To Ensure a Safe "Biomedical Waste Management" of the Hospital

Internship Training
at
Civil Hospital, Ahwa District Dang, Gujarat

By
Harish Gawande

Under the guidance of
Col. (Dr.) Ashok Kaushik

Post Graduate Diploma in Hospital & Health Management
2012–14

Institute of Health Management Research
Jaipur
2014

INSTITUTE OF HEALTH MANAGEMENT RESEARCH
1, Prabhu Dayal Marg
Sanganer Airport, JAIPUR - 302 029, INDIA
Tel. : 3924700, 2791431-32
Fax : 91-141-3924738
E-mail : iihmr@iihmr.org
URL : http://www.iihmr.org
Gram : HEALTHINST

To whomsoever it may concern

This is to certify that Dr. Harish Gawande,

student of Post Graduate Diploma in Hospital and Health Management

from Institute of Health Management Research, Jaipur

has undergone internship training at Civil Hospital, Ahwa, District Dang, Gujarat

from February 2014 to May 2014.

The candidate has successfully carried out the study designated to his 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 him future endeavors.

Dr. (Col.) Ashok Kaushik
Dean, Academics and Students Affairs
IIHMR, Jaipur

General Hospital
Ahwa - Dangs
High School Road
At. Po. Ahwa Taluka: Ahwa, Dist: Dang
Ph. No. 02631 - 220204 Fax 220205

Certificate from Organization

This certificate is awarded to

Dr. Harish Gawande

In Recognition of having successfully completed his Internship in the department of **Hospital Administration**

And has successfully completed his Project on

TO ENSURE A SAFE "BIOMEDICAL WASTE MANAGEMENT" OF THE HOSPITAL

From **15th February 2014 – 16th May 2014**

In **Civil Hospital, Ahwa, district Dang, Gujarat**

He comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning.

We wish him all the best for future endeavors.

(Chief District Medical Officer)
Training & Development

CIVIL SURGEON
GENERAL HOSPITAL
AHWA - DANG.

GENERAL HOSPITAL * AHWA-DANG * सत्यमेव जयते

INSTITUTE OF HEALTH MANAGEMENT RESEARCH
1, Prabhu Dayal Marg
Sanganer Airport, JAIPUR - 302 011, INDIA
Tel. : 3924700, 2791431-32
Fax : 91-141-3924738
E-mail : iihmr@iihmr.org
URL : http://www.iihmr.org
Gram : HEALTHINST

Original Literally Work Declaration

INSTITUTE OF HEALTH MANAGEMENT RESEARCH, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that the Dissertation Titled:	To Ensure Safe "Biomedical Waste Management" Of The Hospital
Submitted by:	Dr. Harish Gawande
Enrollment No.:	17-1404
Under Supervision of:	Col. (Dr.) Ashok Kaushik
For Award of :	Postgraduate Diploma in Hospital and Health Management of the Institute
Carried out during the period	19th February 2014 to 19th May 2014
From	Civil Hospital, Ahwa, District Dang, Gujarat

embodies my original work and has not formed the basis for the award of any degree, diploma associateship, fellowship titles in this or any other Institute or other similar institution of higher learning.

Signature

ABSTRACT

Medical care is vital for our life and health, but the waste generated from medical activities represents a real problem of nature and human world. Improper management of waste generated in health care facilities causes a direct health impact on the community, the health care workers and on the environment Every day, relatively large amount of potentially infectious and hazardous waste are generated in the health care hospitals and facilities around the world. Indiscriminate disposal of BMW or hospital waste and exposure to such waste possess serious threat to environment and to human health and requires specific treatment and management prior to its final disposal.

This report was made as a dissertation project conducted in the Civil Hospital, Ahwa, District Dang. The researcher was posted as the Assistant Hospital Administrator in the hospital. Many issues relating to the mismanagement of Bio medical waste were discovered in the hospital, like

- Untimely collection
- Improper segregation, (not done category-wise)
- Lack of awareness among staff
- Wrong disposal methods, etc.

These issues were highlighted and brought into notice of the senior management.

To acquire a deeper understanding of the current practice, a set of questionnaires was prepared. These questionnaires were targeted to the doctors, nurses and housekeeping staff.

The first questionnaire judged the level of understanding of the staff about the correct biomedical waste management. A questionnaire was designed, to assess the basic understanding of the BMW knowledge of the staff. On the basis of the responses of this questionnaire, a graph was prepared to represent the level of understanding of BMW basics.

The second questionnaire was prepared to assess the knowledge of segregation of biomedical waste, based on the government-approved color codes of the BMW bins. Following this, a training was conducted and again the staff was given the same

questionnaire. The results of this second questionnaire showed positive improvement in the staff's awareness about segregation of BMW. This result was depicted with the help of a graph.

A lot of time was spent to discover the gaps in the present system of BMW management. These findings were presented to the senior management of the hospital, along with some proposed solutions. Many of these solutions were implemented with an immediate effect.

After a week of implementations of the new solutions, observations were made again, and the new practices seemed to have an improved result on the overall management of BMW.

ACKNOWLEDGEMENT

I take this opportunity to express my profound gratitude and deep regards to my guide, **Dr. Ashok Kaushik**, for his exemplary guidance, monitoring and constant encouragement throughout the course of this dissertation. The blessing, help and guidance given by him time to time shall carry me a long way in the journey of life on which I am about to embark.

I also take this opportunity to express a deep sense of gratitude to Dr. Konkani (Chief District Medical Officer, Civil Hospital Dang), for his cordial support, valuable information and guidance, which helped me in completing this task through various stages.

I am obliged to staff members of the Civil Hospital, for the valuable information provided by them in their respective fields. I am grateful for their cooperation during the period of my assignment.

I thank almighty, my parents, sister and friends for their constant encouragement without which this assignment would not be possible.

TABLE OF CONTENTS

List of Figures

List of Abbreviations

Approx.	Approximate
BBMW	Biomedical Waste
CDMO	Chief District Medical Officer
Mins	Minutes
NSV	Non Scalpel Vasectomy
TL	Tubal Ligation/ Tubectomy

List of Appendices

Appendix 1	Pre Training Questionnaire
Appendix 2	Information About Segregation Of Bio Medical Waste
Appendix 3	Bio Medical Checklist

INTRODUCTION

The Civil Hospital is district hospital located 150 km from Surat. This hospital started as a 119 bed hospital, and with the increase in population of the district, the bed capacity was increased to 170.

The hospital is soon about to inaugurate a new wing, which is 250 bed, and will be a multi-specialty center.

To ensure a healthy and safe treatment is given to patients in the hospital, it is extremely important that all kinds of precautionary measures should be undertaken in order to prevent any kind of nosocomial infection. After spending an initial first week in understanding the various processes and working of the hospital, I realized that there is a scope of improvement in the area of biomedical waste management. By ensuring correct practices of BMW disposal, we can not only prevent spread of diseases, but we can also prevent breeding of vectors and pathogens. We have all heard the saying, "Cleanliness is next to Godliness". All of us are well aware about the importance of safe biomedical waste disposal practices, but the challenge was to train the housekeeping staff and incorporating new and sound practices for collection, segregation and disposal of the biomedical waste of the hospital.

In this process, it was not only ensured that all staff which comes in contact with the BMW gained sufficient knowledge about it, I myself learnt various new lessons, about BMW management, and also about management of the hospital in general.

METHODOLOGY

1. PROBLEM STATEMENT

What can be done to improve the biomedical waste management in the hospital?

2. RESEARCH QUESTION

'Bio-medical waste' 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 disease.

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.

The particular research question for this study was:

What methods could be undertaken by the hospital management to ensure safe and timely disposal of biomedical waste generated by the hospital.

3. AIM

To ensure proper and timely disposal of hospital-generated biomedical waste.

4. OBJECTIVES

The objectives of this project were:

- Study of current waste disposal practices of the hospital & observe the gaps
- Formulating and introducing improved practices to ensure corrective actions for waste disposal
- Suggesting measures to achieve waste management system as per act

5. LITERATURE REVIEW

Literature available on this subject have been referred to. Available information on web-site has been studied. These efforts have helped to develop a more theoretical as well as practical knowledge of the recent developments of this subject.

The Act, protocol and statutes covered under **Bio-Medical Waste (Management and Handling) Rules, 1998** have been carefully reviewed for clear understanding of the stipulations.

- The 1998 Act in respect of the Management and Disposal of the bio-medical-waste was promulgated by the Ministry of Environment and Forest of the Union Government of India on 20th July,1998. The entire gamut of the Act ambits the total range of the subject and precisely consists of the following headings :

  - Short Title and Commencement
  - Application
  - Definition of the Generating Units
  - Duty of the Occupier
  - Treatment and Disposal
  - Segregation, Packing, Transportation And Storage
  - Prescribed Authority
  - Authorization
  - Advisory Committee
  - Annual Report
  - Maintenance of records

- Accident reporting

This Act has been elaborate towards the direction of total and comprehensive management and disposal of the bio-med-waste. It defines the Generating Units, type of the generated waste, the responsibilities of the Generating Units, technology to be ensured for treatment, methodology for handling & management of the generated waste, along with a definite time frame for total adherence by the Generating Units to all the stipulations of the Act.

While **reviewing** the Act during the process of the study, it has been felt that Indian tradition has been of resistance to adherence to any imposed rules or to any promulgation of instructions by the Statutory Body issued for mandatory implementation for suggested change over so-called traditional system.

Thus it is felt that this Act, though deals in details on all the techno-administrative aspect of the subject, is conspicuously silent about the reprimand on the defaulting Generating Units in respect of total and timely adherence of this **ACT.**

As introduction to **The Bio-Medical Act, 1998** proper, the following explanatory notes are for convenience of understanding :

Explanatory notes on the Act

- **The Act has been formulated under 12 headings as 'Rules'**
- **Under Rule No.5 & 6 , few schedules have further been added , which specify the technicality of the management & handling of the waste.**

Rule No.5 has Schedule-I, Schedule-V & Schedule-VI and
Rule No.6 has Schedule-II, Schedule-III & Schedule-IV under them

- **Under Rule No. 8 is Form-I for *'Application of Authorization'***
- **Under Rule No. 10 is Form-II giving the format of *'Annual Report'***
- **Under Rule No. 12 is Form -III for *'Accident reporting"***

Now appended below is the text of the Act:

THE BIO- MEDICAL WASTE
(MANAGEMENT AND HANDLING) RULES 1998

MINISTRY OF ENVIRONMENT AND FORESTS NOTIFICATION

NEW DELHI, 20TH JULY 1998

In exercise of the powers conferred by section 6,8 and 25 of the Environment (Protection) Act, 1986 the Central Government hereby notifies the rules for the management and handling of bio-medical waste.

1. SHORT TITLE AND COMMENCEMENT

(1) These rules may be called the Bio- Medical Waste (Management and Handling) Rules, 1998.

(2) They shall come into force on the date of their publication in the official Gazette.

2. APPLICATIONS

These rules apply to all persons who generate, collect, receive, store, transport, treat, Dispose or handle bio-medical waste in any form.

3. DEFINITIONS: In these rules unless the context otherwise requires:-

(1) "Act" means the Environment (Protection) Act 1986 (29 of 1986)

(2) "Animals House" means a place where animals are reared/kept for experiments or testing purposes;

(3) "Authorization" means permission granted by the prescribed authority for the

generation, collection, reception, storage, transportation, treatment, disposal and/ or any other form of handling of bio-medical waste in accordance with these rules and any guidelines issued by the Central Government.

(4) "Authorized person" means an occupier or operator authorized by the prescribed authority to generate, collect, receive, store, transport, treat, dispose and/ or any other form of handling of bio-medical waste in accordance with these rules and any guidelines issued by the Central Government;

(5) "Bio-medical waste" means any waste any waste, which is generated during the diagnosis, treatment or immunization of human beings or in research activities pertaining thereto or in the production or testing of biological, and including categories mentioned in Schedule I;

(6) "Biological" means any preparation made from or micro- organisms or product of metabolism and biochemical reactions intended for use in the diagnosis, immunization or the treatment of human beings or animals or research activities pertaining thereto;

(7) "Bio-medical waste treatment facility" means any facility wherein treatment disposal of bio-medical waste or processes incidental to such treatment or disposal is carried out;

(8) Occupier in relation to any institution generating bio- medical waste, which includes a hospital, nursing home, clinic dispensary, veterinary institution, animal house, pathological laboratory, blood bank by whatever name called means a person who has control over that institution and/or its premises

(9) "Operator of a bio-medical waste facility" means a person who owns controls or operates a facility for the collection, reception, storage, transport, treatment, disposal or any other form of handling of bio-medical waste;

(10) "Schedule" means schedule appended to these rules;

4. DUTY OF OCCUPIER

It shall be the duty of every occupier of an institution generating bio-medical Waste which includes a hospital, nursing home, clinic, dispensary, veterinary Institution, animal house pathological laboratory, blood bank by whatever Name called to take all steps to ensure that such waste is handled with Any adverse effect to human health and the environment

5. TREATMENT AND DISPOSAL

(1) Bio-medical waste shall be treated and disposed of in accordance with Schedule I, and in compliance with the standards prescribed in Schedule. V

(2) Every occupier, where required, shall set up in accordance with the time-schedule in accordance with Schedule VI requisite bio-medical waste treatment facilities like incinerator, autoclave, microwave system for treatment of waste, or, ensure requisite treatment of waste at a common waste treatment facility or any other waste treatment facility

6. SEGREGATION, PACKING, TRANSPORTAION AND STORAGE

(1) Bio-medical waste shall not be mixed with other wastes

(2) Bio-medical waste shall be segregated into containers/bags at the point of generation in accordance with Schedule II prior to its storages, transportation, treatment and disposal. The containers shall be labeled according to Schedule III.

(3) If a container is transported from the premises where bio-medical waste is generated to any waste treatment facility outside the premises container shall, apart from the label prescribed in Schedule III, also carry information prescribed in Schedule IV.

(4)Not withstanding anything contained in the Motor Vehicles Act, 1998 rules there under, untreated bio-medical waste shall be transported only vehicle as may be authorized for the purpose by the competent authority as specified by the government.

(5)No untreated bio-medical waste shall be kept stored beyond a period of 48 hours: Provided that if for any reason it becomes necessary to store the waste beyond such period, the authorized person must take permission of the prescribed authority and take measures to ensure that the waste does not adversely affect human health and the environment.

7. PRESCRIBED AUTHORITY

(1) The Government of every State Union Territory shall establish a prescribed authority with such members as may be specified for granting authorization and implementing these rules. If the prescribed authority comprises of more than one member, a chairperson for the authority shall be designated.

(2) The prescribed authority for the State Union Territory shall appoint within one month of the coming into force of these rules.

(3) The prescribed authority shall function under the supervision and control of the respective Government of the State Union Territory.

(4) The prescribed authority shall on receipt of form I make such enquiry as it deems fit and if it is satisfied that the applicant possesses the necessary capacity to handle bio-medical waste in accordance with these rules, grant or renew an authorization as the case may be.

(5) An authorization shall be granted for a period of three years, including an in trial period of one year from the date of issue. Therefore, an application shall be made by the occupier/operator for renewal. All such subsequent authorization shall be for a three years. A provisional authorization will be granted for the trial period, to enable the occupier/operator to demonstrate the capacity of the facility

(6)The prescribed authority may after giving reasonable opportunity of being heard to the applicant and for reasons thereof to be recorded in writing, refuse to grant or renew authorization.

(7)Every application for authorization for authorization shall be disposed of by the

prescribed authority within ninety days from the date of receipt of the application.

(8)The prescribed authority may cancel or suspend an authorization, if for reasons, to be recorded in writing, the occupier/operator has failed to comply with any provision of the Act or these rules:

Provided that no authorization, shall be canceled or suspended without giving a reasonable opportunity to the occupier/operator of being heard.

8. AUTHORISATION

(1)Every occupier of an institution generating, collecting, receiving, storing, transporting, disposing and/or handling bio-medical waste in any other manner, except such occupier of clinics, dispensaries, pathological laboratories, blood banks providing treatment/service to less than 1000 (one Thousand) patients per month, shall make an application in form I to the prescribed authority for grant of authorization.

(2)Every operator of a bio-medical waste facility shall make an application in form I to the prescribed authority for grant of authorization.
(3)Every application in Form I for grant of authorization shall be accompanied by a fee as may be prescribed by the Government of the State or Union Territory.

9. ADVISORY COMMITTEE

The Government of every State/Union Territory shall constitute an advisory committee. The committee will include experts in the field of medical and health, animal husbandry and veterinary sciences, environment management, municipal administration and any other related department or organization including non-governmental organizations. The State Pollution Control Board/Pollution control Committee shall be represented. As and when required, the committee shall advise the Government of the State/Union. Territory and the prescribed authority about matters related to the implementation of these rules.

10. ANNUAL REPORT

Every occupier/operator shall submit an annual report to the prescribed authority in Form II by 31 January, every year to include information about the categories and quantities of bio-medical wastes handled during the preceding year. The prescribed authority shall send this information in a compiled form to the Central Pollution Control Board by 31 March, every year.

11, MAINTENANCE OF RECORDS

(1)Every authorized person shall maintain records to the generation, collection, reception, storage, transportation, treatment, disposal and/or any form of handling of bio-medical waste in accordance with these rules and any guide issued.

(2) All records shall be subject to inspection and verification by the prescribed authority at any time.

12. ACCIDENT REPORTING

When any accident occurs at any institution or facility or any other site, where bio-medical waste is handled or during transportation of such waste, the authorized person shall report the accident in Form III to the prescribed authority forthwith.

13 APPEAL

Any person aggrieved by an order made by the prescribed authority under these rules may, within thirty days from the date on which the order is communicated to him, prefer an appeal to such authority as the Government of State/Union Territory may think fit to constitute:

Provided that the authority may entertain the appeal after the expiry of the said period of thirty days, if it is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.

Appended below are the Schedules (Schedule-I to Schedule VI)

SCHEDULE -I (See Rules 5)

CATEGORIES OF BIO-MEDICAL WASTE

Option	**Waste Category**	**Treatment & Disposal**
Category No.1	Human Anatomical Waste (human tissues, organs, body parts	Incineration /deep burial
Category No.2	Animal Waste (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal houses)	Incineration /deep burial
Category No.3	Microbiology & Biotechnology Waste (waste from laboratory cultures, stocks or specimens of microorganisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biological, toxins dishes and devices used for transfer of cultures)	Local autoclaving Microwaving/ incineration
Category No.4	Waste sharps (needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps	Disinfections (chemical Treatment / autoclaving/ Microwaving and mutilation Shredding
Category No.5	Discarded Medicines and Cyto-toxic Drugs (waste comprising of outdated, contaminated and discarded medicines)	Incineration / destruction and Drugs disposal in secured landfills
Category	Solid Waste (Items Contaminated with blood,	Incineration autoclaving/

No. 6	and body fluids including cotton, dressings, soiled plaster casts, lines, beddings, other material contaminated with blood)	Microwaving
Category No. 7	Solid Waste (wastes generated from disposable items other than the waste sharps such as tubing, catheters, intravenous sets etc.)	Disinfections by chemical treatment autoclaving Microwaving and mutilator Shredding
Category No. 8 Category No. 9	Liquid Waste (waste generated from laboratory and washing, cleaning, house keeping and disinfecting activities) Incineration Ash (ash from incineration of any bio- medical waste)	Disinfections by chemical Treatment and discharge Into drains. Disposal in municipal landfill
Category No. 10	Chemical Waste (chemical used in production of biological, chemicals used in disinfections, as insecticides, etc)	Chemical treatment and Discharge into drains for Liquids and secured landfill for solids.

SCHEDULE V

(See Rule 5 and Schedule I)

STANDARDS FOR TREATMENT AND DISPOSAL OF BIO-MEDICAL WASTES

- ***STANDARDS FOR INCINERATION***

All incinerations shall meet the following operating and emission standards

A. Operating Standards

1. Combustion efficiency (CE) shall be at least 99.00%
2. The Combustion efficiency is computed as follows:

$$C.E = \frac{\%\ CO_2}{\%\ CO_2 + \%\ CO} \times 100$$

3. The temperature of the primary chamber shall be 800 + 50 deg. C°.

4. The secondary chamber gas residence time shall be at least 1 (one) second at 1050 + 50°C, with minimum 3% Oxygen in the stack gas

B. Emission Standards Parameters Concentration mg/Nm3 at (12% CO2 correction)

(1) Particulate matter 150
(2) Nitrogen Oxides 450
(3) HCL 50
(4) Minimum stack height shall be 30 meters above ground
(5) Volatile organic compounds in ash shall not be more than 0.01%

Notes:

- Suitably designed pollution control devices should be installed/retrofitted with incinerator to achieve the above emission limits, if necessary.
- Wastes to be incinerated shall not be chemically treated with any chlorinated disinfectants.
- Chlorinated plastics shall not be incinerated.
- Toxic metals in incineration ash shall be limited within the regulatory quantities as defined under the Hazardous Waste (Management and Handling Rules) 19189.
- Only low sulfur fuel like L.D.O.L.S.H.S./ Diesel shall be used as fuel in the incinerator.

- ***STANDARD FOR WASTE AUTOCLAVING***

The autoclave should be dedicated for the purpose of disinfecting and treating bio-medical waste.

(I) When operating a gravity flow autoclave, medical waste shall be subjected to:

(i) a temperature of not less than 121C° and pressure of 15 pounds per square inch (psi) for an autoclave residence time of not less than 60 minutes; or

(ii) a temperature of not less than 135C° and a pressure of 31 psi for an autoclave residual time of time of not less than 45 minutes; or

(iii) a temperature of not less than 149C° and a pressure of 52 psi for an autoclave residual time of not less than 30 minutes

(II) When operating a vacuum autoclave, medical waste shall be subjected to a minimum of one pre-vacuum pulse to purge the autoclave of all air. The waste shall be subjected to the following:

(i) a temperature of not less than 121C° and pressure of 15 psi per an autoclave residual time of not less than 45 minutes, or

(ii) a temperature of not less than 135° and a pressure of 31 psi for an autoclave residual time of not less than 30 minutes.

(III)Medical waste shall not be considered properly treated unless the time, temperature and pressure indicators indicate that the required time, temperature and pressure were reached during the autoclave process. If for any reasons, time temperature or pressure indicator indicates that the required temperature, pressure or residence time was not reached, the entire load of medical waste must be autoclaved again until the proper temperature, pressure an residence time were achieved.

(IV) Recording of operational parameters

Each autoclave shall have graphic or computer recording devices which will automatically and continuously monitor and record dates, time of day, load identification number and operating parameters throughout the entire length of the autoclave cycle.

(V) Validation test

Spore testing: The autoclave should completely and consistently kill the approved biological indicator at the maximum design capacity of each autoclave unit. Biological indicator for autoclave shall be Bacillus stearothermophilus spores using vials or spore strips, with at least 1x 10 spore per milliliter. Under no circumstances will an autoclave have minimum operating parameters less than a residual time of 30 minutes, regardless of temperature and pressure a temperature less than 121C° or a pressure less than 15 psi.

(vi)Routine Test

A chemical indicator strip/tape that changes color when a certain temperature is reached can be used to verify that a specific temperature has been achieved. It may be necessary to use more than one strip over the waste package at different location to ensure that the inner content of the package has been adequately autoclaved.

- ***STANDARDS FOR LIQUID WASTE***

The effluent generated from the hospital should conform to the following limits:

PARAMETERS	**PERMISSIBLE LIMITS**
Ph	6.5-9.0
Suspended solids	100 mg/1
Oil and grease	10mg/1
BOD	30 mg /1
COD	250mg/1

Bio - assay test : 90% survival of fish after 96 hours in 100% effluent.

These limits are applicable to those hospitals which are either connected with sewers without terminal sewage treatment plant or not connected to public sewers. For discharge into public sewers with terminal facilities, the general standards as notified under the Environment (protection) Act, 1986 shall be applicable.

- ***STANDARDS OF MICROWAVING***

1. Microwave treatment shall not be used for catatonic, hazardous or radioactive wastes, contaminated animal carcasses, body parts and large metal items.
2. The microwave. System shall comply with the efficacy test/ routine tests and a performance guarantee may be provided by the supplier before operation of the unit.
3.The microwave system shall comply and consistently kill the bacteria other pathogenic organisms that is ensured by approved biological indicator at the maximum design capacity of each microwave unit biological indicators for microwave shell be bacillus subtilin spores using vials or spore strips with atheist lx104 spores per milliliter.

- ***STNDARDS FOR DEEP BURIAL***

1 A Pit or trench should be dug about 2meters deep. It should be half filled with waste, then covered with lime within 50cm of the surface, before filling the rest of the pit with soil.
2. It must be ensured that animals do not have any access to burial sites. Covers of galvanized iron/wire meshes may be used.
3. On each occasion, when the wastes are added to the pit, a layer of 10 cm of soil shall be added to cover the waster.
4. Burial must be performed under close and dedicated supervision.
5. The deep burial site should be relatively impermeable and no shallow well should be close to the site.
6. The pits should be distant from habitation, and sited so as to ensure that no contamination occurs of any surface water or ground water. The area should not be prone to flooding or erosion.
7. The location of the deep burial site will be authorized by the prescribed authority.
8. The institution shall maintain record of all pits for deep burial.

SCHEDULE VI (See Rule 5)

SCHEDULE FOR WASTE TREATMENT FACILITES LIFE INCINERATOR AUTOCLAVE/MICROWAVE SYSTEM

Appended below are the prescribed forms (Form – I to Form – III)

A. Hospitals and nursing homes in towns with population of 30 lakhs and above	By 31st December, 1999 or earlier
B. Hospitals and nursing homes in towns with population of Below 30 lakhs,	
(a) With 500 beds and above	By 31st 1999 or earlier
(b) With 200 beds and above our	By 31st December, 2000 or earlier
(c) With 50 beds and above but less than 200 beds	By 31st December 2001 or earlier
(d) With less than 50 beds	By 31st December, 2002 or earlier
C. All other institutions generating bio-medical waste not included in A and above	By 31st December, 2002 or earlier

6.2 REVIEW OF LITERATURE

This chapter deals with the review of literature, which given an insight in to the various aspects of the problem under study.

The investigator reviewed some of the literature which is relevant and use full to the present study in identifying and focusing attention on the problem and in the analysis and interpretation of data. For a better understanding of the present study, the review of literature is organized into 4 parts.

1. Literature related to knowledge on Bio medical waste management.
2. Literature related to attitudes towards Bio medical waste management.

I. Literature Related to Knowledge on Bio Medical waste management.

N. Mathar Mohideen (2006) conducted a study to assess the knowledge, attitude and attitudes of nurses regarding "Bio Medical Waste management in selected hospitals of S.N.R. District Kolar" Structured interview schedule was used to assess the knowledge, and attitude of the nurses. Observational check list was used to assess the attitudes of nurses on Bio medical waste management. Very negligible percentage of the nurses had high knowledge (1.7%) on fifths of the nurses had average knowledge (20%) and more than three fourth of the nurses had below average knowledge. In the attitudes, only 1.7 percentages of the nurses had adequate attitudes. This study concluded that only 1.7% i.e., a very negligible percentage of nurses had high knowledge and adequate attitudes.

MS Swati Onawale (2006) conducted a study to assess the knowledge and attitudes of the health team members regarding Bio medical waste segregation and disposal in the health care establishment of a village in pure district.

During the survey it was noticed that none of these clinic had the needle cutter or needle burner. There was no incinerator to incineral the biomedical waste so it was burnt in the back yard of the clinic. The study result revealed the need for in service education to the health care practitioner and therefore a teaching was conducted for them.

II. Literature related attitudes of Bio medical waste management:

Gupta S. Boojh R (2006) conducted a study on biomedical waste management attitudes at Balrampur Hospital, Lucknow, India. The study shows that infectious and non infectious wastes are dumped together with in the hospital premises, resulting in a mixing of the two, which are then disposed of with municipal waste at the dumping sites in the city. All types of wastes are collected in common bins placed outside the patient wards. For disposal of this waste the hospital depends on the generosity of the Lucknow municipal corporation, whose employees generally collect it every 2 or 3 days. The hospital does not have any treatment facility for infectious waste. The results of the study demonstrate the need for strict enforcement of legal provisions and a better environmental management system for the disposal of bio medical waste in the Balrampur Hospital, as well as other health care establishments in Lucknow. The study concluded that every health care establishment has to know about rules and regulations regarding bio-medical waste management.

III. HCW

HCW is defined as the total waste generated in health care facilities and in addition to hospitals and clinics includes waste generated by blood banks, research facilities and laboratories irrespective of the volumes, characteristics and composition (Pruss, Giroult, Rushbrook, 1999). HCW is sub-divided into health care general waste (HCGW) and health care risk waste (HCRW).

The health system is under pressure to dispose of HCW in such a way as to avoid unnecessarily high levels of environmental damage. Health care facilities worldwide are beginning to subscribe to the social goals of a cleaner and safer environment.

To manage health care waste optimally, health care providers should consider all stages of the medical product's life cycle, by looking at the medical product's upstream2 and down-stream activities (Kaiser, Eagan, Shaner, 2001).

A number of factors contribute to the volume of HCW generated by health care facilities. These factors include waste management policy, the level of economic development of a country, the size of the health care facility and the type of medical specialties practicing in a particular country (Yimer 2005). The volume of HCW generated in a heath care facility depends on numerous factors, such as 2 This concerns the product development stage, where issues such as raw materials and processes used in the production of a particular product are involved. Down-stream refers to the product life after use in terms of its effects on the environment when disposed of.

Health Waste Management in Public Clinics

The number of beds (or patients), types of health care services or medical activities provided, the economic, social and cultural status of patients and the general conditions of the area in which the health care facility is situated (Jang et al 2006; Askarian et al 2004a) An audit of HCW is necessary to understand the types and volumes of HCW generated so that an appropriate HCW management policy can be formulated (Chitnis et al 2005, Almuneef & Memish 2003).

An audit of HCW conducted in Gauteng province in South Africa identified three critical problems in the HCW management system, namely: environmental damage, occupational health, and public health. These critical problems arose as a result of excessive and incorrect manual handling of HCRW, the unsafe utilization of equipment, and the excessive emission of pollutants from HCRW treatment plants (Fischer et al 2003).

Public sector clinics in Gauteng produced HCRW at a rate of 0.002kg/patient/day to 0.5 kg/patient/day, while private sector clinics produced 0.06kg/patient/day to 0.48 kg/patient/day (DACEL 2000).

The South African Bureau of Standards (SABS 2004) developed a new SABS Code 10248:2004, entitled "Handling and disposal of waste material within health care facilities". This provides guidelines for the management of health care waste from its generation to disposal.

The SABS code 10248 of 2004 includes the following:

 Types of HCW (infectious, pharmaceutical and radioactive) and determines the classes of disposal sites for these classes of waste.
 Marking and labeling of HCW for transportation purposes.

Health Waste Management in Public Clinics

 Management's responsibilities (formulation of HCW management policy, waste management plan, assigning responsibilities, training, supervision, and workplace hygiene).
 Storage of hazardous health care waste.
 Segregation and packaging of waste prior to removal.
 Guidelines in the case of spillages of hazardous HCW.
 Treatment and disposal methods.
 Disposal by small scale generators.
 Minimum guidelines for remote rural health care facilities where legal requirements cannot be met.

2.2) Best Practices for Hospital Waste Management

Major changes have been made in the management of hazardous waste so that the requirements of the European Hazardous Waste Directive are met. In accordance with this, there has been a revision of the guidance document Safe Disposal of Clinical Waste by NHS Estates. On the basis of this, the department of Health revised the joint-agency guidance and it's publishing its final form as a 119-page document was done on the 30th November 2006, under the gateway reference 6874 (Department of health, 2006). As far as the best practice of hospital waste is concerned, this document is the latest reference from the government's end.

Moreover, it is very details and gives information regarding all aspects of waste management.

It also gives the mandatory and optional settings. This document actually replaces the Health Services Advisory Committee's guidance document _Safe disposal of clinical waste' (The Management of Health and Safety, 1999). Revision and updating of the 1999-guidance was done so that we can take into consideration, the changes in legislation

regulating the management of waste, its storage, transportation, treatment and disposal, and health and safety (Tudor 2009).

On the basis of this, concise 17-page guidance on healthcare waste had been published by the Royal College of Nursing. This guidance is widely used in UK as the best management practice. The RCN guidance include guidelines about the definition and classification of medical waste, waste segregation, waste assessments, waste audits, Accidents and incidents, training and competence and community nursing. A national color coded system is now used for the segregation of waste and is linked to an appropriate disposal path (DoH, 2006, RCN guidance on health care waste). Staffs are provided with different color coded receptacles and sack holders which should be positioned in locations close to the point of waste production and should be replaced when ¾th full, securely tied and appropriately labeled (DoH 2006). The argument here is that although this system helps in separating different types of waste, it doesn‘t actually reduce the amount of waste produced. In fact it has created some confusion among the workers to put which waste in which bin. Hence there is every chance that the waste ends up in a wrong bin especially when the bins are kept together. In a study conducted by Saini et al(2005), they found that there is a significant gap of knowledge, attitude and practices among the health care employees at the hospital.

STUDY DESIGN & METHODS

This study is Descriptive Cross-sectional study.

The data had been collected from the staff of the hospital, once before and once after a training session, organized for awareness of BMW handling. Staff was divided on the base of nature of work, i.e., nurses, doctors, and housekeeping.

Primary Data:

For this particular study, primary data was collected by observing the practices followed in the hospital for collection and treatment of waste.

Secondary Data:

The secondary data that was used in this study were the records of previous waste disposals and the various regulations prescribed by the government to ensure safe disposal of hospital-generated waste.

Sampling Method:

Stratified sampling

In the study, the various strata within which the data will be divided are based on the type of treatment required to dispose it:

- **Yellow Bag Waste** – discarded medicines, infectious waste (used bandages, gauzes, cotton, or any other things which come in contact with the human body fluids), anatomical waste, including human body parts (example placenta)
- **Red Bag Waste** – Plastic waste (like catheters, injection syringes, tubing, IV bottles)
- **Blue Bag Waste**- Sharps waste example glass pieces, syringes, etc.
- **Black Bag Waste**- Domestic waste (paper waste, food waste, dry waste etc.,)

Also, the staff was also stratified, based on the nature of their work:

- Doctors
- Nurses
- Housekeeping

Method:

- In order to improve the practice of BMW treatment, first the current process was observed
- Deviation in current process was found out from the standards set by the government for BMW disposal
- New strategies for improving management of BMW were formulated based on the overall observations in the hospital working
- Staff was educated about the new processes
- Evaluation of the new process and comparing the results with the former was done.

6. ETHICAL CONSIDERATIONS

- Patients' confidentiality was respected

- Data was used strictly for research purpose
- The collected information was kept confidential and was disclosed
- Views and opinions of the interviewees were respected and no form bias opinions were formed

1. Research Procedure Adopted

Method:

The study was divided into the following steps:

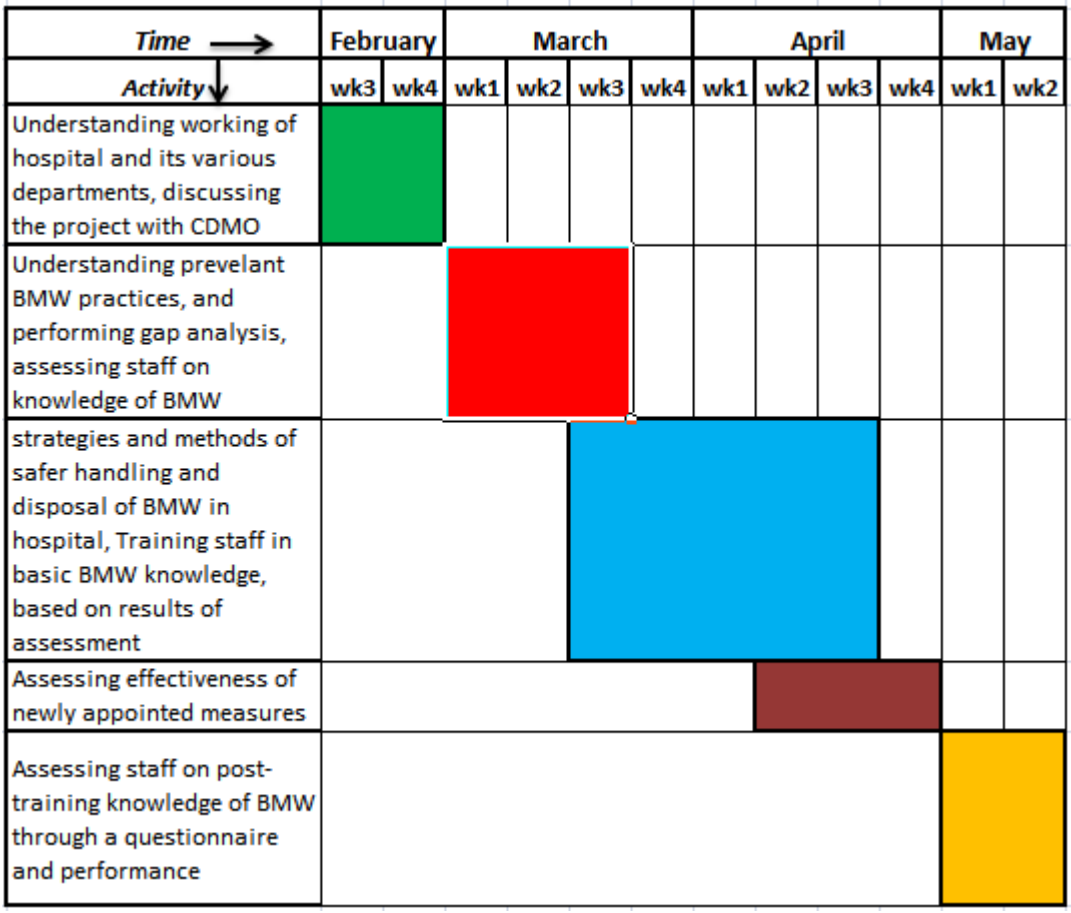


Figure 1: Activity Planning

The student spent initial 2 weeks of the dissertation period to understand the working environment of the hospital, its departments and the work culture. The topic of the project

was selected after consultation with CDMO, after realizing the crucial need for a better management of BMW practices of the hospital. The next two weeks were spent to critically analyze the prevalent practices of the BMW management, finding out areas which had scope of improvement and also to assess the knowledge of staff regarding BMW, with the help of a questionnaire (see appendix 1). Recommendations were proposed to the CDMO for improved and safer BMW collection, storage and disposal of BMW, of which, some were implemented with an immediate effect. The next step was to assess the effectiveness of the newly employed measures and whether the basic understanding of staff regarding BMW had increased or not.

2. Sampling Method

Non-Probability Sampling

Non-Probability Sampling or convenience sampling refers to when researchers take whatever individuals happen to be easiest to access as participants in a study. This is only done when the processes the researchers are testing are assumed to be basic and universal, that they can be generalized beyond a narrow sample.

For this particular study, the sample selected was the staff working in the hospital, and which came directly in contact with the BMW generated in the hospital, i.e., Doctors, nurses and housekeeping staff.

3. Research Instruments

In this study, the research instruments employed were as follows:

- **Interviews**: the housekeeping staff was interviewed to understand the process of handling of BMW, and to know the possible reasons for the gaps found in the management of BMW.
- **Checklist**: a checklist was prepared for each ward, and regular reading was made to record compliance of BMW rules.
- **On-field observations**: Daily inspection of the hospital helped in discovering many gaps in the process of BMW handling:

OBSERVATIONS:

1. Every ward has four colors (Yellow, Red, Blue, and Black) of BMW bins kept near staff /store room. These four bins are used by both the staff as well as patients.

Figure2: The 4 kinds of bins used by the hospital to collect BMW

2. Hospital staff (nurses and housekeeping), and patients use these bins for throwing waste.
3. One housekeeping staff takes out the bins in the morning from Monday to Friday.
   And the waste is collected at any time of the day, according to the convenience of the housekeeping staff.
4. Only one record register for BMW is present for the whole hospital.
5. No BMW bin is present in the Postmortem room, kitchen, NRC (Nutrition Rehabilitation center), Main medical Store.
6. The record of BMW for the whole hospital is maintained by housekeeping staff
7. Access to BMW room is very easy; anyone can enter the room as there is no lock present. The window of the room is also kept open.
   Stray dog can also reach BMW waste.

Figure 3: Door of the BMW storage Room

Figure 4: Inside the BMW storage Room

8. Black bags were seen kept in the BMW room.
9. Irregularity by the GP board vehicle is observed. Collection of waste is not scheduled, leading to piling up of BMW in the hospital campus. This waste is then burnt within the campus, without the knowledge of officers.

Figure 5: Black Bags piling up in BMW storage Room

10. Housekeeping staff use only gloves as precautionary measure to handle BMW.

Figure 6: Housekeeping Staff collecting BMW

11. During various camps organized by the hospital, like NSV (Non Scalpel Vasectomy), TL (Tubal Ligation/ Tubectomy), disability camp, mixing of BMW occurs due to overload of work amongst the housekeeping staff
12. Only one person (housekeeping staff) is responsible for removal of BMW from the hospital.

13. Discrepancy of data is observed between records of HMIS /GHIMS and actual data
14. The BMW license is renewed on an annual basis.
15. Collection and transportation of BMW occurs in an open container. No seal or label is put on the container while or after the collection.
16. At a few instances, the BMW bag was filled more than its 2/3rd capacity.
17. Sometimes spillage of BMW from containers occurs while transporting.
18. Even though a Sanitary Committee is in place, it is non-functional. No auditing of the BMW takes place.
19. The expired medicines, including syrups, are disposed-off by dissolving in water, and no official record is maintained of the same.
20. When the Macintosh / rubber bed sheets become non-usable the housekeeping staff disposes them by burning or dumping them in landfills.
21. Hospital BMW is weighed only by the agent who collects the hospital waste, and that too is done irregularly.
22. Entry of weight of BMW in records occurs only once, at the end of a month. These records are sometime manipulated.
23. In some places, like OPD, mutilators were found not functioning properly.
24. Proper segregation of waste, according to colors was not observed. On asking the in charge about this, it was found that patients use any bin for throwing waste.
25. Discarded medicines were thrown in water after removing their cover.
26. Laboratory did not use 1% Hypochlorite solution for treatment of sharp objects.

- **Questionnaire**: A total of three questionnaires were prepared.

Questionnaire # 1 (Refer to Appendix # 1)

The first questionnaire was designed to assess the knowledge of the staff regarding BMW. Basic questions were asked to the staff (doctors, Nurses and housekeeping), and the following result was obtained:

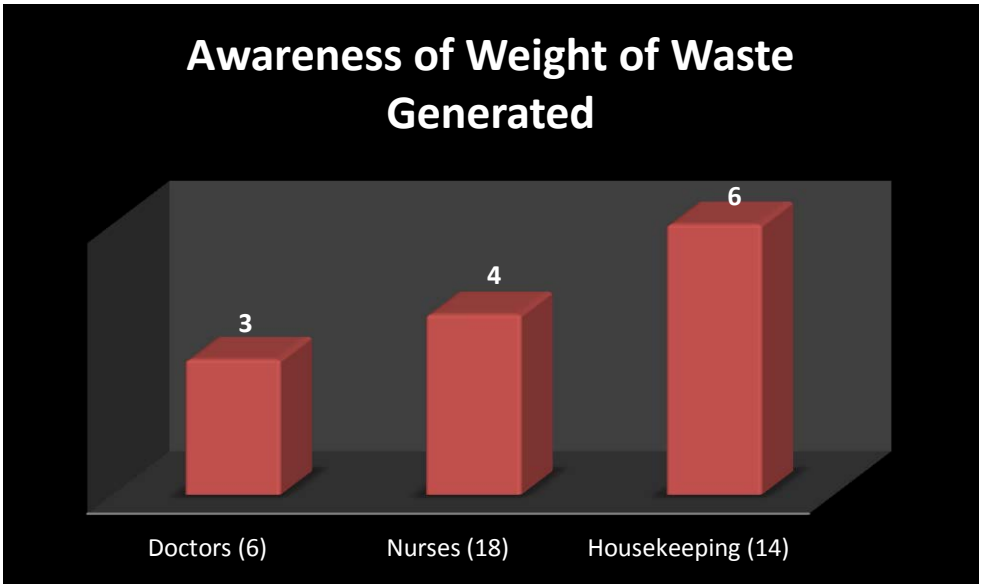


Figure 7: Awareness of Weight of Waste Generated

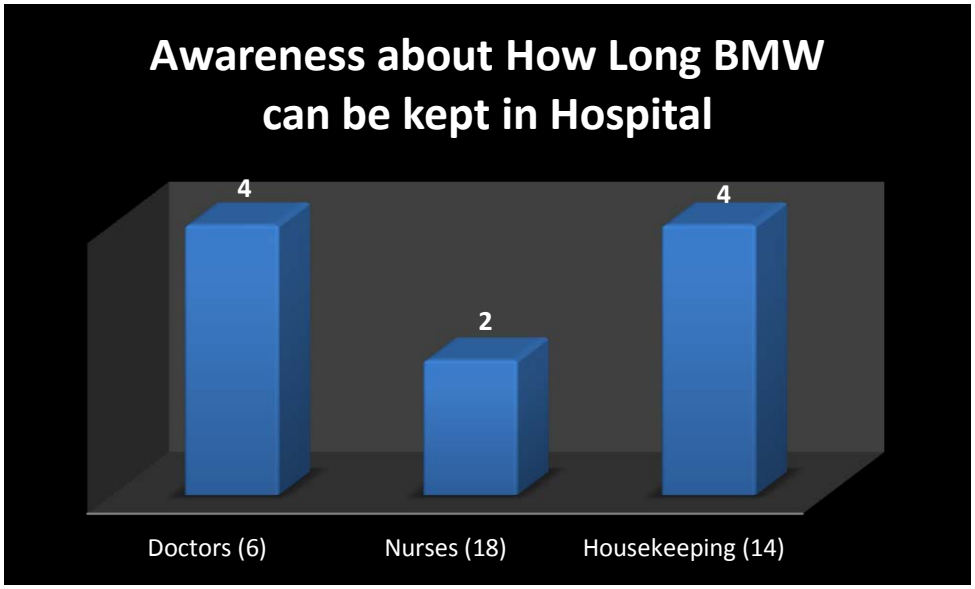


Figure 8: Awareness about How Long BMW can be kept in Hospital

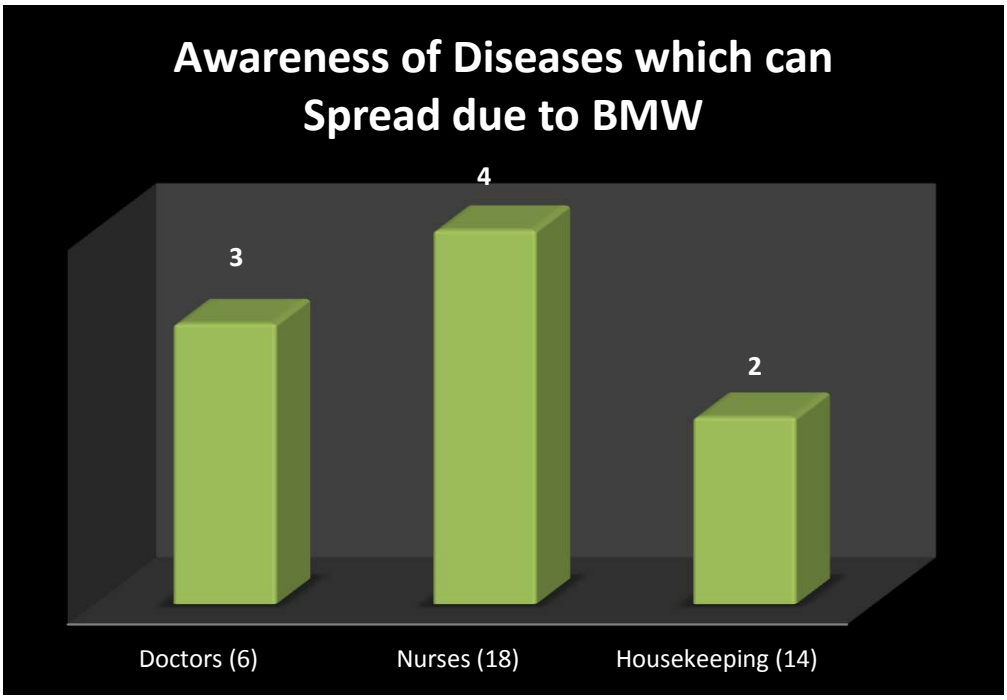


Figure 9: Awareness of Diseases whcich can Spread due to BMW

The above given figure shows that of a total of 6 doctors, 18 nurses and 14 housekeeping staff took part in this questionnaire.

Three fundamental questions were posed:

1) Do you know about the approximate BMW generated in the hospital per day?
2) Do you know for how long can we store the BMW in the hospital?
3) Are you aware of a few diseases that can be caused due to BMW?

- As we can see from the above figure, 3 doctors, 4 nurses and 6 housekeeping staff were aware of the approximate weight of BMW generated in the hospital daily.
- For the second question, about the storage period, only 4 doctors, 18 nurses and 14 housekeeping staff could answer correctly.
- The staff seemed mostly unaware about the diseases which could be spread through BMW. Only a small number of doctors (3), nurses (4) and housekeeping staff (2) could give a satisfactory answer.

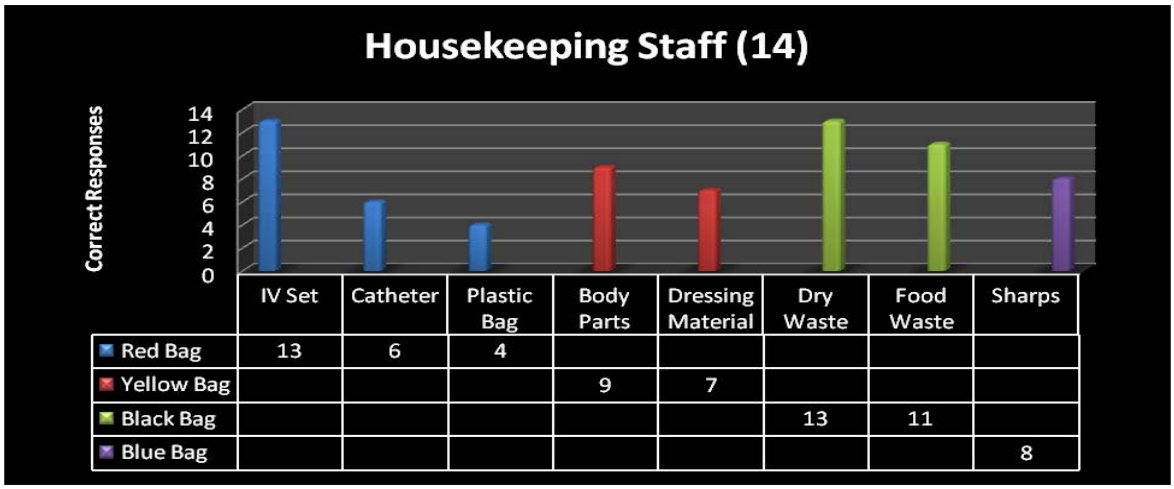
Questionnaire # 2 (Refer to Appendix # 2)

Following this, a second questionnaire was prepared to be filled by the nursing and housekeeping staff. These set of questions were framed to assess whether the staff was aware which waste is to be thrown in which bag (Red/ Yellow/ Blue/ Black). Different kinds of wastes were listed:

- Gloves
- Catheter
- Syringe
- Uro Bag
- IV set
- Plastic Bottle
- Macintosh
- Blood Bag
- Plastic Test tube
- Tubing
- Dressing Material
- Anatomical waste
- Infected Material
- Blood Material cotton
- Discarded medicine
- Sharp
- Broken Glass
- Scissor
- Glass syringe
- Ampules
- Dry waste
- Food waste
- Medicine and syringe paper

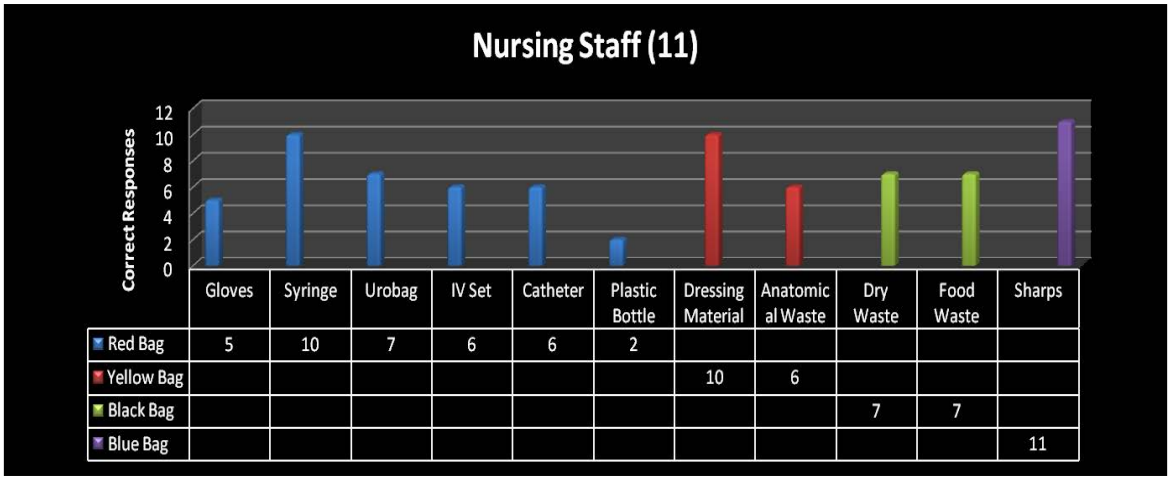
The respondents were asked to classify them according to the color of waste bag they belonged in.

Following figure depicts the result obtained from this questionnaire:



	IV Set	Catheter	Plastic Bag	Body Parts	Dressing Material	Dry Waste	Food Waste	Sharps
Red Bag	13	6	4					
Yellow Bag				9	7			
Black Bag						13	11	
Blue Bag								8

Figure 10: Pre Training Analysis of Questionnaire filled by Housekeeping Staff



	Gloves	Syringe	Urobag	IV Set	Catheter	Plastic Bottle	Dressing Material	Anatomical Waste	Dry Waste	Food Waste	Sharps
Red Bag	5	10	7	6	6	2					
Yellow Bag							10	6			
Black Bag									7	7	
Blue Bag											11

Figure 11: Pre Training Analysis of Questionnaire filled by Nursing Staff

- A total of 14 housekeeping staff and 11 nurses answered this questionnaire.
- As we can see from the graphs, the staff has fairly good amount of knowledge about the
- Almost 75% of the staff has knowledge regarding the Yellow Bag and Black Bag waste.
- For the blue bag waste, a training session is needed to make the staff aware about the waste which is thrown in the blue bag.

Training Session

A training session was then held, to educate the staff of the various segregation methods. Information of BMW that was given to the staff during this training session is as follows:

1. Rule for Bio Medical Waste 1998 0f India**:**

Any waste generated during diagnosis, treatment or immunization of human beings or any animal.

2. Color coding for various kinds of hospital generated waste
3. **Diseases** which can spread due to mismanagement of BMW:

- HIV
- Hepatitis B,C
- Hospital Acquired Infection
- Respiratory Infection
- Skin Infection,
- T.B
- Gastro-Enteric –Infection
- Skin Infection, etc.
- It also leads to Water, Soil, and Air pollution.

4. In our hospital, average weight of BMW generated per day is 12 to 15kg.
5. We are required to give an annual feedback to the Pollution Board about the hospital's BMW generation.
6. Waste should not be kept for more than 12 hours in the wards and for more than 48 hours in the hospital.
7. License of BMW of our hospital is under the CDMO.
8. Record must be maintained regularly, under supervision of the CDMO.
9. All wards in-charges, including the OPD/ Laboratory/ OT in-charge should be responsible for the regular maintenance of BMW generated in their respective wards, in terms of its weight and disposal.
10. Black bags of BMW should be burnt in incinerator. Since our hospital does not have an incinerator, we need to hand over these to the Gram Panchayat. But due to our improper segregation of waste, we end up having piles of black-bag waste
11. There should be a BMW room in every hospital and it should be maintained properly.

Questionnaire # 3 (Refer to Appendix # 2)

After this training, the same questionnaire was given to staff to be filled, and the results of the same are as follows:

Nursing Staff (11)

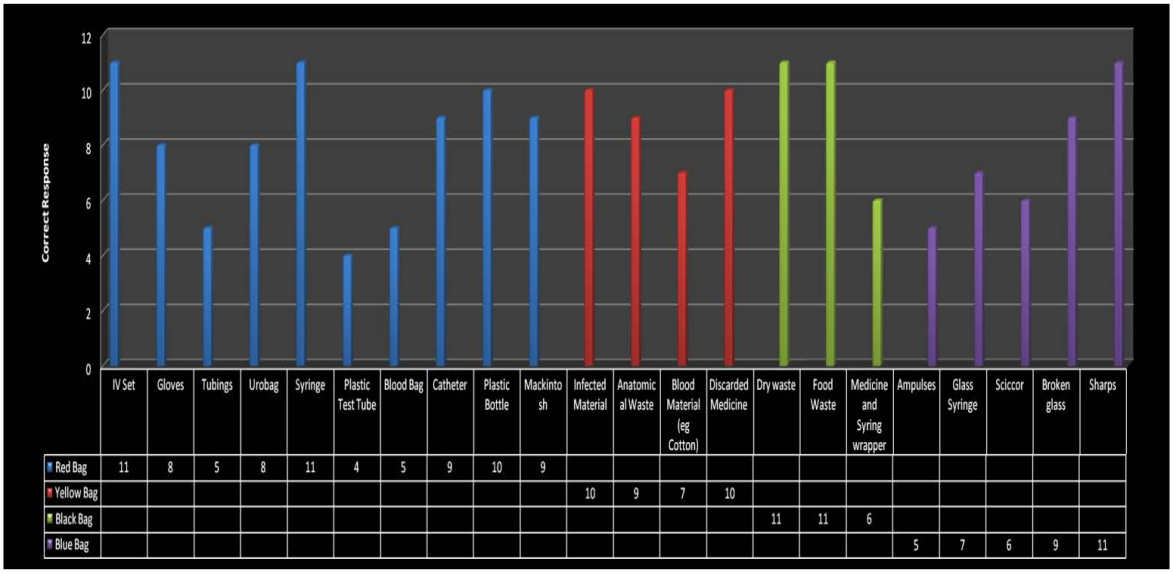


Figure 12: Post Training Analysis of Questionnaire filled by Nursing Staff

Housekeeping Staff (14)

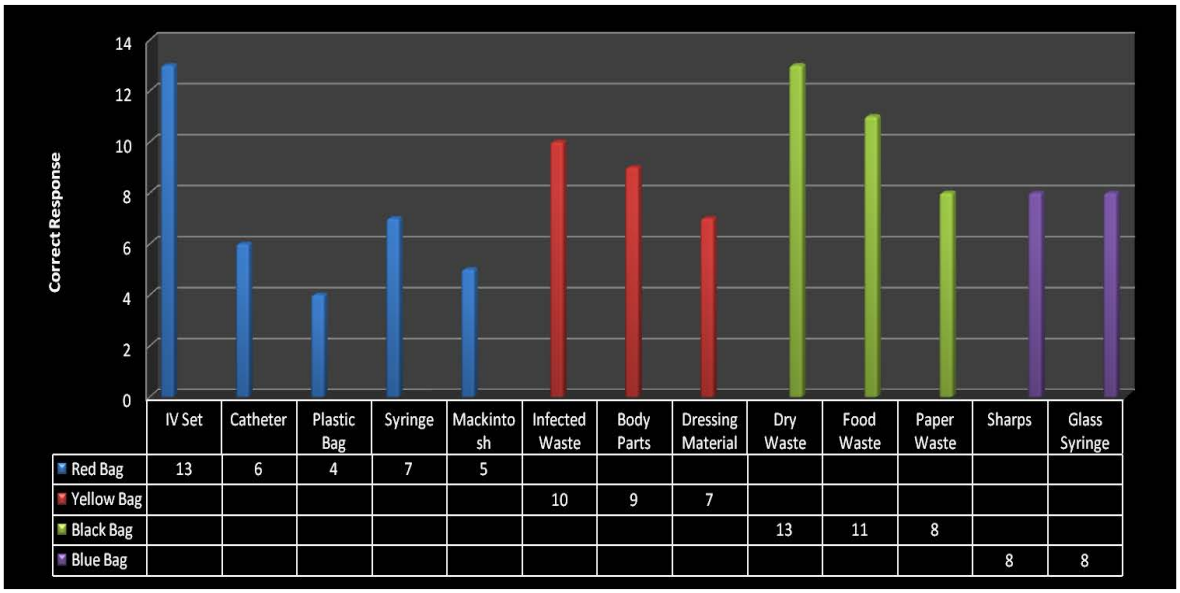


Figure 13: Post Training Analysis of Questionnaire filled by Housekeeping Staff

As we can see from the above figures, there is a considerable increase in the correct responses from the staff, as compared to the previous analysis.

RESULT

After a week of training and educating staff on safe handling of BMW, following observations were made in the hospital:

EVALUATION NEW OF PROCESS

1. There was change noticed in the timing of BMW collection. The collection van was now more regular, but the timing for collection coincided with the OPD timing.
2. Collection of BMW occurred only once a day, specifically allocated to one housekeeping staff.
3. No other staff was present as a back-up in case the specified staff was on duty or was absent.
4. Containers for BMW (in storage rooms) started being cleaned on alternate days.
5. The cleaning of BMW bins present in every ward was done on daily basis.
6. An educational poster depicting correct segregation practice of BMW was placed in every ward, and was being followed properly.
7. The housekeeping staff had started using gloves and face masks while collecting BMW.

Figure 14: Post Training Collection of BMW

8. There had been an increase in the number of black BMW bins. The position of other bins was also changed. They were not kept within the reach of patients anymore.
9. Old bins which were used for the collection of BMW had been removed from service.
10. Cutting of gloves, catheters, IV set and bottles was being done by almost all staff of the ward.
11. The frequency of BMW removal had increased during camps (NSV or TL) organized in the hospital.
12. BMW bins were been placed in the Postmortem room and the medical store room
13. Sanitary committee was already present in the hospital, as told by the CDMO.
14. But the post of Sanitary Inspector was vacant. Other members of the committee were Assistant Hospital Administrator and Dentist
15. Since the dentist was generally busy in his/her own work, he did not go for inspection rounds, and the reports were prepared only by the AHA.
16. The checklist prepared was placed in every ward (Refer to Appendix #, but a register to maintain a daily record and a weighing machine was yet to be provided in each ward
17. The records of hospital's BMW were still being maintained by a housekeeping staff. (Refer Annexure # 3)
18. Foot collector for BMW container was yet to be procured; still the same container was being used.
19. During the collection of BMW by the GPC vehicle, weighing of BMW started being inspected by AHA
20. But weighing machine was yet to be changed by GPC.
21. Mutilators were found not calibrated.
22. BMW with marked level had not been procured.
23. Contact with the Gram Panchayat was made and the black bins were collected.
24. There was no change in the condition of the expired medicines, they were being discarded in the same way. Proper records were not being maintained, and the official denied permission to keep a record.
25. Macintosh/Rubber bed sheet was being disposed off properly by putting it into in Red bag.
26. Entry weights were being recorded on a daily basis but by housekeeping staff alone.
27. Record of absenteeism of staff due to injury or general reason was not maintained.

RECOMMENDATIONS

After several discussions with the nursing and admin staff of the hospital, and analyzing the extent of changes which could be incorporated into the system, following recommendations/ corrective measures were proposed to the CDMO of the hospital:

1. An annual practical training should be given to all housekeeping staff in handling the BMW.

- A committee should be set up for BMW Management. This committee would be responsible for:
- Inspection of proper collection of BMW on a daily basis

2. Making a weekly report, which should then be submitted to the CDMO.
3. The following measures should be employed, to smoothen the collection procedure of BMW:

- Collected according to a set routine, for instance, in the morning, collection should start from the Female MW, then MMW, Eye ward, Gynea Ward, then OT, Emergency ward and then placed in the BMW room.
- In the evening, collection should start from OPD then, Female MW then MMW, Eye ward, Gynecology Ward, OT, emergency ward and then finally to the BMW room.
- Specific timing should be set for collection of BMW from the hospital, for example, 08:00 am in the morning and 06:00 pm in the evening and no other task should be undertaken during this time by the staff responsible for BMW collection.
- There should be a specific and separate way to transport the BMW from the hospital to the BMW storage room. This rout should not be inside the hospital, and must never come in contact with the patients.

4. Standard Operating Procedures should be formulated and followed for management of BMW.
5. For example, allotting specific housekeeping staff in morning and evening shifts, to collect BMW and also to handover duty, in case of absenteeism.
6. The staff which would handle the BMW should have proper understanding of the procedure and hazards of BMW. He/she should also be educated in advance about all the diseases which may spread due to BMW.
7. A record register should be placed and regularly updated in each ward.

8. Each ward of the hospital should have a weighing machine.
9. BMW should be collected in a safe and sealed container.
10. GPC vehicle should have proper timing.
11. Position of red, yellow and blue bins in the wards should be such that they are out of reach for patients. Often it was found that patients used these bins, rather than using black bins for throwing food and other domestic waste. Because of this, these bins get filled very quickly, and they are not emptied in time, sometimes for days together.
12. Often it was found that the patients use the BMW bins to throw domestic waste like food waste. Since the housekeeping staff is already overloaded with work, they can't keep a check on this. This leads to filling of the BMW bins, which sometimes require to be changed thrice in one day.
13. Proper cleaning of BMW plastic bins, BMW room, the place of storage of these bins, and the main BMW container should be mandatory.
14. There should be more frequent removal of the BMW during like NSV and TL.
15. The Mutilator should be repaired, calibration should occurs periodically and the BMW committee /sanitary committee should be given the responsibility to keep this records
16. A checklist to collect BMW should be placed in every ward, and the time at which the waste is collected should be noted by the ward in charge. At the end of the week, this list should be collected by the sanitary committee.
17. BMW handler should wear Gloves, Face mask, Head mask, Apron and Shoes.
18. BMW bins should have the symbol of BMW. If the container has cytotoxic waste, then symbol of cytotoxicity should be present on it.
19. Weighing of BMW should be monitored on a daily basis.
20. BMW audit team should keep a record of Absenteeism of staff due to hospital acquired infection, and any others injuries like Needle stick injury ,or any other disease related to the BMW should also be recorded.
21. A chart depicting proper segregation of BMW with categories should be placed in every ward.
22. Medical stores and Post mortem room should also have BMW bins.
23. BMW bins should have a mark to indicate the level till where it should be filled.

24. BMW bins should be cleaned with soap and disinfectant daily or else weekly.
25. Monthly meeting should take place of .Members of sanitary team. Topics like monthly injuries that occurred due to BMW, gaps and recommendations should be discussed.
26. Chemical treatment of sharps should be for a minimum of 30 minutes .
27. 1% Hypo chlorite solution must be used in every ward and in the lab.

CONCLUSION

In Indian scenario, ever increasing environmental pollution has become a menace. While **cause** of health hazards is the increasing environmental pollution, the **effects** are Hepatitis, Typhoid fever, Tuberculosis, Diarrheal infection, Malaria or the recent flare-up of the Dengue fever.

As medical practitioners, we are very sincere to fight out the effects through administration of vaccination, but we do lack in sincerity to fight out the cause.

It is in this light, re-thinking is necessary in respect of management and disposal of the bio-medical-waste.

Implementation of the Act is definitely one aspect of controlling the menace of the bio-medical-waste, but more stress is required in creation of Authority to force implementation of the provisions of the Act.

While major step has been taken towards management of the bio-med-waste with the formulation of the provisions of the Act, few more steps need 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 the healthy"***

APPENDIX

Appendix 1

Pre Training Questionnaire

Structured Questionnaire

Section # 1

The information collected through this questionnaire is purely for research purpose and will be kept confidential.

1. What is Bio Medical Waste?

☐ Waste of home

☐ Waste from society

☐ Waste of hospital

☐ Don't know

2. Are you aware that hospital waste /Bio Medical Waste is segregated?

☐ Yes

☐ No

3. If yes, why it is segregated?

☐ Because it is hazardous

☐ It is only a government formality

4. How many different colored bags are used for segregation of BMW?

☐ 5

☐ 4

☐ 2

☐ don't know

5. What are the colors that are used for bags of BMW ?

☐ Green , Yellow , Black , White

☐ Green , Yellow, Black , Red

☐ Red, Blue , Black, Yellow

☐ Red , Blue , Black , white

☐ don't know

6. Is BMW hazardous ?

☐ Yes

☐ No

☐ It is only a government formality

☐ Don't know

The information collected through this questionnaire is purely for research purpose and will be kept confidential.

7. For how many hours can we keep the Bio Medical Waste in a hospital ?

☐ 72hours

☐ 48hours

☐ 24 hours

☐ Don't know

8. What are the precaution to be taken while handling BMW ?

☐ Apron , Goggles, Gloves, Face mask

☐ Only gloves

☐ Only mask

☐ Only apron

9. What do we do with the BLACK bag waste?

☐ Burn anywhere

☐ Dump anywhere

☐ Burnt in Incinerator

☐ Don't know

10. Do you know the quantity of waste generated every day?

☐ Yes

☐ No

11. If yes, then how much?

☐ Amount _____(Kg)

☐ Approximate _____(Kg)

12. Are you aware of any legislation for BMW / hospital waste?

☐ Yes

☐ No

13. Do you know where the Bio Medical Waste is disposed?

☐ Yes

☐ No

14. Do you know the requirements of the BMW room /store room?

☐ Yes

☐ No

15. Is there maintenance of BMW record?

☐ Yes

☐ No

16. Who keeps the record of BMW? (only designation to be mentioned)

_____

17. Have you undergone any formal training for BMW?

☐ Yes

☐ No

☐ Don't know

18. Do you think there is any need of training for handling the BMW waste?

☐ Yes

☐ No

19. Do you think you should have knowledge of Waste Management?

□ Yes

□ No

20. Is it required to make notes regarding the BMW / Hospital Waste and is it of any importance?

□ Yes

□ No

21. Do you know of any disease which can occur to the hospital staff due to BMW / Hospital waste?

□ Yes

□ No

22. If yes, mention any one disease?

_____

*****

Structured Questionnaire

The information collected through this questionnaire is purely for research purpose and will be kept confidential.

Section # 2

Please provide the following information:

1. Gender

□ Male

□ Female

2. Age range (in years)

□ 20 to 30

□ 30 to 40

□ 40 to 50

□ 50 to 60

□ 65 above

3. Education

□ below 10^{th}

□ 10^{th} pass

□ 12^{th} pass

□ Diploma

□ Graduate

□ Post Graduate

4. **Designation**

_____

5. Length of service

□ below 1year

□ Between 1to 3 years

□ 3 to 5 years

□ 5 to 10 years

□ 10 to 15 years

□ 15 to 20 years

□ 20 to 25 years

□ 25 to 30 years

□ 30 years and above

*****

Appendix # 2

Information about segregation of Bio Medical Waste

What all can be disposed-off in the following kinds of bins?

Ward In charge Name _____

Ward Name _____

Signature _____

RED BAG

……..

……. .

Yellow Bag

……..

……

Blue/white Bag

……

……..

……

……..

Black Bag

……

…….

……

……

Appendix # 3

BIO MEDICAL CHECKLIST

GENRAL CIVIL HOSPITAL

AHWA, DANG

S. No.	Checklist	Detail	Y/ N
	No of beds		
	Name of departments		
	Name of ward in charge		
	Adequate no. of BMW Bins (Red ,Yellow, Blue, and Black)		
	Container for needle present?		
	Mutilators (Needle/syringe cutter) available?		
	If yes, is it in proper working condition?		
	Weighing machine available?		
	1% fresh Sodium Hypochlorite solution available?		
.	BMW record register present?		
.	Was BMW collected today, and at proper timing (9.a.m)?		
.	Was the BMW weight registered?		
.	Were BMW bins filled more than the marked level?		
.	Were bins cleaned with soap and disinfectant?		
.	Was the waste transported in closed container?		
.	Did the housekeeping staff use protection while handling BMW (like Gloves, Apron,		

	Shoes, Face mask)?		
.	Was plastic waste like IV set, Bottles, Syringes, latex gloves, catheters, cut by scissors before disposal?		
.	Were the bins sealed during collection of BMW?		
.	Did BMW collection occur from predefined route?		

Appendix # 4

FORM - I (See Rule 8)

APPLICATION FOR AUTHORISATION

(To be submitted in duplicate)

To

The prescribed authority (Name of the state Gout / UT Administration)

Address :

1. Particulars of Applicant**……**

(i) Name of the Applicant

(In block letters & in

full)**……**

(ii)Name of the institution:

……

Address:

Tele No.,……. Fax No **…….**

2. Activity for which authorization is sought:

- Generation
- Collection
- Reception
- Storage
- Transportation
- Treatment
- Disposal
- Any other form of handling

3. Please state whether applying for fresh authorization or for renewal:

(In case of renewal previous authorization number and date

4. (i) Address of the institution handling bio- medical wastes:

(ii) Address of the place of the treatment facility:

(iii) Address of the place disposal of the waste:

5. (i) Mode of transportation (in any) of bio-medical waste:

(ii) Mode (S) of treatment:

6.Brief description of method of treatment and disposal (attach details):

7. (i) Category (see Schedule I) of waste to be handled

(ii) Quantity of waste (category-wise) to be handled per month

8.Declaration

I do hereby that the statements made and information given are true to the best of my Knowledge and belief and that I have not concealed any information.

I do also hereby undertake to provide any further information sought by the prescribed authority in relation to these rules and to fulfill any conditions stipulated by the prescribed authority.

Signature of the applicant

Designation of the applicant

Date :

Place :

Concluded.

FORM II (See rule 10)

ANNUAL REPORT

(To be submitted to the prescribed authority by 31 January every year)

1. Particulars of the applicant:

(i) Name of the authorized person (occupier/operator)

(ii) Name of the institution:

Address

Tel No.

Telex No.

Fax No.

(2) Categories of waste generated and quantity on a monthly average basis:

(3) Brief details of the treatment facility:

In case of off-site facility:

Name of the operator :

(1) Name and address of the facility:

Tel. No.: Telex No: Fax No.:

4. Category wise quantity of waste treated:

5. Mode of treatment with details:

6. Any other information:

7. Certified that the above report is for the period

from**……..…**to**……**

Signature ……

Place**……** Designation**…….**

FORM III (See Rule 12)

ACCIDENT REPORTING

1. Date and time of accident:

2. Sequence of events leading to accident

3. The waste involved in accident

4. Assessment of the effects of the accidents on human health and the Date environment:

5. Emergency measures take:

6. Steps taken on alleviate the effects of accidents:

7. Steps taken to prevent the recurrence of Such as accident

2. BIBLIOGRAPHY:

Books:

- Text Book of Preventive and Social Medicine
  K. Park

- Bio-Medical Waste (Management & Handling) Rules,1998
  A.K. Sharma

- Disposal of Hospital Wastes in Bangalore & their Impact on Environment
  H.V.N. Rao

- The Book of Hospital Waste Management, 2000

Web:

http://www.cwejournal.org/vol7no1/need-of-biomedical-waste-management-system-in-hospitals-an-emerging-issue-a-review/

http://www.delhi.gov.in/wps/wcm/connect/doit_health/Health/Home/Directorate+of+Health+Services/Biomedical+Waste+Mgmt