Mini-Review

iMedPub Journals
www.imedpub.com

Health Systems and Policy Research
ISSN 2254-9137

2021
Vol.8 No.S2: 004

Healthcare Waste Management in Oman

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Received date: August 5, 2021; **Accepted date:** August 19, 2021; **Published date:** August 26, 2021

Citation: Al-Jaradi NHS (2021) Healthcare Waste Management in Oman. Health Sys Policy Res Vol.08 No.S2: 004.

Abstract

Although healthcare waste is a small volume waste stream, it imposes significant risks to human health and the environment, particularly if improperly managed. In Oman, be'ah company is continuously monitoring the end-to-end management system of healthcare waste i.e. from the point of generation to the final disposal in order to deal immediately and effectively with any potential risks. This session will highlight the most important take-home message that we all, as waste management specialists, need in our daily work.

Keywords: Healthcare waste; Waste management; Improper disposal; Health risks; Toxic pollutants

Introduction

Healthcare waste is broadly defined as all types of waste generated from healthcare activities, which include general waste, sharps, pathological waste, pharmaceutical products, radioactive waste, chemical materials, clothes, textiles, and other infectious materials. Although, hazardous healthcare waste represents a small volume of the total generated healthcare waste, it imposes significant risks to human health and the environment, particularly if improperly managed. Therefore, safe handling, collection, transportation, treatment and final disposal of hazardous healthcare waste must be in-place in order to avoid any harmful impact.

During the past few years, there has been a worldwide increase in the level of public concern regarding the management of healthcare waste. Healthcare activities lead to the production of wastes that may cause adverse health effects. Some types of healthcare waste impose higher risks to health compared to others. In 2000, the World Health Organization (WHO) has estimated that illicit drug injections with contaminated syringes caused 21 million hepatitis B infections, 2 million hepatitis C virus infections and 260,000 HIV infections (WHO, 2004).

The Government of Oman recognized the potential risks imposed by healthcare waste. In 2010, Oman's Ministry of Health (MOH) carried out for the very first time a 'Vaccination Week' to vaccinate healthcare workers and other high-risk groups (such as waste worker dealing with healthcare waste). However, vaccines against hepatitis C, HIV, and some other infectious diseases still do not exist. For example, in the Omani population, the prevalence of HIV antibodies ranges between 0.9% and 1.2% in sera from blood donor and 13.5% in sera derived from dialysis and renal transplant patients.

Considering Oman legislations, polluter pays principle, precautionary principle, duty of care principle, proximity principle and technical policies there is a need to reduce both the cost and environmental impact arising from the generation and disposal of health care settings.

Healthcare Waste Management in Oman

Oman is located on the southeastern coast of the Arabian Peninsula in Western Asia with a population of around 4.6 million people and an area of 309,501 km². This article addresses the revolutionary transition of Healthcare Waste Management system in Oman, only within seven years. From relying on practices of uncontrolled incineration and random dumping of hazardous healthcare waste from health facilities across the country to ensuring proper collection, transportation, treatment and safe disposal of more than 99.9% of the healthcare waste generated by health facilities throughout Oman in state-of-the-art Healthcare Waste Treatment Facilities (**Figure 1**).

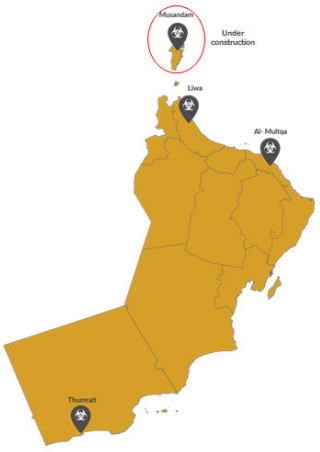

Figure 1: Healthcare waste treatment facilities in Oman.

As per the National Healthcare Waste Strategy Report issued in 2014, around 4,500 tons of healthcare waste is generated annually in Oman. Prior to 2012, the infrastructure for healthcare waste management was incomplete, whereby only few of the major primary governmental hospitals were equipped with old-style incinerators to burn their waste without proper control and treatment of the emitted flue gases. The majority of health facilities relied on transporting their waste to the nearest hospital equipped with incinerators or random dumping in the nearest dumpsite, despite the hazardous nature of their generated waste. Although there were already some regulations and laws governing this sector, these policies varied a lot from one region to another. Therefore, there was minimal compliance, especially in remote areas. Such lack of compliance exposed all individuals exposed to hazardous healthcare waste, including those within health facilities and outside these sources handling or exposed to such waste due to improper management, to human health and environmental risks.

Consequently, the government decided to grant Oman Environmental Services Holding Company (be'ah) the mandate and the legal status as the only entity responsible for solid waste management, including healthcare waste, in the country. This royal decree authorized the company to become the government's arm in transforming waste management, ensuring compliance, changing prevailing perceptions and fostering sustainable economic growth such as restructure, corporatize and privatize the waste management activities across the Sultanate.

The be'ah restructured the existing infrastructure and laid down a solid basis for healthcare waste management, starting first with building three main treatment facilities across the country. These state-of-the-art healthcare waste treatment facilities were established as per the latest international standards recommended by the World Health Organization (WHO) to ensure the safe management and disposal of such waste using the latest scientific methods and technologies.

Treatment technologies

The be'ah healthcare waste treatment facilities' relies on two types of technologies. They are incineration and autoclave (**Figure 2**).

Figure 2: An incineration and autoclaving devices in healthcare waste treatment facility.

Incineration method

Initially incineration comprised burning waste as efficiently and completely as possible in a controlled fashion with as little smoke as possible. This has now developed into burning waste within very close tolerances for primary and secondary combustion of the waste, flue gas treatment including chemical treatment and filtration. The emission standards have become very much more exacting to meet and in most countries are subject to laws and regulations. Most countries emission control requirements are derived from either EU or US EPA laws or regulations.

In be'ah healthcare waste treatment facilities, there are two lines of incinerators each has a nominal capacity of 2.75 tons per day. The emissions control process is regularly tested and complied with the EU regulations in addition to the availability of continuous emission monitoring system built-in within the facility that are set to ensures compliance with EU standards.

Autoclaving method

Autoclaving is the process of raising the temperature of a substance in the presence of saturated steam. Steam is chosen because saturated steam has a fixed pressure and temperature relationship, and saturated steam penetrates cell walls and kills organisms because it is moist. The standard of sterilization is a statistical ratio usually referred to as a log10 Kill, i.e. 1 organism in a sample containing 1 million may survive. In the main three facilities of be'ah, there are 6 lines of T1000 autoclaves each has a nominal capacity of 3 tons per day.

By 2018, be'ah successfully took over the Healthcare waste management sector and succeeded in providing its healthcare waste management services to all public, as well as private health facilities throughout the country, ensuring proper collection, transportation, treatment and safe disposal of more than 99.9% of the healthcare waste generated by health facilities across Oman. For its expertise in the management of healthcare waste, be'ah won the Middle East Waste and Recycling Award for Medical Waste Management Best Practice (MWMBP) in 2019.

However, be'ah is still facing certain challenges such as, improper waste segregation in health facilities i.e. by waste generators, which makes the proper treatment and safe disposal of such waste much more challenging. Moreover, be'ah has to cross hundreds of kilometers in order to collect small quantities of healthcare waste from remote areas in the country. Due to the long distances, there might be a delay in waste collection, which is often associated with high operational costs. Thus, be'ah sought to find solutions to such challenges by addressing some necessary behavioral and technical changes aimed to enhance Healthcare Waste Management (HWM) in Oman. Accordingly, be'ah established strong strategic relationships with global organization in the field of healthcare waste management, such as, World Health Organization (WHO), and the International Solid Waste Association (ISWA), in order to exchange expertise and enhance the overall Healthcare Waste Management in the country.

It is extremely important to raise awareness and to implement policies within health facilities to ensure proper waste segregation in order to eliminate the risks of harmful pathogens and toxic pollutants to healthcare workers, the public and the environment. Consequently, be'ah worked hand-in-hand with Ministry of Health, as a regulator as well as a waste generator, to achieve a mutual goal of overcoming certain challenges within health facilities. Therefore, be'ah conducted numerous awareness campaigns for health workers within health facilities, including medical and paramedical staff, aimed to spread knowledge on the importance of waste segregation and to share on-ground challenges resulted from improper management of healthcare waste within health facilities and their consequent harmful impact on human health and the environment.

These campaigns contributed effectively in revisiting the policies, procedures and guidelines within all health facilities, making necessary changes to ensure full compliance by health workers in dealing with hazardous healthcare waste and improving waste segregation from point of generation as per WHO standards. These changes led to a great decrease in the total number of injuries resulted from improper disposal of waste, as well as a noticeable decrease in collected healthcare waste implying an improvement in waste segregation from health facilities [1].

The be'ah eco-system project

In comparison to traditional waste management practices, be'ah took a step forward by working on implementing a state-of-the-art automated system, which will provide a full-fledged business control and operation center for monitoring, overseeing, regulating and managing waste operations activities, in order to create an intelligent solid waste management culture in Oman.

The be'ah Eco-system project will integrate be'ah internal systems, all sub-contractors systems, and all external stakeholders systems on a single platform to allow be'ah to automate end-to-end processes related to each waste stream's operations with an ambitious aim to implement IoT-enabled technologies in the near future [2].

For instance, many healthcare institutions across the country require a large number of bins. However, the level of filling of these bins is inconsistent and varies a lot, to the extent that sometimes it might take from one day up to 5-7 days. IoT-enabled technologies can effectively handle such variable filling/emptying requirements, which are determined mainly by healthcare facilities' location, type of waste and seasonal effects. Moreover, IoT-enabled technologies can monitor the location of bins, loading/unloading operations and trucks routing as well as the treatment methodology used for each type of waste, whereby all of these data can be made available online through a live tracking mobile application [3].

This project, expected to be completed by 2021, will substantially contribute in sustaining effective and efficient management of healthcare waste, which will contribute in eliminating many challenges and enhancing the overall healthcare waste management in Oman (**Figure 3**) [4].

Figure 3: Be'ah eco-system which will provide an integrated smart waste management system for optimization of existing collection, transportation, treatment and final disposal of waste operations.

Conclusion

Oman had witnessed more than 300% increase in generation of healthcare waste between the years 2012 and 2018. Nevertheless, Oman Environmental Services Holding Company (OESHC) (be'ah) was on the task of leading and successfully managing the healthcare waste sector, ensuring proper collection, transportation, treatment and safe disposal of more than 99.9% of the healthcare waste generated by health facilities throughout Oman, despite all challenges.

Acknowledgements

This paper has been submitted as part of the requirements to participate in the 16th International Expo on Recycling and Waste Management (IERWM). I would like to thank my organization, Oman Environmental Services Holding Company (be'ah) for giving me the opportunity to represent the company and participate in the 16th International Expo on Recycling and Waste Management.

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