

## A Study of the Bio-Medical Waste Management in a Teaching Hospital (NCMC and Hospital, Panipat)

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**Abstract: Background:** Biomedical Waste means any waste, which is generated during diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining thereto or in the production or testing of biological, and including categories as mentioned in the Bio-medical Waste (Management and Handling) Rules, 1998. This is now a statutory requirement for Indian Hospitals. **Aim:** To Study the implementation of various processes to comply with the statutory provisions of Bio-Medical Waste Management Rules, 2016. **Objective:** To assess the current status of Bio-Medical Waste Management at N.C. Medical College and Hospital, Gap Analysis vis-a-vis Bio-Medical Waste Management Rules, 2016, To initiate necessary interventions for ensuring compliance with new BMW Management of Rules, 2016, Assess the impact of the implementation strategy and to recommend further interventions, if necessary. **Materials and Methods:** This Prospective and Retrospective study has been conducted in a three year old, 330 bed's hospital at Israna, Panipat affiliated with NC Medical College. The College has obtained 'Letter of Permission' from Medical Council of India in 2016. Consequently, the first batch of 150 students is undergoing training for degree of MBBS since October 2016. The study has been conducted from the duration from March 2017 through June 2017. This study is based on both primary and secondary sources. Secondary data regarding hospital waste management techniques was collected from internet sources, books, journal articles, and reports. **Results:** Total waste generated during the period of October 2016 to May 2017 was 21579 kg. This comes to 0.51 kg per patient per day. The segregation of BMW according to the categories represents that the maximum BMW generated is in Yellow category comprising of 69.23%, red 19.23%, blue 7.69% and white 3.84% respectively. The total general waste for the month of May 2017 was 2471 kg, maximum waste generated from wards 1263 kg (51.10%) and minimum from Administrative areas 58 kg (2.34%). **Conclusion:** Cost effective system for providing better medical waste treatment facilities along with generation of awareness to reduce and recycle the waste is necessary to sustain the environment. The Bio-Medical Waste Management Rules 2016, have holistically addressed the issue of safe of hospital wastes.

**Keywords:** Biomedical waste, hospital, infection, segregation, transport and treatment.

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### I. Introduction

The waste produced in the course of healthcare activities carries a higher potential for infection and injury compared to other types of waste. Therefore, it is essential to have a safe and reliable method for its handling; else it may result in serious public health consequences and significant impact upon the environment.

The focus on the environment protection and waste management worldwide has led to numerous legislations in various countries.

Biomedical Waste means any waste, which is generated during diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining thereto or in the production or testing of biological, and including categories as mentioned in the Bio-medical Waste (Management and Handling) Rules, 1998. This is now a statutory requirement for Indian Hospitals.<sup>1</sup>

Between 75% to 90% of waste produced by the health care providers is non-risk or general waste, comparable to domestic waste. The remaining 10-25% waste is regarded as hazardous and may create a variety of health risks.<sup>2</sup>

Bio-medical (management and Handling) rules, 1998 were notified by the Ministry of Environment and Forest (MoEF) under the Environment (Protection) Act, 1986.

In exercise of the power conferred by the Section 6, 8 and 25 of the environment (Protection) Act, 1986 (29 of 1986), and in supersession of the Bio- Medical Waste (Management and Handling) Rules, 1998 and further amendments made thereof, the Central Government vide G.S.R. 343(E) dated 28<sup>th</sup> March, 2016 published the Bio- Medical Waste Management Rules, 2016.

These rules apply to all persons who generate, collect, receive, store, transport, treat, dispose, or handle bio medical waste in any form including hospitals, nursing homes, clinic, dispensaries, veterinary institutions, animal houses, pathological laboratories, blood bank, Ayush hospitals, clinical establishments, research or educational institution, health camps, medical or surgical camps, vaccination camps, blood donation camps, first aid rooms of schools, forensic laboratories and research labs.

The 'Prescribed Authority' for enforcement of the provision of these rules in respect of all the health care facilities located in any State/Union Territory is the respective State Pollution Control Board (SPCB)/Pollution Control Committee (PCC) and in case of health care establishments of the Armed Forces under the Ministry of Defense shall be the Director General, Armed Forces Medical Services (DGAFMS). These rules stipulate duties of the Occupier or Operator of a Common Bio- Medical Waste Treatment Facility as well as the identified authority. According to these rules, every occupier handling bio-medical waste, irrespective of the quantity is required to obtain authorization from the respective prescribed authority i.e. State Pollution Control Board and Pollution Control Committee, as the case may be. These rules consist of four schedules and five forms.

In a press release on 27 March 2016, Shri Prakash Javadekar, Union member of State(IC) Environment, Forest and Climate Change released the new Bio-medical Waste Management Rules, 2016. He said, "The New Bio-medical Waste Management Rules will change the way country used to manage its waste earlier. Thus it will make a big difference to Clean India Mission."<sup>3</sup>

A three year old, 330 bed hospital at Israna, Panipat has been affiliated with NC Medical College. The college has obtained 'Letter of Permission' from Medical Council of India in 2016. Consequently, the first batch of 150 students is undergoing training for degree of MBBS since Oct 2016.

Bio-Medical Waste Management being a contemporary topic has been selected for this study in consultation with the Hospital Administrator of NC Medical College and Hospital. The hospital is required to comply with the statutory provisions of the 2016 Rules in the prescribed time bound schedule, which shall be regulated by the Haryana State Pollution Control Board.

The purpose of this study is to document existing resources, infrastructure and practices related to BMWM at the hospital.

## **AIMS AND OBJECTIVES**

To Study the implementation of various processes to comply with the statutory provisions of Bio-Medical Waste Management Rules, 2016.

### **Objective:**

To assess the current status of Bio-Medical Waste Management at NC Medical College and Hospital.

1. Gap Analysis vis-a-vis Bio-Medical Waste Management Rules, 2016.
2. To initiate necessary interventions for ensuring compliance with new BMW Management of Rules, 2016.
3. Assess the impact of the implementation strategy.
4. To recommend further interventions, if necessary.

## **II. Materials And Methods**

**PLACE OF STUDY:** This study has been conducted in a three year old, 330 bed's hospital at Israna, Panipat affiliated with NC Medical College. The College has obtained 'Letter of Permission' from Medical Council of India in 2016. Consequently, the first batch of 150 students is undergoing training for degree of MBBS since October 2016.

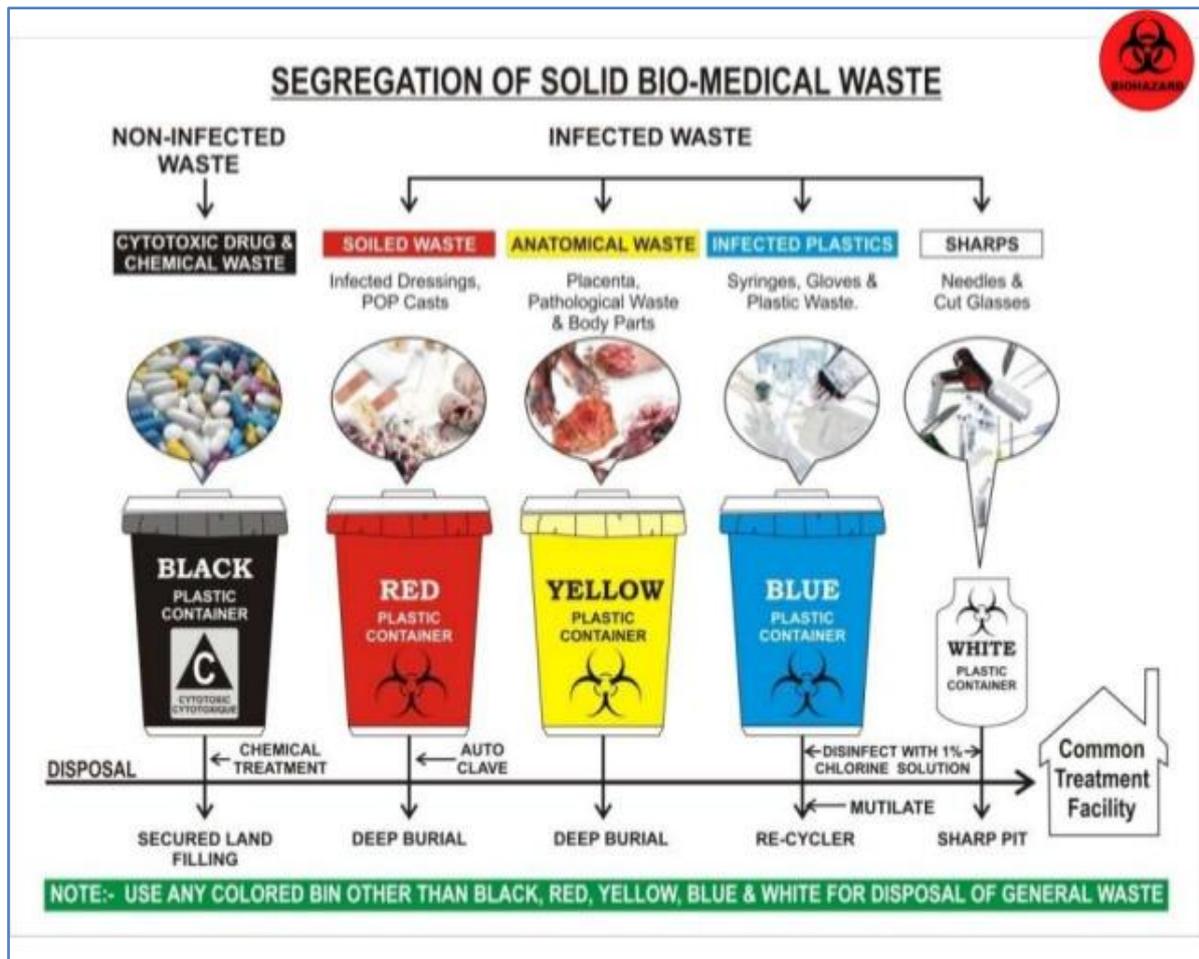
**PERIOD OF STUDY:** The study has been conducted from the duration from March 2017 through June 2017.

**TYPE OF STUDY:** Perusal of records, Personal interviews, Prospective and Retrospective study.

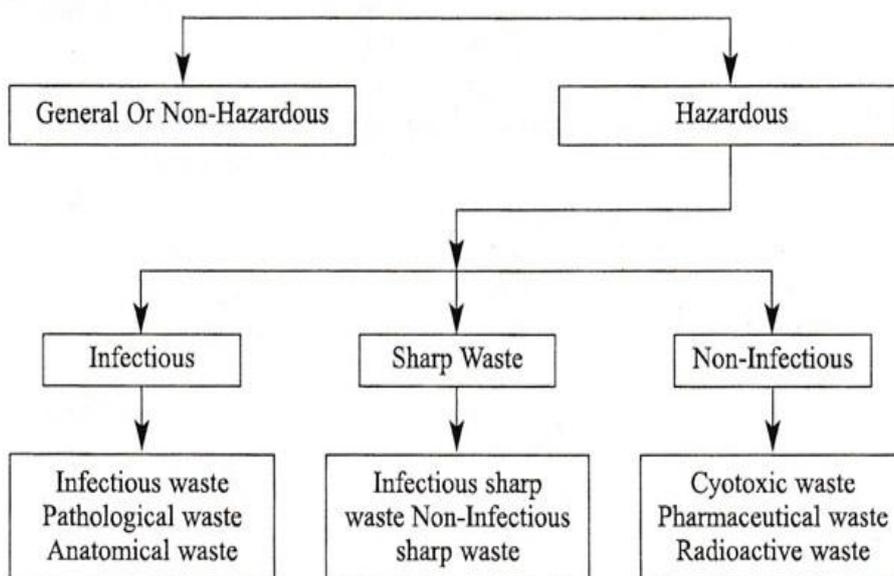
### **METHODS:**

This study is based on both primary and secondary sources. Secondary data regarding hospital waste management techniques was collected from internet sources, books, journal articles, and reports. Qualitative methods were used to collect primary data, including interviews with key informants using question guides composed of both open and close ended questions. Interviews were held with the hospital's staff, doctors, administration and general public living near the dumping sites. To view onsite conditions of the hospital waste and to collect visual data, field visits were made where personal experience was used and observations were

made. Data collected was compiled and analyzed. Percentage and proportion were used for interpretation of findings. The findings have been compared with the published literature on this subject.



**Fig. 1: Characterization and classification of biomedical waste**



**Fig. 2: Showing a detailed classification of Hospital waste**



**Fig.4: Showing colour coding of container for biomedical waste.**



**Fig.5: Showing poster and colour coded container.**



Fig.6: Showing transportation of biomedical waste for treatment.

### III. Results

NC Medical College and Hospital was granted LOP (Letter of Permission) in Aug 2016 for establishing a medical college with capacity of 150 MBBS student admissions in a year. A Hospital of 330 beds is a mandatory requirement. The college and the hospital are located in the same campus.

Table 1: Distribution of beds in the hospital.

S. No.	Department	No. of Beds
1	General Medicine	72
2	Paediatrics	24
3	TB and Chest	8
4	Skin and VD	8
5	Psychiatry	8
6	General Surgery	90
7	Orthopaedics	30
8	Ophthalmology	10
9	ENT	10
10	Obstetrics	25
11	Gynaecology	15
12	ICCU	5
13	ICU	5
14	PICU/NICU	5
15	SICU	5
16	Casualty	10
17	Total beds	330

In addition to the wards shown above, the usual departments such as outpatient, inpatient, operation theatres, labour room, laboratory, blood bank, pharmacy, CSSD, laundry, kitchen, administrative, engineering, mortuary, etc. are functioning.

Since inception of the hospital Bio-Medical Waste Management at the hospital is being observed as per the erstwhile rules of 1998 (as amended). However, since 2016 Rules have come into force the Hospital is in the process of transition to conform with the new rules. The salient changes in the new rules and progress on implementation is shown below.

Table 2: Showing progress in compliance to biomedical waste management rules.

S. No.	Items	Progress
1.	Provision within premises for a safe ventilated and secure location for storage of segregated biomedical waste in coloured bags or containers as per schedule: a. Segregation of waste in yellow, red, blue and white bags. b. Blood bags, microbiology waste is pre treated at site. c. puncture proof containers for sharps, needles and syringes.	a. Being done b. being done by Autoclave and chemical treatment with sodium hypochlorite as appropriate.

		c. being done besides needle destruction and syringe needle cutting.
2.	Plastic bags as per BIS standards when published, non chlorinated bags is to be obsolete within 2 years from date of manufacturing.	Shall be procured ex trade when BIS rules published and manufacturing begins.
3.	Mutilation and shredding to prevent reuse	Needle destroyer and syringe cutter, then sent to CBWTF.
4.	No chemical treatment before incineration(except microbiology,laboratory and highly infectious waste)	Being complied
5.	Cytotoxic drugs disposal to be returned to the manufacturer.	No cytotoxic drugs being used by the hospital.
6.	Installation of incinerator not permitted.	Incinerator not installed,BMW handed over to CBWTF
7.	Standards for autoclaving- temperature and pressure recording,validation by biological indicator and spore testing.	Being done
8.	Liquid waste standards	Being done, some systems are under installation and testing.
9.	Labelling for biohazard	Being done.
10.	Application for renewal of authorization on Form 2 (new form)	Being done
11.	Authorisation by pollution control board on form 3 (new form)	Application submitted and authorization awaited from HPCB
12.	Annual report on Form4 (new form)	Submitted
13.	Not to treat Biomedical waste with municipal waste.	Being segregated, no mixing.
14.	Provide training to all health care workers involved in handling of Biomedical waste at the time of induction and at least once a year. Details of training programme conducted, no. of personnel trained and not trained to be given in the annual report.	All existing workers trained. Refresher training planned half yearly. New worker shall be trained at time of induction.
15.	Wearing of PPE by HCW's- gloves, mask, apron, boots, goggles, while handling BMW.	Wearing apron, gloves and mask. Boots and goggles to be procured.
16.	Immunise all healthcare workers and others involved in handling of Bio medical waste for protection against Hepatitis B and Tetanus.	Some workers have been immunized,remaining workers shall be immunized in batches.
17.	Establish bar code system for bags/containers for waste being sent outside premises.	The CBWTF shall establish the system soon.
18.	Pretreatment of liquid chemical waste at source before mixing with other effluents.	Being done.
19.	Health checkup at time of induction and atleast once a year for all health care workers and maintain records.	Being done in batches, shall be completed soon.
20.	Maintain upto date day to day basis the BMW management and display on website.	Shall be done after modification of website.
21.	Report accidents to prescribed availability on Form 1 on occurrence and in annual report.	Shall be complied with.
22.	Display annual report on website.	Shall be done after modification of website.
23.	Establish Bio medical waste management committee to monitor and review the system halfyearly basis and submit minutes in annual report.	Being done

**Table 3: Showing month wise distribution of biomedical waste (October 2016- May 2017)**

Month	No. of Patients	Patient Days	Total waste	Categories of BMW				BMW total	BMW%	Black	Black (%)
				Yellow	Red	Blue	White				
Oct'16	215	5173	2638	365	90	40	6	501	18.99%	2137	81%
Nov'16	221	5308	2707	396	92	48	7	542	20.16%	2165	79.97%
Dec'16	228	5570	2841	435	89	66	6	596	20.97%	2245	79%
Jan'17	233	5282	2694	476	128	60	6	670	24.87%	2024	75.12%
Feb'17	256	5226	2665	389	108	56	7	560	21%	2105	78.98%
March'17	243	4969	2534	298	72	30	5	405	15.98%	2129	84%
April'17	228	5149	2626	280	75	34	5	394	15%	2232	84.99%
May'17	240	5636	2874	292	76	31	5	403	14.05%	2471	85.97%
Total		42313	21579	2991	752	375	47	4071		17508	

**Table 4: Showing distribution of biomedical waste of May 2017 month**

Month	Source	Yellow	Red	Blue	White	Total	%
May'17	Casualty and OPD	36	9	4	2	51	12.65%
	Laboratory and Blood Bank	18	5	2	1	26	6.45%
	Wards	146	37	18	4	205	50.87
	Operation theatre	58	15	4	3	80	19.85%
	Labor room	28	7	4	2	41	10.18%
Total		286	73	32	12	403	

**Table 5: Showing generation of waste from Casualty and OPD**

Category	Total waste	%
Yellow	36	70.58%
Red	9	17.64%
Blue	4	7.84%
White	2	3.92%
Total	51	100%

**Table 6: Showing laboratory and blood bank wise distribution of biomedical waste.**

Categories	Waste	%
Yellow	18	69.23%
Red	7	19.23%
Blue	2	7.69%
White	1	3.84%
Total	26	100%

**Table 7: Showing ward wise distribution of biomedical waste.**

Categories	Waste	%
Yellow	146	71.20%
Red	37	18.00%
Blue	18	8.78%
White	4	1.95%
Total	205	100%

**Table 8: Showing Operation theatre wise distribution of biomedical waste.**

Categories	Waste	%
Yellow	58	72.50%
Red	15	18.75%
Blue	4	5.00%
White	3	3.75%
Total	80	100%

**Table 9: Showing Labour Room wise distribution of biomedical waste.**

Categories	Waste	%
Yellow	28	68.29%
Red	7	17.00%
Blue	4	9.75%
White	2	4.87%
Total	41	100%

**Table 10: Showing General waste generation in various areas of hospital**

Categories	General waste	%
Casualty and OPD	85	3.43%
Laboratory and Blood Bank	95	3.84%
Wards	1263	51.10%
Operation theatre	150	6.07%
Labor Room	70	2.83%
Stores and Engineering	270	10.92%
Administrative areas	58	2.34%
miscellaneous (surrounding areas/)	480	19.42%
Total	2471	100%

#### IV. Discussion

Biomedical waste is any waste in the form of solid or liquid, including its containers and any product, which are generated during the treatment, diagnosis and immunization of human beings and animals in research. Basically health care wastes refer to all wastes produced which are discarded and not intended for any further use in hospitals.<sup>4</sup> Many synonyms to medical waste exist and they are currently used interchangeably in different parts of the world and in different scientific journals. A study reported that some of the easily come across synonyms are clinical waste, hospital waste and bio-medical waste. The WHO uses the term “healthcare waste” in reports and other official publications.<sup>5</sup>

Al-Mutair et al., (2004) defined medical waste as any solid or liquid waste capable of causing infectious diseases generated as a result of patient diagnosis, treatment or in related research through the immunization of humans and animals.<sup>6</sup> Phillips (1999) defined clinical waste as: - waste arising from the investigation, treatment or in medical care of patients.<sup>7</sup> According to Pruss et al. (1999) Health care waste 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.<sup>8</sup> Abor and Bouwer (2008) focus their definition to include all types of wastes produced by health facilities such as general hospitals, medical centers and dispensaries.<sup>9</sup> WHO (2005) considered the BMW is a byproduct of hospitals that includes sharps, non-sharps, body parts, blood, chemicals, medical devices, radioactive materials and pharmaceutical products. Medical wastes constitute a larger part of hazardous wastes.<sup>10</sup>

The generation of these wastes is an ongoing phenomenon as long as human Civilization persists. Hospital waste is sub-divided into health care general waste (HCGW) and health care risk waste (HCRW). The health system is under pressure to dispose of health care waste in such a way as to avoid unnecessarily high levels of environmental degradation. The aim of health care facilities worldwide is beginning to subscribe to the social goals of a cleaner and safer environment. Determining which portion or components of clinical waste is infectious is challenged by its inherent heterogeneous nature and definitional problems.<sup>11</sup> No tests currently exist to objectively determine whether waste is infectious or not Infectious is defined by Rutala and Mayhall (1992).<sup>12</sup> The U.S. EPA, 1986 and Centers for Disease Control, despite their discrepancies in clarifying the term infectious waste, have designated pathological waste, blood and blood products, contaminated sharps (scalpels, needles and blades) and microbiological waste (cultures and stocks) as infectious.<sup>11</sup> In general, for waste to be infectious, it has to contain enough virulence capable of causing an infectious disease including a portal of entry in a susceptible host.

Biomedical wastes are considered a special area where hazards and Risks not just confined to the health of generators and operators of hospitals but also the health of general people. In general hospital waste is broadly grouped into infectious waste and non-infectious waste.

Generally Health Care centers produce different types of wastes, which have been increasing over the years in its type and amount. The hospital waste, in addition to the risk for workers and personnel who handle them also poses a threat to public health and their environment. Prüss et al. (1999), classified the sources of health care waste into two groups as major or minor according to the quantities of waste production.<sup>8</sup>

Total waste generated during the period of October 2016 to May 2017 was 21579 kg. This comes to 0.51 kg per patient per day. This is within range between 0.5 and 2 kg/bed/day.<sup>28</sup>

Total general waste generated was 17508 kg, of which maximum 2471 kg was generated in the month of May 2017 and minimum 2024 kg in the month of January 2017.

Total BMW generated was 4071 kg out of which maximum 670 kg was generated in the month of January 2017 and minimum 394 kg was generated in April 2017.

This is in conformance with the findings of other workers who found general waste constitutes 75%-85% and BMW 15-25%.<sup>14,28</sup>

The waste generation rates ranged from 0.25 to 7.0 kg/bed/day<sup>14</sup> in seven European countries and the US, 0.4-5.5 kg/patient/day<sup>15</sup> in 12 developing and developed countries and 0.11–3.9 kg/bed/day<sup>16</sup> at hospitals of Japan, Turkey, US, Canada, India, Thailand, and Bangladesh.

It is observed that the bed occupancy recorded was 215 minimum in October 2016 to maximum in February leading to 256.

The BMW generated department wise has been shown in table no.4 for the month of May 2017. [Table 3]

During month of May 2017, 403 kg BMW was generated, maximum 205 kg (50.87%) was from the Wards, 80kg (19.85%) from Operation theatre, 51 kg (12.65%) from Casualty and OPD, 41 kg (10.18%) from Labor room and 26 kg (6.45%) from Laboratory and Blood bank.

Category wise distribution of 403 kg of BMW during may 2017 is, Yellow category 286 kg (70.97%), Red category 73 kg (18.12%) Blue category 32 kg (7.94%), White category 12 kg (2.97%) [Table 4]

The segregation of BMW according to the categories represents that the maximum BMW generated is in Yellow category comprising of 70.58%, red 17.64%, blue 7.84% and white 3.92% respectively.

Category wise segregation of biomedical waste from Casualty and OPD, maximum waste segregated into yellow category i.e. [Table 5]

The segregation of BMW according to the categories represents that the maximum BMW generated is in Yellow category comprising of 69.23%, red 19.23%, blue 7.69% and white 3.84% respectively. [Table 6]

The segregation of BMW according to the categories represents that the maximum BMW generated is in Yellow category comprising of 71.20%, red 18%, blue 8.78% and white 1.95% respectively. [Table 7]

The segregation of BMW according to the categories represents that the maximum BMW generated is in Yellow category comprising of 72.50%, red 18.75%, blue 5% and white 3.75% respectively. [Table 8]

The segregation of BMW according to the categories represents that the maximum BMW generated is in Yellow category comprising of 68.29%, red 17%, blue 9.75% and white 4.87% respectively. [Table 9]

The total general waste for the month of May 2017 was 2471 kg, maximum waste generated from wards 1263 kg (51.10%) and minimum from Administrative areas 58 kg (2.34%). [Table 10]

Hospitals, nursing homes and the private clinics are places to serve patients but they also generate a huge corpus of dangerous or hazardous wastes. Since the beginning, hospitals have been made for the treatment of sick people, though during that time we neither knew about the adverse effects of garbage produced by the health care units nor did we have a clue that it poses serious health problems and that filth is also generated on human body and their environment.

Biomedical waste is a small fraction of municipal waste. There should be a greater concern on how much of the waste produced is actually contagious or unsafe. Infectious hospital waste represents only a small fraction of total medical waste. Mostly hazardous and infectious waste is coming from hospitals and clinical activities. Only small amount is coming from industrial and domestic sources. According to World Health Organization<sup>4</sup> approximately 85% hospital wastes are non-hazardous in nature, 10% consist of infectious waste, and around 5% waste are non-infectious but come in hazardous category. In the U.S.A. for example, about 15% of medical wastes are regulated as infectious category. According to Agarwal et al., 1998 in Pakistan about 20% of hospital waste is found to be potentially hazardous.<sup>13</sup>

The waste generation rates ranged from 0.25 to 7.0 kg/bed/day<sup>14</sup> in seven European countries and the US, 0.4-5.5 kg/patient/day<sup>15</sup> in 12 developing and developed countries and 0.11–3.9 kg/bed/day<sup>16</sup> at hospitals of Japan, Turkey, US, Canada, India, Thailand, and Bangladesh.

The major components of total plastic wastes constitute cafeteria plastics, medical packaging, sharps, blood bags, I.V. bags and tubing. The major sources of plastic wastes generated by the hospitals were laboratory facilities, operating rooms, and cafeterias.<sup>17</sup>

Since health care establishments differ in ways previously mentioned, including the size of medical staff and proportion of reusable items used in the establishment such a technique produces results relative to each healthcare establishment.<sup>18</sup>

Public sector clinics in Gauteng produced hospital waste at a rate of 0.002 kg/patient/day to 0.5 kg/patient/day, while private sector clinics generated 0.06kg/patient/day to 0.48 kg/patient/day.<sup>19</sup> The different steps in waste management are reduction, segregation, storage, transportation and treatment.

In selecting clinical waste management technologies, the terms 'treatment' and 'disposal' are often wrongly used interchangeably. Luttrell et al., (2003)<sup>21</sup> clarify treatment as an alteration of a waste stream or contaminated site in order to reduce, eliminate or immobilize hazardous constituents, while disposal implies disregard for return and is thus considered to be permanent storage or release. Pruss-Ustun et al. (2005)<sup>22</sup> suggested that strategies such as education of HCWs on the risks and precautions, reduction of invasive procedures, use of safer devices, and procedure and management of exposures are available to prevent infections due to sharps injuries. According to the authors, efficient surveillance and monitor of occupational health hazards related to blood borne pathogens in the industrialized world help to reduce the risk of transmission.

On the other hand the authors have noted that similar surveillance and monitoring systems are weak and dysfunctional or sometimes completely absent in developing countries.

The issue of improper hospital waste management in India was first highlighted in a writ petition filed by Dr BL Wadhwa against Union of India in the Hon'ble Supreme Court of India in 1994. The petition related to dumping of hospital waste and garbage of Safdarjung Hospital at Bhalseva Dump by the civic authorities, as the incinerator had not been working for several days and was suffering from frequent breakdowns. In the event of no standby arrangements for disposal of hospital waste, the same could contaminate the water of river Yamuna. The contention was the dumping of hospital waste should be stopped henceforth and measures initiated for standby incinerator facility, for proper disposal of waste.<sup>26</sup>

Consequent to the supreme court of India directions, the final notification was issued on 20 July 1998 and gazzetted on 27 July 1998. These were further amended in 2002, 2003 and 2016. Therefore the current rules were framed in exercise of powers conferred by section 6, 8 and 25 of Environment Protection Act 1986 (29 of 1986). Status is that 1998 rules have been superseded by the Bio-Medical waste management rules 2016 and came into force with effect from 28 March 2016.<sup>27</sup>

The hospital has obtained necessary consent under Air (Prevention and Control of Pollution) Act 1981 and Water (Prevention and Control of Pollution) Act 1974. A Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP) have been installed and are functional.

Based upon an Application (along with applicable Fee) by the Hospital, the Haryana state pollution control board has issued biomedical waste authorization certificate to the Hospital for generation, collection, reception, storage, transportation, treatment, disposal and handling of biomedical waste.

The BMW generation by various departments segregated at source and in colour coded bags that are provided and stored in colour coded bins. A team of 3 persons- supervisor and his workers are deployed to collect the waste from the respective wards and department and transport the bags in a covered wheel barrow to the central storage point. Non BMW is transported separately by other housekeeping personnel to the deep burial site.

From the Central Storage Point of the Hospital, the waste is transported by the staff of M/s Divya Waste Management Co, Kandela, District Jind who is authorized to operate Common Bio-Medical Waste Treatment Facility (CBWTF). Individual hospitals are not permitted to install Incinerators within their premises and are required to handover their biomedical waste to the common bio-medical waste treatment facility. The Hospital submits an annual report pertaining to biomedical waste management to the Haryana state pollution control board. Earlier the annual report on form II, for calendar year January to December was submitted by 31 January of next year. Under the new rules 2016, the annual report is to be submitted on form IV by 30 June of next year. Verbal communication has been received by the Hospital that soon all reports and returns are to be filed online, instead of the current system of submission as hard copies.

Personal interaction with the Medical Superintendent and administrative department officials to apprise them with the proposed study and their permission obtained.

A representative of the hospital introduced me all wards, departments of the hospital and familiarized me with the staff and the procedure being followed in the hospital. The BMW process was studied and the data has been shown in table no.2

Personal interviews were conducted with the HsOD, nursing staff, operation theatre in-charge, BMW in-charge, supervisor and the workers handling BMW to understand the process of collection, segregation, transport of the BMW and for the collection of data from the records maintained from the respective departments as well as to understand the awareness regarding BMW (Management and Handling) Rules by the staff.

A Bio-Medical Waste Management Committee has been formed in the Hospital under chairmanship of the Medical Superintendent with a Faculty Member from Dept of Microbiology as Secretary. Representatives from General Medicine, General Surgery, Paediatrics, Obstetrics and Gynaecology, Nursing Superintendent, and Housekeeping Supervisor are also Members of this Committee. The Committee is engaged in task of implementation of the provisions of the Bio-Medical Waste (Management and Handling) Rules 2016; and ensuring compliance within the specified time schedule.

**The following items are provided in the hospital:-**

- Colour coded bins and Biodegradable bags.
- Posters of the latest BMW segregation at the bin sites.
- Needle destroyers and syringe cutters. Twenty seven Needle Destroyer and Syringe cutter are placed in wards and departments.
- Puncture proof containers for syringes, sharps, broken glass.
- Covered wheel barrow to collect and transport the BMW.
- Central BMW storage point with locking facility to prevent nuisance by stray animals.
- Hand held weighing machine to weigh the BMW generated.
- Autoclave machines are available in blood bank and microbiology department for treatment of hazardous waste.
- The central store keeps the reserve stock of plastic bags and spare bins, gloves, aprons, Needle Destroyer and Syringe cutter, chemicals and cleaning material. It is noted that there is no generation of radioactive and cytotoxic waste in the hospital. [Table 2]

## **V. Conclusion**

The management of biomedical wastes poses a great challenge to the policy planners, city administrators, medical personnel and workers. Cost effective system for providing better medical waste treatment facilities along with generation of awareness to reduce and recycle the waste is necessary to sustain the environment. The Bio-Medical Waste Management Rules 2016, have holistically addressed the issue of safe of hospital wastes. The NCMC and Hospital authorities have taken due cognizance of the various action imperatives to comply with the provisions of The Bio-Medical Waste Management Rules 2016 within the prescribed time schedule.

## **VI. Recommendations**

1. BMW management committee should meet more frequently to monitor and review the compliance with rules 2016 as the hospital commenced full scale operations in October 2016, therefore in the initial stages many SOP's have to be formulated and implemented.
2. Construction of a room for storage of BMW pending collection by CBWTF. The room should be well ventilated, secure, adequate space to prevent mixing of Hazardous and non hazardous waste, deny a way to stray animals.
3. Preparation of SOP's to ensure timely initiation of application and reports, training of workers, updating of immunization data on website. Health checkup of workers, immunization of workers.

4. Procurement of personal protective equipments of hospital waste management workers.

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