CHAPTER X

CONCLUSION AND RECOMMENDATIONS

The problem of Bio-Medical Waste disposal has acquired monumental proportions today and is receiving attention all over as it has link with the public health and the environment and there is a commitment to safeguard the both from the physical and social impacts associated with it. Everyday the country's numerous health care institutions produces millions of tones of the most diverse and difficult to manage waste i.e. the Bio-Medical Waste. An alarming percentage of the waste litters within and outside of the health care institutions, especially in the Government health care institutions and has turned the place into a breeding grounds of lethal virulence and epidemics as pigs and dogs sniffing at and digging their faces into piles of garbage and heaps of infectious material lying within the health care compound. Likewise, the rag pickers are also engaged in collecting the infectious and other waste according to their requirements and thereby causing serious threat not only to the public health but to the environment as well. From paper scrap to cardboard boxes, from plastic bottles of intravenous bags and catheters, from batteries to broken thermometers, from used bandages to blood soaked surgical gowns, the Bio-Medical Waste of all categories can be found littering inside and outside of the health care institutions throughout the country.

It is very surprising that where on the one hand huge investment is made in constructing large and well equipped health care institutions on the other, little thought is given in dealing with the Bio-Medical Waste generated in it. Management of Bio-Medical Waste in a health care institution should be based on a scientific approach to the process of waste generation, storage, transport, treatment and its disposal. It is out of mention to say that the waste should be managed in an environmentally safe manner and this is possible only if the health care personnel have proper knowledge of risks management associated with the handling of such waste.

A lot has been said but little is done towards the management of the Bio-Medical Waste in our country. Health care institutions, which on the one hand plays an important role in preventing the proliferation of disease and valuable human lives,

on the other it has the potential to pollute the environment if infectious Bio-Medical Waste generated by them is not properly treated and subsequently disposed of. Although the Notification of the Bio-Medical Waste (Management & Handling) Rules, 1998 was issued by the Ministry of Environment and Forests, Government of India to regulate and manage the hospital generated waste and was in force till 2016 when the new Bio-Medical Waste Management Rules, 2016 came into force in the country to overcome the lacunae that was existed under the old Rules, the health care institutions all over the country are yet to react to it seriously to the safe and rational management of the Bio-medical Waste.

Therefore, taking into consideration the seriousness of the problem persisted in the management of the Bio-Medical Waste throughout the country and to examine the efficacy of the existing Rules, the researcher has undertaken the subject with several objectives in hand which includes among others, detailed in-depth knowledge about the existing Bio-Medical Waste scenario prevailing in the country, its evolution by tracing out the past history, international documents (general and specific) to deal with the same, general and particular laws of the country under which the subject could be properly dealt with, the existing scenario of Bio-Medical Waste in developed countries like USA, UK, China etc. On the basis voluminous data, primary and secondary, the researcher had tried to reach to the findings with relevant remarks under this work. The chapterisations of this research work is based on the hypothesis that whether the health care institutions are discharging its duties properly or in gross violation of the existing Rules or there is lacunae in the Rules itself making the situation difficult to manage.

Another object of this research work was to highlight on the practices prevailing in Siliguri town regarding the disposal of the Bio-Medical Waste in accordance with the Rules for which the researcher had undertook to conduct field study as part of the empirical research and it has been found that the scenario in the Siliguri town is more or less similar to that prevailing in the other health care institutions in the country. Being the primary aim, the researcher had visited different health care institutions located in Siliguri, questioned and interviewed different health care personnel. A glimpse of the chapter dealing with the empirical study shows a very grim picture of the city in disposing off the Bio-Medical Waste, whether it is in the Government hospitals, or in the private hospitals and nursing homes. It has been

seen that despite having the Rules, in tune of the practices prevailing in other parts of the country, the city is also not an exception in this regard. It should be mentioned here that the existing situation in the Government health care institutions in the city is worse compare to the private health care institutions.

In this background, where the Bio-Medical Waste management all over the country including Siliguri town portray the similar picture, there is an urgent need to develop a framework within which progress can be made on a step by step basis which shall foster the philosophy that any small but steady step of improvement is better than doing nothing. The framework can be compared with a ladder where each stair is a detailed plan of action that aims to accomplish a goal and provides the basis for moving up to the next level, leading ultimately to the establishment of a sound in-house management programme at the top. To achieve the same strict implementation of the following must be ensure and then only instead of being only in the paper disposal of the Bio-Medical Waste would be practically and effectively possible.

RECOMMENDATIONS

Therefore, every health care institution should begin with the following:

1. The policy guidelines

The policy provides a framework within which the management of the Bio-Medical Waste is to be operated. If the framework is not well conceived, the tasks of those concerned with the management of the Bio-Medical Waste would be very difficult. The policy makers should also provide support and guidance to the concerned persons involved in the management. Bio-Medical Waste guidelines are intended to provide an approach to the management, for management of the waste that is safe for the waste handlers, the public and the environment. To ensure effective management of the Bio-Medical Waste every health care institution must prepare a policy guideline with an assured implementation scheme. The policy must be compiled taking into consideration various polices, national and international relating to the management of the Bio-Medical Waste. This depends, of course, on the financial capacity each health care institutions has. For the proper and effective implementation of the policy it is essential to establish a Management Cell whose task would be to prepare an integrated master plan regarding training and education with

more emphasise on practical training, priority on the maintenance of hygiene and cleanliness apart from the strict follow up of the existing Rules in terms of collection, segregation, storage, transportation and final disposal. Depending on the financial capacity, the policy should incorporate the plan for the purchase of modern developed equipments with environmentally sound and cost effective criteria to provide riskless and injury less handling of the Bio-Medical Waste.

2. Bio-Medical Waste management cell

A separate wing, called Bio-Medical Waste Management Cell can be set up for each of the health care institution, which would maintain an inventory of waste generated ward wise and the quantum sent for treatment and disposal. The health care institutions should establish a Bio-Medical Waste Management Committee and appoint a Management representative who will be directly responsible for establishing systems and procedures, implementing and maintaining the systems and assisted by a team of adequately trained staff. The members of the Committee should include representatives from the various departments including the nursing and house-keeping staffs. The management cell should frame a waste management strategy to ensure that all relevant regulatory requirements are fulfilled. The strategy should clearly outline management commitment

a. To the principle of responsible waste management;
b. In term of resource allocation;
c. Highlight the accountabilities and responsibilities of management, staff and contractors;
d. Clearly define the various categories of the waste stream; clearly articulate appropriate disposal procedures and
e. Provide adequate and ongoing education

Strict compliance of the strategy by each and every health care personnel involved in the management of the Bio-Medical Waste is the most essential function of the head of the Management. The making of policies and setting up of the Management Committee would be futile if the strategies are not successfully implemented. The Committee should decide that steps to be taken against those who has shown casual attitude towards the proper implementation of the Bio-Medical Waste.

3. Bio-Medical Waste management action plan

The health care institutions should develop a plan, an action plan, to give effect of its Bio-Medical Waste Management Policy. The members of the Bio-Medical Waste Management Committee should begin by conducting a survey for understanding the entire systems in each functional area and should prepare a document in this connection. The document should cover the following aspects:

1. Roles and responsibilities of each staff engaged;
2. Type and quantity of waste generated in each functional area.
3. Description of existing methodology practices under each activity such as segregation, internal and external transportation, pre-treatment, storage, post treatment and final disposal of the waste generated in various units.
4. One should cross check whether the activities are adequate as per standard practices.
5. Existing methodology should be modified appropriately, consistent with-the type, quantity and frequency of waste generated in each unit.

The action plan should lay the standard operating procedures covering all components and modes of handling the waste. The first step would be to identify the procedures for the management of entire waste right from the collection, segregation to transportation and disposal. The head of the particular ward/unit who has given the charge of managing the Bio-Medical Waste in that ward/unit should be properly educated and trained under whose guidance the waste is to handled with proper care and caution. Each ward/unit should have an identified collection point with the displayed instructions to attract the attention of the persons involved in the handling of the waste. The person must have a vigilant eye over the entire process especially those involve in segregation process because improper segregation would make the entire waste management process in jeopardy and all the effort would go in vain. Only trained and experience sweepers should be engaged in this process. Such personnel may be assisted by the not-so-trained sweepers who not only would obtain the practical knowledge, in the course of time, they would become a trained and experienced waste handler and the risk factor in the primary stage would be completely reduced to nil. It should be remembered that the location of the primary storage should essentially be nearby the treatment area. The hygiene of the primary

storage area should be maintained by using the disinfectant and it should also be inaccessible to animals, insects etc.

For carrying the waste bags from the source of generation to primary storage area help of three/four wheeled trolley with sufficient storage capacity should be used. The trolleys should be regularly cleaned and dried up after every use. At the time of carrying the infectious waste special care should be taken so that no spillage should be leaked. While loading the waste bags proper care should be taken so that the risk factor of injury could be minimised. The collected waste should not be left over inside or outside the ward/unit even for a temporary period, other than the central storage. It should be ensure by the head of the unit/ward that while handling the waste proper precaution and safety guards like gloves, masks, apron, gumboots etc. has been followed.

The method of cross-checking after following each step in the entire system of Bio-Medical Waste management is considered as an effective step and if the same is implemented, the risk factor would be nil. The head of the ward/unit may be held responsible to the higher authority for not discharging the duty of cross-checking on a regular basis. The existing methodology may vary from time to time depending on the situation keeping in view the ultimate aim of managing the waste in a scientific way.

4. Ensuring infection control practices

Infection control refers to policies and procedures used to minimise the risk of spreading infections in the health care institutions. The control of infection in the health care institution is the responsibility of all health care personnel. The hospital acquired infections known as nosocomial infections requires a hygienic and sanitised environment and maintenance of good practices and use of protective gear. Routine cleaning of every ward is absolutely essential, as that will keep the environment free from dust and soil. Infection control practices can be grouped in two categories:

a. Standard precautions: To be applied to each and every patient at all times, regardless of his diagnosis or infectious status. This includes hand-washing and antisepsis, use of appropriate personal protective equipment while handling organs, blood, body substance etc.

b. Additional precautions: These are infection control precautions specific to modes of transmission such as airborne, droplet and contact and are applied in addition to standard precautions, wherever necessary.

Many a times it has been seen that despite the availability of the protective equipments, due to lack of education and training the handlers of Bio-Medical Waste are careless in wearing the same and the consequent result is the spreading and contacting of infection to those handlers including the patients, the visitors, the nurses and all who are directly or indirectly connected with it. To stop the same the head of every ward/unit should be careful and should see whether protective measures have been followed. In addition to it, such person should also see whether appropriate protective equipment has chosen depending on the risk of exposure of certain type of Bio-Medical Waste, *e.g*. sharps waste. Sharps should be disinfected or destroyed as per the policy guidelines of the health care institutions. The health care institution, as far as possible, should make arrangement of the sharp handling devices to avoid injury to the user and to others who may come into contact with the sharp items.

5. Proper Education and Training

The purpose of education and training is to minimise the risk of the injury associated with the waste handling and facilitate efficient waste management. The authority of the health care institution must provide education and training to the following personnel:

a. Waste generators;
b. Waste handlers, collectors and transporters;
c. Key managers instrumental in the implementation of the waste management plan; and
d. Operators responsible for treatment and disposal methods.

Training of the health care personnel is an important aspect for a successful Bio-Medical Waste management programme. Training will provide orientation for new as well as existing health care personnel with new responsibilities and help in continual updates as the policy changes. It has been seen that the segregation and handling of Bio-Medical Waste is carried out to a large extent by the health care personnel without adequate training. Training should focus on all principles relating

to the management of the waste. The training module may be divided into five categories, with each category linked to one of the five main categories of the training programme. Such modules are:

a. Introduction to Bio-Medical Waste problems,
b. Development of a strategic approach,
c. Policy development and programme planning,
d. Planning at health care facilities level and
e. Strategic planning at the local health care level.

Regular training of the health care personnel would increase awareness among them. The training should be made mandatory for all the health care institutions. At the same time, Bio-Medical Waste related education materials both in printed and electronic format like posters, books, booklets, films, videos slides is to be prepared. Audio-video screening sessions, field visits, situation analysis, problem solving, informal interactions along with the module based training should be incorporated in training programme.

It has been seen that in many health care institutions the health care personnel are involved in the management of the Bio-Medical Waste without proper training and without having knowledge about how to handle it. In-house training of health care personnel should be made mandatory for each health care institution which would help in the proper management of the waste. In addition to this, the health care personnel should attend the training programme conducted either by the concerned department of the Government or any other private organisations. The benefit of attending such training programme is that the health care personnel would be well versed with latest methodology of the waste management. It has been seen that despite having proper training and education due to lack of infrastructure in the health care institutions the management of waste could not be possible as per the developed and scientific way of management that has been newly introduced. Therefore, the health care institutions should make arrangement of all those equipments the availability of which would help the health care personnel to act in accordance with the trained knowledge.

6. Emphasis on Bio-Medical Waste Audit

Waste audit is an important step in the management of the Bio-Medical Waste because the success of the entire waste management depends on it. The purpose of the waste audit is to determine current performance in terms of safety, efficiency, environmental impact assessment, costs and regulatory compliance. The following information should be collected and assessed in accordance with the guidelines:

a. Types, volume and/or weight, quantities and composition of waste generated;
b. Hazard assessment of waste;
c. Incidence and severity of waste handling injuries;
d. Incidence and nature of spills and leakages;
e. Sources of solid and liquid waste;
f. In-house procedures or processes producing waste;
g. Points of generation, collection and storage sites;
h. Contents of waste containers;
i. Loading, transport and disposal methods;
j. Transportation records and waste dockets;
k. Costs of disposable versus reusable items; and
l. Costs of waste packaging, internal and external transport, treatment and disposal.

The policy guidelines of every health care institution should include in their respective policy the matter relating to the waste audit. It has been found that although the policy guidelines provides for the same, however due to its non-implementation, the situation remains the same. In order to achieve the goal of effective management of the Bio-Medical Waste, the health care institutions should make periodical assessment under the supervision of a responsible trained person. The audit would help in identifying the areas where there is lack of proper management and after detecting it, appropriate corrective measures can be taken to remove the defects. Regular waste audit is an important aspect in the management of the Bio-Medical Waste identifying the most negligible area *i.e.* any ward or department within the health care institutions and accordingly appropriate steps could be taken to overcome it. It would also help in identifying the persons for whose negligent and careless act

made the situation worse and thereby appropriate departmental steps can be taken against them.

7. Need for Waste minimisation

It is the duty of the authorities of every health care institution to identify and quantify the waste generation. Effective measures should be adopted to reduce the amount of waste by controlling the demand/inventory, wastage of consumable items and breakages, etc. Another option is recycling of certain wastes such as paper, glassware, plastic material, etc. after proper cleaning and disinfection.

As far as possible, healthcare establishments should encourage purchase of reusable items made of glass and metal. Meticulous segregation is the key to minimise the quantity of waste to be treated. Waste minimisation can save health care institutions a great deal of money in the long run. Waste can be minimised by the following methods:

a. Source reduction: It can be made possible through product substitution, technology change and good operation practices. This includes less wastage of products, autoclaving instead of chemical disinfection, and selection of the items that are less wasteful and less hazardous.
b. Recovery and recycling: Recovery can be possible by converting the waste products into new products encompassing recycling of the Bio-Medical Waste. The concept of recycling of some Bio-Medical Waste gaining popularity in some health care institutions for non-hazardous category of waste. It can reduce the cost considerably and can also generate revenues either through reduced disposal costs or through payments made by the recycling agencies.
c. Reuse: Few Bio-Medical Wastes can be reuse which in turn can minimise the volume of costly waste disposal streams, though a high standard of patient care and worker safety may preclude reuse of some items. Health care institutions should critically examine current waste streams and determine what products can be separate out at the point of generation to be effectively reused.
d. Composting organic waste: Composting is a type of recycling organic waste such as vegetable food scraps matter to produce compost or soil conditioner to be used in the agriculture or other similar purposes.

An effective Bio-Medical Waste management plan along with proper training make to possible to minimise the waste considerably. This can be done in the following ways:

a. Development and proper implementation in the product purchasing policy. It includes the technique of selecting the product which are less hazardous;
b. Development and implementation of product substitution policy which can often lead to cost-effective solutions.
c. Where substitution cannot be achieved due to a limited range of products, management should approach the suppliers to change the product *e.g*. change from solvent-based products to water-based or from lead-based paints to less hazardous alternatives;
d. Choosing of cost-effective items with minimum possible use for the treatment of the patients would reduce the wastage of items;
e. Reusable items should be preferred to disposable items whenever it is clinically appropriate, environmentally sound and practical to do so.

8. Ensuring occupational safety and health issues

Bio-Medical Waste treatment and disposal system pose a very wide variety of health and safety hazards for the handlers and other waste management personnel. Many systems have the potential to release toxic materials into the workplace, excessive amounts of heat to the area and produce high levels of noise. This system can physically harm the personnel through accidents. Only by way of developing a detailed health and safety plan and diligent follow-up monitoring, can workers be protected against these hazards.

Of course, the best method for protecting the health care personnel is to eliminate the danger as far as possible. Where it is not possible, they should be provided with personal protective equipment to minimise exposure. It should be noted that the inappropriate selection of this equipment can cause over exposure, illness, or even death of the persons involved in the handling and management of the Bio-Medical Waste. With the help of proper and adequate training the health care personnel should be educated and awareness should be raised to wear gumboots, hand gloves, eye cover etc. and if they work without following the same, they may expose themselves to injuries with sharps and needles.

In addition to this, in every health care institution a sharps management system should be developed because the potential infections can be caused from specific categories of hazardous Bio-Medical Wastes, especially from sharps. The development of sharps management system could maintain occupational safety and health of the health care personnel handling the same. The process of secured segregation and collection would also help in the maintenance of occupational safety of the health care personnel.

9. Adoption of new technologies for the treatment of the Bio-Medical Waste

Alternative medical waste treatment technologies have attracted the attention of a great amount of research and development activities over the last many years. Treatment by various technologies provides the mechanism to reduce or eliminate the number of pathogens, thereby minimising or eliminating the potential for disease transmission or microbial destruction required of any Bio-Medical waste treatment process.

Health care institutions are often faced with the difficulty of selecting the right technology for treatment and disposal of Bio-Medical Waste. No single technology is ideal for all kinds of waste and all scales of operation. There is a range of methods available to treat and dispose of such wastes. Any treatment option for the specific types of waste should fulfil the following:

1. Render sharps incapable of causing penetration injury;
2. Render the waste unrecongnisable;
3. Achieve a significant volume reduction;
4. Result in minimum levels of hazardous or toxic by-products;
5. Reduce the potential for the transmission of infection;
6. Have continuous automatic monitoring and recording;
7. Meet occupational health and safety standards;
8. Provide pre-treatment refrigerated storage facilities; and
9. In the case of autoclaves, be tested at least annually to ensure that optimal performance is maintained.

Such technology can be classified into the following three categories:

1. Soft Technologies;

2. Hard Technologies; and
3. Other Technologies.

Under the soft technologies cleaning devices such as brooms, mops, storage devices like dust bins, temporary sheds or storage device, handling devices like dust pans, trolleys, etc. could be used. This also includes chemical treatment devices with a view to destroy micro-organisms such as using of hypochlorite solution, chloramines, iodine, formaline, ethylene oxide gas etc. Personal safety devices, for example, gloves boots, eye glasses, masks, aprons etc. are the protective gears should be made mandatory for all the personnel handling the waste.

The hard technologies includes among other needle cutter, syringe destroyers, shredders, boiling water sterilisers, autoclaves, microwaves, incinerators, gas sterilisation, irradiation, plasma pyrolysis, etc. The installation of these machineries should be made mandatory for every health care institutions, at the same time this is to be ensured that such equipments should function properly and in case the same is non-functioning, effective measures should be taken immediately.

Proper care must be taken while using the hard technologies especially incinerators because many a time it has been seen that the disposal of Bio-Medical Waste through incineration recreate pollution as the emission it dispersed causes air pollution without reducing the pollutant present in it. The use of blower is an effective measure that helps in reducing the pollutant and it has to be ensured that at the time of incineration the blower machine should function properly.

Other technologies includes safe pits for sharps, landfill etc. In order to minimise the cost burial in safe pit is an effective and economical methods but the pits should be properly designed and constructed. Apart from the safe pits, landfill is another method for final disposal of Bio-Medical Waste. It is a traditional disposal method which is not free from danger. Because leaching can contaminate ground water or people or animals can access the area which is dangerous. However, if the Bio-Medical Waste is properly segregated than most of the non-infectious waste can be disposed of by landfill in the designated site which must be declared as restricted area.

The management of the health care institutions should adopt and follow the most practicable technologies to the extent of its financial capacity and should have willingness to install those technologies because many a time it has been seen that although the particular institution has the capacity to install the modern technology but due to lack of interest or carelessness or callousness the same remain unaffected. Therefore, it should be made mandatory for all the health care institution to implement developed technologies with the change in the nature of Bio-Medical Waste with a view to reduce the risk factor involved in it. In addition to this, a record is to be maintained by the head of the every ward/unit where such technologies have been set up and it should be monitored on a regular basis by the same person to keep updated whether such equipments are functioning properly.

Besides, the adoption of Radio Frequency Identification (RFID) technology (as followed in China) would help in preventing new-born babies from getting mixed up in hospitals. Employing medical waste monitoring systems to manage medical wastes are new weapons that are quietly changing the management of modern hospitals which if adopted and followed in Indian health care institutions would help in changing the Bio-Medical Waste management scenario effectively. Further, All nursing stations should equipped with RFID devices to complete the transfer of waste between nurses and transportation staff. Medical waste transfer stations are equipped with PC terminals, electronic scales, barcode scanning guns, RFID devices and printers to complete the weighing and transfer of medical waste. To avoid cross contamination, non-contact identification technology is adopted.

10. The need for the installation of reprocessing technologies

To encourage the concept of reuse and recycling of some categories of the Bio-Medical Waste there is an urgent need for the installation of reprocessing technologies within the compound of the health care institutions. The effect of installation of reprocessing technologies would reduce the tendency of disposing of the waste which is an expensive practice followed everywhere. Although, initially it may affect the budget of the health care institutions, however, in the long run, apart from the successful cost reduction, it would create employment as more people would be required to be engaged in the recycling or reuse process.

11. Role of the Pollution Control Board

Although the concern department of the Government has been doing its job but due to the lethargic attitude of the employees the proper management of the Bio-Medical Waste is still at sea. Still there is a need to re-view the practices followed in the various health care institutions of the country because with the tremendous growth of this industry, it is expected that more and more waste will be generated, consequently, it give rise to the need of proper treatment and disposal of the same and if the same attitude of the Government employees persists, the situation would be dangerous. Therefore, within the framework of the Rules the concern officers should show a vigorous approach with strict attitude in discharging their duties towards the management of the Bio-Medical Waste. This is possible if the concerned person make surprise visit in the health care institution and if it finds any violation, it may cancel the authorisation to run the same. Such department may also direct the private agencies engaging in the disposal activity to submit periodic report regarding the incineration, shredding, autoclaving, microwaving etc. and it can be cross checked by making surprise visit of the place where disposal process is being carried out.

12. Provision for Penalty

Under the existing Bio-Medical Waste Management Rules, 2016, no specific provision has been made on punishment for infringing the Rules instead the violator is subject to punishment under Section 15 of the Environment Protection Act, 1986 the maximum of which extends to seven years. It is to be noted here that in USA the Pollution Control Board, an enforcement machinery have been conferred with the power to enter into the place of generation as well as disposal of the Bio-Medical Waste site at reasonable times to inspect the premises and obtain the samples of medical waste. If it is found that there is a gross violation of the laws, the occupiers would be liable to strict civil penalty by paying fine of exemplary amount in order to prevent further violation the purpose of such high fines is with a view to send the message that it is more expensive to pollute than to legally dispose of the waste. Further, the Pollution Control Board may also be conferred with the power under the law to criminal penalties by sending the violators to the jail which is also based on deterrent theory of punishment.

There is no denying the fact that some of the recommendations mentioned above have been already following by most of the health care institutions because they are the basis which are universally applicable in every health care institutions throughout the world for the management and disposal of the Bio-Medical Waste. This includes framing of policy, establishment of management cell, training and educating of the health care personnel engaged in the whole management aspect etc. With a positive vigour and attitude it should be successfully implemented and to make it successful the steps which have been recommended under each head of recommendation is strictly to be followed. It has been seen that due to careless and lethargic attitude among most of the health care personnel the basic framework for the management of the Bio-Medical Waste failed in its root level. This attitude could be change if the concern authority i.e. the pollution control board changes its perception towards the same. The coordination between the health care institutions and the concern authority with positive attitude would make it possible in the successful disposal of the Bio-Medical Waste. Therefore, the widely accepted old philosophy 'better late than never' can be appropriately applied in this connection considering its ill-effect on the human health and the environment which is the need of the hour.