Abstract—The proper management of medical waste must be given priority and the medical waste generator has to ensure the proper medical waste management involving collection and disposal by private medical clinics with a potential disposal mixing with municipal waste stream. The study determined methods of medical waste management; and identified problems encountered and proposed measures for improvement. The study was carried out from January to October 2008 in Taiping, Malaysia; where 19 of 72 private medical clinics (n=19) (26.4%) participated in the study. Data was collected through a self-administered questionnaire survey. The analysis showed private medical clinics who disposed of medical waste with general waste (n=3) (15.8%), with inappropriate types of containers for collecting. The main problem encountered by private clinics was improper practices due to lack of awareness (n=11) (57.9%). The charges imposed by DOE registered contractor was not reasonable (n=2) (10.5%). The private medical clinics did not engage the registered contractor (n=3) (15.8%).

Keywords – DOE - Department of Environment

I. INTRODUCTION

Medical waste is of environmental concern because of its infectious nature that can spread diseases and cause injury to human [23]. Management of medical waste must be given special attention because of the potential risk to health or pollution to the environment and should be disposed of at a licensed disposal facility. The responsibility of medical waste generator is to ensure proper management of medical waste [13]. According to Malaysia Environmental Quality Report 2006 published by the Department of Environment, the amount of clinical and pharmaceutical waste generated was 32,270.34 metric tonnes which consists of 2.9% of the total scheduled waste in 2006.

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II. LITERATURE REVIEW

World Health Organization (WHO) defined medical waste as “any waste which consists wholly or partly of human or animal tissue, blood or other bodily fluids, excretions, drugs or other pharmaceutical products, swabs or dressings, needles or other sharps; and any other waste arising from medical, nursing, dental, veterinary, pharmaceutical or similar practice, investigation, treatment, care, teaching or research, or the collection of blood for transfusion” [29]. WHO estimated 80% from total healthcare waste is not infectious and only 20% is infectious or poses risk of injury or hazardous to human beings [38] (Table 1).

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-infectious waste</td>
<td>80%</td>
</tr>
<tr>
<td>Pathological waste and infectious waste</td>
<td>15%</td>
</tr>
<tr>
<td>Sharps waste</td>
<td>1%</td>
</tr>
<tr>
<td>Chemical or pharmaceutical waste</td>
<td>3%</td>
</tr>
<tr>
<td>Pressurized cylinders, broken thermometers etc.</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

Source: Management of Solid Healthcare Waste at Primary Healthcare Centres - A Decision-Making Guide [38]

Private Healthcare Facilities and Services Act 1998 and Private Healthcare Facilities and Services (Private Medical Clinics or Private Dental Clinics) Regulations 2006 are enforced by Ministry of Health for the registration, licensing and operating of private medical clinics.

Under Section 7(1) of the Act, a certificate of registration to establish, maintain, operate or provide a private medical clinic may only be issued to a registered medical practitioner [16].

Under these Regulations, hazardous waste includes both infectious and non-infectious waste. Infectious waste includes human, animal, biological waste or contaminated sharps and any items that may be contaminated with pathogens, whereas non-infectious waste includes toxic chemicals, cytotoxic drugs, radioactive, flammable and explosive waste.

Under the same Regulations, the private practitioner or owner of the private medical clinic shall take the following actions:

(i) infectious and non-infectious waste shall be separated at the point of generation.

(ii) infectious waste shall be discarded into clearly identifiable containers or plastic bags that are leak-proof and puncture-resistant and the containers shall be marked with the universal symbol for biological hazards (three black crescents superimposed on a circle
with white background and the word “INFECTIOUS SUBSTANCES (WASTE)” at the bottom).

(iii) non-infectious waste shall be handled in accordance with good safety practice and any written law relating to handling of such waste,

(iv) all hazardous waste shall be packaged, transferred and disposed of in a manner accepted by the relevant authority to protect both the persons and the environment.

A person who commits an offence under these Regulations shall be liable on conviction to a fine not exceeding five thousand ringgit or to imprisonment for a term not exceeding one month or to both [18]. The control of hazardous waste including medical waste in the private medical clinics is included under the licensing procedures of Ministry of Health.

The concessionaire agreements for medical or clinical waste management in government healthcare facilities was signed between Ministry of Health and three concession companies in October 1996 whereby all medical or clinical waste generated in all government hospitals and clinics are managed and disposed of by three concession companies which are Faber Medi-Serve Sdn Bhd for states of Perlis, Kedah, Penang, Perak, Sabah and Sarawak; Radiicare (M) Sdn Bhd for Wilayah Persekutuan Kuala Lumpur and Putrajaya, Selangor, Pahang, Kelantan and Terengganu, and Pantai Medivest Sdn Bhd for Negeri Sembilan, Melaka and Johor. The management of medical waste in all government hospitals and clinics are well organized and systematic.

Unfortunately the medical waste management in private medical clinics is not well established and not standardized because not all the private clinics engage the services from the above mentioned companies.

The Malaysia Medical Association (MMA), Department of Environment (DOE), Ministry of Health, and the three companies held a meeting in Putrajaya on 25th February of 2001 on the same issue, whereby the Memorial of Health had given the MMA a deadline until 1st March 2002 to seek the services of these companies.

The MMA were facing problems of costs and services offered by the companies. It was agreed that private medical clinics must follow the practice of the small health centre of the Ministry of Health that is to send the clinical waste to the nearest service centre. The Director-General of DOE has agreed that clinics can group together and send their waste. Alternatively, they can also seek assistance of the nearest private laboratory or private hospital. Private medical clinics must ensure that wastes are delivered to the allocated service centre that is run by the companies.

Service centre is a place where all medical waste that has been collected from hospitals or clinics is kept temporarily before sending them to disposal site.

In 2004, approximately 430,000 tonnes of scheduled waste was generated in Malaysia. Approximately 18.8% was treated and disposed of in the toxic waste treatment and disposal facility in Bukit Nanas, Negeri Sembilan; 58.0% was recycled and recovered at licensed premises; 19.7% was treated and stored within the premises of generators; 0.7% was exported for recycling and 2.7% was disposed of at clinical waste incinerators [24].

According to the Malaysian Auditor General’s Report 2007 on the appalling methods used to dispose of clinical waste at hospitals and clinics, the government has paid RM131,400,000 to the concession companies for the management of medical waste in 140 government healthcare facilities. The total quantity of medical waste handled for the year 2005 to 2007 was 203,529 metric tonnes. The findings revealed in the report were of clinical waste contained and dumped in drums labeled ‘domestic waste’. The findings noted that needles and sharp objects were not segregated from other waste and were not disposed of in ‘sharp containers’ as required.

General waste was disposed of together with medical waste, thus increased the quantity of medical waste and incurred extra cost. ‘Sharp containers’ that contained needles and sharp objects were kept for too long before disposal. ‘Sharp containers’ were badly maintained and almost never washed. The medical wastes were transported from health clinics to hospitals using ambulances, vans or four-wheeled drive vehicles which did not have approval from the DOE. The waste water was allowed to flow into common public drains without first being treated [3].

Medical waste is potentially dangerous since it can spread disease because of the infectious nature of some waste, and/or cause injury through the presence of sharps such as needles and scalpels. It is important to safeguard the health and safety of the public, patient and healthcare staff against the risk posed by medical waste.

The method of medical waste segregation, storage, collection and disposal in private medical clinics is not fully implemented and not standardized. This could be due to the quantity of medical waste generated is too small and cost of collection and disposal is too high especially for small private medical clinics.

Illegal disposal of medical waste in open ground, in landfill site or in open municipal bins, renders them freely accessible to drug addicts, rag pickers, scavengers, and children, thereby increasing the risk of transmission of infections. There is potential of disposing medical waste into the municipal general waste bins or landfills due to the high cost and lack of enforcement from the authority. The number of private medical clinics is too many and scattered throughout the country, hence it is not easy to carry out the enforcement effectively and also the difficulties in collection and disposal of medical waste by a registered contractor.

This study is carried out to determine the method of medical waste collection and disposal in private medical clinics and to identify problems encountered in medical waste management and to propose measures for improving the medical waste management.

Medical waste is potential to transmit infection such as Hepatitis B virus (HBV), Hepatitis C virus (HCV) and Human Immunodeficiency virus (HIV) to human. Epidemiological studies indicated that a person who experiences one needle stick injury from a needle used on an infected source patient has risks of 30%, 1.8%, and 0.3% respectively of becoming infected with HBV, HCV and HIV. Other risks include physical injury and adverse local or systemic effects through contact with potentially hazardous pharmaceuticals that may also be present [37]. In the past, the re-use of needles and syringes has caused the spread of infectious diseases such as HIV and hepatitis [33].
The introduction of disposable or single-used needles and syringes as a solution to control the spread of infectious diseases has indirectly created unnecessary problem because the disposable needles and syringes are being disposed of in dumping ground and reused or recycled by irresponsible person. Furthermore, there is an increase in the quantity of medical waste generated especially disposable or single-use needles and syringes. The unsafe disposal of medical waste poses public health risks [37]. Failure to dispose of contaminated needles and syringes safely may lead to dangerous recycling and repackaging which lead to unsafe reuse. Contaminated injection equipment may be scavenged from waste areas and dumping grounds and either is reused or sold to be used again. WHO estimated that, in year 2000, contaminated injections with contaminated syringes caused 21 million hepatitis B virus infections (32% of all new infections); 2 million hepatitis C virus infections (40% of all new infections); and at least 260,000 HIV infections (5% of all new infections) [37]. The negative health and environmental impacts of medical waste may include the transmission of disease by viruses and microorganisms, as well as contamination of underground water tables by untreated medical waste in landfills.

Some of the most common problems concerning medical waste in developing countries in Asia are separation of infectious waste from general waste; reuse of disposable syringes and other untreated equipment; lack of awareness and training for healthcare professionals; and inadequate storage facilities, transportation and disposal equipment. Medical waste problem is often overlooked or simply viewed as a solid waste issue. Therefore, in order to protect public health, proper medical waste management requires committed planning, training and tracking throughout the medical waste collection, storage, treatment and disposal process. The problem faced in the management of medical waste is due to limited reliable information on the quantities and characteristics of various types of medical waste generated in healthcare facilities [11]. Improper waste management is increasingly becoming a potential public health risk and an environmental burden [4]. WHO recommended that healthcare waste management should put into a systematic, comprehensive framework, and should become an essential feature of healthcare services. WHO has advocated that medical waste should be treated as special waste. Medical waste may represent serious health hazards to health personnel if not properly managed [27][30]. The management of medical waste in many developing countries is often poor [27][29]. The management of medical waste is driven by concerns about health and environmental effects, uncertainty regarding regulations, and the negative perceptions by waste handlers [4]. In many developing countries, hazardous and medical waste are still handled and disposed together with domestic waste, thus creating a great health risk to municipal workers, the public and the environment [6].

A.D. Patil and A.V. Shekdar (2001) in India, found in their study that smaller private nursing homes and clinics do not take any precautions and often dispose of their healthcare waste in the municipal waste bins [1]. Safe disposal of medical waste is an essential component to maintain standard of hygiene, safe working and reduction of risk [8].

Askarian M et al. (2004) carried out a survey in 15 private hospitals in Fars Province, Iran to determine the amount of different types of waste produced and the current situation of waste management. The results indicated that the waste generation rate is 4.45 kg/bed/day, which includes 1830 kg (71.44%) of domestic waste, 712 kg (27.8%) of infectious waste, and 19.6 kg (0.76%) of sharps. Segregation of the different types of waste is not carried out perfectly. Two (13.3%) of the hospitals used containers without lids for on-site transport of waste. In the hospitals under study, there are no training courses about hospital waste management and the hazards associated with them. The training courses that are provided are either ineffective or unsuitable [2].

III. METHODOLOGY

The methodology is the tool used to carry out a research which includes why, where, what, who and how the research is done. The main topics covered are the study area, selection of private medical clinics, methods of study, data collection and data analysis.

The selected study area is Taiping, Perak. Taiping is located at a longitude of 100°43’41.53” E and latitude of 4°51’24.32” N. Total population of Taiping is 191,104 in 2007. There are 72 private medical clinics in Taiping.

The study respondents selected were all private medical practitioners in Taiping (N=72). Questionnaires were sent to all the respondents.

The response from the private medical clinics was very poor, only 19 respondents or 26% of 72 private medical clinics replied and returned the questionnaires. In a study carried out in Croatia by Natalija Marinkovic et al. (2008), the questionnaire was sent to 75 state-owned health care facilities and 76 private practices. The response from state-owned health care centers institutions was very high (93%). However, only 18 (24%) private practices responded to the survey [28].

More than half of the medical clinics or 11 (57.9%) generated less than 1 kg of human tissues/blood/fluids waste per day and only 1 medical clinic generated 1-5 kg of human tissues/blood/fluids waste per day. Seven respondents did not answer this question. In all the medical clinics that generated syringes/needles/other sharps waste, 17 (89.5%) generated less than 1 kg per day, 1 (5.3%) generated 1-5 kg per day and 1 (5.3%) generated more than 20 kg per day. There were 13 (68.4%) medical clinics generated less than 1 kg of expired drugs/vaccines waste per day, while 6 (31.6%) respondents did not answer the question.

Majority of the respondents provide only medical service which generate very small amount of medical waste. In this survey, the quantity of medical waste generated by majority of the medical clinics was less than 1 kg per day which is very much different from bigger hospital and medical centre. This would increase the possibility of disposing medical waste as general waste because the quantity of medical waste is small. The types of medical waste are gloves, mask, apron, gauzes, cotton wool, swabs, human tissues, blood, body fluids, syringes, needles, sharps, expired drugs and vaccine. Other domestic waste generated by medical clinics includes food, paper, plastic, metal or aluminium and glass. The quantity of domestic waste was
also less than 1 kg per day. Suwannee Adsavakulchaisri (2002) in her study on waste from hospitals and clinics in Phitsanulok, Thailand noted that the average daily medical waste generated in clinic was 0.041 kg per patient [32]. The findings of this study is quiet similar to the one done by Suwannee Adsavakulchaisri. Even though the quantity of medical waste is a small proportion, there is still cross infection risk and potential danger for environment associated with mismanaged waste.

The survey tried to determine the respondent’s knowledge on the type of containers to be used for storing or collecting medical waste in their clinics. The type of containers were general waste bin, normal plastic bag, biohazard plastic bag, sharp bin and other containers such as paper basket or keep in the store. The medical clinics (n=13) used the correct containers for storing food waste while 6 respondents did not answer. Paper waste generated in medical clinics (n=15) are collected in general waste bin, normal plastic bag and other containers. Plastic waste is collected in general waste bin and normal plastic bag in medical clinics (n=13). A respondent collected plastic waste in biohazard plastic bag. Five respondents did not answer this question. Ten respondents collected metal/aluminium waste in general waste bin, normal plastic bag and other containers. One 1 respondent collected them in sharp bin, 8 respondents did not answer, 4 respondents collected glass waste in general waste bin, 2 in normal plastic bag, 4 in sharp bin, 2 in other containers and 7 did not answer.

Gloves/mask/apron waste generated in 5 medical clinics are collected in general waste bin, 3 in normal plastic bag, 4 in biohazard plastic bag, 1 in sharp bin and 6 did not answer. Four medical clinics collected gauzes/cotton wool/swabs waste in general waste bin, 4 in normal plastic bag, 7 in biohazard plastic bag, 1 in sharp bin and 3 did not answer. One medical clinic collected human tissues/blood/ fluids waste in general waste bin, 1 in normal plastic bag, 7 in biohazard plastic bag, 1 in sharp bin and 8 did not answer. One medical clinic collected syringes/needles/other sharps waste in normal plastic bag, 3 in biohazard plastic bag, 14 in sharp bin and 1 did not answer. Two medical clinics collected expired drugs/vaccines waste in general waste bin, 2 in normal plastic bag, 4 in biohazard plastic bag, 4 in sharp bin, 1 in other containers and 6 did not answer.

About 63.2% or 12 of the medical clinics have collection/disposal schedule for their medical waste while 31.6% or 6 did not have and 1 did not answer.

There was a medical clinic that disposed of medical waste daily and another one every alternate day. Four medical clinics disposed of medical waste once a week, 3 once a month and 9 clinics disposed of medical waste irregularly. One respondent did not answer. The irregularity of disposal is due to the small amount of medical waste generated.

Out of 19 medical clinics surveyed, 5 (26.3%) kept inventory or record of medical waste while 14 did not.

Fourteen (73.7%) respondents agreed that clinic owner is responsible for the management of medical waste in private medical clinic while 5 (26.3%) respondents did not agree.

Five (26.3%) respondents agreed that expensive container is the problem faced in medical waste management while 14 (73.7%) did not agree. The medical clinics can only use specific container provided by registered contractor to secure safety in handling the waste. If not they would not collect their waste.

Six (31.6%) respondents agreed that high cost of collection/disposal is the problem faced in medical waste management while 13 (68.4%) did not agree. The method of disposal is by thermal treatment that is using incinerator.

Three (15.8%) respondents agreed that space limitation for keeping medical waste containers is the problem faced in medical waste management while 16 (84.2%) respondents did not agree.

Fifteen (78.9%) respondents agreed that the quantity of medical waste generated is too small is the problem faced in medical waste management while 4 respondents did not agree.

Two (10.5%) respondents agreed that the procedure is too complicated or tedious is the problem faced in medical waste management while 17 did not agree.

IV. CONCLUSION

This descriptive study has achieved its objective by discovering the method of medical waste collection and disposal methods used in private medical clinics. The type of container used and method of disposal for medical waste was not appropriate. The problems encountered in medical waste management were also identified. The recommendations were proposed to improve the medical waste management in private medical clinics.

Based on the data and information collected in the study, it can be concluded that the medical waste management in private medical clinics is improper, inconsistent, unsatisfactory and do not comply with the requirements under the Environmental Quality (Scheduled Waste) Regulations 2005. There is possibility that the medical waste generated by private medical clinics is mixed and handled together with general waste because lack of training, enforcement and responsibility or to save cost.

ACKNOWLEDGMENT

The process of completing the research needs assistance, guidance and support from various parties and individuals. Without their help, it is impossible to complete the research. I take this opportunity to convey my appreciation and thanks to everyone who has contributed to the research. First of all, I would like to thank my supervisor, Dr Puziah bt Abdul Latiff who has given support, advice, guidance and critic from beginning until the research is completed. I would like to thank all private medical practitioners in Taiping who have involved in the research. Special thanks to Dr Khaw and Dr Choong who have contributed tremendously in the research. I would like to thank Mr Mahalingam, the Manager of Faber Medi-Serve Sdn Bhd in Taiping Hospital who has provided assistance and information in the research. I would like to thank Mr Subramaniam a/l Karuppannan who has guided me throughout the research. Finally, I would like to thank my beloved wife, Tan Poh Kwan and my children for their love, care and support throughout the research.

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