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*Research Article***The Biomedical Waste Management: A case study of Rewa, MP****Dwivedi Neelima<sup>1\*</sup>, Arnold Rashmi<sup>2</sup>**<sup>1</sup>Department of Zoology, St. Kinaram College, Sonbhadra, India.<sup>2</sup>Department of Botany, Govt. Girls College, Rewa, India.*\*Email: neelimaforenvironment@gmail.com***ABSTRACT**

Today Biomedical waste (BMW) management has acquired significant importance. It is toxic, infectious and poses threats to environment as well as to the human life and therefore requires special handling and treatment. With increasing public awareness, technological advancements and governmental interventions, the need of proper disposal of health care waste is gaining strength. However waste management practices in the health care sector are full of challenges. The paper, attempts to explore major health care waste management challenges faced by the health care units in India with special reference to Rewa, Madhya Pradesh, a small city in central India.

**Key words:** BMW, biomedical waste, remediation, Rewa, biomedical waste management.

**Introduction:**

The management of BMW requires serious discussion and honest implementation on the part the government as well as the public. According to the report of the Ministry of Environment, Forest & Climate Change (MOEFCC) in 2011, over 13000 healthcare facilities in the country violated Biomedical Waste (Management and Handling) Rules, 1998.

The Health Care Units (HCU) such as hospitals and dispensaries in India has multiplied several times in last three decades

which are generating huge amount of BMW creating an alarming situation. Previous studies show that, there is a lack of segregation practices. The BMW is mixed with general waste which makes whole waste stream hazardous. Open burning of the waste by clinics, dispensaries and hospitals lead to release of dioxin and mercury in air, besides ash emissions from the medical waste incinerators (Kaiser et al., 2001).

Pollutants from BMW seriously affect human health. World Health Organization (WHO) has predicted that India is on the

verge of having an HIV epidemic. The Tuberculosis (TB) and HIV jointly are taking great toll on the human health and life. Hepatitis B and C infections are on the rise. Mortality due to Hepatitis C has gone up significantly (Verma, 2010). Around 700,000 people across the globe die of antimicrobial resistance (AMR) annually which is caused due to mutations in infectious bacteria. This happens when antibiotics are ill-regulated and overused, or when they are used inappropriately for non-human health. Poorly regulated waste water not only spreads antibiotic residues and antibiotic-resistant bacteria throughout the environment, but increases human antibiotic consumption and the spread of antibiotic-resistant pathogens. Bacterial mutations and the superbugs they create make treating basic infections next to impossible (Singh, 2019).

The environmental regulations actually call for the treatment of infectious medical waste on a daily basis if it is stored at room temperature. A number of treatment methods are available for treating medical waste before disposal. These are:

- i) **Incineration Technology:** Incineration designed especially for treatment of health care waste should operate at temperatures between 900 and 1200°C (Pruss et al., 1999).
- ii) **Non-Incineration Technology:** Non-incineration treatment includes four basic processes: thermal, chemical, irradiative, and

biological. The main purpose of the treatment technology is to decontaminate waste by destroying pathogens. There are several non-incineration:

- a) **Autoclaving:** Autoclaving is an efficient wet thermal disinfection process. Typically, autoclaves are used in hospitals for the sterilization of reusable medical equipments.
- b) **Microwave Irradiation:** Most microorganisms are destroyed by the action of microwaves of a frequency at about 2450 MHz and a wavelength of 12.24 cm. The microwaves rapidly heat the water molecules in the microorganism and the infectious components are destroyed by heat conduction.
- c) **Chemical Methods:** Chemical treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent is used for destroying pathogens.
- d) **Plasma pyrolysis:** Plasma pyrolysis is a state of the art technology for safe disposal of medical waste. It is an environment friendly technology, which converts organic waste into commercially useful by-products.

Ministry of Environment, Forest & Climate Change (MOEFCC) notified the Bio-medical Waste (Management & Handling) Rules, 1998 under the Environment (Protection) Act, 1986 (CPCB, 2017). The newly notified Bio-medical Waste Management Rules, 2016

have wider ambit and apply to all persons who generate, collect, receive, store, transport, treat, dispose, or handle bio medical waste in any form including hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories, blood banks, ayush hospitals, clinical establishments, research or educational institutions, health camps, medical or surgical camps, vaccination camps, blood donation camps, first aid rooms of schools, forensic laboratories and research labs (CPCB, 2017).

Recently, Green Supply Chain Management (GSCM) has gained popularity with both academics and practitioners with objectives of reducing waste and preserving the quality of product-life and the natural resources. It involves integrating environmental needs into supply chain management, including product designing, material sourcing, manufacturing, delivery of the final product to the consumer as well as end-of-life management of the product after its useful life (Srivastava, 2007; K.Muduli and A.Barve, 2014).

However, the intention of such rules and good practices has not been translated into daily practices as the compliance is very poor. A majority of reasons may be attributed to the poor health care waste

management practices in India. Major challenges are lack of operational strategy and segregation practices, poor regulative measures, inadequate awareness and training, lack of green procurement policy and institutional arrangements, waste-picking and reusing practices, financial constraints and non-committal management, and finally non-vigilant societies (K. Muduli and A. Barve, 2012).

The management of BMW is not systematic and small city like Rewa faces several practical challenges. The violation of rules and standard practices are rampant. This paper attempts to understand the ground level challenges in the city and suggest, valuable recommendations.

## **2. Methodology:**

**2.1 Study Area:** The area selected for the study is Rewa, a small size city in the state of Madhya Pradesh, India having a population of 2,363,744. The study focuses on the BMW generated from the various Government hospitals and Private Nursing homes within the Rewa city. The Rewa Municipal Corporation has 45 wards and the survey was carried out as per the list of Government Hospitals, Private and Nursing Homes provided by C.M.O, Rewa. In all, two Government Hospitals (viz. Sanjay Gandhi Memorial Hospital and Kusabhau Thakare District hospital, Bicchia) and 22

Private Nursing Homes of Rewa were studied.

**2.2 Method:** Both primary and secondary data have been collected for study.

**Primary data:** Steps involved in the study of the BMW generated from different HCUs involved following considerations:

- i) The quantitative determination of waste was collected by surveying the various HCUs' (Government Hospitals/ Private Nursing Homes) of Rewa City on daily basis for the three seasons (viz. rainy, summer and winter season).
- ii) The Bio-Medical Waste data was then categorized under different waste categories ( from 1 to 9) as per the rules.
- iii) The quantified data of BMW is then tabulated according to the categories.
- iv) The disposal patterns of BMW is then classified as on- site and off- site disposal patterns.
- v) The BMW is also categorized as infectious and non-infectious.
- vi) Survey of identified HCUs and data collection was done on annual basis to know seasonal variation.

**Secondary data:** The secondary data were taken from different sources like Rewa Municipal Corporation Office of Town and Country Planning, Meteorological Station,

Kuthuliya Statistical Department and Office of the Chief Medical Officer, Rewa.

### **Results and discussions:**

The whole research work was conceived to study the following aspects:-Survey & identification of government and private nursing homes of the city and their classification in three categories according to their bed strength viz.

- a. Above 500 beds
- b. 50-200 beds
- c. 0-50 beds

The first category consists of HCUs' above 500 beds. In this category only Sanjay Gandhi Memorial Hospital, Rewa (1141 beds) was covered.

The Bio-Medical Waste generation in rainy season was observed to be the highest with output of approx. 258.9 kg/day while during summer season it was 222.89 kg/day and during winter season it was 193.77 kg/day.

The second category comprises HCUs' having 50-200 beds. Under this category lies Kushabhau Thackrey Government District Hospital, Bicchiya, Rewa of 50 beds. The BMW was approx. 15.35 kg/day during rainy season followed by 10.52 kg/day during summer season & 6.88 kg/day is generated during winter season. The seasonal pattern of the output was the same in this category as well.

Similarly the 3<sup>rd</sup> category consists of HCUs' having 0-50 beds, in which 22 private nursing homes were covered. Their average BMW generation during rainy season was 103.88 kg/day. While during summer season, it was estimated at 69.91 kg/day followed by

winter season when Bio-Medical Waste was 42.9 kg/day.

This waste was then classified into infectious and non-infectious waste, the ratio of which was observed to be 3:1.

**Table1. Generation of BMW from Government and Private Hospitals in Rewa**

Sr. No.	Seasons	Category wise generation of BMW in Kg/day (Approx.)								Avg. BMW kg/day (1+..9)	BMW Monthly (Kg)	BMW generated seasonal (Kg)
		1	2	3	4	5	6	7	9			
<b>Group – 1 (above 500 Beds : Govt. S. G. M. H., Rewa)</b>												
1	Rainy	110.00	-	26.00	15.00	3.00	68.00	27.90	9.00	258.90	7767.00	31068.00
2	Summer	96.00	-	21.00	9.00	3.00	60.00	26.0	7.89	222.89	6686.70	26746.80
3	Winter	85.00	-	17.00	5.00	2.00	57.00	21.0	6.77	193.77	5813.10	23252.40
Total		291.00	0.00	64.00	29.00	8.00	185.0	74.90	23.66	675.56		
Average		97.00	0.00	21.33	9.67	2.67	61.70	24.97	7.89	225.19		
<b>Group – 2 (50-200 Beds : Dist. Hospital, Rewa)</b>												
1	Rainy	5.93	-	-	3.66	-	2.83	2.33	0.6	15.35	460.50	1842.00
2	Summer	4.23	-	-	2.76	-	1.67	1.54	0.32	10.52	315.60	1262.40
3	Winter	3.02	-	-	1.57	-	1.07	1.02	0.2	6.88	206.40	825.60
Total		13.18	0.00	0.00	7.99	0.0	5.57	4.89	1.12	32.75		
Average		4.39	0.00	0.00	2.66	0.0	1.86	1.63	0.37	10.92		
<b>Group – 3 (0-50 Beds : Pvt. Nursing Homes, Rewa)</b>												
1	Rainy	20.7	-	-	25.1	-	30.8	10.28	6.82	103.80	3116.40	12465.60
2	Summer	14.23	-	-	16.0	-	25	12.81	3.49	69.90	2097.42	8389.70
3	Winter	6.32	-	-	6.6	-	15.8	5.79	2.42	42.90	1287.00	5148.00
Total		41.25	0.0	0.0	47.7	0.0	71.6	28.88	12.73	216.60		
Average		13.75	0.0	0.0	15.9	0.0	23.9	9.63	4.24	72.20		
Cat-1=Human Anatomical waste				Cat-2= Animal Waste				Cat-3=Microbiology& biotechnology waste				
Cat-4= Waste Sharps				Cat-5= Discarded medicine and cytotoxic drugs				Cat-6= Soiled waste				
Cat-7=Solid waste				Cat-9= Incineration Ash								

In the study many issues have been observed which shows that there is a big scope of systemic upgradation in the management of BMW. Some of the key issues that must be addressed on priority basis have been discussed here.

As per the rules, the clinics should get registered with formal recyclers and also with SPCB. However, there was no comprehensive list of health care institutions with the SPCB or with other organizations.

Central Pollution Control Board (CPCB) and the State Pollution Control Boards are responsible for enforcing environmental rules in the hospitals. However, due to inadequate manpower, infrastructure and administrative powers to implement the laws, the cases of non compliance are very high (Dwivedi et al., 2009). There is also lack of coordination between the regulatory authorities (CPCB) and the Department of Health, which has functional control over hospitals.

It was further observed that in almost all the hospitals and nursing homes in Rewa there was no efficient operational strategy and the BMW management has got least priority. Indian hospitals wastes are collected in mixed forms, transported in open carts and waste sharps are discarded without disinfecting which has involved risks. Amongst the registered institutions, some

clinics were found disposing the BMW even twice a week in accordance with the collection trips made by the recyclers, which is against the rules.

It was recorded that the practice of segregation of the waste was inadequate in hospitals - starting from generation to disposal. BMW is mixed with municipal waste. Lack of segregation practices significantly increases the quantity of the infectious medical waste that makes the entire mass potentially infectious (Gupta et al., 2009). Likewise liquid waste having infectious materials and chemicals comprising antibiotics are discharged to the common sewage without any treatment which can contaminate the water bodies. Such practice has wider implications including development of resistance to the antibiotics.

One of the main reasons of casual approach towards improper segregation could be lack of awareness and proper training. Awareness of appropriate handling and disposal of BMW among health personnel was found lacking and need priority attention. Unless all the hospital staff at all levels work together the system cannot function effectively.

Health care units produce large amount of waste. Efforts have been made by

environmental regulatory agencies and waste generators to better manage the waste from healthcare facilities in recent years but they are not enough. So there is an urgent need for raising awareness level on medical waste issues. In fact no agency has been assigned the task of spreading awareness (Verma, 2010). The Rules have not been publicized as widely as required. Especially, the smaller HCUs were found not be fully aware of them. Further, a number of issues have not been explained in details, such as standards of collection and storage devices, equipment, etc. (Patil and Shekdar, 2001).

Proper onsite infrastructural facilities and modern technologies for storage, collection, treatment and disposal of wastes have so far been limited in India. Therefore, the biomedical waste is openly dumped into the open bins on the road sides or close to the residential areas.

Major infrastructural constraints require governmental interventions. Lack of approved dumping sites has led to dumping of BMW almost everywhere. Further, self-contained onsite treatment methods may be a desirable facility, but it is feasible only for large healthcare facilities and are impractical or uneconomical for smaller institutes. Therefore, a common system needs to be developed (Rao et al, 2004).

Reuse of plastic syringes and other plastic material used in the health care is a lucrative business in India. The products from the recycled material are finally sold to the unsuspecting patients or their relatives (Verma, 2010). Lack of awareness regarding the risk involved with biomedical wastes as well as the monetary returns encourages waste-picking and reusing activities (Patil and Pokhrel, 2005). The issue of waste-picking and reusing cannot be addressed without proper BMW management and education.

Dedicated funds for disposal of BMW may be a cause of its neglect. As per an estimate, cost involved in disposal of hospital waste is INR 3000-4000 per tonne (Patil and Shekdar, 2001). Besides, funds are required for conducting training and awareness programs for health care staffs. Normally, a separate allocation of funds for waste management is not found in Indian hospitals. The smaller HCUs ignore waste management practices due to financial constraints (Rao et al., 2004).

Finally, the practice of 'use and throw' also adds to the volume of waste. The reusable items made of glass and metals which can be disinfected and reused is not a main stream activity. Practice of Green Procurement Policy can be effective in waste minimization in the first place (Verma, 2010). For example, mercury thermometers can be replaced with mercury free

thermometers. Health care units should stimulate the purchase of environmentally preferable products by mandating certain practices in their purchasing policy.

#### 4. Conclusion:

The BMW management has multiple stakeholders and requires their collective efforts. On the part of Government and monitoring agencies, it is imperative that proper common infrastructures are provided and compliance of extant rules is ensured strictly. Different agencies should work in coordination. Adequate number of approved sanitary landfills in the city. There is an urgent need for the establishment of Common Bio-Medical Waste facility in Rewa, so that the Bio-Medical Waste disposal of the city takes place in proper & environmentally sound way.

On the part of hospitals, BMW management should involve functionaries from top to bottom levels besides proper compliance of rules and acquisition of modern technologies. The principle of 'reduce, recovers, reuse and dispose' need to be promoted. It should be supported by appropriate education and training of the health care staffs and management team within the existing policy and regulative framework.

#### 5. Recommendations:

i) There should be clear operational

plans and strict compliance of rules. Accordingly, location and capacity of the storage containers, frequency of collection for various types of wastes and schedule of activities should be fixed. Infectious wastes are to be stored in the designated colour-coded leak-proof containers for safe handling and should be disinfected in the hospital before it is transported to a common treatment facility, such as an incinerator or controlled landfill.

ii) Segregation should start at the source of generation and by the generation itself. Bio-Medical Waste should not be mixed with other waste.

iii) Demonstrative programs and frequent trainings should be conducted for all concerned including hospital employees and municipality workers.

iv) Housekeeping staff should mandatory wear protective devices such as gloves, face masks and gowned while handling the waste.

v) Various regulatory agencies, Hospitals, Medical association and Municipal Corporation should work together for proper management of BMW.

vi) The health care system of the city should align their activities with 'Swachh Bharat Mission' and strengthen themselves to handle eventualities like spread of epidemic and biological warfare.



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