



**Dr. Ashish Maheshwari**  
Assistant Professor, Transfusion  
 Medicine, ILBS, New Delhi

PDCC: ILBS, Delhi in 2015

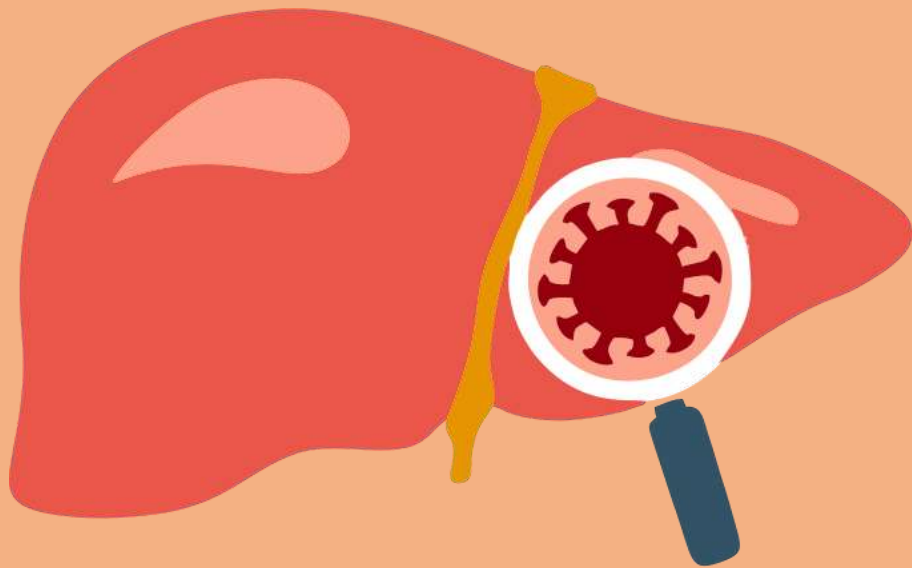
MD: PGI Chandigarh in 2014

MBBS: RNT Medical College, Udaipur in 2009

- *Teaching and research experience of more than 7 years after post-graduation with many research papers and book chapters.*
- *Involved in many teaching and training programs of NACO & project ECHO as a resource faculty.*
- *He has been awarded the Young Investigator Award at ISBT, Dubai 2016 for his research work on Guillain Barre Syndrome patients with TPE.*
- *He is a member of the International society of blood transfusion and a lifetime member of the Indian society of transfusion Medicine.*

# PRAKASH

**PR**ogrammed **A**pproach to **K**nowledge  
**A**nd **S**ensitization on **H**epatitis



**HEPATITIS INDUCTION PROGRAM**

## **Bio-Medical Waste Management**

**Dr. Ashish Maheshwari**

Assistant Professor,

Transfusion Medicine,

Institute of Liver and Biliary Sciences,

New Delhi

# BIOMEDICAL WASTE MANAGEMENT

WHAT WE SHOULD KNOW ?

1. BMW and BMW MANAGEMENT RULES
2. BMW AMENDMENTS SINCE 2016 (LAST AMENDED in 2019)
3. CATEGORIES OF WASTE
4. WASTE DISPOSAL
5. BMW MANAGEMENT FOR COVID 19 (17.07.2020)

[https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW\\_Amended\\_10.05.2019.pdf](https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW_Amended_10.05.2019.pdf)

[https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW-GUIDELINES-COVID\\_1.pdf](https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW-GUIDELINES-COVID_1.pdf)

- **Hospital waste:** Waste that is generated as a result of Diagnosis, treatment, or immunization and Research of human beings or animals.
- **Bio-medical waste (BMW):** According to BMW (Management and Handling) Rules, 1998 of India, "Bio-medical waste" means any waste produced during the diagnosis, treatment, or immunization of human or animal research activities pertaining thereto or in the production or testing of biological.
- BMW management follows the **cradle to grave approach (from creation to disposal)** which is characterization, segregation, quantification, storage, transport, and treatment of BMW.
- **Infectious waste:** The wastes which contain pathogens in sufficient concentration or quantity that could cause diseases. It is hazardous e.g. culture and stocks of infectious agents from laboratories, waste from surgery, waste originating from infectious patients.

# Facts of BMW

- Since beginning, the hospitals/**health care settings are known for the treatment of sick persons** but we were unaware about the adverse effects of the garbage and filth generated by them on human body and environment.
- Now it is a well established fact that **hospital waste is a potential health hazard** to the health care workers, public and flora and fauna of the area.

# SOURCES OF BIO MEDICAL WASTE

- **Hospitals/Nursing homes/Clinics**
- **Medical laboratories**
- **Blood banks**
- **Mortuaries**
- **Medical research & training centers**
- **Biotechnology institution/production units**
- **Animal houses etc.**
- **Home if health care is being provided there to a patient (e.g. injection, dressing material etc.)**

# Biomedical waste current situation in India

- Data from Government of India indicates that the total BMW generated in the country is 484 tonnes per day from 1,68,860 HCFs
- Unfortunately, out of this 484 tonnes, only 447 tonnes is treated while 37 tonnes is left untreated per day
- There are 198 CBMWTF in operation and 28 are under construction
- The number of HCFs using CBMWTF are 1,31,837 and approximately 21,870 HCFs have their own treatment facilities on-site



सत्यमेव जयते

# भारत का राजपत्र

# The Gazette of India

असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (i)

PART II—Section 3—Sub-section (i)

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

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NEW DELHI, MONDAY, MARCH 28, 2016/ CHAITRA 8, 1938

**MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE**

**NOTIFICATION**

New Delhi, the 28th March, 2016

BMWWM – Dr. Ashish Maheshwari

**Central Pollution Control Board : statutory organization under the MEFCC**



# Bio-Medical Waste Management Rules, 2016

## Rules 1-18

## Schedules 1-4

- S-1: BMW categories and their segregation, collection, treatment, processing and disposal options
- S-2: Standards for treatment and disposal of BMW
- S-3: List of prescribed authorities and the corresponding duties
- S-4 : Part-A: Label for BMW bags or containers  
Part-B: Label for transporting BMW bags or containers


## Forms 1-5

- Form-1: Accident reporting
- Form-2: Application for authorization or renewal of authorization
- Form-3: Authorization
- Form-4: Annual report
- Form-5: Application for filing appeal against order passed by the prescribed authority

1998	2016
Occupiers with more than 1000 beds required to obtain authorisation	It is now mandatory for all the healthcare facilities generating BMW including health camp or AYUSH to obtain authorisation
Operator duties are not listed	Duties of the operator have been listed
BMW was divided into ten categories (reduced to eight categories in 2011 guidelines)	BMW is divided into four categories
No format for annual report (format for annual report included in 2011 guidelines)	A format for annual report has been appended with the rules
Schedule present were I, II, III, IV, V, VI	Change of Schedule to I, II, III, IV
Forms I, II, III, IV, V (VI form was included in 2011 guidelines)	Forms I, II, III, IV, V
Chemical pre-treatment was with 1% sodium hypochlorite	Chemical pre-treatment with 10% sodium hypochlorite
The minimum limit for the release of carcinogenic dioxins and furans have not been specified	The minimum limit of carcinogenic dioxins and furans released from incinerator has been clearly specified
Outsourcing of BMW was not mandatory	Outsourcing is strongly recommended (if treatment facility is located within 75 km of radius from hospital)
The methods of disposal are incineration/autoclaving/microwaving/mutilation/shredding	The newer methods introduced apart from those of 1998 are plasma pyrolysis/hydrolysis/encapsulation/inertisation
Cytotoxic drugs to be discarded in black colour bag	Cytotoxic drugs to be discarded in yellow bag
Chemical solid waste to be discarded in black bag	Chemical solid waste to be discarded in yellow bag
Waste sharp/metal sharp are to be discarded in blue/white bag	Waste sharp/metal sharp are to be discarded in transparent puncture proof box
Majority of the BMW rules were for discarding the waste	Majority of the waste disposal rules are directed for recycling the waste

# BMW Management Basic Steps

- 
- Segregation & pre-treatment at the site of generation as per color coding

- 
- Collection of segregated waste from all areas of the hospital (Emergencies (3 times/day), OPDs and Labs (2 times/day), Wards and offices (Once a day).)

- 
- Transportation from various areas of the hospital to storage site

- 
- Barcoding and Weighing of bags at storage site

- 
- Transportation for final disposal at CBMWTF



Collect & sort



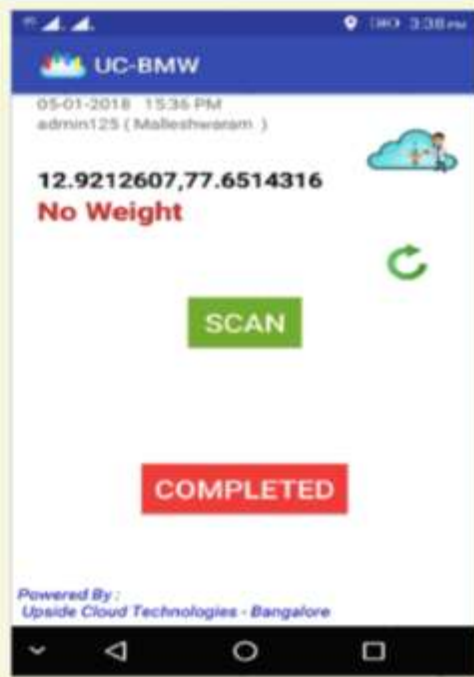
Barcode



Scan with weight & Record



Report Generation



UC BMW App Screenshot



# Segregation

- Separation of entire waste generated in a hospital should be done in defined waste categories.
- Segregation Ensures that waste
  1. Treated according to hazards of waste
  2. **Correct disposal** routes are taken
  3. **Correct transportation equipment** will be used

# How segregation help?

- Recycling is a good environmental practice, which can also double as a **revenue generating activity**.
- Recycled plastic material can be used for **non-food grade applications**.
- Of the general waste, the **biodegradable waste can be composted** within the hospital premises and can be used for **gardening purposes**.
- **Reduces the cost of treatment and disposal** (80 – 85 % of a hospital's waste is general waste, which does not require special treatment, provided it is not contaminated with other infectious waste)

# Segregation key facts

- Operator of a CBMWTF will assist in the training of HCW from where the waste is being collected.
- **BMW have been classified into four categories based on colour code so** segregation is improved .
- One of the main principle of disposal of BMW is that **segregation has to be done at the source** of generation of the waste itself.
- Untreated human anatomical waste, animal anatomical waste, soiled waste and biotechnological waste should not be stored beyond a period of 48 hours.

Anatomical waste, chemical waste, soiled waste, chemotherapy waste, discarded linen and medicines and laboratory waste



शारीरिक, रासायनिक, गंदा कपड़ा, दवाइयों सम्बंधित एवं

Contaminated plastic waste



दूषित प्लास्टिक कचरा

Glass waste and metallic implants






कांच की वस्तुएं एवं धातु प्रत्यारोपण




Metal sharps



धारदार धातु कचरा

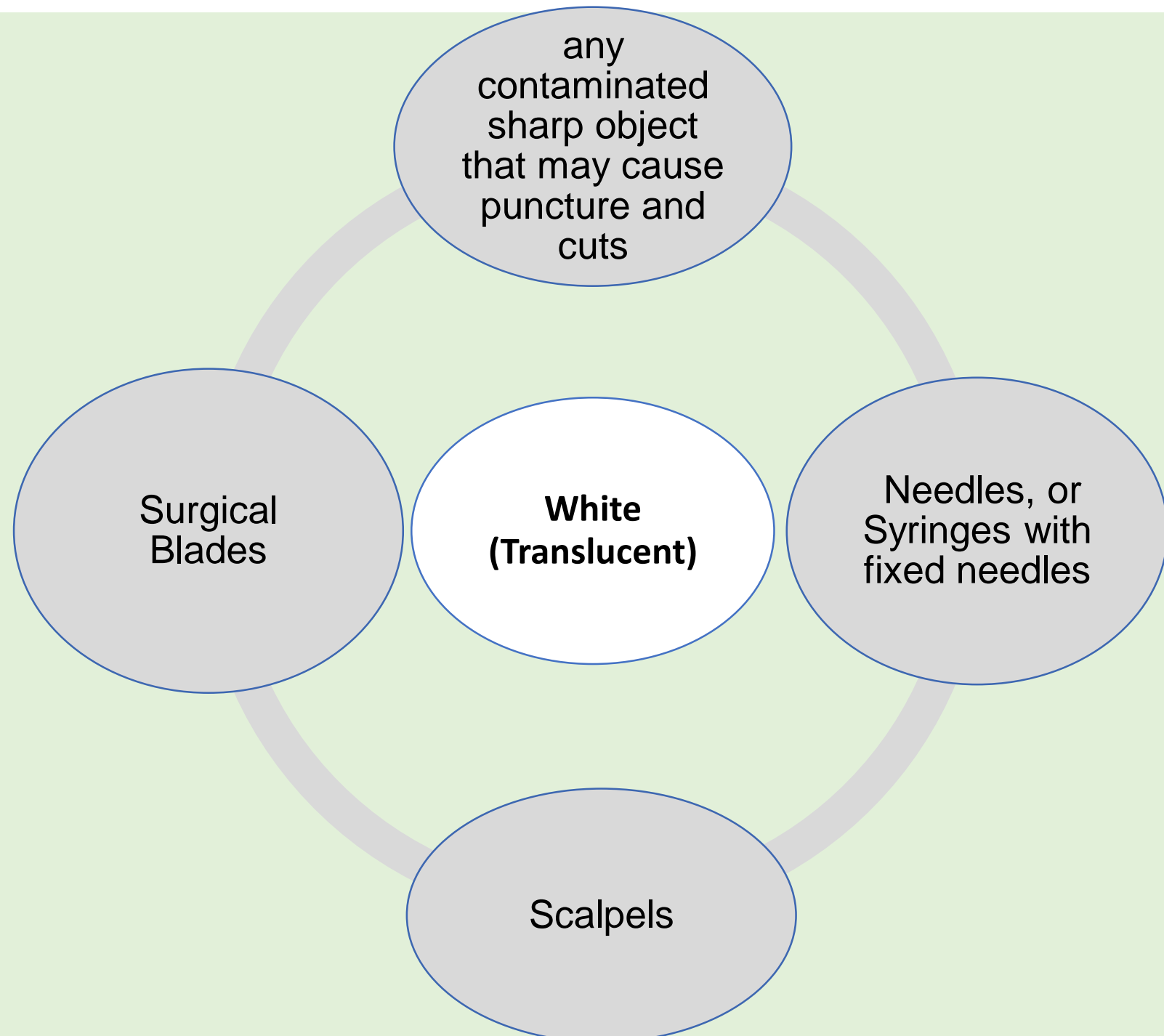





Category	Type of waste	Type of Bag or container to be used	treatment and Disposable options
<b>Yellow</b>	<b>Human Anatomical Waste</b>		Incineration or Plasma Pyrolysis or deep burial
	<b>Animal Anatomical Waste</b>		Incineration or deep burial. In absence of above facilities, autoclaving or micro-waving followed by shredding or mutilation or combination of sterilization and shredding.
	<b>Soiled Waste:</b> Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs		Yellow colored non-chlorinated plastic bags
	<b>Expired or Discarded Medicines:</b>		<b>Non- chlorinated chemical disinfection</b> followed by incineration. In absence of above facilities, shredding or mutilation
	<b>Discarded linen, mattresses, beddings contaminated with blood or body fluid.</b>		

Cat.	Type of waste	Type of Bag or container to be used	treatment and Disposable options
<b>Yellow</b>	<b>Chemical Waste</b>	Yellow containers or non-chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility.
	<b>chemical Liquid waste</b>	Separate collection system leading to effluent treatment system	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other waste water. The combined discharge shall be disposed through <b>effluent treatment plants.</b>
	<b>Microbiology, Biotechnology and other clinical laboratory waste: or discarded blood and blood components.</b>	<b>Autoclave safe plastic bags or containers</b>	<b>Pre-treat</b> (Autoclaving or microwaving) <b>to sterilize with non-chlorinated chemicals</b> hereafter for Incineration.
			



Category	Type of waste	Type of Bag or container	treatment and Disposable options
<p><b>White (Translucent)</b></p>	<p><b>Waste sharps including Metals:</b> <b>Needles</b>, syringes with fixed needles, needles from needle tip cutter or burner, <b>scalpels, blades</b>, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps.</p>	<p>Puncture proof, Leak proof, tamperproof containers</p>	<p><b>Autoclaving</b> or Dry Heat Sterilization followed by <b>shredding</b> or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or <b>sanitary landfill</b> or designated concrete waste sharp pit.</p>




Category	Type of waste	Container used	Treatment and Disposable options
<p><b>Blue</b></p> 	<p><b>Glassware:</b> Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.</p>	<p>Cardboard boxes with blue colored marking</p> 	<p><b>Disinfection</b> (by soaking the washed glass waste after cleaning with detergent and <b>Sodium Hypochlorite treatment</b>) or through autoclaving or microwaving or hydroclaving and then sent for <b>recycling</b>.</p>
 <p>Ankle Implants</p>	<p><b>Metallic Body Implants</b></p>		



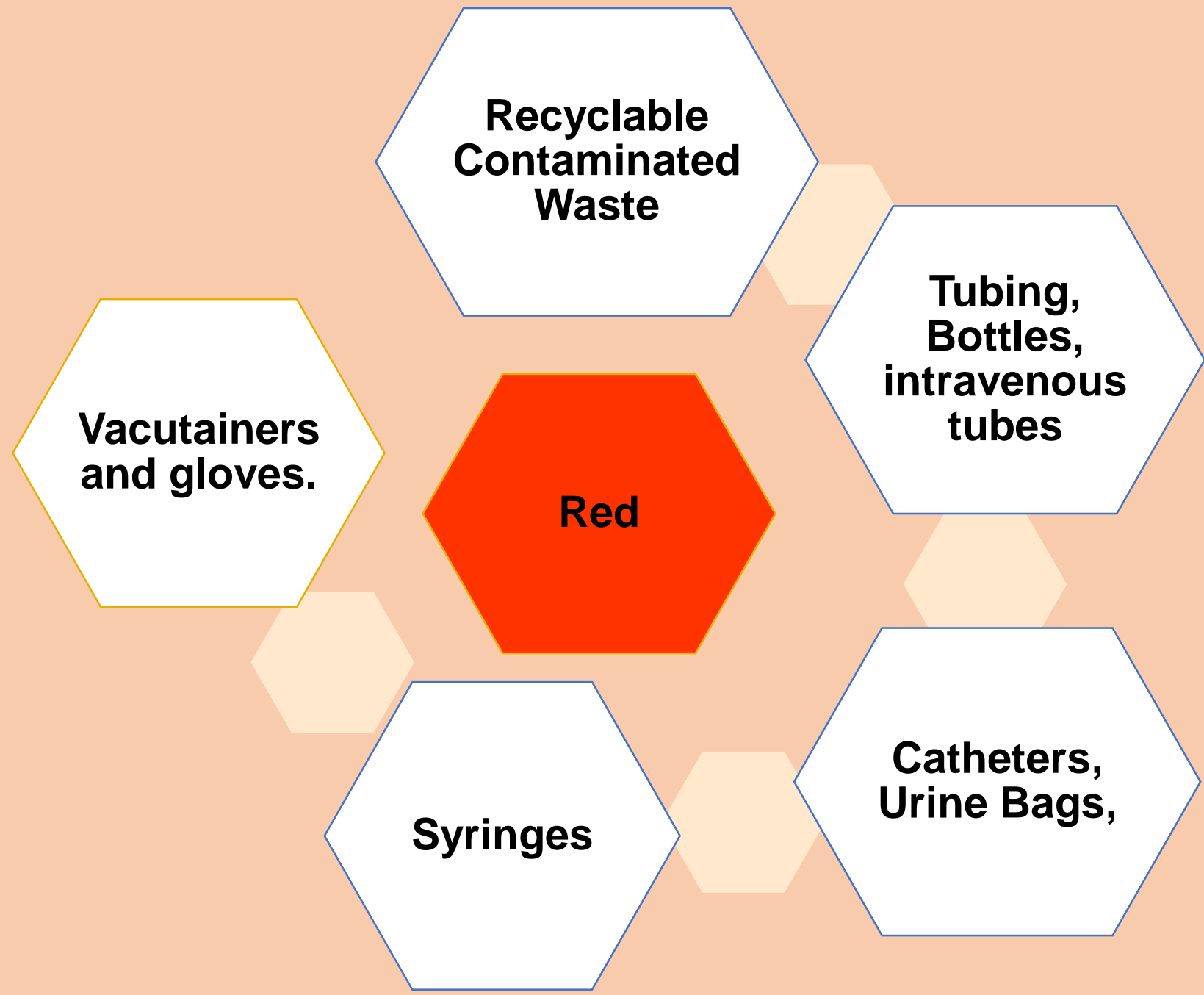
**Broken/  
Discarded  
glass vials  
ampoules**

**Blue  
Marking  
Bin**

**Metallic  
Body  
Implants**

Cat.	Type of waste	Type of Bag or container to be used	treatment and Disposable options
<b>RED</b>	<p><b>Contaminated Waste (Recyclable)</b></p> <p>Wastes generated from disposable items such as <b>tubing, bottles, intravenous tubes</b> and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and vacutainers with their needles cut) and gloves.</p>	<p>Red colored non-chlorinated plastic bags or containers</p> 	<p><b>Autoclaving or micro-waving/hydroclaving followed by shredding or mutilation</b> or combination of sterilization and shredding. <b><u>Treated waste to be sent to registered or authorized recyclers</u></b> or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. <b><u>Plastic waste should not be sent to landfill sites.</u></b></p>





# Storage

Holding of BMW for a certain period of time, then sent for treatment & disposal

- Stored for a period varying from two to twelve hours
- Central storage located within establishment and away from patient rooms, operation theatres, laboratories or any public access areas



# **SCHEDULE II- STANDARDS FOR TREATMENT AND DISPOSAL OF BIO-MEDICAL WASTE- RULE 2016**

- STANDARDS FOR INCINERATION
- STANDARDS FOR PLASMA PYROLYSIS
- STANDARDS FOR AUTOCLAVING
- STANDARDS FOR MICROWAVING
- STANDARDS FOR DEEP BURIAL
- STANDARDS FOR DRY HEAT STERILIZATION

# SCHEDULE III-2016

AUTHORITY	CORRESPONDING DUTIES
MINISTRY OF ENVIRONMENT, FORESTS AND CLIMATE CHANGE	<b>POLICY MAKING</b> , FINANCIAL ASSISTANCE
CENTRAL/STATE MINISTRY OF HEALTH AND FAMILY WELFARE	GRANT OF <b>LICENSE</b> TO HEALTH CARE FACILITIES
MINISTRY OF DEFENCE	Grant and renewal of authorisation to <b>Armed Forces</b> health care facilities
CENTRAL POLLUTION CONTROL BOARD	<b>Prepare Guidelines</b> on bio-medical waste Management and submit to the Ministry of Environment, Forest and Climate Change
STATE GOVERNMENT ADMINISTRATION	To <b>ensure implementation of the rule</b> in all health care facilities or occupiers
STATE POLLUTION CONTROL BOARDS	<b>Compilation of data and submission</b> of the same in annual report to Central Pollution Control Board within the stipulated time period.
LOCAL BODIES LIKE GRAM PANCHAYAT, MUNICIPALITIES	Provide or <b>allocate suitable land</b> for development of common bio-medical waste treatment facilities in their respective jurisdictions

SCHEDULE-IV (2016)

**LABEL FOR BIO-MEDICAL WASTE  
CONTAINERS/BAGS (PART 'A')**

**BIOHAZARD SYMBOL**



**BIOHAZARD**

**CYTOTOXIC HAZARD SYMBOL**



**CYTOTOXIC**

**HANDLE WITH CARE**

**Note : Label shall be non-washable and prominently visible.**

## SCHEDULE IV- 2016, PART B

### LABEL FOR TRANSPORTING BIO-MEDICAL WASTE BAGS/ CONTAINERS

1. WASTE CATEGORY NO.-----
2. WASTE QUANTITY-----
3. SENDERS NAME AND ADDRESS
4. PHONE NUMBER
5. CONTACT PERSON
6. IN CASE OF EMERGENCIES PLEASE CONTACT:
7. NAME AND ADDRESS:
8. PHONE NO.:

DAY-----MONTH-----  
YEAR-----  
DATE OF GENERATION-----

RECEIVERS NAME AND ADDRESS:  
PHONE NO.:  
CONTACT PERSON:

NOTE: LABEL SHALL BE NON-WASHABLE AND PROMINENTLY VISIBLE.

## FORMS of BMWWM 2016

F1. **ACCIDENT** REPORTING

F2. APPLICATION FOR **AUTHORIZATION** OR RENEWAL OF AUTHORIZATION OF HEALTH CARE FACILITIES

F3. AUTHORIZATION FOR **OPERATING FACILITY** COLLECTION, TREATMENT, STORAGE , TRANSPORT AND DISPOSAL

F4. **ANNUAL** REPORT

F5. APPLICATION FOR **FILING APPEAL** AGAINST ORDER PASSED BY PRESCRIBE AUTHORITY

# ANNUAL REPORT -2016

## ACCIDENT REPORTING-2016

Form - IV  
(See rule 13)  
ANNUAL REPORT

[To be submitted to the prescribed authority on or before 30<sup>th</sup> June every year for the period from January to December of the preceding year, by the occupier of health care facility (HCF) or common bio-medical waste treatment facility (CBMWTF)]

Sl. No.	Particulars	
1.	Particulars of the Occupier	
	(i) Name of the authorized person (occupier or operator of facility)	Director PGIMER, Chandigarh.
	(ii) Name of HCF or CBMWTF	#GIMER, Chandigarh
	(iii) Address for Correspondence	Sec-12, Chandigarh
	(iv) Address of Facility	Sec-12, Chandigarh
	(v) Tel. No, Fax, No	0172-2755554, 5958, Fax-0172-2744401
	(vi) E-mail ID	Pgimer-chd@nic.in
	(vii) URL of Website	http://pgimer.edu.in
	(viii) GPS coordinates of HCF or CBMWTF	30.7624 N, 76.7763 E
	(ix) Ownership of HCF or CBMWTF	[State Government or Private or Semi Govt. or any other] Autonomous Body
	(x) Status of Authorization under the Bio-Medical Waste (Management and Handling) Rules	Previous authorization was up to 31/08/2016, fresh authorization has been applied vide EV (II) PG/2016/BMW/MSGB-5280 dated 31 Aug 16.
	(xi) Status of Consents under Water Act and Air Act	Valid up to: CPCC/BMW/2014/154 dt 25 Apr 14
2.	Type of Health Care Facility	
	(i) Bedded Hospital	No. of Beds 1740 + 206 (Observation beds)
	(ii) Non-bedded Hospital	Not Applicable
	(Clinic or Blood Bank or Clinical Laboratory or Research Institute or Veterinary Hospital or any other)	
	(iii) License number and its date of expiry	N/A
3.	Details of CBMWTF	Not Applicable
	(i) Number healthcare facilities covered by CBMWTF	N/A
	(ii) No of beds covered by CBMWTF	N/A
	(iii) Installed treatment and disposal capacity of CBMWTF:	N/A Kg per day
	(iv) Quantity of biomedical waste treated or disposed by CBMWTF	N/A Kg/day
4.	Quantity of waste generated or disposed in Kg per annum (on monthly average basis)	Yellow Category :254688 Kgs/Annum Red Category: 37303 Kgs/Annum White : Blue Category : 82017 Kgs/Annum (White+Blue) General Solid Waste : 1869800 Kgs/Annum

7.	Details trainings conducted on BMW	
	(i) Number of trainings conducted on BMW Management.	22
	(ii) Number of personnel trained	428
	(iii) Number of personnel trained at the time of induction	Nil
	(iv) Number of personnel not undergone any training so far	---
	(v) Whether standard manual for training is available?	Yes
	(vi) Any other information	Nil
8.	Details of the accident occurred during the period	
	(i) Number of Accidents occurred during the year	Needle stick injuries - 40
	(ii) Number of the persons affected	40
	(iii) Remedial Action taken (Please attach details if any)	The concerned Health Care Workers/Waste handlers were provided required post exposure prophylaxis and counselling. All HCWs/Waste handlers reinforced to adapt needed safety measures including Personal protection equipment etc.
	(iv) Any Fatality occurred, details.	Nil
9.	Are you meeting the standards of air Pollution from the incinerator? How many times in last year could not met the standards?	Yes Nil
	Details of Continuous online emission monitoring systems installed	---
10.	Liquid waste generated and treatment methods in place. How many times you have not met the standards in a year?	Nil
11.	Is the disinfection method or sterilization meeting the log 4 standards? How many times you have not met the standards in a year?	Yes, Nil
12.	Any other relevant information	{Air Pollution Control Devices attached with the Incinerator}

Certified that the above report is for the period from 01 Jan 16 to 31 Dec 16.  
The report has been prepared with inputs from office of H.E (Bio Medical) PGIMER, Chandigarh.



# Cleaning agents and disinfectants

1. **1% freshly prepared Sodium Hypochlorite** can be used as a disinfectant for cleaning and disinfection
2. The solution **should be prepared fresh.**
3. Leaving the solution for **a contact time of at least 10 minutes** is recommended.
4. **Alcohol (e.g. isopropyl 70% or ethyl alcohol 70%)** can be used to wipe down surfaces where the use of bleach is not suitable, e.g. metals.

# Frequency of cleaning of surfaces:

## 1. High touch surfaces:

Disinfection of high touch surfaces like (doorknobs, telephone, call bells, bedrails, stair rails, light switches, wall areas around the toilet) should be done **every 3-4hours**.

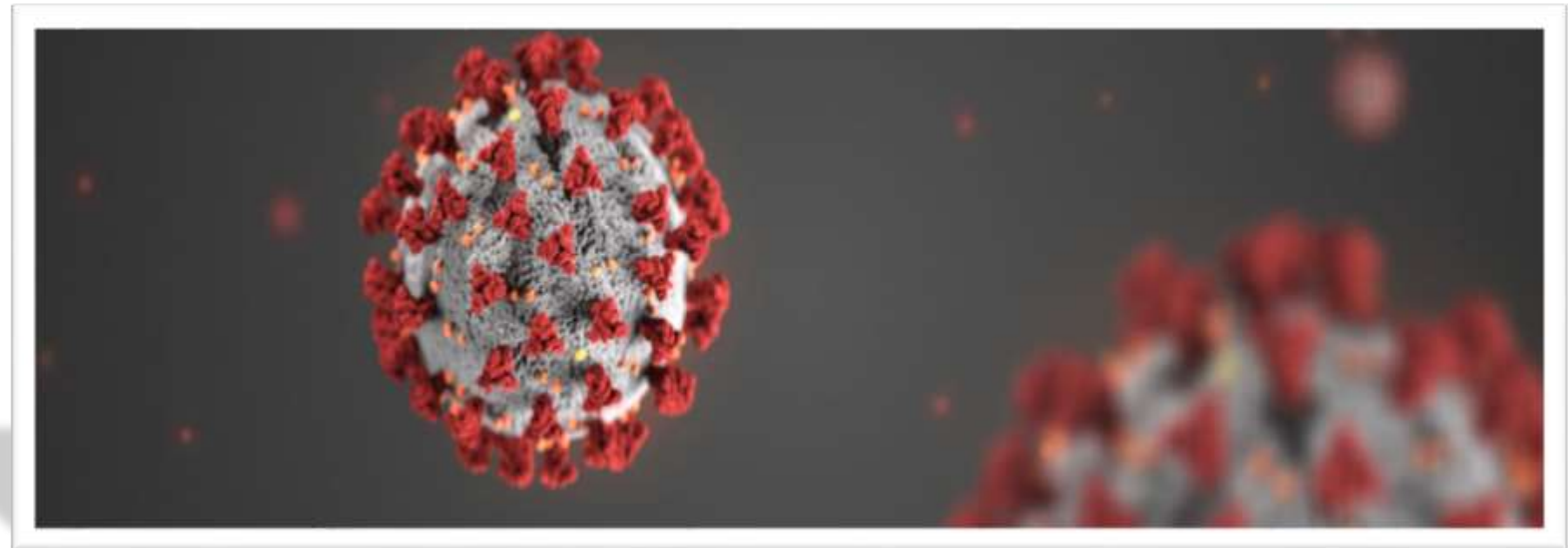
2. **Low-touch surfaces:** For Low-touch surfaces (walls, mirrors, etc.) mopping should be done **at least once daily**.

Best Practices for Environmental Cleaning in Health-care Facilities in Resource-Limited Settings. CDC. November, 2019)

# Safety measures for BMW Disposal

- All the generators of biomedical waste should adopt universal precautions and appropriate safety measures while handling the bio-medical waste.
- It should be ensured that: drivers, collectors and other handlers are aware of the nature and risk of the waste.
- Written instructions provided regarding the procedures to be adopted in the event of spillage/ accidents.
- Protective gears provided and instructions regarding their uses are given.
- workers are protected by vaccination against tetanus and hepatitis B.

# Management of Biomedical Waste from a Covid 19 Ward



- Use a **dedicated collection bin** labelled as “COVID-19” to store COVID-19 waste and **keep separately** in a temporary storage room prior to handing over the bin to an authorized staff of CBWTF.
- Biomedical waste collected in such isolation wards **can also be lifted directly from ward into CBWTF collection van.**
- A label “**COVID-19 Waste**” to be pasted on these items also.
- The (inner and outer) surface of containers/bins/trolleys used for storage of COVID-19 waste should be **disinfected with 1% sodium hypochlorite** solution **daily.**
- Biomedical waste if any generated from **quarantine centres/camps** should be **collected separately in yellow coloured bags** (suitable for biomedical waste collection).

# WASTE MANAGEMENT IN COVID-19 WARDS, COVID-19 SAMPLE COLLECTION CENTERS AND LABORATORIES

Record of waste generated from COVID-19 isolation wards should be maintained separately. Opening or operation of COVID-19 isolation wards and sample collection centres should be reported to SPCBs.



Biomedical waste should be segregated as per the SWM Rules as depicted in poster number 1 and 5 of this guide.



Collected biomedical waste should be stored separately in temporary storage room prior to handing over to authorized staff of Common Biomedical Waste Treatment Facility (CBWTF).

Only dedicated trolleys with "COVID-19" label should be used in COVID-19 isolation wards.



Dedicated sanitation workers should be deployed separately for handling biomedical waste and general solid waste for COVID-19 wards.



General waste not having contamination should be disposed as solid waste as per SWM Rules, 2016.

Biomedical waste can be filled directly from the isolation wards into CBWTF collection van.

Double layered bags (using 2 bags) should be used for collection of waste from COVID-19 isolation wards.



Collection of biomedical waste should be carried out separately in appropriately colour coded and specifically dedicated bins with an additional label of "COVID-19 Waste". If authorized waste collector shall hand over yellow bag waste to CBWTF operator for final disposal.

The (inner and outer) surface of containers/bins/trolleys used for storage of COVID-19 waste should be disinfected with 1% sodium hypochlorite solution daily.

# GUIDELINES FOR HANDLING AND DISPOSING WASTE FROM QUARANTINE CAMPS/ HOMES/ HOME-CARE FACILITIES

General solid waste (household waste) should be handed over to waste collector identified by Urban Local Bodies (ULBs) or as per the prevailing local method of disposing general solid waste.

Maintain separate bins for biomedical waste and general household waste.



Persons operating Quarantine camps/centres should call the CBWTF operator to collect biomedical waste as and when it gets generated.



Biomedical waste from quarantine centres/camps should be collected separately in yellow coloured bags provided by ULBs. These bags can be placed in separate and dedicated dust-bins of appropriate size.

Persons taking care of quarantine home / home-care should deposit generated biomedical waste from suspected or recovered COVID-19 patients by any of the following methods:

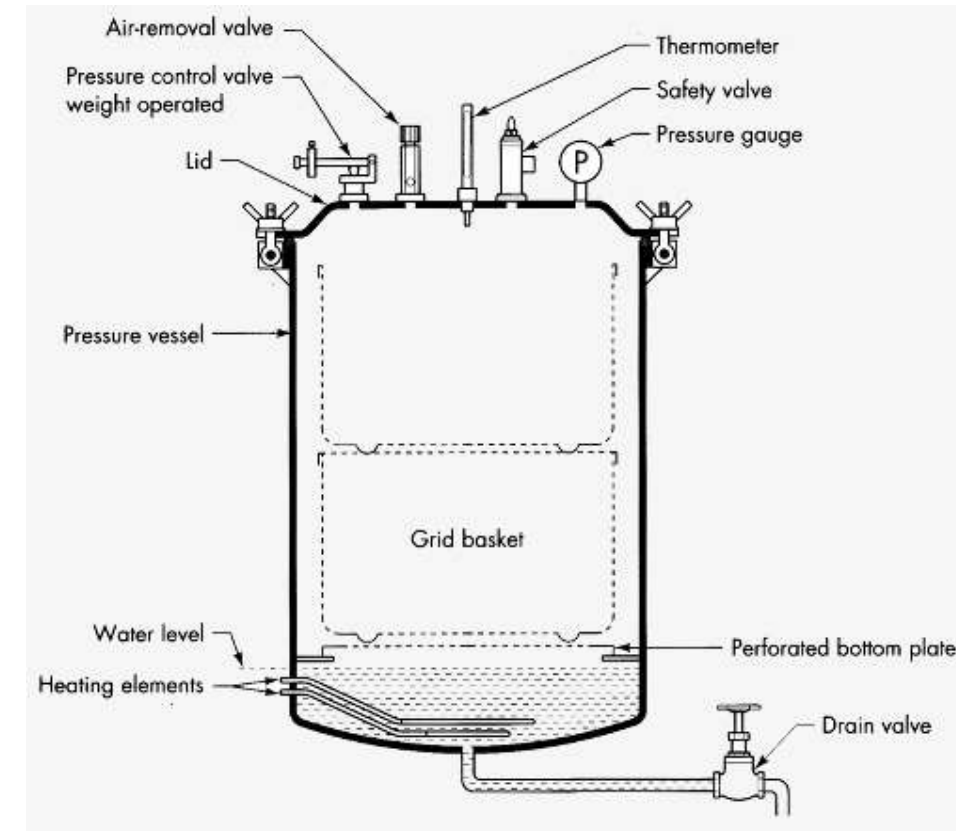
Hand over the yellow bags containing biomedical waste to authorized waste collectors at door steps engaged by local bodies; or Deposit biomedical waste in yellow bags at designated deposition Centres established by ULBs



**AUTOCLAVE** : An autoclave is a machine that uses steam under pressure to kill harmful bacteria, viruses, fungi, and spores on items that are placed inside a pressure vessel.

## OPERATING STANDARDS:

TEMPERATURE	PRESSURE	TIME
121 °C	15 PSI	60 MINS
135 °C	31 PSI	45 MINS
149 °C	52 PSI	30 MINS



:

## Validation test for autoclave:

- Once in three months for CBMWTF
- Biological indicator for autoclave shall be *Geobacillus stearothermophilus* at least  $1 \times 10^6$  spores for sterilization

# Dry Heat Sterilization

Temperature not less than 185°C, at least for a residence period of 150 minutes in each cycle, which sterilization period of 90 minutes.

## Validation test for Dry Heat Sterilization:

- Should completely and consistently kill the biological indicator *Geobacillus Stearothermophilus* or *Bacillus Atropheaus* spores using vials with at least  $1 \times 10^6$  spores per ml.
- The test shall be carried out once in three months



**HOT AIR OVEN**



# Incineration

Destruction of waste material by burning- In incinerators or combustion chambers.

It is high temperature dry oxidation process, that reduces organic and combustible waste to inorganic incombustible matter and results in a very significant reduction of waste-volume and weight. The process is usually selected to treat wastes that cannot be recycled, reused or disposed off in a land fill site.

## EMISSION STANDARDS:

### OPERATING STANDARDS:

- Combustion efficiency (CE) shall be at least 99.00%.
- The temperature of the primary chamber shall be a minimum of 800°C and the secondary chamber shall be minimum of 1050°C +/- 50°C
- Wastes to be incinerated shall not be chemically treated with any chlorinated disinfectants.

PARAMETER	Limiting concentration in mg Nm <sup>3</sup>
Particulate matter	50
Nitrogen oxides	400
HCL	50
Total dioxins and furans	0.1ng
Hg and its compounds	0.05

STACK HEIGHT: Minimum stack height shall be 30 meters above the ground



# Plasma Pyrolysis or Gasification

- Plasma pyrolysis technology is the disintegration of organic compound into gases and non-leachable solid residues in an **oxygen-starved environment**. Plasma pyrolysis utilizes large fraction of electrons, ions and excited molecules together with the high energy radiation for decomposing chemicals.
- Combustion efficiency (CE) shall be at least 99.99%
- Complete destruction of waste
- Destroys pathogens by uv radiation
- **Free from nitrous oxides and dioxin emissions**
- Negligible bottom ash
- Low man power requirement
- Environment friendly system
- Provisions for generation of electricity from waste



- **Encapsulation** is a waste disposal method that packs hazardous materials in containers made of impervious and non-reactive material. The containers are sealed with concrete, plastic, or steel for burial or storage.
- **Inertization** consists in mixing pharmaceutical waste with cement and lime in a container before burying to minimise the risk that toxic substances migrate into the surface or groundwater.
- Alkaline **hydrolysis** is related to the ancient technology of rendering animal carcasses. The principle is that high pH (>10) aqueous solution or slurry **breaks down complex biological molecules**. The caustic liquid and high temperature kill living organisms, including pathogens. Bacteria are destroyed as are viruses, rickettsia, fungi, and (perhaps) prions. Either sodium hydroxide or potassium hydroxide solutions or slurries are employed

# Disposal

- Sanitary Landfills
- Burial pit
- Encapsulation
- Sharp Pit



# Quiz Time

# Which statement is false for BMW rules 2016?

- A. Schedules 1 includes standards for treatment and disposal of BMW
- B. Schedules 4 Part-A includes Label for BMW bags or containers
- C. Schedules 3 includes List of prescribed authorities and the corresponding duties
- D. Schedules 4 Part-B includes Label for transporting BMW bags or containers

**Correct Answer: Schedules 1 includes standards for treatment and disposal of BMW**

# Which statement is false for BMW rules 2016 in its Schedules?

- A. Central pollution control board responsible for prepare guidelines on bio-medical waste Management
- B. Ministry of environment, forests and climate change is responsible for Grant of license
- C. State pollution control boards responsible for compilation of data and submission of annual report
- D. State government administration is responsible to ensure implementation of the rules in all the health care facilities or occupiers

**Correct Answer: Ministry of environment, forests and climate change is responsible Grant of license**

# Which statement is false for BMW rules 2016?

- A. Biological indicator for autoclave shall be *Geobacillus stearothermophilus* at least  $1 \times 10^6$  spores for sterilization
- B. Biological indicator for microwave shall be *Bacillus Atropheaus* at least  $1 \times 10^4$  spores for sterilization
- C. Combustion efficiency (CE) shall be at least 99.00% for pyrolysis.
- D. Minimum stack height shall be 30 meters above the ground for incineration.

**Correct Answer: Combustion efficiency (CE) shall be at least 99.00% for pyrolysis.**



# Autoclaving and microwaving are done for which of the following types of medical waste ?

- A. Human anatomical waste
- B. Cytotoxic drugs
- C. Microbiological waste
- D. Recyclable contaminated waste

**Correct Answer: Recyclable contaminated waste**

# Fetus, placenta & extracted tooth to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Yellow**

**Syringes (without needles and fixed needle  
Syringes with their needles cut) to be discarded  
in which bin/container ?**

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Red**

# Arthroscopy blade to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: White puncture & leak-proof box**

# Animal carcasses to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Yellow**

# Metal sternal wire to be discarded in which bin/container?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Blue**

# ICT test cards, ELISA plate to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Red**

# Cardioplegia needle and surgical stab knife to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: White puncture & leak-proof box**



# Disposable (single use non-linen based) masks and gowns to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Yellow**

# Glass slides and glass pipettes to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Blue**

# Discarded containers of chemicals and disinfectants to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Yellow**

# Cover of the foleys catheter of a HbsAg positive patient to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Black**

# Silver X Ray Film Developing Liquid to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Yellow**

# Live or attenuated vaccines to be discarded in which bin/container ?

- A. Yellow
- B. Red
- C. Blue
- D. White puncture & leak-proof box
- E. Black

**Correct Answer: Yellow**



**Let the wastes of "the sick" not contaminate the lives of "the healthy"**

## REFERENCES:

**BMW MANAGEMENT RULES, 2016: MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE**

[https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW\\_Amended\\_10.05.2019.pdf](https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW_Amended_10.05.2019.pdf)



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