

**ANALYSING THE DYNAMICS OF HOSPITAL WASTE
MANAGEMENT**

**Internship Training
at
Santokba Durlabhji Memorial Hospital
Jaipur**

**By
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**Under the guidance of
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**MBA Hospital & Health Management
2013–15**



**Institute of Health Management Research
Jaipur
2015**

TO WHOMSOEVER MAY CONCERN

This is to certify that **Col Rahul Bhatnagar** student of MBA Hospital and Health Management from IIHMR University, Jaipur has undergone internship training at **Santokba Durlabhji Memorial Hospital, Jaipur.**

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all her future endeavors.



Col Dr. Ashok Kaushik

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May 19, 2015

CERTIFICATE

This certificate is awarded to Col. Rahul Bhatnagar in recognition of having successfully completed his Internship for the period from 09.02.2015 to 09.05.2015 in the department of House keeping. He has successfully completed his project on Analysing the dynamic of Hospital Waste Management in SDM Hospital.

During the period of his internship programme with us he was found to be punctual, hardworking, and a keen learner.

We wish him all the best for his future endeavors.


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INSTITUTE OF HEALTH MANAGEMENT RESEARCH, JAIPUR

CERTIFICATE BY SCHOLAR

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OF HOSPITAL WASTE MANAGEMENT
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supervision of PROFESSOR SANTOSH KUMAR Ph.D. for award of
MBA Hospital and Health Management/ ~~MBA Pharmaceutical Management~~ of the university
carried out during the period from 01 FEB 2015 to 30 APR 2015 embodies
my original work and has not formed the basis for the award of any degree, diploma associate
ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Signature

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Abbreviations

BMW	Bio-Medical Waste
BMWM	Bio-Medical Waste Management
CPCB	Central Pollution Control Board
CTF	Common Treatment Facility
ETP	Effluent Treatment Plant
HBV	Hepatitis B Virus
HCF	Health Care Facility
HCV	Hepatitis C Virus
HCW	Health Care Worker
HIV	Human Immunodeficiency Virus
IPD	In-Patient Department
OPD	Out Patient Department
STP	Sewage Treatment Plant

CHAPTER I

Introduction

Background

1.1 A hospital is a complex institute providing healthcare services to the people. Over the years many technological inventions have taken place and the facilities for effective treatment have thus increased manifolds. While this has enhanced the services provided in the hospital, it has also increased the waste generation in the process of providing patient care. The bio-medical waste produced in this process carries a high potential for infection and injury to the people generating such waste, waste handlers. It also affects the environment if not handled properly.

1.2 Bio-medical waste is a waste that is generated during the diagnosis, treatment or immunization of human beings and is contaminated with patients' fluids such as syringes, needles, ampoules, organs and body parts, placenta, dressings, disposable plastics and microbiological wastes. Following materials are generally considered to be bio-medical waste:

- **Solids:** Things like catheters, tubes, disposable gowns, masks, scalpels, medical gloves, wound dressings from the solid waste.
- **Liquids:** Blood, body fluids and tissues. Cell, organs, tissue cultures compose the liquid.
- **Sharps:** Blades, lancets, material made of glass, needles, syringes fall in this category.
- **Laboratory waste:** Hazardous chemicals with biological components, media, medicinal plants, radioactive material with biological components form the laboratory waste.
- **Yellow Bag Waste** – discarded medicines, infectious waste (used bandages, gauzes, cotton or any other things which comes in contact with the human body fluids) anatomical waste, including human body parts.
- **Red Bag Waste** - plastic wastes (like catheters, injection syringes, tubing, IV bottles)
- **Blue Bag Waste** – Sharp waste ex glass pieces, syringes
- **Black Bag Waste**- domestic waste (paper waste, food waste, dry waste etc)

 Santokba Durlabhji Memorial Hospital cum Medical Research Institute, Jaipur			
BIO MEDICAL WASTE SEGREGATION CHART			
YELLOW BAG	RED BAG	BLUE BAG	BLACK BAG
Anatomical & Soiled Waste • Blood and Body Fluids Stained Dressings, Swabs, Cotton etc. • Soiled Plaster Casts • Tissues • Organs • Body Parts • Microbiology Waste	Infected Plastics • Mask • Gloves • Head Caps • I/V Sets and Tubings (Cut before disposal) • Catheters (Cut before disposal) • Vacutainers (Without Needles) • Urine Bags • Blood Bags • Droppers • Infected Plastic Bottles	SHARPS • Scalpels • Lancets • Blades • Ampoules • Glass Pieces • Glass Bottles, Glass Slides	General Waste • Paper, Cardboard, Kitchen Waste • Discarded Medicines • Expired Medicines • Plastic Water Bottles, Other Bottles of General Waste, Wrappers etc. • ECG Lead

Fig. 1.1: Bio-Medical Waste Segregation Chart on display

1.3 Since the waste generated is infectious in nature, the proper collection, storage, treatment and disposal becomes very important. If improperly dealt with then waste can lead to various health and environmental hazards:-

- Injuries to people handling the waste
- Infection to staff dealing with the waste, the patients visiting the hospital
- Some of the waste can be re-used which lead to infection
- Environmental hazards due to chemical waste and radioactive waste

1.4 For these reasons, the process of classifying waste at site of its generation, storing and proper transportation of the bio-medical waste assumes great importance. The process of segregating the bio-medical waste from the general waste at the site of generation, collecting, storing, treating the waste and then finally disposing it is called the Bio-medical waste management.

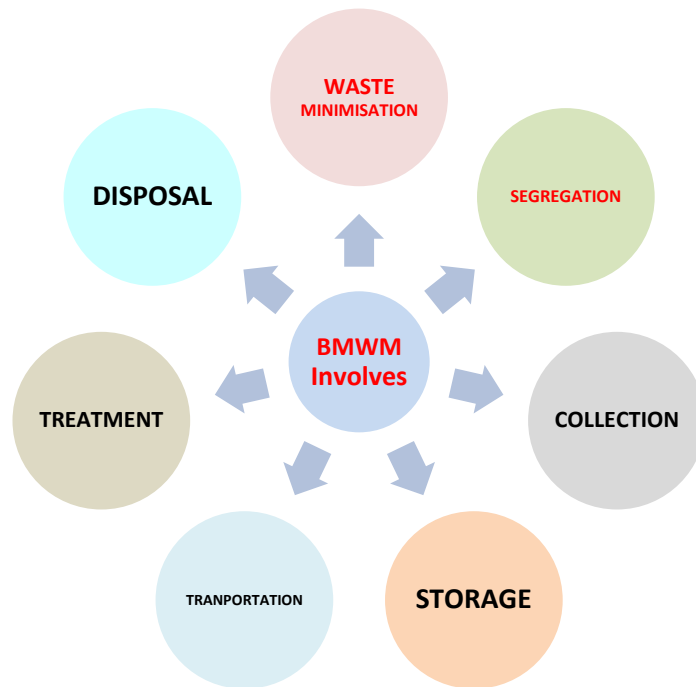


Fig. 1.2: Various aspects of BMW management



BIOHAZARD SYMBOL **CYTOTOXIC HAZARD SYMBOL**

RECYCLE SYMBOL

Fig. 1.3 :Labels for bio-medical waste containers / bags

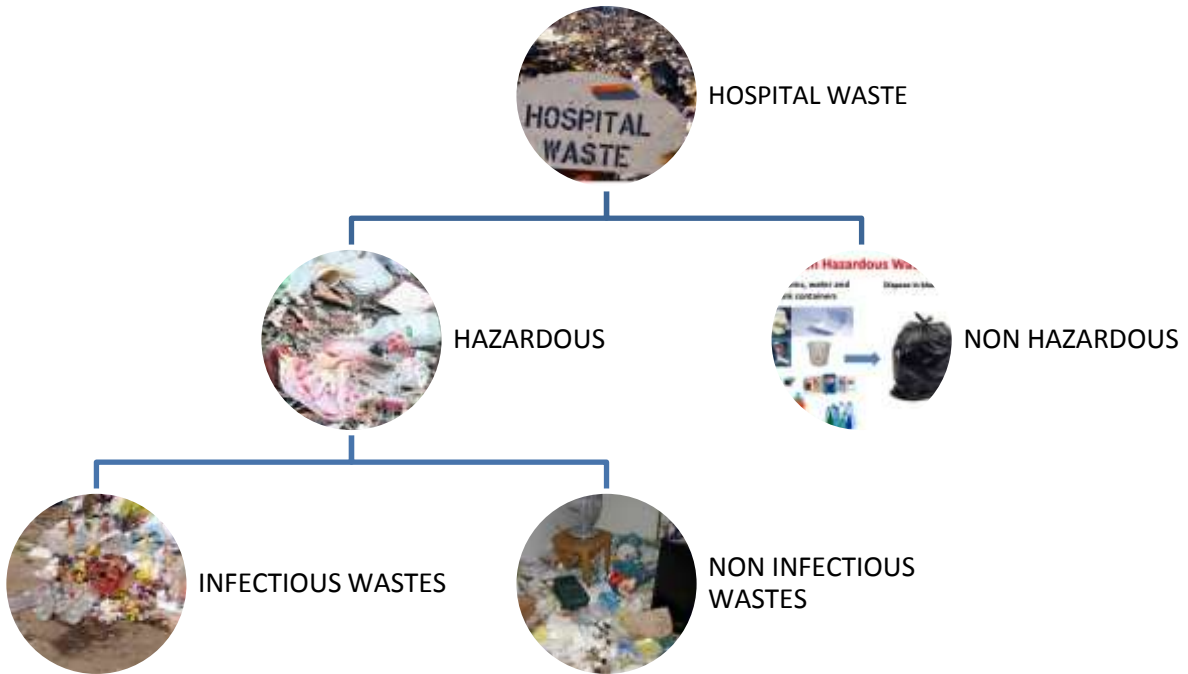


Fig. 1.3: Classification of hospital wastes

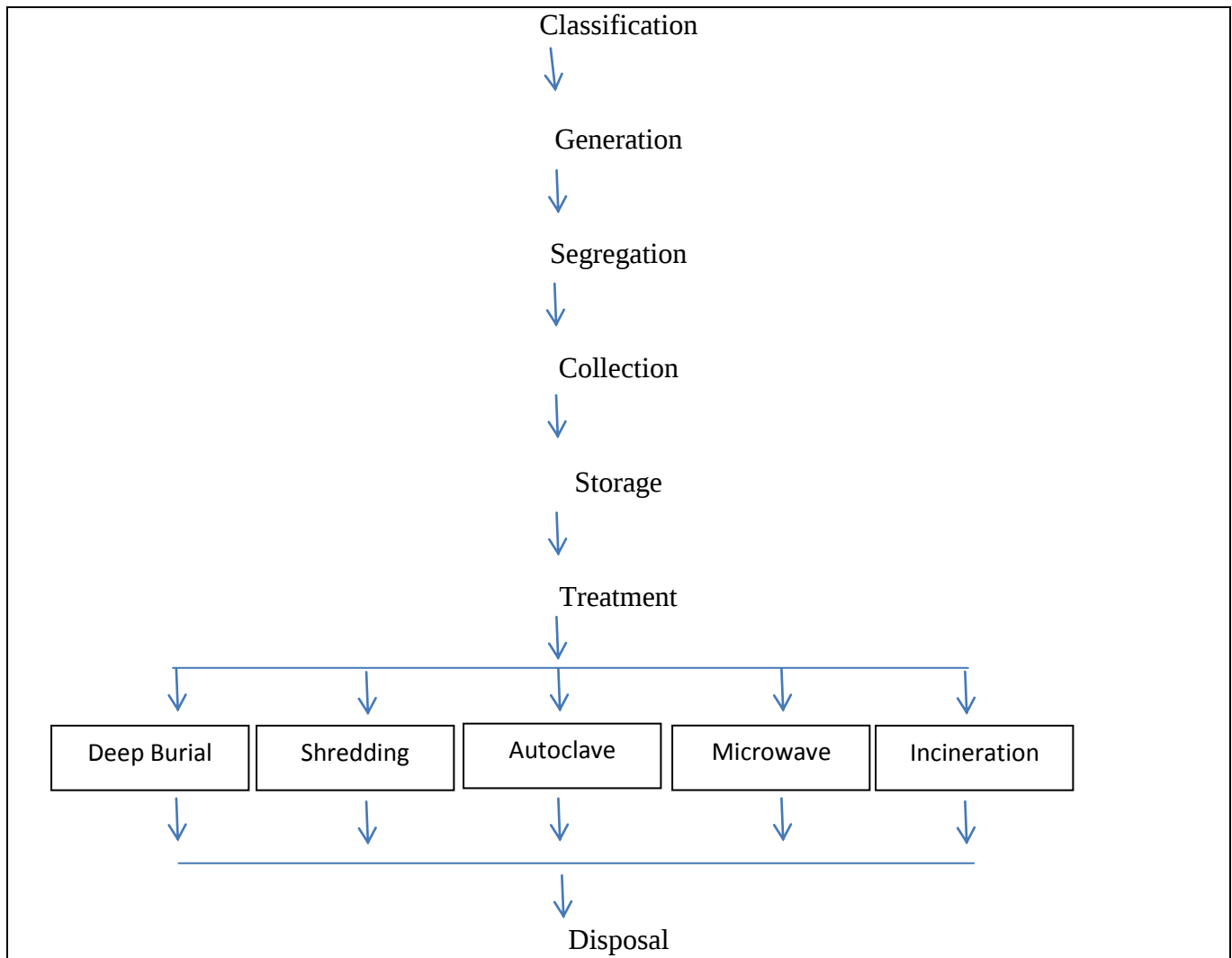


Fig. 1.3: Steps Involved in the Bio-Medical Waste Management

1.5 Highlights of the Indian Medical Environment

- Number of Hospitals in India has doubled in India in last ten years.
- Bed Capacity has doubled in last ten years.
- Total Health expenditure has grown by 40 times in last 40 years.
- Total number of Hospitals is 11,174 out of which 57% are in private sector.
- Total Health Care Industry is 103,000 Crs (5.2% of GDP)
- Pharmacy Contributes 17,000 Crs & Healthcare delivers about 86000 Crs.
- Govt. spending on Healthcare is 17,000 Crs and Private Industry spends 69,000 Crs.
- India does not even meet 1/3rd of Healthcare Standards set by WHO.
- The Private spending in Healthcare is expected to grow to 175,000 Crs by 2016 whereas Govt. spending may raise to 61,000 Crs by the year 2016.

- Total number of beds are expected to grow from 1500,000 (2001) to 3000,000 (2016).
- By 2016 Healthcare Industry will be 8% of GDP and will give employment opportunities to 9 Million People.

1.6 Santokba Durlabhji Memorial Hospital has come into existence since 1971. It is the oldest private charitable hospital in Rajasthan. Being a hospital, the bio-medical wastes were generated and being disposed of as per the need of the hour. However, in 1998 with the introduction of Bio-Medical Waste (Management and Handling) Rules, 1998, the hospital was bound to incorporate the rules in letter in spirit. Since then, the hospital has expanded and moved leaps and bound. It has grown in various facilities and so has its waste generation. The hospital desired to check the efficacy of the bio-medical waste practices and that it conforms to the present norms of laws. Over a period of time, some discrepancies in terms of practices and knowledge were perceived to have crept in. The management was desirous of identifying the same and recommend solutions to overcome these shortfalls.

Problem Statement

1.7 What can be done to improve the bio-medical waste management in the hospital?

Research Questions

1.8 ‘Bio-medical’ means any waste generated during diagnosis, treatment or immunization of human beings or animals. Management of healthcare waste is an integral part of infection control and hygiene programs in healthcare settings. Disposal of this waste is an environmental concern, as many medical wastes are classified as infectious or bio-hazardous and could potentially lead to the spread of infectious diseases.

1.9 As hospitals face severe financial constraints, the need to review programs to ensure cost effectiveness is critical. Waste management practices have come under scrutiny because inappropriate waste disposal is very costly, in terms of disease burden and environmental damage. This study seeks to answer the following research questions:

- *What is system of Bio-Medical Waste Management existing in the hospital?*
- *What are the perceived bottlenecks in the system?*
- *Can these bottlenecks be removed from the system?*

Aim

1.10 To strengthen the Bio-Medical Waste Management practices at SDMH hospital by ensuring proper and timely disposal of the bio-medical wastes.

Objectives

1.11 The specific objectives of the project were:

- To examine the Bio-medical management system of the hospital under the study
- To identify the bottlenecks of Bio-Medical Waste management system
- To provide recommendations to overcome the bottlenecks.

Rationale

1.12 Santokba Durlabhji Memorial Hospital has come into existence since 1971. It is the oldest private charitable hospital in Rajasthan. The hospital desired to check the efficacy of the bio-medical waste practices and that it conforms to the present norms of laws. A similar study was carried out some ten years ago. But over the period of time, the hospital has undergone expansion and so quantum of waste generation has also increased. The management was desirous of identifying the same and recommend solutions to overcome these shortfalls. A dedicated manpower has been earmarked for the BMW practices but there is a perceived gap in the expectations of the management and the product outcome. The subject was also gaining importance because at the all India level, there are almost 0.03 million HCFs with almost 2.5 million beds and generating 500 T of bio-medical wastes daily being treated centrally by almost 225 CTFs.

1.13 The study was termed useful by the management because it has far reaching consequences on the image, legal obligations, and health of the patients, staff, general community and environmental concern of the hospital. Also, the importance of the Bio-medical Waste Management lies in the fact if the management is not proper then it can lead to various health and environmental hazards. The various hazards are:

- **Risk of injuries:** Injuries from sharps are the chief cause of physical injuries. The various healthcare providers like the doctors, nurses and other paramedical staff, the staff involved in the collection and storage of waste are at a special risk of inflicting sharp injuries on themselves(HIV,HBC)
- **Risk of Infection:** This is the most common and significant hazard. It could be in the form of Nosocomial infection from one patient to the other or it could be the risk of infection to the waste handlers including the scavengers.
- **Risk of infections outside hospitals:** The waste handlers, scavengers and eventually the general public are also at a risk of getting infected from the sharps and other wastes.
- **Risk associated with hazardous chemicals, drugs:** this being handled by personnel handling the wastes at all levels.
- **Disposables:** Recycled-repacked and sold maybe un-noticed.

CHAPTER II

Literature Review

2.1 **Background:** The literature review is essential for undertaking this study. It will help in understanding the structure and methodology in conducting the study on various sub subjects in this study. Through this literature review, one got to know the present state of work done in the field of BMW practices in the hospital. Various existing laws and legal notifications with latest amendments were also made aware of.

2.2 The Ministry of Environment and Forests, Government of India in exercise of powers conferred by sections 6,8,25 of Environment (Protection) Act 1986 has notified waste(management and handling)rules 1998 on 27 July 1998. The rules were amended on 6 March 2000 and 2 June 2000. The purpose of these rules is to arrest widespread dissemination of communicable diseases by managing medical waste. It also mitigates this transmission in handlers of medical waste. At state level, Rajasthan Pollution Control Board (RPCB) has been notified as “Prescribed Authority” to implement statutes of Central Government in this regards. Similarly Regional Office of Pollution Control Board, First floor, Udyog Bhavan, Jaipur is the Prescribed authority.

2.3 Very strangely, hospitals in Rajasthan are required to apply for treating medical waste. This application is time wasting, costly and riddled with red-tapes like many other governmental requirements. The basis of charging fees is not standardized; hence hospitals try to avoid the very application. Presently the charging ratio is linked with cost of hospital infrastructure and not with cost of facilities to be provided. . In Ophthalmology hospitals not much waste is generated, but in gynaecology hospitals hospital waste is voluminous. Therefore charging both hospitals same fees for similar infrastructure is definitely unjustified. This needs to be changed at the earliest.

2.4 Basic Document of WHO gives unit wise generation of bio medical Waste;

- OPD: Bandages, plastics, sharps
- Injection Room: solids, sharps, injections
- General Ward: solid sharp, soiled waste
- Emergency Ward: Sharps, solids, soiled waste
- Labs: Placenta, soiled, solid sharps
- ICU: Sharps, soiled waste, solid

2.5 **Segregation of medical waste at source:** Segregation is the first and main step towards having a sound waste management program in any hospital. It helps in ensuring that quantity of waste needing

special attention is considerably reduced and is more manageable and cost effective. Many researches have been done in this direction. Varkey Peter,K in Cochin; and Srisanthil in Trivandrum in 2000 and 2004 respectively have shown that both these cities in Kerala are much advanced in field of medical waste segregation. Jatani Prachi 2004 in “Hospital crisis blame game continues in Mumbai” has come out with observation that incorrect colour coded bags are used in Mumbai in hospitals. Chaithra, Bharthi, and Manjunath(2004) carried out a cross sectional investigation in Aug, Sep 2004 in few hospitals of Bangalore, and were shocked to see awareness levels of staff.

2.6 From above and practically today also lackadaisical attitude of hospital agencies can be seen towards segregation. Primary reasons are finance, poor awareness and loss of monitoring by all agencies.

2.7 **Infectious sharp waste disposal:** Sharps are responsible for major threat of risk of blood borne diseases from biomedical waste. In medical tool kits many things form sharps- like syringes, needles, scalpel blades, catheters, glass vials, used slides, cutting piercing tools. Sheikh Parveen 1999 surveyed two hospitals in Mumbai and found no special emphasis on disposal of sharps. This results in spread of Hepatitis B, and AIDS. These must not be available to rag pickers, children, drug addicts. Puncture proof bags must be used to store these, but no one does so.

2.8 Environment council 1999 undertook comparative study for disposable versus durable devices in OTs. Major findings were that disposable system had a significantly higher negative impact upon the environment than durable ones in form of energy consumption, resource depletion and contribution to environmental problems as global warming, acidification and toxicity to humans. Disposable systems are costly. Desai Rajni(2010) conducted a study where 91% of doctors agreed that improper disposal was responsible for spread of communicable diseases. Correspondent of Focus Hyderabad Healthcare (2002) highlighted the menace of recycling medical waste. 13 out of 17 brands of syringes do not fall under required standards. Rag pickers are responsible for recycling medical waste enroute to disposal area. Anurupa MS, Suryakant and Vijay Kumar (2005) have researched in Devangere, Karnataka. They concluded that teaching hospitals were more aware towards management of sharps.

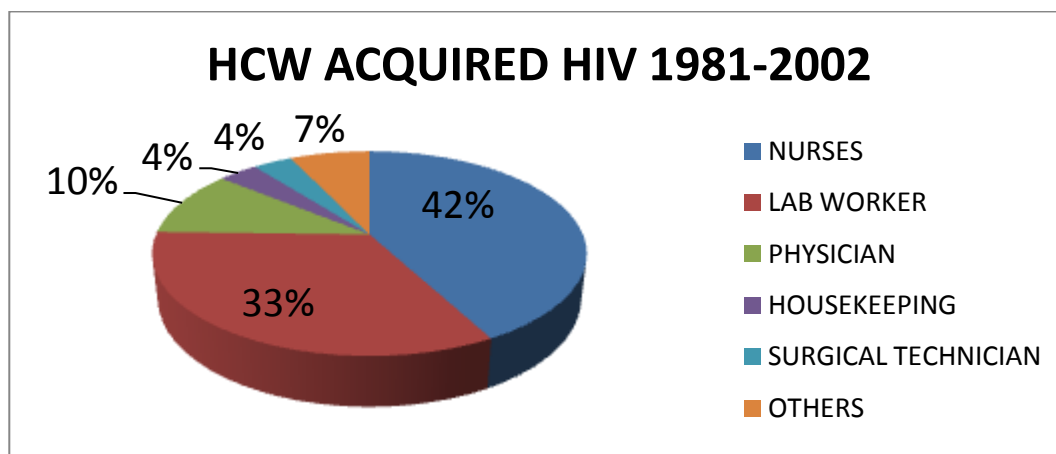


Fig. 2.1: Cases of HIV acquired due to injuries in BMW management

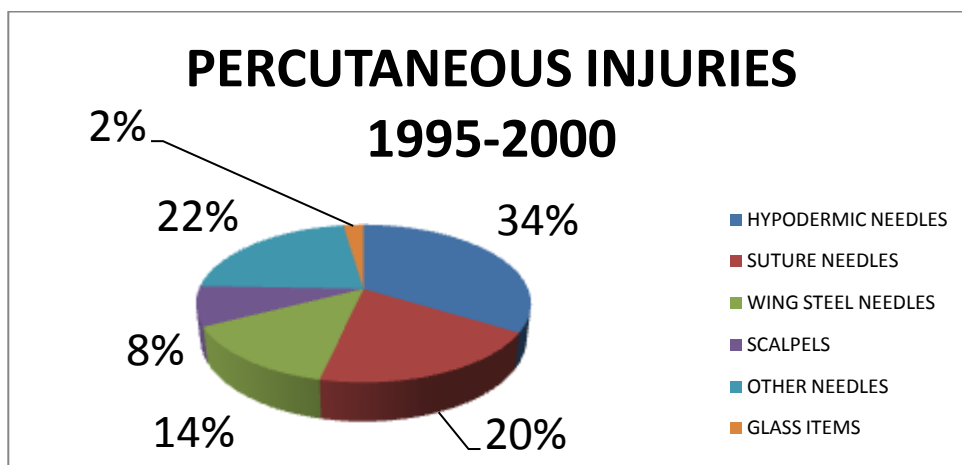


Fig. 2.2: Skin Injuries occurring due to various items

2.9 A film has been made by Government medical college Jammu along with Messers Medicom Networks, New Delhi. The name of this training film is **‘Future Begins With Us’**. It was released by the then minister of Environment and Forests, Mr A Raja on 06 January 2006 and Ms Razia Sultana, Project Director Environment Protection Training and Research Institute (EPTRI), Hyderabad. In this documentary all aspects of training have been dealt with in the form of self-learning document for superintendent, administrators and housekeeping staff. This has been made in support with World Health Organisation (WHO). The copy of the documentary is also attached with this thesis.

2.10 In ‘Performance audit Report on management of Waste in India’ report by CAG, Acharya DB has enunciated three precautions for transportation:

- Direct contact with medical waste should be avoided.
- Bags should not be overfilled and emptied into other bags.
- Transportation must only be done in authorized vehicles.

CHAPTER III

Methodology

Introduction

3.1 The hospital identified the challenges that are being faced by the management. Time period of about two months was available. The sociology of hazardous waste, risk, and disasters is a relatively new discipline with an increasing volume of empirical research by scholars. The best method of undertaking the study would be through the descriptive research methods. This method is designed to gain information about present existing conditions. The principal aim of this research is to describe the nature of the situation as it exists at the time of study and to explore the causes of the phenomenon. The system approach was taken in this study. Inputs in various forms were seen, processes were understood and thereafter the outputs were analyzed to find the key findings and recommendations.

Ethical Clearance

3.2 Ethical clearance and permission to collect the information from various departments and personnel was taken from the Deputy Medical Superintendent.

Study design

3.3 The most encompassing and expansive way of undertaking this study is through the '*descriptive research*'. It is the most common and widely used method in gathering data regarding the attitudes and opinions of group of people by asking them to provide you with important information by means of *questionnaires*. Second direct means of acquiring data is by 'observation'. Observation has been categorised into three types: activity analysis, product analysis and situational analysis. Third method to be used by the means of devices or descriptive survey instruments.

3.4 Steps followed to put in practice the design:-

- First of all a general visit to all the departments in the hospital was made.
- On subsequent visits to these departments various observations about the bio-medical waste management in the hospital were noticed.
- The observations were made about the process of BMW, all the steps of hospital followed and the practices of the hospital staff.
- When these observations were made, instruments were selected to get further data on the bio-medical records.
- After the observations were made about the running practices of BMW management in the hospital. A questionnaire was prepared to assess the awareness of the staff regarding the Bio-medical waste management.
- The questionnaire was administrated to the staff and the information the collected and analysed.

- After the analysis of all the data obtained from the instruments, results were noted down and possible suggestions were given.

Study Area

3.5 The study area which was identified was the Santokba Durlabhji Memorial hospital, Jaipur. The study was conducted between March 2015 and April 2015. No sampling was done and all patient care areas of 355-bedded hospital were included in study. These areas were: Emergency Area, Waste Collection Points of Wards, Treatment Rooms of OPDs, Intensive Care Units and Operation Theatres .

3.6 Each area was visited on any 3 non-consecutive days in the study period. No visit was made on Sundays and on Public Holidays. Areas were visited during morning hours between 7 am to 10 am and evening hours of the same day between 2 pm and 4 pm. Thus a total of 6 visits were made to each area. The chosen timings were such when maximum BMW is generated in a patient care area as this was the time when blood samples of patients were taken and medication injections were given. Although medication injections were also given during evening hours and night hours, such time period was excluded from the study due to operational difficulties in collecting data during these timings. All observations were made by same researcher.

Framework

3.7 Data recorded covering various aspects of BMW management at source of generation of waste was:

- Primarily, 4 broad functions are carried out at source viz. placement of 4 colour-coded i.e. black, yellow, red and blue waste bins which are lined on inner side by similarly coloured waste bags;
- Segregation of waste in such waste bags i.e. general waste like waste paper, wrapper of drugs, cardboard, left-over food etc. is to be put into black; soiled infected waste like dressing material, cotton swabs etc. is to be put into yellow; plastic waste like plastic syringes, dextrose bottles, intravenous sets, Ryle's tubes, urinary catheters etc. is to be put into red and sharps like hypodermic needles, surgical blades, glass etc. is to be put into blue bags
- Mutilation of recyclable waste like disposable syringes, plastic dextrose bottles, plastic tubings and hypodermic needles
- Disinfection of certain categories of waste notably plastics and sharps. In the hospital, electrically operated needle cutters were used to mutilate hypodermic needles and nozzle (hub) of disposable syringes and scissors were used to cut the plastic tubings and 1% bleaching powder was used to disinfect plastics and sharps.
- Correct sealing and labelling of the waste bags.

- Proper storage of these waste bags in the respective departments before central collections.
- Proper and safe transportation of the bio-medical waste to central storage rooms in the hospital.
- Weighing and transferring the waste load to the central storage rooms.
- Timely lifting of the wastes by contract vehicles and route out to treatment facilities.

Data Type

3.8 Data collection is a term used to describe the process of preparing and collecting data. Data is the basic input for any decision making process. In this study, two types of data was collected and analysed:

- **Primary data:** Data which are collected from the field under the control and supervision of the invigilator. In this case, questionnaires and verbal interviews were the major means of collecting primary data.
- **Secondary data:** Records fathered by already existing records gathered by someone else maybe in context of some other requirement is called secondary data. In this case, existing registers and records available in the housekeeping department, internet and books on the subject were referred to.

Sample Size

3.9 Sample size determination is the act of choosing the number of observations or replicates to include in a statistical sample. The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample. In this case, a sample of 10 doctors, 15 nurses / paramedical staff and 15 housekeeping staff was used to represent a stratified sampling size.

Sampling techniques

3.10 The technique used in this study for sampling was non probability convenience sampling. In this type of probability sampling, members of selected sample are chosen from that part of population which is conveniently available at hand. It definitely suffers from some biases and errors of non-response but it is definitely less time consuming and less expensive. The junior resident doctors mainly from IPD, duty nurses and housekeeping staff of BMW department were considered.

Instruments

3.11 Records about the bio-medical generated in the hospital were collected from the record register maintained in the housekeeping department of the hospital.

3.12 The observations about the practices of bio-medical waste management were made during the visits to the various wards in the hospital. The staffs were continually asked for their suggestions regarding general cleanliness, Bio-medical waste management and any other resource that might be required for the process. The questionnaire was administered to the available staff by providing the questionnaires to the care-taker who in turn administered to the nurses and housekeeping staffs from the wards. Doctors were asked the questions and details filled.

Methods

3.13 The data to be collected was of the primary and secondary nature. The methods applied for collecting the primary data were:

- **Observation method:** Observation method was utilized to collect the primary data. In terms of PV Young's Observation maybe defined as systematic viewing coupled with consideration of seen phenomenon". The researcher used the non-participative observation technique.
- **Interview Method:** The process involved oral-verbal stimuli and reply in terms of oral-verbal responses. Time required for the process was less and the data analysis becomes easier. Personal information can be easily obtained. While asking the questions, structured and previously framed questions were asked.

3.14 The method used for collecting secondary data is through academic pursuit of book, magazines, official websites and Google website. However, reliability, suitability and accuracy of the data must be kept in mind.

Data Management

3.15 Data management consists of data collection in a systematic and consistent manner, data storage in order to reconstruct/ replicate the subject study under similar conditions, data protection for its integrity and loss, data retention for a specified time, data analysis in which raw data is chosen, evaluated and interpreted into meaningful and conclusive meaningful information. It also includes data sharing and data reporting with others. The data was stored electronically by means of notes, graphs and pictures.

Analysis Plan

3.16 Data collected was based on hypothetical questions which were designed to be interpretive, leading and with multiple choices. The aim was to move from the qualitative data that had been collected into some form of explanation, understanding or interpretation of the people and situation we were investigating. The model taken into practice was the one shown below

Noticing, Collecting and Thinking Model



Fig. 3.1: Noticing, collecting and thinking model

Gantt Chart

3.17 The time period for the study was divided into a time table and then converted into a Gantt chart for the ease of better planning and time discipline.

Fig. 3.2: Time Table for the Project

Time	Febuary		march				apr			
Activity	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8	week 9	week 10
Understanding the varioius hopital departments										
Preperation of abstract for SCM management										
Understanding prevelant BMW practices in SDMH										
Strategies and new methods of handling										
Questionnaires and report filing										

Limitations of study

3.18 There were some barriers which were encounter during the conduct of this study. Also, being a private charitable hospital, there were some constraints in checking out possible implementations of recommendations.

- The present administrative setup is being streamlined in the hospital. There exist gaps in the demarcation of duties in administration department.

- The contracted company “Instromedix, 10, Joshi Bagh, Tonk Road, Jaipur” under contract with Jaipur Nagar Nigam is very reluctant in allowing any visitors in their complex. They put up all official barriers for allowing any visitors.
- It was very difficult to ascertain as to what the Nagar Nigam Company was doing to dispose of the waste. The location of ‘Laxmi Bhatti’ near Kanauta, off Jaipur Agra highway is not accessible by normal 4x2 vehicles.
- Answers to the questionnaire had to be taken verbally since writing answers was time-consuming for all the participants.
- The private company which had installed the Sewage water treatment plant was unwilling to share the details about effectiveness and shortfalls of the existing setup. In spite of a visit to its office in Bani Park, Jaipur, the engineer was unwilling to share the technical drawbacks and non-implementation of the STP installed in the hospital.

CHAPTER IV

ANALYSIS

Introduction

4.1 After the literature review was carried out and the methodology devised, the hospital department visits were conducted. The observations were taken and recorded in questionnaire form and visit findings. Certain pictures were also taken to re-emphasize on the observations. The same were then analyzed to come out with various findings on the subject study.

Data Analysis

4.2 The data collected was converted from the questionnaire to bar charts through micro-soft Excel sheets. Certain data was stored and analysed in a tabular form. Also, the environment for the moment was captured through the camera and pictures were used to emphasize on certain points. The observations during the visits to various departments of the hospital were analysed and compared with the existing rules and regulations as per BMW rules. Also, critical aspects of patient safety, staff safety, aesthetic look of the hospital and better management issues were kept in mind. After the detailed analysis of the collected information, the same was interpolated to:

- General findings
- Critical findings

4.3 **General Findings:** The general findings are enumerated below along with some pictures to emphasise the issues.

4.4 The study reveals that major products in SDMH hospital were the non-infectious waste. Around 85% of the wastes were non-infectious. There were very less quantity of sharps present, still the management of sharps need better ideas.

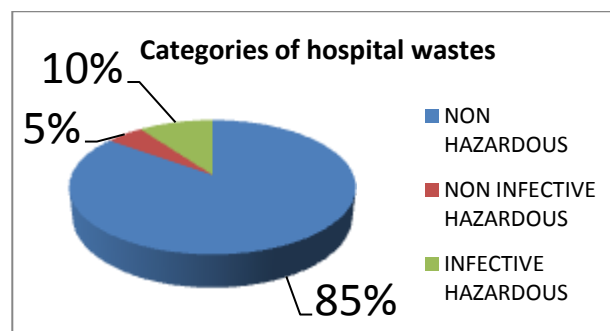


Fig.4.1: % Composition of waste

4.5 The important sources for the waste generation in the hospital were OPD and waiting area, administrative rooms and stores, casualty, OT, labour room, laboratory kitchen and wards. The following sources of wastes were identified in the locations indicated as point of source. Administrative room, stores and wards did not produce infectious waste. Mainly the infectious sharps were present in labour room and wards. OT room and laboratory did not have so much of general wastes.

Point of source	General waste	Infectious Waste	Infectious sharp Waste	Non-Infectious Sharp
OPD and Waiting Area	Y	Y	N	N
Adm room and Stores	Y	N	N	Y
Casualty	Y	Y	N	Y
OT	N	Y	N	Y
Labor Room	N	Y	Y	N
Lab	N	Y	N	Y
Injection Room	Y	Y	Y	N
Ward	Y	N	Y	Y

Y-Yes N-No

Fig. 4.2: Table showing source of types of wastes

Number of days	Bio-medical waste (in kgs)	Total waste (in kgs)
1	380	730
2	300	725
3	390	827
4	320	680
5	330	900
6	320	1025
7	310	920
8	300	821
9	390	1022
10	250	725

Fig. 4.3: Table showing weight collected from 01-10 Apr 2015

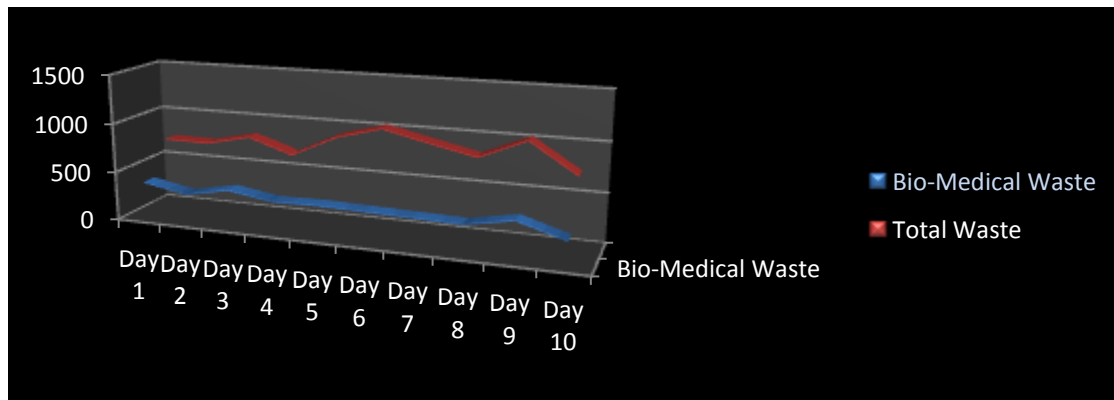


Fig. 4.4: Graphical display of weight collection data of 10 days

4.6 The mean was calculated for ten days observation regarding quantity of total waste and bio-medical waste and it was found to be an average 746 kg of total waste and 299 kg of bio-medical waste was generated each day.

4.7 **Segregation** It was observed that segregation practices were followed satisfactorily. Every ward has four colours (yellow, red, blue and black) of BMW bins kept near staff / store room. However, at times during the time of transportation to the hospital central storage facility, the wastes are sometimes mixed. These four bins were used by both staff and patients. Analysis showed that trolleys of two sizes, big and small must be held with the hospital so that lesser load could be kept in smaller trolleys and mixing to avoid extra turnaround be avoided.

4.8 **Collection** Whatever be the final method of disposal, collection is an important aspect in waste management. Though the bags are transported in the trolleys, It is also noticed that that patient are least concerned.



Fig.4.5: Waste being collected amidst patients and attendants

4.9 **Transportation** Housekeeping staff attached with each department are responsible for the transportation of the waste bags from the source to the departmental storage area. The waste is then centrally collected by the central dedicated housekeeping staff in four trolleys of colour differences and taken to the hospital waste storage rooms. Waste is transported through the common passage meant for the patients and attendants. The findings were that there are no separate ramps for waste movement. Also, the warning boards were not used to stop intermingling of staff and attendants.



Fig. 4.6: Trolley moving through common passage

4.10 Further transportation of the wastes is done in two ways. General waste is transported through a contracted person in his pick-up vehicle twice in a day. However, he and his attendant, carry out further segregation at the site itself for isolating plastics and reusable waste. This creates bad sight and foul odour in the surrounding. Findings show that the contractor should first carry the general waste out of the hospital premises and then sort out each bag to avoid foul smell.



Fig.4.7: Waste picker sorting the bags in open

4.11 The colour bags except the black are taken by the central waste treatment facility vehicle which has been paid for by the hospital once a day. The sanitary staff assisting this vehicle is changing frequently and not at all well versed with the necessary precautions to be taken. They are also not equipped with the PPE clothing thereby increasing the chances for catching any high infection while clearing then wastes. The findings show that no separate PPE clothing is given to these men. Also, the staff is not permanent and keeps changing for duties.



Fig.4.8: Contract labourer without PPE

4.12 **Storage** The storage facilities in the IPD are located centrally at the end of the corridors. However, in case of ICUs and some wards, the housekeeping staffs in the wards tie up the colour waste bags and dump them in the washrooms for the central collection party to take them. This creates unhygienic conditions in the washrooms which are primarily designed to be used by the patients and their attendants. The analysis shows that storage of space, tying ropes and lack of supervision are the main reasons.



Fig.4.9: Bags lying in the washrooms

4.13 The central storage room of the hospital are adequate and separate from each other. Though their walls are broken including the floors, they do have separate doors and are kept under lock and key. However, the capacity of these rooms is just adequate for holding the bags for a maximum of two days only. Also, after the clearing has been done by the contracted vehicle, the general area becomes dirty, foul smelling and strewn with leftover of wastes, spills and other toxic articles. Findings are that there should be climate control facilities in case waste is held for two or more days. Disinfectants is a must after the garbage collection drill.



Fig. 4.10: Central storage rooms for Bio-Medical Wastes

- During the through check-up of the black bags before they were being despatched to the landfill, it has been noticed that there have been some needles, blood bags, tubing and other infectious material finding their way in these black bags. It was analysed that such mistakes occur mainly during the night shifts as there is lesser supervision on the staff on duty at night.
- Dedicated housekeeping staff is used to pick up the waste at the allotted times:
 - 0700-0730 am in the morning from IPD and OPD
 - 0930h from the IPD
 - 1430-1500h from IPD and OPD
 - 1900-2000h from IPD and OPD
 - Weighing machine is installed at the gates of storage rooms of the wastes. The record of BMW for the whole hospital is maintained by the housekeeping staff. Detailed analysis showed that the weights were not being taken and weighing machine was not being utilized at all. There is no supervision during the time of transfer of wastes.



Fig.4.11: Ready for collection drills

- Collection and transportation of BMW is done in trolleys but they have no proper cover on them.



Fig. 4.12: Open parking for waste trolleys without lids

- Labels are not placed on the disposal bags thus making it extremely difficult to note the waste collected from the various departments. Findings show that supervision is lacking.



Fig. 4.13: Unlabelled filled bag being disposed

- Detailed audit of the BMW practices in the hospital is not being carried out by the administration or BMW committee. Findings show that due to lack duties demarcation, the responsibility of BMW management is not clear to the staff.
- Hospital authorities have contracted out waste BMW collection BMW to two agencies:
 - General wastes (black bags). Collected generally twice a day.
 - Bio-medical Wastes. Collected once a day. (needs regularity)



Fig.4.14: Waste vehicles for both type of loads

- Findings show that supervision of and accountability of these firms is less towards the hospital. They are not regular in their duties.

4.14 Certain findings based on the interview through questionnaire of the stratified stratum of doctors, nurses and housekeeping staff are enumerated below.

4.15 **Findings from Doctors Interview**

- When the doctors were interviewed 85% of the doctors considered BMW management as disposing of the waste proper bags, 5% considered it to be preventing spread of disease and 10% believed BMW as segregation of waste at source and disease prevention.
- When asked about the BMW program initiation in their institution, 5% were unaware, some were like it has started earlier and nobody followed, some of them said it would start in future.
- All the doctors in the hospital follow universal precaution in the institution.
- When asked as to who is responsible for BMW management program, 20% called it Administrative responsibility. 50% looked it as an individual responsibility while 30% looked it as everyone's' responsibility.

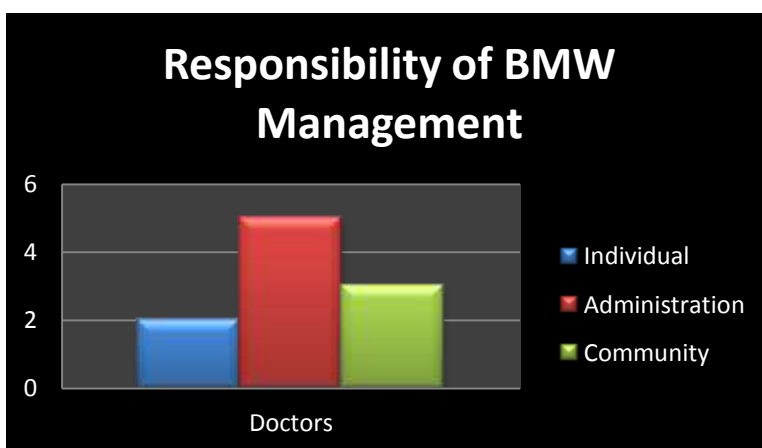


Fig. 4.15: Responsibility of BMW Management

- On enquiring about whether the institution had any waste audit system, 85% of them refused to have any knowledge of the same.
- When the doctors were asked whether the hospital have any bio-medical waste management team, excepting 25% of the doctors, all of them claimed of being aware of it.
- Only 75% of the doctors were aware of the guidelines provided by biomedical wastes (management and Handling) rules 1998.
- All the doctors were of the opinion that they never have had any accidental exposure in their institution.

4.15 **Findings from Nurses Interview**

- Only 16.7% of the paramedical staff was aware about the guidelines laid down by the biomedical waste (handling and Management) Rules.
- Of all the nurses enquired, 83.33% thought that the hospital waste were hazardous. Out of them, 27% considered blood and related products as hazardous, while 53% considered sharps like

needles most hazardous, 13% consider liquid waste as most, while remaining 7% considered other non-specific materials hazardous.

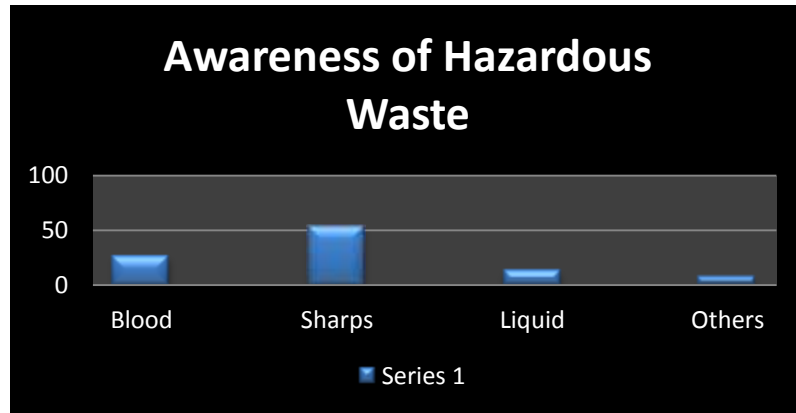


Fig. 4.16: Awareness in Nurses about Hazardous waste

- In all the nurses' interviews, 72% considered HIV as most common disease to spread because of improper BMW disposal, while other 21% consider HBV / HCV to be the most common disease.

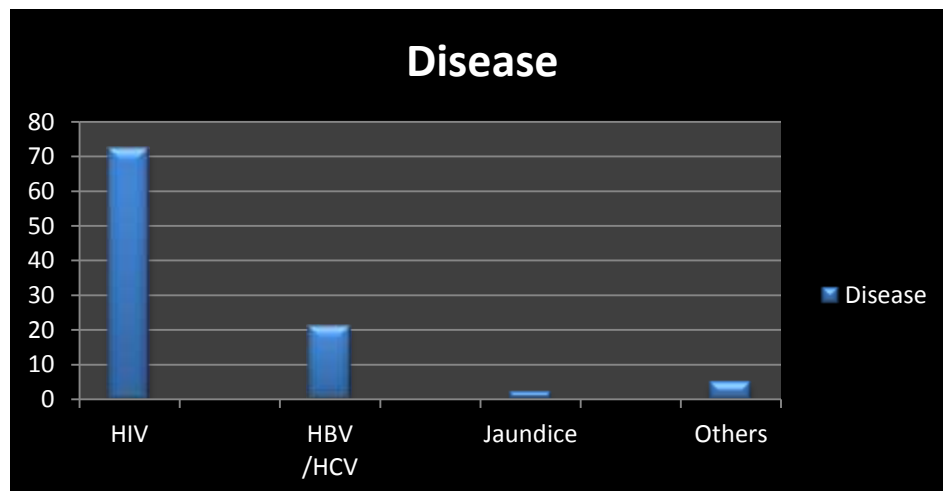


Fig. 4.17: Disease awareness from hospital wastes

- 100% nurses said that they had taken the vaccinations for Hepatitis from the hospital.
- 37% of the nurses did not any training on segregation of wastes.
- 75% of the staff used needle cutter before disposing the used needle, while the remaining could not due to non-availability.

4.16 Findings of Housekeeping Staff interviews

- Most of the housekeeping staff was aware that the hospital waste management is very important and the waste generated is hazardous
- 70% of the housekeeping staff felt that sharps is the real cause for infections while 20% felt that it is the blood and related product which is responsible.

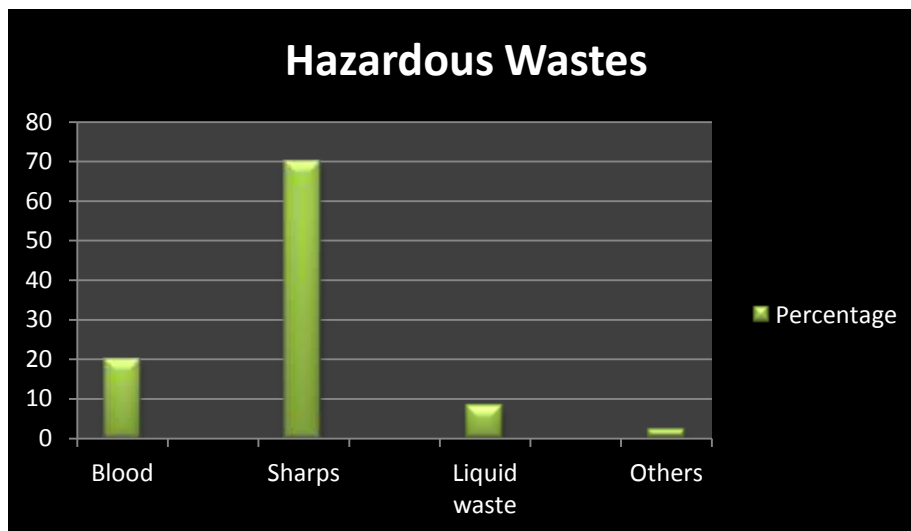


Fig. 4.17: Hazardous wastes as per housekeeping staff

- The awareness levels of hazardous wastes in the housekeeping staff was exceptionally high and most of them were fully aware of the colour bags and their uses.
- Most of the housekeeping staff was vaccinated but then they were not aware of the latest vaccination date or any refresher vaccination.

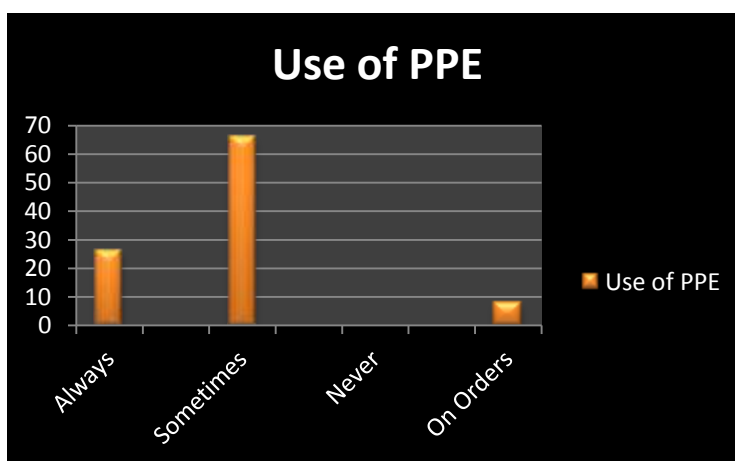


Fig. 4.18: Use of PPE by housekeeping staff

- 66% staff said that they used the complete PPE sometimes while only 26% used it always. Nobody of them wore aprons. In fact the hospital had tried giving them the same and some felt that it was the best thing for them. But it restricted their movement during the collection drill.
- 36.67% of the housekeeping staff committed that their departments treated hospital waste before giving it to BMW management workers. People were also unaware about the incinerators and its usage.
- 22.27% of them were aware about sodium hypochlorite usage. Almost everyone among the staff knew about the disinfectant usage in the hospital. But none of the staffs were happy with the quality of phenyl being used in the hospital.
- 63.3% of the staff had taken three doses of vaccinations. The same were given free of cost by the hospital
- 20% of them had opinion that waste could not be kept for more than a period of 24hours. While 50% felt that the time limit was 48 hours. 15% felt that waste should be disposed as and when the vehicle comes.

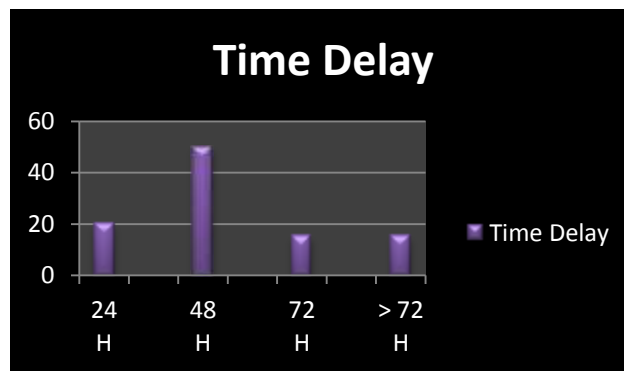


Fig. 4.19: Time limit to keep the wastes in storage

4.17 Department Wise Findings

The following departments were observed as the main generating sites for BMW:

- Laboratory
- OPD
- Wards
- Operation theatres

4.18 The observations were made on the following headings:

- The type of waste generating source and area
- The segregation technique
- Conditions of the dustbins and sharp containers
- Any equipment for waste treatment

4.19 **Laboratory**

➤ ***The types of waste:***

- Sharps, needles, lancets, broken glass, test tubes, glass slides, cover slips
- Plastic syringes, urine collection boxes
- Human tissues, blood, urine and other body fluids

➤ ***Segregation Technique:***

- All the colour containers were present and the disposal was done
- 1 % Hypochlorite solution was present with an addition bucket for straining the items

➤ ***Conditions of dustbins and sharp containers:***

- Dust bins are having cover lids but generally have open mouth
- Foot operated buckets were very few

➤ ***Any equipment for waste treatment:***

- Bucket filled with 1 % hypochlorite solution
- Minor spill kit

4.20 **Findings**

- The department was clean and tidy with respect to other departments of the hospital
- There was no spillage of blood or mercury records
- There was some doubt about the details of waste segregation

4.21 **OPD and Injection Room**

➤ ***The types of waste:***

- Sharps, needles,, broken glass, test tubes, glass slides,
- Plastic syringes
- Human tissues, blood, pus

➤ ***Segregation Technique:***

- All the colour containers were present and the disposal was done correctly

➤ ***Conditions of dustbins and sharp containers:***

- Dust bins are having cover lids but generally have open mouth
- Foot operated buckets were very few

➤ ***Any equipment for waste treatment:***

- Needle breaking equipment

4.22 **Findings**

- There is general shortage of staff
- There was no spillage of blood or mercury records
- There was some doubt about the details of waste segregation

- The dustbins were present but not covered which gives bad impression to those moving in the OPD premises.
- The patients have dirtied the dustbins with spits and poor disposal of litter

4.23 **Wards**



Fig. 4.20: Layout of waste bins

➤ ***The types of waste:***

- Sharps, needles,, broken glass, test tubes, glass slides,
- Plastic syringes
- Human wastes, blood, vomiting

➤ ***Segregation Technique:***

- All the colour containers were present and the disposal was done correctly

➤ ***Conditions of dustbins and sharp containers:***

- Dust bins are having cover lids but generally have open mouth
- Foot operated buckets were very few. The nurses were using their hands to open the mouth of the bins.

➤ ***Any equipment for waste treatment:***

- Needle breaking equipment

4.24 **Findings**

- There is general shortage of staff, only one ward boy was handling the wastes.
- There was no spillage of blood or mercury records
- There was some doubt about the details of waste segregation
- The yellow containers were also kept one between two beds over and above the one kept centrally.
- The yellow bags are then shifted through the ward.

4.25 **Operation theatres**

➤ ***The types of waste:***

- Sharps, needles,, broken glass,
- Plastic syringes, tubing, cannulas
- Human wastes, blood, body parts during surgery

➤ ***Segregation Technique:***

- All the colour containers were present and the disposal was done correctly
- Sharps did not collect in sharp containers.

➤ ***Conditions of dustbins and sharp containers:***

- Dust bins are having cover lids but generally have open mouth
- Foot operated buckets were very few.
- Sharp containers were not functional.

➤ ***Any equipment for waste treatment:*** No

4.26 **Findings**

- The bio-medical waste is collected and removed from the area every 8 hours.
- Waste is not immediate removed after any surgery.

Critical Findings

4.27 The observations were analysed and findings were obtained. Some of the findings were of general and minor nature which could be summarily overcome by carefulness. However, certain critical findings of the study which requires special attention are enumerated below.

4.28 **Regarding Staff**

- The housekeeping staff is not being rotated for the duty.
- Training for the staff is not customised.
- The staff is not being briefed or debriefed on daily basis by a dedicated supervisor. Staff has low motivation level and suffers from lack of recognition.



Fig.4.21: Interaction with staff

4.29 Regarding the garbage Area

- Good quality disinfectant with persistent smell is not available.
- The small sized gloves have been provided to the staff.
- The garbage bags are not being weighed.
- Record of cleaning of the storage areas is a not maintained.

4.30 Regarding dustbins and Polybags

- Label location is given on the bag but that is inconvenient. No labels are being put on the bags for identification.



Fig.4.22: Label required with date and time

- Not all dustbins are foot controlled needing hand help for opening and closing.

4.31 Regarding Segregation and Collection

- Sharps are not being collected in puncture proof boxes.



Fig. 4.23: Careless segregation in departments

- Mixing of wastes noticed especially in night shifts.
- The waste bags are dumped in the washrooms by the dedicated housekeeping staff.



Fig. 4.24: Dumping bags in washrooms

4.32 **Regarding Transportation of waste**

- Transportation trolleys being overloaded and not covered.



Fig. 4.25: Open and overloaded trolley intra-mural transportation

- Record of cleaning of the trolleys not existing.
- While moving in the lifts especially in the OPD building, the trolleys cause dents and blockage in move.



Fig.4.26: Congested lift due to big trolleys



Fig.4.27: Need for 'NO ENTRY' Boards

- Patient attendants keep sleeping on the corridors and so these trolleys move very close to them while transporting.

CHAPTER V

RECOMMENDATIONS

5.1 **Introduction:** According to WE Deming, the quality Guru *“Good quality does not necessary mean high quality. It means a predictable degree of uniformity and dependability with the quality suited to the requirements”* Total Quality Management is “achieving total quality through everyone’s commitment and involvement”(Mitchell, 1997). The TQM approach lays stress on systematic way of tackling problems. After perusing the details of critical findings, some issues are placed for the consideration of the hospital which in long run will help these hospitals to strengthen their BMW management practices being followed in the hospitals. It has been tried that the recommendations given are logical, relevant and feasible. Situational bias has been removed and importance to correct data and deductions has been kept in mind.

5.2 Critical findings were discussed with the nursing and admin staff of the hospital and analysing the extent of changes that could be brought into the system. Following recommendations are proposed:

- HR department must make a note of carrying out rotation policy of the BMW staff. Special allowances or monetary awards maybe considered to help in increasing the motivation level of staff.
- Small weigh machines must be given to the departments to weigh the weight of bags being disposed.
- A dedicated supervisor plays a very important role in coordinating the day to day activities of BMW. The role should not be overlapping.
- Trolleys of variable sizes be made available to avoid mixing of loads and easy ferrying in lifts.
- Better coordination is desired with security staff and cleaning staff with BMW staff to avoid patient attendant mix around and overlapping of sweeping drills.
- Customised training for each cadre of hospital staff is the need of hour.
- Waste audit should be conducted with sincerity.
- BMW management committee must include the Director and other top administration officers to become high powered and should meet every month to monitor the progress of BMW management in the hospital.
- Better IEC material and awareness programmes must be launched to increase the knowledge and general awareness of the Bio-Medical waste hazards and better practices.

CHAPTER VI

CONCLUSION

6.1 **Introduction:** In Indian scenario, ever increasing environmental pollution has become a menace. While cause of health hazards is the increasing environmental pollution effects are Hepatitis, typhoid fever, TB, Diarrheal infection, malaria or the recent flare up of swine flu or dengue. With the increasing demands of healthcare facilities and the hospital industry poised for a growth of around 10-15 n% annually, the problem of BMW will tend to increase .The issue now is not restricted to the hospital only. It is also a problem of the world community as the environment is affected.

6.2 The Bio-Medical Waste Management Rules 1998 were introduced in this context and this has definitely increased the compliance of the hospitals towards the bio-medical wastes, but there is still a long way to go on this issue. Hospital wastes are highly infectious when fresh and so proper BMW practices are of utmost importance.

6.3 Being a routine and mundane work, it often loses the attention and focus of higher management in a hospital. Further, it is not adding towards the economics of the hospital directly. Gradually, the gaps and shortcuts creep in the practices of BMW activities.

6.4 **Methodology:** The topic was selected to identify the existing practices in a hospital, identify any gaps and bottlenecks in the process and give recommendations to overcome the same so that the system becomes robust and self-sustaining. The study was carried out for about three months in the SDMH hospital, Jaipur. Non probability sampling with descriptive research technique was undertaken. Sample size was restricted to 40. However, primary data collection by means of questionnaires and observations was used whereas for the secondary data collection, literature review, books and internet was used.

6.5 **Findings and recommendations:** After collecting the primary and secondary data, data analysis was done and certain key findings were obtained. The findings were mainly concerned with practices, lack of supervision, knowledge gaps, monotonous job profile and training elements. Recommendations for better and sustained functioning of the BMW practices were given linked with the critical findings:

- HR department must appoint a dedicated supervisor for all shifts and employ a rotational policy to involve more and more housekeeping staff in the BMW practices.
- Conscious efforts are required by all the staff including doctors, nurses, paramedical staff, housekeeping staff, administrations, patients, and other related agencies to ensure the success of BMW management.
- Higher management has to get directly involved in terms of regular monitoring and conducting waste audit in the hospital.

- Knowledge base has to be increased by customised training for all personnel of the hospital. Greater awareness to be made by better use of IEC material and posters highlighting the dangers of pitfalls in mismanaged disposal of bio-medical wastes.

6.6 The study was very successful because certain activities of the hospital look very non-technical and mundane but have far reaching implications in terms of health, image, environmental laws and in short in financial consequences. The larger picture involving almost 3 lac health care facilities with 3 million beds in India generating almost 500 tonnes of bio-medical wastes daily and being disposed of through almost 225 CTFs poses a monstrous image if we start accepting discrepancies in the practices of the BMW practices.

6.7 This study is providing a standard setup for other future studies to take upon from hereon. The structure of the study can be replicated in different situation or environment. Certain statistical data could be established in this field to frame stricter rules for certain departments like OTs or ICUs or emergencies vis-à-vis administration rooms, OPDs and Imaging rooms. Technological advancements can be certainly helpful in devising safer and faster means of final disposal of the bio-medical wastes at the CTFs. Government should also think of advancement of national policies on the subject. The previous order is now a little old dated and needs revision. Now in the amendment of 2011, the HCFs irrespective of number of patients will need to apply for authorisation State pollution control board for necessary BMW waste disposal.

6.8 As medical practitioners, we have to be sincere to fight out the alarming proportions of Bio-medical wastes being generated in this health, environment conscious society of today. While major steps have been taken towards management of the bio-medical waste with the formulation of the provisions of the act, a few more steps need to be taken to reach the logical end of the issue to achieve following slogan in letter and spirit,

“Let the waste of the sick not contaminate the life of healthy”

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Annexure A

Biomedical Waste Management: An infrastructural Survey of Hospitals

Lt Col SKM Rao, Wg Cdr RK Rayala, Lt Col SS Bhatia, Lt Col VR Sharma

Abstract

Background: The ministry of Environment & Forests notified the Bio-Medical Waste (Management and* Handling) Rules, 1998 in July 1998. In accordance with the rules, every hospital generating BMW needs to set up requisite BMW treatment facilities on site or ensure requisite treatment of waste at common treatment facility. No untreated BMW shall be kept beyond 48 hours. The cost of construction, operation and maintenance of system for managing BMW represents a significant part of overall budget of the hospital if the rules of the BMW have to be implemented in true spirits. Two types of cost are required to be incurred by hospital for BMW management, internal and external. Internal cost is the cost of segregation, mutilation, disinfection, internal storage and transportation including the hidden cost of protective equipment. External costs are off site transportation, treatment and final disposal.

Methods: A study of hospitals was carried out from various sectors like Govt, Private, Charitable institutions etc to assess the infrastructural requirement for BMW management. Cost was worked out for a hospital where the entire infrastructure as per each and every requirement of BMW rules had been implemented and then it was compared with other hospitals where hospitals had made compromises on each stage of BMW management.

Results: Capital cost incurred by benchmarked hospital of 1047 beds was Rs 3 lac 59 thousand excluding cost of incinerator and hospital is incurring Rs 665/-per day as recurring expenditure.

Conclusion: after analysing the results of study, it was felt that there is an urgent need to standardize the infrastructural requirement so that the hospitals following BMW rules strictly do not suffer additional costs.

CENTRAL POLLUTION CONTROL BOARD

(Hazardous Waste Management Division)

DELHI – 110 032

Subject: Status and Issues on implementation of Bio-medical Waste (Management & Handling) Rules, 1998 and as amended

1. Introduction to the Bio-medical Waste (Management & Handling) Rules, 1998 and amendments made thereof:

The Bio-medical Waste (Management & Handling) Rules, 1998 and amendments thereof (hereafter referred as BMW Rules) were notified under the Environment (Protection) Act, 1986 by the Ministry of Environment & Forests (MoEF) in the year 1998 and further amendments were made in the year 2000 and 2003. As per BMW Rules, 1998, State Pollution Control Boards (SPCBs)/ Pollution Control Committees (PCCs) in the respective States/UTs and Director General Armed Forces Medical Services (DGAFMS) in respect of the Health Care Establishments (HCEs) under the jurisdiction of the Ministry of Defence have been notified as the 'Prescribed Authority' for overall enforcement of the said Rules. As per Rule 10 of the BMW Rules, 'SPCBs and PCCs as well as DGAFMS are required to submit annual report information in a compiled form to the Central Pollution Control Board (CPCB), for the preceding year by 31st March of every year.

2. Bio-medical Waste Management Scenario:

Annual report information for the year 2013 is not received from the Lakshadweep Pollution Control Committee. As per the annual report information received from the State Pollution Control Boards (SPCBs)/ Pollution Control Committees (PCCs) and Director General of Armed Forces Medical Services (DGAFMS) for the year 2013, there are 1,68,869 no. of HCFs having 17,13,742 beds and generating bio-medical waste at about 484 tons/day. 1,05,270 no. of HCFs have obtained authorization under the BMW Rules. There are 198 no. of CBWTFs in operation (28 under construction) as well as 22,245 no. of HCFs are having captive bio-medical waste treatment and disposal facilities and 447 Tons per day (TPD) out of 484 TPD of bio-medical waste generated is treated and disposed of by these facilities. About 7,894 no. of HCFs/CBWTFs violating the provisions of the BMW Rules. The detailed bio-medical waste management scenario in the Country (**Annexure-I**) is given below:

- No. of healthcare facilities : 1,68,869
- No. of beds :17,13,742
- No. of Common Bio-medical Waste Treatment Facilities (CBWTFs) : **198* + 28****

- No. of healthcare facilities (HCFs) using CBWTFs : 1,31,837
 - No. of HCFs having treatment & disposal facilities : 22,245
 - No. of healthcare facilities applied for authorization : 1,06,805
 - No. of healthcare facilities granted authorization : 1,05,270
 - Total no. of on-site/captive treatment equipment installed (excluding CBWTFs) by the HCFs:
 - No. of incinerators
 - i) With Air Pollution Control Device : 331
 - (ii) Without Air Pollution Control Device : 217
 - No. of autoclaves : 3,112
 - No. of microwaves : 250
 - No. of Hydroclave : 15
 - No. of Shredders : 5,179
 - Total no. of treatment equipment installed by the CBWTFs:
 - No. of incinerators : 198
 - No. of autoclaves : 189
 - No. of microwaves : 06
 - No. of Hydroclave : 03
 - No. of Shredders : 202
 - Quantity of bio-medical waste generated in Tons/day : 484
 - Quantity of bio-medical waste treated in Tons /day : 447
 - No. of HCFs violated BMW Rules : 7,894
 - No. of Show-cause notices/Directions issued to defaulter HCFs : 4,391

Note:

- (i) * - **CBWTFs in operation**
- (ii) ** - **CBWTFs under installation**
- (iii) **The information in respect of the Lakshadweep State has been included as per the Annual Report submitted for the year 2012.**

3. Annual Report Information – A Comparison:

<u>Particulars</u>	<u>As per Annual Report Information for the year 2012</u>	<u>As per Annual Report Information for the year 2013</u>
No. of healthcare facilities	1,59,838	1,68,869
No. of beds	16,12,600	17,13,742
No. of Common Bio-medical Waste Treatment Facilities (CBWTFs)	190* + 29**	198*+28**
No. of healthcare facilities (HCFs) using CBWTFs	1,21,279	1,31,837
No. of HCFs having treatment & disposal facilities	21,870	22,245
No. of healthcare facilities applied for	1,02,086	1,06,805

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authorization			

No. of healthcare facilities granted authorization	98,074	1,05,270
Total no. of on-site/captive treatment equipment installed (excluding CBWTFs) by the HCFs:		
· No. of incinerators		
i) With Air Pollution Control Device	431	331
(ii) Without Air Pollution Control Device	233	217
· No. of autoclaves	4,158	3,112
· No. of microwaves	186	250
· No. of Hydroclave	21	15
· No. of Shredders	6,477	5,179
Total no. of treatment equipment installed by the CBWTFs:		
· No. of incinerators	194	198
· No. of autoclaves	157	189
· No. of microwaves	05	06
· No. of Hydroclave	02	03
· No. of Shredders	163	202
Quantity of bio-medical waste generated in Tons/day	416	484
Quantity of bio-medical waste treated in Tons /day	380	447
No. of HCFs/CBWTFs violated BMW Rules	12,990	7,894
No. of Show-cause notices/Directions issued to defaulter HCFs/CBWTFs	11,583	4,391

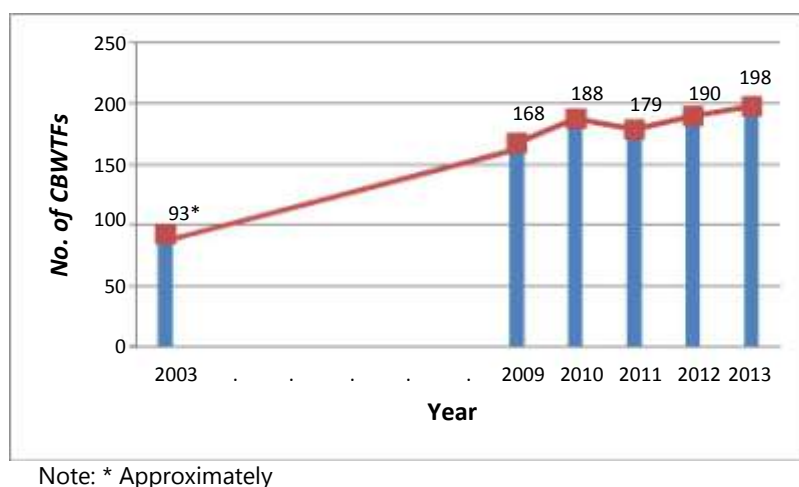
The comparison between the Annual Report Information for the year 2012 and 2013 indicates the following:

- There has been an increase of 9,031 (5.65 %) in number of Healthcare Facilities (HCFs) in the year 2013 as compared to the no. of HCFs reported for the year 2012.
- Simultaneously, there has been an increase in total bio-medical waste generation as it was reported as 484 tons/day for the year 2013 and 416 tons/day for the year 2012 as there is an increase in total no. of HCFs.
- As per the AR-2013, about 92.35 % of bio-medical waste is treated & disposed off.
- To facilitate the treatment and disposal of bio-medical waste generated from the HCFs, there are 198 no. of Common Bio-medical Waste Treatment Facilities (CBWTFs) in operation and 28 no. of CBWTFs under construction. Eight additional CBWTFs have added for the year 2013 which are catering the treatment and disposal services to Healthcare Facilities, as compared to 2012.

- Increase in no. of HCFs having captive treatment & disposal facilities for bio-medical waste is observed, as it was reported as 21,870 in the year 2012 and 22,245 is reported for the year 2013.
- Decrease in number of incinerators installed by HCFs operating without Air Pollution Control Devices from 233 to 217, however, SPCBs/PCCs has to ensure closure of said 217 incinerators who are in operation without APCDs or having single chamber.
- No. of HCFs/CBWTFs violating the provisions of BMW Rules in 2013 has decreased by approx. 39 % as compared to 2012, due to regular follow-up with the HCFs/CBWTFs regarding implementation of BMW Rules as well as CPCB guidelines.

4. Common Bio-medical Waste Treatment Facilities:

There has been an increase in number of CBWTFs over the years. Fig. indicating growth in CBWTFs is shown in **Fig. 1**. At present there are 198 no. of CBWTFs in operation and 22 no. of CBWTFs under construction, as reported by SPCBs/PCCs. Though CBWTFs are widely accepted by the HCFs for the treatment & disposal of bio-medical waste, still there are some States/Union Territories which are yet to develop the CBWTFs in their respective States/UTs.



CPCB has carried out joint inspection of CBWTFs to verify compliance to the provisions of BMW Rules & CPCB guidelines wherein various non-compliances have been observed. Following are the major observations in CBWTFs which are not complied w.r.to the BMW Rules & CPCB guidelines:

1. Some of the CBWTFs are in operation without having valid authorization as required under Bio-medical Waste (Management & Handling) Rules, 1998;
2. Collection of mixed waste from the member HCFs & manual segregation of waste inside the facilities;

3. Separate spacing for storage of treatment equipment, bio-medical waste storage room etc.;
4. Interlocked Programmable Logic Control (PLC) based waste feeding system and recording system with the incinerator;
5. Devices for measuring negative draft in primary chamber, air flow rate in the incinerator chamber and pressure drop across venturi scrubber;
6. Operation of the incinerator in accordance with the provisions as stipulated under BMW Rules;
7. Stack monitoring provision (such as platform, porthole etc.) with the incinerator stack;
8. Procurement of Flue gas analyser for measurement of CO, O₂ & CO₂ level in the stack gases;
9. Recording system for autoclave for operational parameters such as batch number, temperature, pressure, start and end of sterilization of the autoclave as well as validation test to check the efficacy of autoclave;
10. Provision for mechanical feeding system with the autoclave is not installed as required under CPCB guidelines;
11. Provision for disposal of sharp waste in sharp-pit/encapsulation facility and pit for disposal of ash etc.

Respective SPCB/PCC is required to ensure that all the Common Bio-medical Waste Treatment Facilities (CBWTFs) comply with the provisions of Bio-medical Waste (Management & Handling) Rules, 1998 as well as CPCB guidelines.

5. Bio-medical Waste Management in Armed Forces Medical Healthcare Establishments:

Rule 7 (1) of the Bio-medical Waste (Management & Handling) Rules, 1998 as amended, stipulates that "the prescribed authority for enforcement of the provisions of these rules in respect of all health care establishments including hospitals, nursing homes, clinics, dispensaries, veterinary institutions, Animal houses, pathological laboratories and blood banks of the Armed Forces under the Ministry of Defence shall be the Director General, Armed Forces Medical Services". Further, as per Rule 9 A of the said Rules, CPCB shall monitor the implementation of BMW Rules in respect of all Armed Forces Medical Healthcare Establishments under the Ministry of Defence.

As per the Annual Report Information for the year 2013 submitted by Director General Armed Forces Medical Services, there are 361 Armed Force Medical Healthcare Establishments (AFMHCEs) which are generating 11031 kg/day of bio-medical waste. All the AFMHCEs are having their own treatment& disposal facility for the bio-medical waste. Also, all the AFMHCEs have obtained authorization under Bio-medical Waste (Management & Handling) Rules, 1998. As reported by DGAFMS, no incinerator installed by the AFMHCEs is in operation without having Air Pollution Control Devices.

Also, Member Secretary, CPCB has taken a meeting with the officials of Director General Armed Forces Medical Services (DGAfMS) on 05.12.2014 at CPCB, Delhi and following decisions were taken for ensuring effective implementation of the BMW Rules by the Armed Forces Medical Healthcare Establishments (AFMHCs):

1. DGAfMS is required to provide list of AFHCs (having > 45 no. of beds) to CPCB for carrying out periodic inspection by CPCB as per BMW Rules.
2. DGAfMS has to verify compliance to all the Healthcare Facilities fall under the DGAfMS, for which CPCB will provide the 'Check List' for verification of all AFHCs.
3. Based on the inspection reports of 56 AFHCs carried out by CPCB, a consolidated compliances issues will be communicated by CPCB including the main action points for which corrective issues will be communicated by CPCB including the main action points for which corrective measures need to be taken by the DGAfMS in a time bound manner for ensuring compliance to the BMW Rules;
4. Upon receipt of the action points, DGAfMS has to submit point-wise time bound action plan for ensuring compliance by all the AFHCs;
5. Subsequent to receipt of the time bound action plan, CPCB will give necessary directions for ensuring complete compliance by all the AFHCs, by 2017.
6. DGAfMS has to submit AFHC-wise corrective actions taken against the recommendations communicated by CPCB in respect of 56 no. of AFHCs, along with photographs and relevant documents as proof of compliance for the purpose of preparation of a document by CPCB.
7. DGAfMS in consultation with CPCB has to organize four workshops/trainings (in north, south, east and west regions) for the medical, para-medical, engineers, treatment equipment operators and other workers involved in handling of bio-medical waste in AFHCs;
8. DGAfMS may collect information on the international practices being followed in the armed forces healthcare facilities in developed countries with regard to the bio-medical waste management.

6. State-of-art-treatment-technologies for the treatment of Bio-medical Waste:

As per Schedule I of the Bio-medical Waste (Management & Handling) Rules, 1998 & as amended, any Health Care Facility (HCF) or Common Bio-medical Waste Treatment Facility (CBWTF) Operator wishing to use other Stat-of-the-art-technologies other than stipulated under Schedule I of the said rules, shall approach the Central Pollution Control Board (CPCB) to get the standards laid down to enable the prescribed authority to consider grant of authorization. For the purpose of evaluation of new technologies for treatment of bio-medical waste and to suggest suitable standards for any such technologies, an Expert Committee was

reconstituted by CPCB. During the last five years, CPCB have granted provisional approval to the following new Technologies for treatment of bio-medical waste, under the BMW Rules:

- i. Plasma Pyrolysis;
- ii. Waste Sharps Dry heat sterilization and encapsulation; and
- iii. Shredding cum Chemical disinfection (Static/Mobile)'.

7. Issues and Recommendations on Bio-medical Waste Management:

S. No.	Particulars	Issues	Recommendations
1	Non-submission of Annual Report within the due date (i.e., by 31st March of every year)	The annual report information is not submitted regularly within the due date (by 31 March every year) as stipulated under the Bio-medical Waste (Management & Handling) Rules, 1998 by most of the SPCBs/PCCs thereby making it difficult to compile the national status on bio-medical waste management and its submission to MoEF by 30 th June of every year. CPCB has given time frame for ensuring submission of Annual Report on BMW Management within the due date i.e. 31 st March of the every year by all the concerned so that compiled information can be submitted to MoEF by CPCB by 30 th June of every year.	SPCBs/PCCs should direct all the HCFs/CBWTFs located in the respective State/UT for submission of Annual Report in light of the format circulated by CPCB, by 30 th of January of every year in accordance with BMW Rules.
2	Operation of Healthcare Facilities without Authorization under BMW Rules	As per Annual Report Information for the year 2013, there are 63,599 out of 1,68,869 no. of Healthcare Facilities (HCFs) which are operating without obtaining Authorization under BMW Rules which are also violating the BMW Rules. Such HCFs needs to obtain authorization under BMW Rules.	All the HCFs which are in operation without obtaining authorization as required under BMW Rules, 1998 should be directed to obtain authorization from the prescribed authority. The HCFs which generate bio-medical waste butnot require authorization as per BMW Rules should be directed to take adequate steps and to take a membership from the nearby CBWTF for safe disposal of bio-

			medical waste generated by such HCFs.
3	Captive Incinerators in violation of BMW Rules	There are 548 no. of captive incinerators and 217 no. of captive incinerator are operating without APCD or may be having single chamber which are in violation of BMW Rules, in the States like Andaman & Nicobar, Arunachal Pradesh, Assam, Himachal Pradesh, Jharkhand, Jammu & Kashmir, Kerala, Lakshadweep, Madhya Pradesh and Maharashtra. Such, captive incinerators need to be closed by the respective SPCB.	All the Captive BMW Incinerators operated by the HCFs, which are either single chamber or not connected with adequate APCD should be directed to upgrade within immediate effect, failing which action should be taken for closure of such captive incinerators.
4	States/UTs which are yet to develop CBWTFs in the respective State/UT	06 States namely Arunachal Pradesh, Goa, Manipur, Mizoram, Nagaland & Sikkim and 02 UTs namely Andaman & Nicobar Islands, Lakshadweep where, are yet to develop CBWTFs in the respective State/UT.	Action should be taken by the States/UTs of Andaman & Nicobar Islands, Arunachal Pradesh, Goa, Lakshadweep, Manipur, Mizoram, Nagaland & Sikkim for Development of Common Bio-medical Waste Treatment and Disposal Facilities (CBWTFs) in the respective State/UT.
5	Improper implementation of guidelines for the CBWTFs by the SPCBs/PCCs	Some of the States like Haryana, Gujarat and Karnataka are allowing more number of CBWTFs violating the location criteria and coverage area as stipulated under CBWTF guidelines due to which mushrooming of CBWTFs is taking place and leading to Court Matters.	Additional CBWTFs be allowed in the States/UTs only after examining the gap between the bio-medical waste generation & the existing treatment capacities as well as techno-economic viability and feasible operation of the CBWTFs.
6	Installation of ETP/STP by the Healthcare Facilities	Many of the HCFs have not installed ETPs/STPs for ensuring proper treatment of liquid waste generated the HCFs in compliance to the discharge norms stipulated	All the HCFs be directed to ensure compliance to the liquid waste discharge norms stipulated under Schedule V of the BMW Rules, by installing

		under BMW Rules. CPCB already requested all the SPCBs/PCCs for initiating further necessary action.	adequate STP/ETP as required under the BMW Rules to ensure compliance to the discharge norms.
7	Bio-medical Waste Handling by the Healthcare Facilities	During the inspection of the Healthcare Facilities, it has been observed by CPCB that some of the HCFs are not properly handling and disposing the bio-medical waste generated in respect of the segregation of bio-medical waste including disposing off of the mercury waste.	All the SPCBs and PCCs should ensure that the HCFs have adequate facilities for on-site segregation, intra-mural movement and safe storage of Bio-medical waste, prior to sending the waste to the CBWTFs. The HCFs be directed to 'phase out use of mercury based medical instruments' by the year 2020 in line with the 'Minamata Convention for Mercury Phase out'. Also, mercury waste disposal should be in accordance with CPCB guidelines on 'Environmentally Sound Management of Mercury Waste generated from Healthcare Facilities'.

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QUESTIONNAIRE FOR DOCTORS

Name

Sex

Age

Working since

1. What do you mean by BMW management?
2. Is there any waste management programme started in your hospital? Yes /No
3. Does your hospital have a written policy, objective and responsibility on biomedical waste management? Yes / No
4. Are you aware of the guidelines provided by the biomedical wastes (management and handling rules) yes / no
5. Does your hospital have an organised bio-medical waste management team? Yes / no
6. Who is responsible for bio-medical waste management?
 - Management
 - Doctors
 - Nurses
 - Housekeeping staff
 - Others
7. How do you look at bio-medical waste disposal?
 - Individual responsibility
 - Administrative responsibility
 - Community responsibility
8. Does your hospital have a waste audit? Yes/ no
9. Have there been any reported incidents of injuries or accidental exposure to biomedical waste hazards during the handling? yes / no
10. Do you follow universal precautions I the hospital? Yes /no

QUESTIONNAIRE FOR NURSES

Name

Sex

Age

Working since

1. Are you aware of the guidelines provided by the biomedical wastes (management and handling rules) yes / no
2. Is the waste generated in the hospital hazardous? Yes /No
3. If yes, which of the waste generated is hazardous?
 - Blood and related products
 - Sharps i.e. needles
 - Liquid waste
 - Others
4. Which disease can be transmitted if the hospital waste is not managed properly?
 - HIV and AIDS
 - Hep b
 - Jaundice
 - Others
5. Have you taken Hepatitis B vaccination? Yes / no
6. If yes, was it provided to you by the hospital or taken voluntarily?
7. What can be done if someone puts wrong waste in to wrong bag by mistake?
 - Pick up with bare hands
 - Use gloves to pick it up
 - Use of steel forceps and put it in the right bag
 - Others
8. Did you receive any training regarding how segregation of waste material is to be done?
Yes / No
9. Do you use needle cutter before discarding the needle in the waste? Yes/ no
10. Do you follow universal precautions I the hospital? Yes /no

QUESTIONNAIRE FOR HOUSEKEEPING STAFF AND BMW STAFF

Name

Sex

Age

Designation

1. Is hospital waste management important? Yes /No
2. Is all the waste generated in the hospital hazardous? Yes /No
3. If yes, which of the waste generated is hazardous?
 - Blood and related product
 - Sharps ie needles
 - Liquid waste ie cleaning waste
 - Others
4. Which of the diseases can be transmitted if hospital waste is not disposed off properly?
 - HIV and AIDS
 - Hep B
 - Jaundice
 - Others
5. Who are at high risk of getting infected if the BMW is not disposed off properly?
 - Hospital staff
 - Rag pickers
 - General community
 - All of them
6. Do you know about the color coding of hospital waste? Yes/No
7. Which are color bags for segregating the wastes?
 - Yellow
 - Blue
 - Red
 - Black
8. Are you aware of the symbol used? Yes/ no

9. What are the protective gears which you wear while working?
- Aprons
 - Gloves
 - Mask and caps
 - Others
10. Does your hospital treat hospital waste before giving it to the BMW worker? Yes /no
11. Do you know what an incinerator is? Yes /no
12. do you know what is sodium hypochlorite solution is ? Yes /no
13. Are you aware of the disinfectants and antiseptic used in your hospital? Yes /no
14. Do you feel need of new /additional hospital waste management training programme for the employees Yes /no
15. Have you taken Hep B vaccine? Yes /no
16. Do you check punctures / leaks in the bags before or after using them? Yes /no
17. When do you use gloves and mask while working?
- Always
 - Sometimes
 - Never
 - Others
18. How is the waste carried around at different places on the hospital?
- Colored bags in a trolley
 - Dragged in plastic bags
 - Closed bins in a trolley
 - Others
19. What is the maximum time limit for which the BMW can be kept before collecting it?
- 24h
 - 48h
 - 72h
 - > than 72h
20. Are you aware how BMW is disposed off? Yes /no