

# Bio-Medical Waste and Environmental Protection Laws and Policies in India: Management and Solutions to Tackle Its Effects in India

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## ABSTRACT:

With the economic development in the world and in India waste management is a matter of growing concern. Even the developed countries like US, UK, Japan and Canada face the similar issues. Taking into account the growing population of India, biomedical waste management and mismanagement becomes a matter of great concern.

Biomedical wastes are “those types of trash that healthcare facilities make while treating patients, these pollutants pose major risks to both environmental hygiene and human health because they are extremely poisonous and hazardous, therefore it is crucial that these wastes be handled and managed effectively”, which calls for the establishment of an appropriate institutional and regulatory framework. Several legal regulations have occasionally been recognized on a national and international level based on this need. However, there are persistent worries about improper handling of these wastes, making a legal framework analysis crucial. In order to identify inconsistencies in those legal frameworks and the negative effects of widespread inadequate management of healthcare waste on people and the natural environment, this paper aims to evaluate the current laws in India that govern the management of biomedical wastes. It will also analyze the international legal framework on the same topic.

**Keywords:** Biomedical waste, Environment protection, Health Care, MoEF, Treatment and Sustainable Development.

## INTRODUCTION:

The hospital is one of the more complicated organizations that attracts people from all facets “of society, regardless of their age, sex, ethnicity, or religion. This is in addition to the typical hospital inmates, such as patients and employees”<sup>1</sup>. “All of them generate garbage, which is growing in quantity and variety as a result of scientific progress and having an effect.”<sup>2</sup> Hospitals produce waste, which has increased throughout time in both amount and variety.

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<sup>1</sup> Rao SKM and Garg RK, “A study of Hospital Waste Disposal System in Service Hospital” Journal of Academy of Hospital Administration July 1994;6(2):27- 31

<sup>2</sup> Ibid1

Healthcare trash not only endangers patients and the employees who care for them, but it also endangers the ecosystem and the health of the public. “Any waste generated during the diagnosis, treatment, or immunization of humans or animals used in research operations, the manufacture or testing of biological products, or in health camps is referred to as biomedical waste (BMW).”<sup>3</sup> “It uses the cradle to grave methodology, which involves categorizing, quantifying, separating, storing, and treating BMW. The 3Rs, which stand for reduce, recycle, and reuse, are the cornerstone of good BMW behaviour.”<sup>4</sup> Overwhelming amounts of trash have been produced at the centers of care as a result of the growth in procedures performed at the various health care setups. India produces approximately 2 kg of biomedical waste per bed per day, which includes items like anatomical waste, cytotoxic waste, and sharps. These items, when improperly disposed of, can result in deadly infections like “the Human Immunodeficiency Virus (HIV), hepatitis C and B infections”<sup>5</sup>, among others, as well as environmental disruptions and an adverse impact on ecological balance.

In the current day, biomedical waste (BMW) is a significant cause for worry. According to the WHO, 15 to 25 percent of the trash produced in hospitals is unsafe and hazardous to health because it puts people's health at risk. According to estimates, infected sharps and “syringes cause 32% of new Hepatitis B infections, 40% of new Hepatitis C infections, and 5% of new HIV infections per year.”<sup>6</sup> Medical waste includes “solid, liquid, and gaseous waste that is contaminated with organic and inorganic substances”, including radionuclides that are pathogenic and created as a result of in vitro testing on bodily pathogens. Important tissues and fluids are present in hospital trash. According to WHO (1999), around 85% of health hazards to healthcare personnel are caused by non-hazardous public and air hospital waste, 10% by infectious agents, and 5% by hazardous flora in non-infectious areas. The Government of India (notice, 1998) stipulates “that hospital hygiene and maintenance activities include hospital waste management. This entails overseeing a variety of tasks, many of which are engineering-related, including collection, transportation, processing”<sup>7</sup> system functioning or treatment, and waste disposal.

## **1. WHAT IS MEANT BY BIO-MEDICAL WASTES AND WHAT ARE ITS CLASSIFICATION, SOURCE? ALSO WHAT IS THE NEED OF WASTE MANAGEMENT, ITS BENEFITS, AND PROCESS AND STEPS OF WASTE MANAGEMENT?**

### **WHAT IS THE MEANING OF ‘BIO-MEDICAL WASTE’?**

- The term "biomedical waste" or "hospital waste" refers to any waste that contains infectious (or possibly contagious) substances. It includes garbage created in the process of creating biomedical waste that aesthetically resembles waste from a hospital or laboratory (“such as packaging, unused bandages, infusion kits”, etc).
- It also includes garbage from research labs that contains creatures or macromolecules whose release into the environment is generally prohibited.

<sup>3</sup> Tiwari A and Kadu P. “Biomedical Waste Management Practices in India-A Review” *IntJCurr Eng Technol.* 2013;3(15):2030–3

<sup>4</sup> Chartier Y, Emmanuel J, Pieper U, Prüss A, Rushbrook P, and Stringer R, editors, “Safe Management of Wastes from Health-Care Activities” 2nd ed. Geneva, Switzerland: WHO Press; 2014. 1-146.

<sup>5</sup> Narang RS, Manchanda A, Singh S, Verma N, and Padda S, “Awareness of Biomedical Waste Management Among Dental Professionals and Auxiliary Staff in Amritsar”, *India. OHDM.* 2012;11(4):162–9.

<sup>6</sup> ORGANIZATION WH. “Safe health-care waste management”. 2004.

<sup>7</sup> “Govt. of India, Ministry of Environment and Forests Gazette notification No 460 dated July 27”, New Delhi: 1998: 10-20

## CLASSIFICATION OF BIO-MEDICAL WASTE PURSUANT TO THE GUIDELINES OF WORLD HEALTH ORGANIZATION

“Medical waste is divided into eight categories by the World Health Organization (WHO):

1. Waste in general
2. Pathological
3. Radioactive
4. Chemical”<sup>8</sup>
5. Waste that is contagious or potentially infectious
6. Sharps
7. Pharmaceuticals
8. Containers with pressure

## A FEW IMPORTANT / MAJOR SOURCES OF BIOMEDICAL WASTE

- Nursing homes, dispensaries, private hospitals, and public hospitals.
- Primary care facilities.
- Paramedic services and medical research institutes.
- Institutions for animal research and veterinary schools.
- Research facilities and laboratories
- “Mortuaries and autopsy facilities; research and testing facilities for using animals; blood banks and collection services”<sup>9</sup>
- Senior care facilities
- Institutions that study biology.
- Units of production.

## A FEW SMALL SOURCES OF BIOMEDICAL WASTE

- “Clinics for doctors and dentists”<sup>10</sup>
- Slaughterhouses and animal houses.
- “Camps for blood donation”<sup>11</sup>.
- Clinics for immunization.
- Cosmetic piercing, mental clinics, and “acupuncturists.
- Funeral arrangements.”<sup>12</sup>
- “Facilities for people with disabilities”<sup>13</sup>

## NEED OF BIO-MEDICAL WASTE MANAGEMENT IN HOSPITALS

The following list includes the factors that make managing hospital waste so important:

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<sup>8</sup> Team Lease, “Environment (Protection) Act, 1986 & Bio-medical Waste Management Rules, 2016” <<https://www.teamleaseregtech.com/resources/acts/article/73/environment-protection-act-1986-bio-medical-waste-management-rules-201/>> accessed on 18 July 2023.

<sup>9</sup> Ibid 8

<sup>10</sup> Harshit Bhimrajka, “Biomedical Waste Management Rules, 2016” (IPleader, 15June3020)

<<https://blog.ipleaders.in/biomedical-waste-management-rules-2016/#Objective>> Visited on 20 July 2023

<sup>11</sup> Ibid 9

<sup>12</sup> Ibid 9

<sup>13</sup> Ibid 9

1. Sharps injury-related infections among all “hospital staff categories and waste handlers”
2. Nosocomial infections in patients brought on by subpar waste management and infection control procedures.
3. “Risk of infection outside the hospital for waste handlers, scavengers, and occasionally the general population residing close to hospitals”.
4. The risk that dangerous medications and chemicals provide to anyone handling garbage at all levels.
5. Unscrupulous individuals repackage and sell disposable items without even washing them.
6. Drugs that have been discarded are repackaged and marketed to unwary customers.
7. The potential for waste-related “air, water, and soil pollution as well as improper incineration emissions and ash.”<sup>14</sup>

### **THE ADVANTAGES OF MANAGING BIOMEDICAL WASTE**

1. Environments that are cleaner and healthier.
2. A decrease in the frequency of both hospital- and community-acquired illnesses.
3. A decrease in the hospital's infection control expenses.
4. Reusing and repackaging infectious disposables lowers the risk of sickness and mortality.
5. Low prevalence of risks to public and workplace health.
6. Revenue generated from “the proper treatment and disposal of waste and a decrease in the cost of waste management”.
7. A better-looking healthcare system and “an improvement in quality of life”.

### **PROCEDURE FOR MANAGING BIOMEDICAL WASTE**

Hospital waste that is not properly managed has been generated, collected, stored, transported, and treated in an incorrect manner. “Improper handling includes a number of risky behaviors, including handling without personal protective equipment (PPE), inadequate storage (such as high temperatures combined with extended periods of time before treatment), manual transport for greater distances, use of uncovered containers rather than closed plastic bags, etc.”<sup>15</sup> There are other instances as well, such as exposure times that go beyond what is permitted, “a lack of worker and equipment decontamination processes, etc., that all have a different impact on hospital staff”. In India, there is a vast network of medical facilities. It is imperative “to properly collect, segregate, store, transport, treat, and dispose of hospital waste such as components of the body, organs, tissues, blood, and bodily fluids as well as soiled linen, cotton, bandages, and plaster casts from infected and contaminated areas in order to prevent nosocomial or hospital acquired”<sup>16</sup> infections.

### **SIX STEPS FOR MANAGING BIOMEDICAL WASTE**

1. “Waste management
2. Segregation
3. Storage and transportation, third
4. Care and Disposal

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<sup>14</sup> Hem Chandra, “Hospital Waste an Environmental Hazard and Its Management”, (1999)

<sup>15</sup> WHO, (1999), “Guidelines for safe disposal of unwanted pharmaceuticals in and after emergencies”, Essential drugs and other Medicines Department. World Health Organization, Geneva, Switzerland.180

<sup>16</sup> Ibid 13

5. Delivery to the final disposal” location
6. Last resort

Effective strategies to limit infectious waste are required to protect the medical workforce from occupational “health risks associated with hospital waste management. Such management procedures safeguard the environment, public health, and”<sup>17</sup> workers' health from the dangers hospital waste poses. When trash is managed properly, it is handled “from the point of generation through treatment and disposal”<sup>18</sup> in line with established and recognized processes.

## **2. WHAT IS BIO-MEDICAL WASTE SEGREGATION AND HOW COLOUR CONDONING IS DONE FOR BMW?**

### **THE SEGREGATION OF BIOMEDICAL WASTE**

In accordance with the “color coding specified in Schedule-I of the BMW Rules from 2016, bio-medical waste produced”<sup>19</sup> by healthcare facilities must be separated at the place of generation. To guarantee appropriate waste segregation, the following actions must be taken:

- Instead of doing it afterwards, “waste needs to be separated at the point of generation.”<sup>20</sup> As previously stated, the term "Point of Generation" refers to the area under the authority of a doctor, nurse, or other medical professional who is treating a patient and creating bio-medical waste at the same time.
- All of the wards and the waste storage area should have posters or banners promoting the segregation of bio-medical waste.
- At the location where “bio-medical waste is generated, there should be an adequate number of color-coded bins, containers, and bags.”<sup>21</sup>
- The 2016 Plastic Waste Management Rules state that colored plastic bags must comply with them.
- “Provide personnel protective equipment to the team managing biomedical waste.”<sup>22</sup>

### **COLOR CODE FOR BMW SEGREGATION**

The first stage in managing BMW is color coding. A trash must “be treated and disposed of in accordance with” its classification because different wastes are divided into several sorts. All medical facilities around the world have color-coded trash cans that are utilized for waste disposal. Bins are given a particular hue “based on the principle of universality, and waste is” then divided into several categories as a result. This step assists in avoiding the confusion that results when garbage of various kinds are mixed together, which can result in inappropriate management and disposal and further result in the contracting of several diseases. The many categories of garbage include anatomical waste, recyclable contaminated waste, chemicals, laboratory waste including as specimens, blood bags, vaccines, and expired medications. Sharp waste includes scalpels, blades, needles, and other things that might puncture skin. All of the aforementioned wastes are separated into bins of various colors and sent for treatment. Anatomical trash,

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<sup>17</sup> Vikaspedia, “Bio Medical Waste Management Rule, 2016” <<https://vikaspedia.in/energy/environment/waste-management/bio-medical-waste-management/bio-medical-waste-management-rules>> accessed on 18 July 2023.

<sup>18</sup> Ibid 15

<sup>19</sup> Rao S, Ranyal RK, Bhatia SS, and Sharma VR: “Biomedical waste management: An infrastructural survey of hospitals. Med J Armed Forces India” 2004, 60:379-82. 10.1016/S0377-1237(04)80016-9

<sup>20</sup> Ibid 14

<sup>21</sup> Dehghani MH, Ahrami HD, Nabizadeh R, Heidarinejad Z, and Zarei A: “Medical waste generation and management in medical clinics in South of Iran”, MethodsX. 2019, 6:727-33. 10.1016/j.mex.2019.03.029

<sup>22</sup> Ibid 16

contagious waste, chemical “waste, laboratory waste, and pharmaceutical waste are” all collected in yellow bins and encompass nearly all sorts of BMW. Depending on how toxic the trash is, various bins and sterilization techniques are utilized. Autoclaves are the most efficient sterilization equipment. Unchlorinated plastic bags are used for BMW collection, while red bins are utilized to collect recyclable, polluted garbage. Hospital glassware scraps including ampoules and vials are collected in blue bins. Used and contaminated sharps are disposed of in white bins that are translucent. To prevent incidents that could result in disease transmission to handlers, sharp waste must always be disposed of in puncture-proof containers.

### **3. WHAT IS THE PROCEDURE OF ASSESSMENT OF BIO MEDICAL WASTE: THE PERIOD OF COLLECTION, PACKAGING, LABELLING AND STORING? ALSO TRANSPORTED OF BMW?**

#### **3.1 ASSESSMENT OF BIOMEDICAL WASTE**

##### **3.1.1 THE PERIOD OF COLLECTION**

- Every day, at a predetermined time, “bio-medical waste should be collected from each hospital ward.”<sup>23</sup> Throughout the day, collections from wards may occur several times.
- “HCF shall make sure that biomedical waste is gathered, transferred, treated, and disposed of in accordance with the 2016 BMW Rules.”<sup>24</sup> HCF should also make sure that trash from biotechnology, human anatomical research, and animal anatomical research is disposed of within 48 hours.
- “Collection schedules should be predetermined and tailored to the amount of waste generated in each department of the healthcare facility”<sup>25</sup>.
- “General waste should not be collected at the same time as bio-medical waste or in the same trolley”.
- For the majority of wastes, collection should occur every day, timed to coincide with the daily pattern of trash generation. For instance, infectious waste may be collected in the middle of the morning in an IPD ward where changing dressings is the first task of the day to avoid soiled bandages lingering in the area for too long.
- Because visitors to the facility produce a lot of general waste and to prevent its piling in the HCF, “general waste collection must be done right away after the HCFs' visiting hours.”<sup>26</sup> The collection schedules must allow the HCF to reduce or eliminate the need for temporary trash storage in the departments.
- PPEs should be made available for the workers to wear while collecting biomedical waste.

##### **3.1.2 PACKAGING**

- Sharps containers and bio-medical waste bags should only be around three quarters full. They ought to be sealed and prepared for collection once they reach this level.
- “Plastic bags can be knotted or sealed with a plastic tag or tie” but never stapled.

<sup>23</sup> Capoor MR and Parida A: “Current perspectives of biomedical waste management in context of COVID-19”, *Indian J Med Microbiol.* 2021, 39:171-8. 10.1016/j.ijmmb.2021.03.003

<sup>24</sup> Saxena P, Pradhan IP and Kumar D: “Redefining bio medical waste management during COVID- 19 in India: a way forward”, *Mater Today Proc.* 2022, 60:849-58. 10.1016/j.matpr.2021.09.507

<sup>25</sup> Ibid 18

<sup>26</sup> “Guidelines for Management of Healthcare Waste as per Biomedical Waste Management Rules, 2016”, <[https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/Guidelines\\_healthcare\\_June\\_2018.pdf](https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/Guidelines_healthcare_June_2018.pdf)> Accessed on 18 July 2023.

- Extra “bags or containers should be available at every point where waste is collected so that empty ones can be”<sup>27</sup> changed right away.
- “Color-coded waste bags and containers should be marked with the biohazard sign, the date, the type of waste, the amount of waste, the sender's and receiver's information, and”<sup>28</sup> a bar code to enable tracking until disposal.
- Before March 27, 2019, make sure that each bag has bar-coded labels applied to it in accordance with CPCB requirements.

### 3.1.3 LABELING

According to the BMW Rules from 2016, every bag, container, or bin “used for the collection and storage of bio-medical waste must be marked with the Symbol of Bio Hazard or Cytotoxic Hazard, depending on the type of waste”<sup>29</sup>.

According to the CPCB's "Guidelines for barcode System for Effective Management of Biomedical Waste," “bio-medical waste” bags and containers must have bar code labels attached.

### 3.1.4 INTERIM STORAGE

- The HCF wards and several sections discourage the temporary storage of biomedical waste.
- If temporary storage of trash is required in the departments, “it must be kept in the unclean utility/sections”<sup>30</sup>.
- “No garbage should be kept in the areas used for patient care and operations, such as the operating room. Such places should be immediately cleared of any infectious waste”<sup>31</sup>.
- BMWs “must be stored in a designated space away from patients and visitors or in a low-traffic area”<sup>32</sup> when there are no unclean utilities or sections present.

## 3.2 TRANSPORT OF BIOMEDICAL WASTE WITHIN THE FACILITY TROLLEYS FOR TRANSPORTATION

Transporting biomedical waste internally within the walls of the hospital from the location of waste generation/interim storage to the central waste collection center must be done in closed carts or containers, ideally fitted with wheels for easy manoeuvrability. These trolleys or carts are exclusively to be used for the collection of biomedical waste. BMW transportation cannot be performed with patient trolleys. “The size of these waste delivery trolleys should correspond to the amount of garbage produced by the HCFs”.

## BIO-MEDICAL WASTE INTRAMURAL TRANSPORTATION ROUTE

Health care institutions' “bio-medical waste generated in various wards or laboratories must be moved in covered trolleys or carts along a path with little foot traffic” from patients and other visitors. Preferably,

<sup>27</sup> “Central Pollution Control Board, Revised Guidelines for Common Bio-medical Waste Treatment and Disposal Facilities”, (2018), available at [http://cpcb.nic.in/cpcb/old/wast/bioimediawast/Common\\_Bio\\_Medical\\_Waste\\_treatment\\_facilities.pdf](http://cpcb.nic.in/cpcb/old/wast/bioimediawast/Common_Bio_Medical_Waste_treatment_facilities.pdf) accessed 17 June 2023

<sup>28</sup> Ibid 21

<sup>29</sup> Ibid 21

<sup>30</sup> Jayant Singh, “The Management of Law in India: Plastic & Bio-Medical Waste” <https://deliverypdf.ssrn.com/delivery.php?> accessed on 18 July 2023

<sup>31</sup> Ibid 25

<sup>32</sup> Ibid 25

the route of transportation should be planned so that:

- Supplies and garbage are transported via different routes; transportation does not take place in high-risk locations.
- No waste is transported through places with a lot of patients or tourists.
- This path makes it simple to reach the Central Waste collection area.
- To prevent spills and garbage dispersal, safe trash transportation is implemented.

#### **4. WHAT IS CENTRAL WASTE COLLECTION ROOM AND WHAT ARE THE RULE PERTAINING TO RECORD KEEPING?**

##### **ROOM FOR THE CENTRAL WASTE COLLECTION OF BIOMEDICAL WASTE**

To store “bio-medical waste until it is picked up and delivered to the CBWTF for treatment and disposal, each healthcare establishment should make sure that there is a designated central waste collection room on its property.”<sup>33</sup> “Such a space must be the responsibility of a certain individual and must be secured with a lock and key.”<sup>34</sup> When building a central waste collection chamber, the following factors may be taken into account:

- The central garbage collecting room's position must be out of the way of the general public and guests.
- “The amount of space allotted for this chamber must correspond to the amount of garbage produced by the hospital.”<sup>35</sup>
- “The allocated space must be big enough to hold waste for at least two days”.
- The appointed person must be in charge of keeping the central trash collecting room locked up, manned, and covered.
- A concrete ramp must be installed at the center's entrance to make it simple for garbage collection carts to be transported there.
- To make cleaning the area easier, “the flooring should be made of tiles or another glazed material with a slope.”<sup>36</sup>
- The garbage collection chamber needs ventilation, so exhaust fans should be available.
- The healthcare facility must make sure that this “central storage area is safety examined for any potential fire hazards and that, as a result of the inspection, preventive measures, such as the installation of a fire extinguisher and smoke”<sup>37</sup> detectors, are adopted by the healthcare facility.
- The supply of water must be available nearby the main area for keeping waste so that the facility and the containers can be cleaned and washed. The Effluent Treatment Plant shall receive the waste water from the storage facility and wash area.

<sup>33</sup> Blenkharn JI, Odd C: “Sharps injuries in healthcare waste handlers”, *Ann Occup Hyg.* 2008, 52:281-6. 10.1093/annhyg/men010

<sup>34</sup> Thind PS, Sareen A, Singh DD, and Singh S, John S: “Compromising situation of India's bio-medical waste incineration units during pandemic outbreak of COVID-19: Associated environmental-health impacts and mitigation measures”, *Environ Pollut.* 2021, 276:116621. 10.1016/j.envpol.2021.116621

<sup>35</sup> Buzan E, Zupan S, Jugovic S, and Jugovic J: “Changes in rodent communities as consequence of urbanization and inappropriate waste management”. *Appl Ecol Env Res.* 2017, 15:573-88. 10.15666/aer/1501\_573588

<sup>36</sup> Jibril JD azimi, Sipan IB, Sapri M, Shika SA, Isa M, and Abdullah S: “3Rs critical success factor in solid waste management system for higher educational institutions”. *Procedia Soc Behav Sci.* 2012, 65:626-31. 10.1016/j.sbspro.2012.11.175

<sup>37</sup> Diaz LF, Savage GM, and Eggerth LL: “Alternatives for the treatment and disposal of healthcare wastes in developing countries”. *Waste Manag.* 2005, 25:626-37. 10.1016/j.wasman.2005.01.005



- Posters should be displayed with pertinent information, such as the contact information and phone number.
- Posters containing relevant information, like the contact details and phone number, should be put up.
- “It is important to make sure that no general waste is kept in the main area for waste collection”<sup>38</sup>.

### **HAVING A “CAPTIVE TREATMENT AND DISPOSAL SYSTEM, CENTRAL STORAGE FOR HCFS”<sup>39</sup>**

“The health care facilities must make sure that waste generated from the HCF is stored in this central waste collection area until it is transported to the reception area of the captive waste treatment facility on the premises”. “This captive treatment facility treats and disposes of biomedical waste using incinerators, autoclaves/microwaves, shredders, etc”<sup>40</sup>.

The temporary “Storage area utilized for daily waste collection will act as the Central Waste Collection Area for HCFs that have their own treatment and disposal facilities through the utilization of deep burial pits, such as Primary Health Centers (PHCs), which do not come under the coverage area of any CBWTF”<sup>41</sup>. Before being disposed of by deep burial trenches in accordance with the guidelines outlined in the 2016 BMW Rules, the collected trash must be stored here.

### **KEEPING OF THE RECORDS**

1. On a daily basis, each “healthcare facility is required to keep records regarding the generation of biomedical waste” organized by category and the way it is treated and disposed of (either by captive facilities or through CBWTF).
2. “Waste generated by the facility must be recorded category-by-category in the Bio Medical Waste Register/logbook that is kept at the central waste collection area under the direction of one designated person”<sup>42</sup>.
3. “In order to quantify the quantity of bio medical waste, a weighing equipment in accordance with the specifications provided in the CPCB recommendations for the bar code system needs to be stored in the central waste collecting center of the HCF with 30 or more beds”<sup>43</sup>.
4. HCFs with fewer “than 30 beds must keep records of the receipts produced by the CBWTF”.
5. Documents related to the SPCB/PCC-submitted “annual report on biomedical waste management”
6. Records pertaining to accident reports submitted to SPCB/PCC, including the “NIL” report, are listed in item six.
7. “Training on BMW Management records, including both induction and in-service training records”<sup>44</sup>, must be kept.

<sup>38</sup> Rule 9, Bio-Medical Waste Management Rules, 2016.

<sup>39</sup> Thakur Y and Katocha SS: “Emerging technologies in biomedical waste treatment and disposal”. Chem Eng Trans. 2012, 29:787-92. 10.3303/CET1229132

<sup>40</sup> Thakur Y and Katocha SS: “Emerging technologies in biomedical waste treatment and disposal”. Chem Eng Trans. 2012, 29:787-92. 10.3303/CET1229132

<sup>41</sup> Cai X, Du C: “Thermal plasma treatment of medical waste”. Plasma Chem Plasma Process. 2020, 41:1-46. 10.1007/s11090-020-10119-6

<sup>42</sup> Udofia EA, Gulis G, and Fobil J: “Solid medical waste: a cross sectional study of household disposal practices and reported harm in Southern Ghana”. BMC Public Health. 2017, 17:464. 10.1186/s12889-017-4366-9

<sup>43</sup> Padmanabhan KK and Barik D: “Health hazards of medical waste and its disposal”. Energy from Toxic Organic Waste for Heat and Power Generation. 2018, 99-118. 10.1016/B978-0-08-102528-4.00008-0

<sup>44</sup> Ferdowsi A, Ferdosi M, and Mehrani MJ: “Incineration or autoclave? a comparative study in Isfahan hospitals waste management system (2010)”. Mater Sociomed. 2013, 25:48-51. 10.5455/msm.2013.25.48-51

8. Keep track of all employees' annual health examinations.
9. Keep a record of each employee's immunizations.
10. Records about the Bio Medical Waste Management Committee meeting minutes must be kept.
11. Records including information about accidents, including preventive and remedial measures implemented by HCFs in response to such accidents, must be kept.
12. Any installed biomedical treatment equipment that was used to treat biomedical waste must have records of its use.
13. Test results for wastewater produced by medical facilities in the records
14. A log of the recyclable garbage (glass and plastic) that was given to “the authorized recycler per year, measured in kg”. Records pertaining to how healthcare facilities handled BMW must be kept for a minimum of five years.

## **5. WHAT IS THE METHOD AND TREATMENT OF BMW? WHAT ARE THE LAWS CONCERNING THE MANAGEMENT OF BMW AND SILENT FEATURES OF WASTE MANAGEMENT RULES, 2016 AND 2018?**

### **BMW MANAGEMENT AND THEIR SOLUTIONS**

According to the 2016 BMW Rules, Schedule I of the 2016 BMW Rules, and Schedule II of the 2016 BMW Rules, must be followed for treating and disposing of BMW produced from HCF.

The guidelines specifically state that no healthcare establishment may build an “on-site BMW treatment and disposal facility if a CBWTF service is accessible within 75 kilometers of the facility.”<sup>45</sup> The BMW must be disposed of by the CBWTF alone; no public healthcare facility within 75 kilometers of the CBWTF is permitted to build its own treatment and disposal facility. “The disposal of BMW can still be done through a CBWTF who is willing to provide treatment services and who has been given permission by the concerned SPCB/PCC to operate in an area beyond 75 Km radial distance”<sup>46</sup> for public health care facilities, particularly in rural areas. The BMW produced by “HCFs should be disposed of in captive treatment and disposal”<sup>47</sup> facilities or via deep burial pits as authorized by the relevant SPCB/and as indicated in these recommendations in the event that no CBWTF is reached.

According to Schedule I of the BMW Rules, the alternatives for “collection, treatment, processing, and disposal for both groups of healthcare facilities”—those linked to the CBWTF and those not—are described here. 2016

### **TECHNIQUES FOR TREATING BMW**

Treatment for BMW involves a variety of techniques. “One of the most cost-effective methods of waste treatment” is incineration, which involves burning waste at extremely high temperatures between 1800 and 2000 degrees Fahrenheit in order to reduce the overall mass of decontaminated waste by converting it to ash and gases, which are then further disposed of in landfills. The following are significant guidelines for using incinerators: It is forbidden to burn chlorinated plastic bags because they can release dioxin. Incinerators shouldn't be used to burn up metals. Polyvinyl chloride is used to make the metals in BMW.

<sup>45</sup> Chaudhary H, Ahuja R, and Janardan PS: “Bio medical waste management and its treatment”. *Int J Allied Med Sci Clin Res*. 2019, 7:740-4.

<sup>46</sup> Gautam V, Thapar R, and Sharma M: “Biomedical waste management: incineration vs. environmental safety”. *Indian J Med Microbiol*. 2010, 28:191-2. 10.4103/0255-0857.66465

<sup>47</sup> Sharma R, Sharma M, Sharma R, and Sharma V: “The impact of incinerators on human health and environment”. *Rev Environ Health*. 2013, 28:67-72. 10.1515/reveh-2012-0035

These metals emit a significant quantity of dioxin when they are burned. Dioxins are extremely dangerous chlorinated chemical compounds, since they can cause environmental contamination, a greater incidence of cancer, and respiratory symptoms when discharged into the environment.

An alternative to burning is to autoclave. Utilizing steam and moisture for sterilizing was how this procedure worked. 121°C for 20–30 minutes is the operating temperature and time for an autoclave. Pathogenic agents found in the trash are eliminated by the steam, which also sanitizes the medical facility's equipment<sup>48</sup>. Autoclaving is fairly affordable and has no negative health effects. The anatomical, radioactive, and chemical wastes should not be processed in an autoclave, while it is advised for the treatment of disposables and sharps. The most popular techniques involve chemicals like chlorine, hydrogen peroxide, and Fenton's reagent. They are primarily utilized for liquid waste, such as blood, urine, and stool, and they are intended to kill the bacteria present in the waste. They can also be used to handle solid waste, clean surfaces like floors and walls, and disinfect hospital-use equipment. Thermal inactivation is a technique that use high temperatures to destroy the waste's germs and minimize the volume of trash produced. Depending on the type of pathogen contained in the waste, the temperature varies. The contents are then dumped into sewers after treatment is complete.

When medical trash is mixed with regular rubbish, very major environmental and health risks might be caused, which can result in ill health and incurable diseases like AIDS. If thrown improperly, the needle sticks can be very contagious. High risk of HBV or HIV active infection can result from injury from these infected needles. Medical waste workers and scavengers are the groups most likely to unintentionally become infected. Sharps must be properly disposed of in a translucent, white trash container with a thin wall. The likelihood that sharps will puncture a thin plastic bag containing sharps and hurt the trash handler is very high. It may also be the primary factor in serious pollution of the air, water, and land. In BMW, airborne contaminants may persist as spores. As biological air pollutants, they are these. Incinerators and open burning both release chemical air pollutants. Water pollution are yet another concern. When BMW with heavy metals is dumped in water bodies, the water is severely contaminated. In order to prevent the waste inside the landfills from contaminating the neighboring water bodies and subsequently poisoning the drinking water, the landfills where the disposal occurs must be built properly. Open dumping is the main cause of land pollution. Rodents such house mice and black rats must also be kept out of the vicinity of BMW since they can spread infections to surrounding residents.

To reduce the amount of garbage that is discarded at the source, as well as its treatment and disposal, many promising steps have been developed. The 3R approach encourages waste producers to recycle, reduce, and reuse their trash. The 3Rs must be understood by everyone since they can contribute to a healthier and cleaner environment. Unfortunately, the majority of emerging economies struggle to manage BMW effectively. The majority of healthcare staff members lack sufficient waste management training. The garbage handlers are also not well-informed on the risks associated with waste. To prevent mishaps that endanger the environment and living things, every participant in “the waste management process needs to be made aware of the risks associated with BMW.”<sup>49</sup>

## **LAWS CONCERNING THE MANAGEMENT OF BIOMEDICAL WASTE**

The inclusion of biomedical waste in the Basel Convention's category of dangerous and hazardous wastes

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<sup>48</sup> Ibid 13.

<sup>49</sup> Bamakan SMH, Malekinejad P, and Ziaieian M: “Towards blockchain-based hospital waste management systems; applications and future trends”. J Clean Prod. 2022, 349:131440. 10.1016/j.jclepro.2022.131440

signaled to the world the threat posed by this waste type. “In order to regulate and monitor the correct management and disposal of bio-medical and healthcare wastes in India, the Government of India drafted and implemented the Bio-Medical Waste (Management and Handling) Rules in 1998.”<sup>50</sup> “The Bio Medical Waste (Management and Handling) Rules were created in 2011” after these Regulations underwent additional development. However, the country's public and commercial “hospitals, clinics, diagnostic centers, blood banks”, etc. have yet to effectively execute this legislation.

The 2016 Biomedical Waste Management Rules were then made public. The SPCB for the States is the designated entity for carrying out the provisions. Each state is supposed to establish an advisory committee with members from local government, the SPCB, the IMA, NGOs, and the health secretary as its chairperson. “The Ministry of Environment, Forest, and Climate Change”<sup>51</sup> is in charge of annually reviewing how the guidelines are being put into practice. Duties of the occupier of the institution producing biomedical waste and those of “the operator of the biomedical waste treatment facility”<sup>52</sup> have been spelled down in clear terms. Municipal solid garbage and bio-medical waste must be handled separately. The owner of the facility producing biomedical wastes or the operator of the facility treating biomedical waste is responsible for any environmental and/or public damages. “The department in the business allocation of land assignment in the State or Union Territory Government is responsible for choosing the location of the Common Bio-Medical Waste Treatment and Disposal Facility”<sup>53</sup> after consulting with stakeholders. When selecting such a site, consideration must be given to the geographical requirements and the need for land. Although no specific authority is mentioned in the provision, District Magistrates often serve as the “assigning authority (for Kerala, see Rules for Assignment of Land within Municipal and Corporation Areas, 1995).”<sup>54</sup> The inclusion of surgery camps, blood drives, and immunization clinics has been made possible by new regulations. If a CBWTF is within a 75-km radius of the premises, occupiers will not be permitted to “set up an on-site treatment and disposal facility”<sup>55</sup>.

## **SALIENT FEATURES OF THE 2016 RULES FOR BIOMEDICAL WASTE MANAGEMENT**

1. A variety of health “camps, such as immunization camps, blood donation camps, and surgical camps, are now covered”<sup>56</sup> by the rules.
2. The responsibilities of HCF occupiers have changed. The individual with “administrative control over the HCF that is producing BMW”<sup>57</sup> is the occupier.
  - a. Before being disposed of at the CBMWTF or on-site, laboratory, microbiological, and blood bag pre-treatment is required. The sterilization/disinfection procedure should follow “National AIDS Control Organization (NACO) or WHO” guidelines.
  - b. Within two years on the date these guidelines were made public, “use of chlorinated plastic bags, gloves, blood bags, and other items shall be phased out”.

<sup>50</sup>“Basel Convention Secretariat, The Basel Convention at a Glance..., (2014)”, available at [http://archive.basel.int/convention/bc\\_glance.pdf](http://archive.basel.int/convention/bc_glance.pdf) accessed 20<sup>th</sup> June 2023

<sup>51</sup> Rule 12, Bio-Medical Waste Management Rules, 2016

<sup>52</sup> Rule 5, Bio-Medical Waste Management Rules, 2016

<sup>53</sup> Rule 17(2), Bio-Medical Waste Management Rules, 2016

<sup>54</sup> Rule 2(b), The Bio-Medical Waste (Management and Handling) Rules, 1995

<sup>55</sup> Ibid 37

<sup>56</sup> “Bio Medical Waste Management Rules, 2016”. Published in the Gazette of India, Extraordinary, Part II, Section 3, Sub Section (i), Government of India Ministry of Environment, Forest and Climate Change. Notification; New Delhi, the 28<sup>th</sup> March, 2016

<sup>57</sup> Walkinshaw E, “Medical waste management practices vary across Canada”. CMAJ 2011;183:E1307 8

- c. To educate all of “its HCWs and to immunize them against diseases like tetanus and hepatitis B”.
  - d. Pre-treatment at the source will separate liquid waste from other liquid waste before combining them together.
  - e. To implement a “barcode system for BMW parts that will be removed” from the facility for disposal and treatment
  - f. Reporting any significant accidents, particularly those involving fire dangers, blasts, handling BMWs, and corrective action by the appropriate authority
  - g. “Within two years of the date of this notification, the existing incinerator should be improved or modified to meet the revised” requirement.
  - h. A monthly internet update and daily maintenance are required for the BMW disposal registry.
3. The operator of a “facility for the common treatment and disposal of biomedical waste (CBMWTF) now has more responsibilities”<sup>58</sup>. They ought to help with HCW training in the areas where garbage is collected. Barcoding and a global positioning system should also be built for handling BMWs within a year. Keep all records related to the use “of incineration, hydroclaving, and autoclaving for a minimum of five years”<sup>59</sup>.
  4. BMW has enhanced segregation, packaging, transportation, and storage. Based on waste kind, color coding, and treatment choices, biomedical waste has been divided into four groups. Additionally, no longer than 48 hours should “untreated human anatomical waste, animal anatomical waste, dirty garbage, or biotechnology waste be stored. If storage is required for more than 48 hours, the occupier must take all necessary precautions to guarantee that the trash won't be harmful to the environment or human health”<sup>60</sup>.
  5. If a CBMWTF is available “75 kilometers away, no HCF may build an on-site BMW treatment and disposal facility”. If there is no CBMWTF, the occupier must install the necessary “BMW treatment facility, such as a landfill, autoclave, microwave use and or shredder, after obtaining prior approval from the designated authority”. Plastics and glassware should be treated with autoclaving or microwaving, then mutilated or shredded, before being handed to authorized recyclers.
  6. The occupant only receives a single “authorization for BMW disposal for nonbedded HCFs”. For bedded HCFs, the duration of the permission must coincide with the duration of the consent orders.
  7. Environmentally friendly standards for incinerator emissions have been adjusted. The acceptable limit for SPM is 50 mg/nm<sup>3</sup>, the residence duration in the incinerator's secondary chamber is “two seconds, and the standard for dioxin and furan is 0.1 ng TEQ/Nm<sup>3</sup>”<sup>61</sup>.
  8. Every year, “the Ministry of Environment, Forests, and Climate Change will check on how the laws are being followed. Each state will be responsible for establishing a district-level committee with a District Collector, District Magistrate, or Additional District Magistrate as the chairperson to ensure compliance. Additionally, this committee must submit a report to the State Pollution Control Board every six months”<sup>62</sup>.

## CHANGES TO THE 2016 RULES FOR THE MANAGEMENT OF BIOMEDICAL WASTE

“To increase compliance and reinforce the execution of environmentally sound management of biomedical

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<sup>58</sup> Ibid 59

<sup>59</sup> Ibid 60

<sup>60</sup> Ibid 59

<sup>61</sup> Ibid 59

<sup>62</sup> Ibid 28

waste in India, the Bio-Medical Waste Management Rules, 2016 Rules have been revised”.

The revised regulations state that, in order to protect the environment, chlorinated plastic bags and gloves may not be used after March 27, 2019, in medical applications, “by generators of bio-medical waste, such as hospitals, nursing homes, clinics, and dispensaries. The 2018 revisions to the BMW rules exempt blood bags from being phased out”.

**The following are “key elements of the 2018 Bio-Medical Waste Management (Amendment) Rules”:**

1. “Chlorinated plastic bags (aside from blood bags) and gloves must be phased out by March 27, 2019, in all hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories, blood banks, health care facilities, and clinical establishments”.
2. “Within two years of the publication of the Bio-Medical Waste Management (Amendment) Rules, 2018, all healthcare facilities must post their annual reports” online.
3. “By March 27, 2019, owners of common bio-medical waste treatment and disposal facilities must use bar coding and global positioning systems for processing bio-medical waste in accordance with directives issued by the Central Pollution Control Board”.
4. “The State Pollution Control Boards/Pollution Control Committees are required to gather, examine, and analyze the information received and submit it to the Central Pollution Control Board in a new form (Form IV A), which requests specific information about the generation of bio-medical waste by district, information about healthcare facilities with captive treatment facilities, and information about standard bio-medical waste treatment and disposal facilities”.
5. “Every occupier, or person with administrative control over the institution and the premises that generate biomedical waste, is required to pre-treat laboratory waste, microbiological waste, blood samples, and blood bags through disinfection or sterilization on-site in accordance with the World Health Organization's (WHO) or guidelines on safe management of wastes from health care activities and WHO Blue Book 2014 before sending them to the Common bio-medical waste treatment facility”.

## **JUDICIAL DECISIONS RELATED TO THE MANAGEMENT OF BIOMEDICAL WASTE**

### **B. L. WADEHRA V. UNION OF INDIA<sup>63</sup>**

In this historic case, the contentious issue of improper handling of bio-medical waste was the first issue to be decided. Under Article 32 of the Constitution, a lawyer petitioned the Supreme Court of India. He asked for instructions on how to carry out “the Municipal Corporation of Delhi's and the New Delhi Municipal Committee's (NDMC) legal obligations, including the gathering, hauling away, and disposal of garbage and other wastes”.

The mismanagement of biomedical waste was argued before the Apex Court to be a flagrant breach of the rights provided to citizens by Articles 21 and 48A, as well as by Section 51A(g) of the Constitution. In light of the shocking conditions, the Supreme Court issued directives to “the Government of India”, “the Government of the UT of Delhi, MCD, and NDMC directing them to build and install incinerators in all government hospitals with fifty beds or more”<sup>64</sup>, as well as requesting that private hospitals build their own incinerators. Additionally, it mandated that CPCB and SPCB send inspection teams to these locations on a regular basis. Therefore, it accorded the recommended handling and disposal techniques the utmost emphasis.

<sup>63</sup> B. L. Wadehra v. Union of India, 1996 SCC (2)

<sup>64</sup> Ibid 65

**“MAHESH DUBEY V. CHATTISGARH ENVIRONMENT CONSERVATION BOARD”<sup>65</sup>**

In this matter “before the NGT Principal Bench”, the issues surrounding Chhattisgarh's terrible mismanagement of biological waste and improper disposal of such waste were raised. In his plea, the petitioner accused the Chhattisgarh government of handling “the 1998 Bio-Medical Waste (Management and Handling) Rules matter carelessly.”<sup>66</sup> Only 1/5 of the healthcare facilities possessed the necessary equipment for waste treatment, which horrified the tribunal. Even without enforcing the laws, the government remained unaware “of the total number of healthcare facilities in the state”. Additionally, the state has only four CBWTFs for handling biomedical waste. Only two of those four had incinerators that were legally operational. Also not met were the requirements for land and location. As a “result, the tribunal mandated the formation of a State Level Committee, headed by the Chief Secretary for Medical Health and including a representative from” the SPCB, to compile an exhaustive list of all state-run healthcare facilities before creating an action plan for the effective implementation of the 2016 Rules and conducting follow-up monitoring. However, it is important to note that, contrary to “Rule 11 of the 2016 Rules”, the "Advisory Committee" was never mentioned in the verdict. This apparently suggests that, if there is a State Advisory group, it will operate in parallel with the aforementioned group. The State Level Committee did not include any volunteers, in contrast to the Advisory Committee. Thus, it can be inferred that if the verdicts are not in line with the current regulations, the tribunal members' good intentions are defeated.

**SUGGESTIONS**

The following suggestions are suggested as ways to overcome challenges and advance hospital waste management:

1. Determine and track the financial gains from hospital waste reduction.
2. “More precise monitoring and regulation of the hospital waste separation process by the ministry of health, medical education, and environmental protection agency”.
3. Managing materials so that the three main requirements of consuming less, reusing, and recycling are taken into account.
4. Examine laws that are fairly relevant in order to make it easier to lessen the risk of hospital waste and solve its issues.
5. To avoid confusion among the officials in charge of hospital waste separation, review the laws governing the source separation of hospital waste and related definitions.
6. The involvement of experts from “the private sector in the hospital waste management” process.
7. The public and private sectors of the nation are investing both domestically and internationally to bring in contemporary technology.
8. “Meetings with managers and officials to develop a stronger relationship and become more familiar with the practical and scientific solutions” that are accessible.
9. Making fresh scientific suggestions and assisting the University in bettering the execution of the programs.
10. The public media widely advertises to raise public awareness.
11. Using innovative technology that can reduce waste in various medical departments, especially those that could produce hazardous wastes.

<sup>65</sup> Mahesh Dubey v. Chhattisgarh Environment Conservation Board, 2016 SCC OnLine NGT 3724

<sup>66</sup> Ibid 54

## CONCLUSION

Healthcare personnel need to be equipped with a broad range of knowledge and hands-on experience in all areas of biomedical waste management, according to training programs. Accountability among the workers can be increased by regularly inspecting and training the staff. Improper biomedical waste management results in environmental degradation and the growth of pests that spread “diseases like typhoid, cholera, plague, hepatitis, and AIDS.” Without proper sanitation, “the recycling of disposable syringes, needles, intravenous sets, and glass bottles” can spread diseases like hepatitis, tetanus, HIV, and viral infections. Healthy environments, a decrease “in hospital acquired infections and the expense of infection control, a decrease in the reuse of infectious disposables, and the prevention of occupational health” risks “are all advantages of biomedical waste management”. “A safe and healthy future depends on people being aware of the dangers of biomedical waste and how to properly dispose of it”. In order to prevent cross infections between healthcare personnel and patients, “all health care providers, regardless of their designation, experience, and qualification, must be included in these interventions”.