operators are exposed to [6]. According to [16], medical waste incinerators emit a huge amount of toxic gases such as Dioxin which are detrimental to health [17].

3. Methodology

In Mauritius, the public health care sector is free of charge to the population [18]. The Ministry of Health and Quality of Life is responsible for the healthcare waste management [19]. There are 5 regional hospitals offering a full range of medical, surgical and specialist services and there are also smaller district hospitals which provide general medical care: 122 Community Health Centres, 27 local Area Health Centres and 2 medi-clinics. The private health care system of Mauritius consists of private clinics and a number of medical and paramedical practitioners. One private clinic and one public hospital of Mauritius have been selected for the purpose of this paper. This method has been used because data related to medical wastes is highly confidential and inaccessible in Mauritius. These institutions are considered to be among the oldest, largest and most advanced medical institutions. They comprise of many departments such as wards, laboratory, minor and major operating theatre, maternity section and x-ray department and even have their own incinerators to dispose hazardous wastes. Visits were made to the selected private clinic and public hospital and in order to collect appropriate data for assessment. This consisted of a visit to the site of incineration of both the private clinic as well as the public hospital. The staffs were also asked few questions related to the management of wastes. These institutions and the respondents were made aware of the fact that information gathered has been treated with strict confidentiality. Time has been spent in different departments, recording observations and taking note of the different waste management techniques.

4. Results and Discussion

4.1. Management of medical waste at the private clinic

Wastes are produced from different activities of the clinic and the amounts vary from departments. It was noted that approximately 2kg of wastes are produced per bed on a daily basis. The amount of hazardous wastes incinerated per day is approximately 100kg for the clinic and sometimes hazardous wastes from other clinics are also incinerated. During the visit, several techniques that this clinic has adopted to manage its wastes were shown and explained. The medical waste management prevailing may be considered to be among the most appropriate since the adopted techniques help to minimize safety and health risks of the medical personnel, patients and visitors. The clinic has several procedures in place, particularly, a sharp policy which is reviewed on a regular basis. This piece of document is very important as studies have shown that medical personnel, especially nurses exposed to sharp injuries may contract diseases such as HIV/AIDS, hepatitis B and C [12]. Furthermore, the clinic has a waste management committee which helps in management of the wastes. In addition, nurses, medical attendants and other staff are provided with regular training regarding medical waste management and associated hazards. During the visit, a meeting was scheduled with the nurses and medical attendants and it was noted that they are well aware of the risks they are exposed to and how to execute their tasks in the right way. The management of medical wastes from its source of generation to its disposal have been observed. The clinic has a three colour coding bag system - each colour represents a category of waste. Red bags are for hazardous wastes, yellow for soiled linen and black one for municipal waste. Each ward has an autoclave to disinfect used equipment which proves to be safe for patients and medical staff. Also, each ward is provided with rigid polyethylene bottle for sharps disposal. This type of bottle is much safer than the small sharp containers that are used in most medical institutions. The sharp policy of the clinic states that two third filled containers should be replaced by another container to which nurses abide to. With this practice, there is no reported case of sharp injuries. Moreover, soiled linens that are not contaminated are placed in yellow bags which are sent for laundry services. Similarly, wastes such as paper, plastics, kitchen waste and yard waste are placed in black bags and are stored in a well-protected area

outside the clinic, which are then collected by the waste collectors serving this vicinity [11]. Moreover, staffs are provided with appropriate protective clothes and equipment. The management ensures that the staffs wear their protective equipment while executing their tasks. The internal transportation of waste is done by using special trolleys and goods lift which are regularly cleaned [10]. However, the only problem air pollution caused by the incinerator of the clinic which operates approximately four hours. Though the incinerator's stack height has been increased twice, there are still complaints from nearby inhabitants.

4.2. Medical waste management at the public hospital

The public hospital used for the purpose of this study is one of the major hospitals in Mauritius. This public hospital is responsible for medical waste management for some community and health centres within the region. This hospital has around 565 beds [19] and incinerates approximately 1050kg of hazardous wastes daily including wastes from other hospitals and community centres. This hospital also has a three colour coding bags for the disposal of different categories of wastes. However, the management of the waste is carried out in a rather messy way: red bags meant for hazardous waste were found in the storage area of non-hazardous wastes. Furthermore, it seemed that there is no sharp policy being followed at the hospital as it was observed that though the sharp containers were two-third full, nurses continue to use the same containers. The internal transportation of medical waste at the hospital is carried out in a similar way as the clinic. The hospital has a dumping ground whereby non-hazardous wastes in some cases are allowed to be thrown there but prior to the visit, syringes were found in this vicinity. Also, a visit was made to two temporary storage areas which are in a bad condition. One is meant for hazardous wastes and the other for non-hazardous wastes. Moreover, since the incinerator is quite distant from the hospital, the transportation of medical waste is done by special well trained workers [9]. The operator who works on the premises has not been trained to execute this work. Furthermore, though the operator had received protective equipment and clothes, that person was working with only a pair of latex gloves. This untrained worker was carrying out his job the way the worker thought was good. Moreover, the operator was exposed to several types of hazards including excessive heat, noise, foul odours, ergonomic hazards and biological hazards. Wastes are also kept for several days although literatures confirm that hazardous wastes should not be kept for more than 48 hours [20]. Furthermore, the operator stated that for the past two years, no medical test was undertaken. The physical appearance of this worker suggests that he might have occupational health problem. However, no one from the management seems to have time to enquire about the health condition of the incinerator's operator. Though medical wastes are being managed to minimize health risks, the health of people managing these wastes are being constantly put at risk. Moreover, the environment is being affected and degraded not only because of emission of dangerous gases from waste incinerator, but due to the fact that the incinerator is designed in such a way that when it rains, water can get through the incinerator resulting in incomplete combustion of hazardous wastes. And since ashes are disposed in landfill, this may contaminate the land. The incinerator is surrounded by trees and owing to excessive heat and pollution, all the leaves are almost dried endangering species like birds.

5. Conclusion

If there is a poor management of medical waste this may be problematic to the health of workers, patients and public. Also, owing to the toxic nature of medical waste, if there is improper handling, it may lead to the destruction of the natural environment. This may eventually cause a disruption in the balance of the prevailing ecosystem. Even though both the private clinic and hospital have established medical waste practices aiming at minimizing health risks, there are still associated environmental consequences. The Government of Mauritius is totally dedicated to increase the safety of workers, the public well-being, as well as to protect the

environment [18]. Hence, it is imperative that there is significant investment for the proper management of medical waste in order to reduce the associated health and environmental risk.

6. Recommendations

Medical institutions in Mauritius may use the following recommendations for the management of medical waste taking into consideration the environment as well as the associated health risks:

- Medical institutions in Mauritius must adopt a comprehensible guiding principle for the purchase of products laying emphasis on the reduction waste.
- Measuring and quantifying the amount of medical waste generated in each unit of the medical institutions periodically to find out the amount of waste generated is essential. In so doing, an indication of the resource that needs to be allocated may be known.
- A Sharps Management System must be set in hospitals. Also, there is a need of placing proper equipment and containers at all sharp generating points. Training on the proper handling and management of sharps must be given to the staff of hospitals.
- Hospitals must formulate a medical waste management policy for the disposal of medical wastes separately from hospitals' waste management system. This may be carried out by a multidisciplinary team including specialists from the field of environmental health.
- Staff must be made aware of health, safety and environmental issues related to medical waste.
- The Ministry of Health and Quality of Life and as well as the Ministry of Environment and Sustainable Development may collaborate the private clinics in order to invest in environmentally sound and cost effective healthcare waste treatment and disposal technologies. Incinerators being thought to be an ultimate solution may pose serious health problems to the community, their own staffs, and damage to the environment.
- The government may implement policies or regulations that can help in enforcing the proper management of medical waste.
- Medical waste treatment facilities such as incinerators and autoclaves must be operated under an expert proper supervision.
- Workers must be provided with protective equipment and clothes to wear on their work premises.
- Health surveillance as per section 78 of the Occupational Safety and Health Act of Mauritius must be enforced to ensure the health and safety of workers.

References

- [1] Diaz, L.F., Eggerth, L.L., Enkhtsetseg, Sh., Savage, G.M., 2005. Characteristics of healthcare waste. *Waste Management* 28, 1219-1226.
- [2] Oweis, R., Al-Widyan, M., Ohood Al-Limoon, O., 2005. Medical waste management in Jordan: a study at the King Hussein Medical Center. *Waste Management* 25, 622-625.
- [3] DenBos, A., Izapanah, A., 2002. Building capacity for comprehensive medical waste management in Asia. *EM The Urban Environment* 18, 20.
- [4] Abd El-Salam, M.M., 2010. Hospital waste management in El-Beheira Government, Egypt. *Journal of Environmental Management* 91, 618-629.
- [5] Cheng, Y.W., Sung, F.C., Yang, Y., Lo, Y.H., Chung, Y.T., Li, K.C., 2008. Medical waste production at hospitals and associated factors. *Waste Management* 29.
- [6] Mastorakis, N.E., Bulucea, C.A., Oprea, T.A., Bulucea, C.A., Dondon, P., 2011. Holistic approach of biomedical waste management system with regard to health and environmental risks. *Development, Energy, Environment, Economics* 5 (3), 287-295

- [7] Alhumoud, J.M., Alhumoud, H.M., 2007. An analysis of trends related to hospital solid wastes management in Kuwait. *Management of environmental Quality. An International Journal* 18, 502-513.
- [8] Akter, N., Tränkler, J., 2003. An analysis of possible scenarios of medical waste management in Bangladesh. *Management of Environment Quality: An International Journal* 14(2), 242-255.
- [9] Johannessen, L.M., Dijkman, M., Bartone, C., Hanrahan, D., Boyer, G., Chandra, C., 2000. Health care waste management guidance note, Health Nutrition and Population discussion paper. The International Bank for Reconstruction and Development, The World Bank, Washington DC
- [10] Alagoz, A.Z., Kocasoy, G., 2008. Determination of the best appropriate management methods for the healthcare waste in Istanbul. *Waste Management* 28, 1227-1235
- [11] Shinee, E., Gombojav, E., Nishimura, A., Hamajima, N., Ito, K., 2008. Healthcare waste management in the capital city of Mongolia. *Waste Management* 28, 435-441.
- [12] Bendjoudi, Z., Taleb, F., Abdelmalek, F., Addou, A., 2009. Healthcare waste management in Algeria and Mostaganem department. *Waste Management* 29, 1383-1387.
- [13] Rastogi, V., Rastogi, P., Bhatia, S., 2011. Bacteriological Profile of Biomedical Waste: Management Guidelines. *Journal Indian Academic Forensic Medicine* 33 ISSN 0971-0973 No. 2
- [14] Katoch, S.S., 2007. Biomedical Waste Classification and Prevailing Management Strategies. *Proceedings of the International Conference on Sustainable Solid Waste Management*, 169-175.
- [15] Akter, N., 2000. Medical Waste Management. Environmental Engineering Program, School of Environment, Resources and Development.
- [16] Zeller, L., 2010. Air Modeling Report –“BMWNC Medical Waste Incinerators”. Blue Ridge Environmental Defense League
- [17] Rao, SK., Ranyal, RK., Bhatia, SS., Sharma, VR., 2004. Biomedical waste management: An infrastructural survey of hospitals 60 (4)
- [18] National Implementation Plan, 2005. The Stockholm Convention on Persistent Organic Pollutants, Republic of Mauritius Ministry of Environment & National Development Unit.
- [19] Mohee, R., 2005. Medical wastes characterization in healthcare institutions in Mauritius. *Waste Management* 25, 575-581.
- [20] Pruss, A., Giroult, E., Rushbrook, P., 1999. Safe Management of Wastes from Healthcare Activities. World Health Organization, Geneva.