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HEALTH AND
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सत्यमेव जयते

NATIONAL HEALTH MISSION
राष्ट्रीय स्वास्थ्य मिशन

IMPLEMENTATION GUIDEBOOK OF SOLID WASTE MANAGEMENT IN HEALTHCARE FACILITIES

For Sustainable and Safe Waste Practices

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CHAPTER 1

INTRODUCTION

This chapter gives an overview of the need for General waste management practices in HCF, the types of general waste generated, the segregation policy, the roles of occupiers and other relevant stakeholders, and their obligations for the effective implementation of general waste management.

It also covers the document's objectives, scope and briefly describes applicable rules and regulations.

1.1 OVERVIEW

Public Health Facilities produce a substantial quantity of general solid waste, specifically Non-Infectious Waste, due to diverse daily activities. Currently, the HCFs are facing the following major challenges: -

- Inadequate Infrastructure of collection of segregated waste
- Lack of awareness about waste reduction
- Importance of segregation at source
- Periodic collection and transfer of waste
- Resource Recovery and Onsite Processing

Specifically, the periodic collection of waste in segregated form is a challenging task in rural areas.

The generated infectious waste due to clinical and ancillary activities in HCF is being managed in alignment with guidelines of BMW Rules, 2016 and their amendments, but HCF are currently facing challenges in managing its non-infectious solid waste; thus, it's critical to:

- Manage solid waste scientifically.
- Prevent littering, which causes contamination.
- Adopt a holistic waste management approach.
- Safeguard the health of patients, the community, their caregivers, administrative personnel, and other healthcare workers.
- Comply with regulations and maintain aesthetic appearance.

Crucial Considerations:

Due to different physical and chemical properties of general waste the collection, storage, transportation and management require careful attention.

General solid waste must never be mixed with biomedical waste at any handling stage, and their bins for storage should not be placed in proximity to biomedical waste bins.

Factors influencing waste generation (composition and volume) in HCFs:

- Total footfall of patients, visitors and other stakeholders
- Availability of clinical services and dimension of other auxiliary services
- Geographical location of facility and type of availability of local food items
- Culture, lifestyle and socioeconomic conditions of HCF beneficiaries
- Premises of HCF

Importance of scientific waste disposal:

Mitigates health risks by preventing contamination, reducing pollution, and minimizing adverse impacts on air and water quality. Proper waste handling avoids secondary pollution and enhances aesthetic sense/appearance.

Purpose of document:

To provide facility I/C, staff, programme officer & other stakeholders in Health Care Facilities with guidelines for effective, efficient, and comprehensive management of general solid waste.

1.2 OBJECTIVES AND SCOPE

The objectives of solid waste management guidelines for the hospital are to:

1. Promote holistic waste management within HCFs
2. Conserve resources and their judicial use
3. Ensure Compliance with rules and regulations
4. Prevent environmental pollution
5. Avoid contamination and exposure risk to all
6. Enhance aesthetics and safety of the HCF

1.3 REGULATORY FRAMEWORK

Under the Environment (Protection) Act 1986, Solid Waste Management Rules, 2016 were notified, superseding Municipal Solid Waste (Management & Handling) Rules, 2000, which applies to waste generators - institutions, central and state organisations.

As per the rules, HCFs may be categorised into two groups based on waste generation: (a) non-bulk waste generators and (b) bulk waste generators.

Bulk waste generator means that waste generation exceeds an average of 100 Kg Per day or is based on byelaws (a notified regulatory framework for a particular jurisdiction). Based on potential of different waste generation, the applicability of different rules and regulations is as follows: -

Table 1: Waste Management Rules and their applicability

S.No.	Type of Waste	Applicable Rules and Regulations	Applicability
1.	Solid Waste	Solid Waste Management Rules 2016/ 2024[1] and their amendments	"Solid waste" means and includes solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and

[1] Yet to be notified

S.No.	Type of Waste	Applicable Rules and Regulations	Applicability
			market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities mentioned in rule 2;
2.	Biomedical Waste Management	Biomedical Waste Management Rules, 2016 and their amendments	"Bio-medical waste" means any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps, including the categories mentioned in Schedule I appended to these rules;
3.	Construction and Demolition Waste	Construction and Demolition Waste Management Rules, 2016 and their amendments	"C&D waste" means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure;
4.	Hazardous Waste Management	Hazardous and Other Wastes (Management and Transboundary movement) Rules, 2016 and their amendments	"Hazardous waste" means any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment, whether alone or in contact with other wastes or substances, and shall include - (i) waste specified under column (3) of Schedule I;

S.No.	Type of Waste	Applicable Rules and Regulations	Applicability
			(ii) waste having equal to or more than the concentration limits specified for the constituents in class A and class B of Schedule II or any of the characteristics as specified in class C of Schedule II; and (iii) wastes specified in Part A of Schedule III in respect of import or export of such wastes or the wastes not specified in Part A but exhibit hazardous characteristics specified in Part C of Schedule III;
5.	Electrical and Electronic Waste	E-Waste (Management) Rules, 2022 and their amendments	'e-waste' means electrical and electronic equipment, including solar photo-voltaic modules or panels or cells, whole or in part discarded as waste, as well as rejects from manufacturing, refurbishment and repair processes;
6.	Plastic Waste	Plastic Waste Management Rules, 2022 and their amendments	"Plastic" means material which contains as an essential ingredient a high polymer such as polyethylene terephthalate, high density polyethylene, Vinyl, low density polyethylene, polypropylene, polystyrene resins, multi-materials like acrylonitrile butadiene styrene, polyphenylene oxide, polycarbonate, Polybutylene terephthalate;
7.	Batteries Management	Battery Waste Management Rules, 2022 and their amendments	"Battery" means new or refurbished cell and/or Battery and/or their component, including accumulator, which is any source of electrical energy generated by direct conversion of chemical energy and includes disposable primary and/or secondary battery.

This guidebook is limited to the management of General Waste but for scientific management of other waste (except general solid waste) such as e-waste, C&D Waste, Battery Waste, the respective rules will be applicable, and it must be managed with following sectoral best practices.

1.4 WASTE GENERATION AND DISPOSAL

- In HCF, it's estimated that general waste constitutes about 85 % of total waste, but this may vary depending upon different factors.
- Type and composition of waste are crucial in determining their segregation, collection, transportation, processing, and disposal method.
- Adequate infrastructure is essential for effective waste collection, storage, transportation, processing, treatment, and disposal.
- Climatic factors and HCF's existing infrastructure play a significant role in effective collection and disposal of generated waste.

Composition of Waste

General waste categorisation based on the physico-chemical properties of waste generated:

- **Non-biodegradable (Dry Waste) –**
  - » Defined as "waste other than bio-degradable waste, and inert street sweepings includes recyclable and non-recyclable waste, combustible waste, etc."
- **Biodegradable (Wet Waste) -**
  - » Organic material degradable by micro-organisms into simpler stable compounds

Special Care Waste:

It includes discarded paint drums, pesticide cans, CFL bulbs, tube lights, used batteries, used needles and syringes, etc., generated at the household level.

> "Health Care Facilities generate about 85% of waste as non-infectious in nature"– WHO (Safe management of wastes from health-care activities, Second Edition 2014)

1.5 SEGREGATION OF WASTE

Guidelines for segregation of general waste

- All types of waste should be segregated at the point of generation into biodegradable waste, non-biodegradable and Special Care waste categories
- Use Blue colour containers for non-biodegradable waste, and Green Colour containers for the storage of biodegradable waste
- Keep Special Care waste in designated bins of Black colour

1.6 STAKEHOLDERS

The relevant stakeholders or waste generators are:

- Health Care Facilities- Hospitals (DH, SDH, CHC, PHC, AAM-SHC/USHC/ PHC/ UPHC, Clinics, Dispensaries, AYUSH hospitals, Pathological laboratories, Blood banks, or any Clinical establishments generate general waste).
- Outreach Activities or Occasional Generators- Health camps/ melas/ Shivirs, medical/surgical camps, vaccination camps, VHSNDS/ UHSNDS, blood donation camps or other such facilities or activities.
- Other stakeholders are- ULBs/Third Party Vendors/Village Panchayats/ JAS/ PSG/MAS/LSGD/Authorized Recyclers/Waste Processor

1.7 RESPONSIBILITIES OF WASTE GENERATOR

The waste generators must follow the following interventions as per SWM Rules, 2016 for proper waste management across different streams: -

Table 2: Responsibilities of Occupier for Waste Management in HCFs

S.No.	Required Interventions	Responsibilities of Occupier
1.	Source Segregation The generated waste streams shall be segregated and stored in three separate suitable bins - - Biodegradable (Green) - Non-biodegradable (Blue) - Special Care Waste (Black)	The waste generator must store biodegradable, non-biodegradable, and special care waste categories in relevant coloured bins separately. The stored segregated waste shall be handed over to authorised waste pickers or collectors as per the directions or notifications issued by the local authorities from time to time.
2.	Horticulture Waste Collection and disposal - Grass trimming, leaves, etc.	Process it onsite within the parks and gardens, as far as possible, otherwise store it separately within premises and dispose of it as per the directions of the local body received from time to time.
3.	Littering	Avoid littering inside as well as in auxiliary premises. Three bin systems of adequate capacity shall be placed at different locations to avoid throwing, burning, or burying the generated solid waste within or outside premises or in the drain or in nearby deep vacant area.

S.No.	Required Interventions	Responsibilities of Occupier
4.	Health Camps/ Events/ Gatherings	General waste should not be mixed with biomedical waste. Further, the organizer of such event shall ensure the segregation of waste at the source and handing over of segregated waste to a waste collector or agency as specified by the local body.
5.	Authorized Stall Vendors	Each Stall Vendor should have separate bins for the collection of Non-biodegradable, Biodegradable, and special care waste, and they must transport/ dispose off their waste as per the approved general waste management guidelines of HCF.
6.	Processing and Disposal	Handover the recyclable material to either the authorized waste pickers or the authorized recyclers. For biodegradable waste: - a) Facility having total area >5000 Sq.M - Biodegradable waste shall be processed, treated, and disposed off through composting or biogas within the premises as far as possible. b) Facility having total area <5000 Sq.M - Biodegradable waste shall be transferred to ULB/ Village Panchayat and transported to designated sites for further processing.
Note: As per SWM Rules, 2016		

DO's

- Manage solid waste scientifically to ensure hygiene and compliance with regulations.
- Segregate waste into biodegradable, non-biodegradable, and special care waste.
- Store waste in designated color-coded bins (Green for biodegradable, Blue for non-biodegradable, Black for special care).
- Provide training to staffs and stakeholders on proper waste disposal practices.

DON'Ts

- Mix general solid waste with biomedical waste at any handling stage.
- Place bins for general waste nearwv biomedical waste bins. (Contradicts with the comment given above – CHECK again)
- Waste accumulation or overflow in storage areas.
- Forget to consider waste management plan during outreach activities

CHAPTER 2

STRATEGY AND ACTION PLAN

This chapter briefly explains the proposed action plans that each HCF level could follow to manage its solid waste within its existing resources.

Considering India's diversity in terms of climatic and economic conditions, implementation strategies must be aligned as per the SWM Rules 2016. State Policies, ULB byelaws, or Panchayat directions in the context of resource and financial capabilities are equally important.

The strategic action plan aims to guide HCFs and their stakeholders in formulating short-term, mid-term, & long-term plans for SWM which will cover:-

- The different types of waste
- Their characteristics
- Strategies to be adopted for the management of each category of waste
- The implementation framework for each component

The envisaged strategy aims to:

- Provide an objective-oriented plan for achieving goals
- Utilize the action plan to turn it into specific, actionable steps
- Strengthen existing waste management practices by navigating complexities optimising resources, and achieving desired outputs

Information sources for the strategy and framework:

- Analysis of available primary as well as secondary data
- Discussions with stakeholders
- Domain experts
- Successful practices across the country

Key Considerations for Effective Waste Management Strategy in HCF

- Analyse each component's effectiveness and outcomes for learning and incorporate it into the strategy and framework.
- Consider factors like waste generation potential, its constituents, local weather conditions, existing infrastructure, available resources, institutional set-up, and local rules and regulations
- Develop a sustainable strategy with action plans for short, mid and long-term goals according to state policies.
- Prepare a general waste management strategy for each HCF separately.

The proposed strategy should be aligned to: -

- Waste Prevention
- Waste Minimization
- Waste Recovery
- Waste Recycling and Reuse
- Onsite Processing
- Scientific Processing, Treatment, and Disposal.

Proposed waste management plan

- Segregation of waste and it's transfer/processing, aligned with set goals.
- Deliberate accountability, required infrastructure, available resources, feasibility, and viability for the entire process within the institution's resources.
- For effective implementation, the approach to the Healthcare Waste Management Strategy must align with the national programme and the state waste management policy.
- The envisaged waste management action plan shall be developed to establish priorities and tasks for avoiding, reducing, reuse, recycling, and efficiently managing the safe and scientific disposal of waste materials generated at the HCF.
- Based on waste quantification and prevailing scenario, the approach for holistic waste management could be like :-

Table 3: Responsibilities of Bulk and Non-Bulk Waste Generator

Waste Generator (<100 Kg/Day)	Waste Generator (>100 Kg/Day)
Primary Collection – Through primary bins in segregated form like Nonbiodegradable, Biodegradable and Special Care Waste	Primary Collection – Through primary bins in segregated form like Nonbiodegradable, biodegradable and Special Care Waste
Secondary bins and collection system – Required during outreach activities only	Secondary bins and collection system – Should be integrated with primary collection system
Transportation of Waste- Through ULB/ Village Panchayat/ Authorised Vendor in Primary Collection vehicles	Transportation of Waste - Through Owned/ ULB/ Village Panchayat/ Authorised Vendor in secondary collection vehicles
Material Recovery - Onsite or transferred to designated MRF Facility	Material Recovery - Onsite or transferred to designated MRF Facility
Onsite Processing – Decentralised – Own capacity	Onsite Processing – Decentralised – Own capacity
Centralised Processing - ULB/ Panchayat Level	Centralised Processing - ULB/ Panchayat Level
Treatment and Disposal - ULB/ Village Panchayat Level	Treatment and Disposal - ULB/ Village Panchayat Level

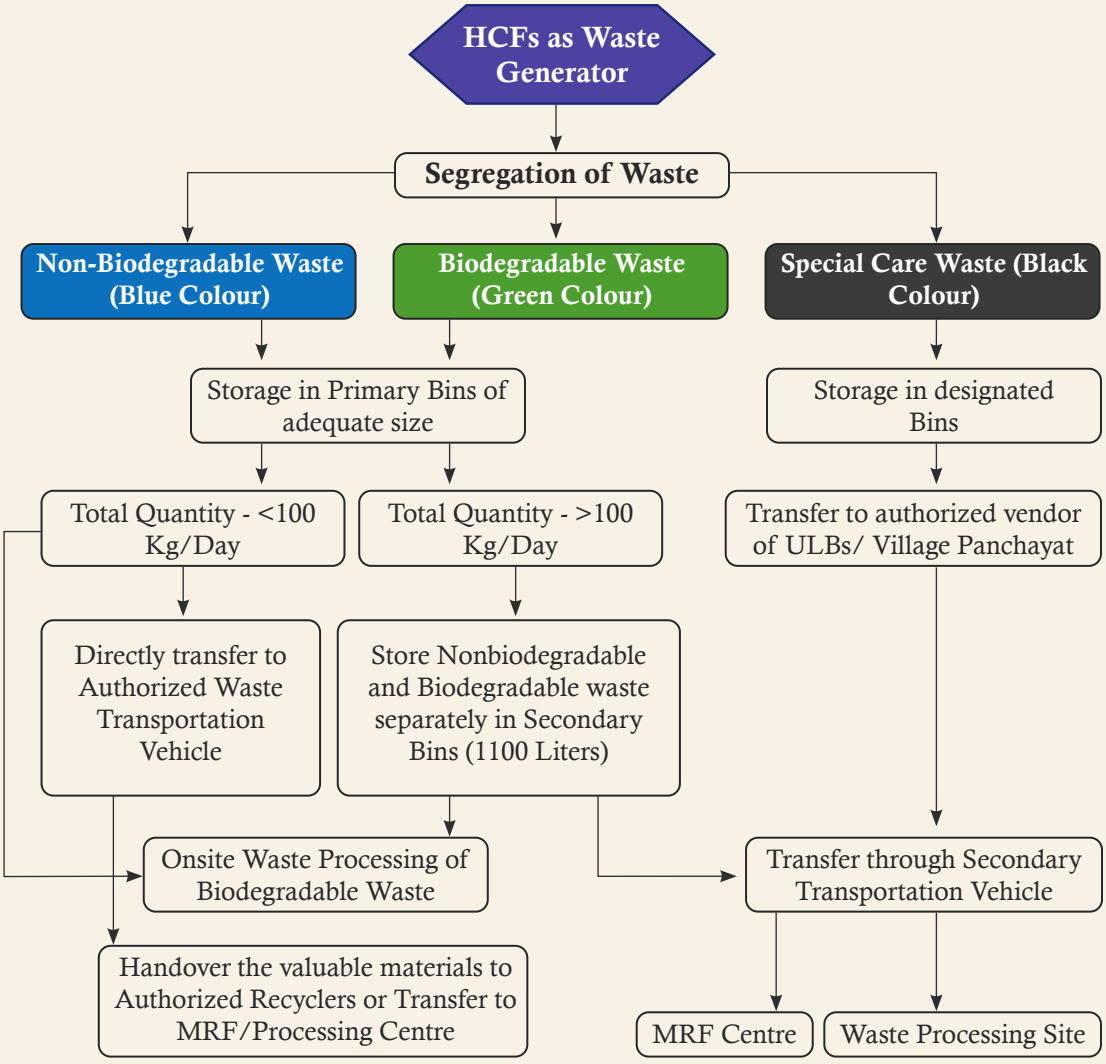
If any HCFs are generating more than 100 Kg/day of general waste they must do:-

- Registration as bulk waste generator with concerneanled local body through centralized online portal.
- Processing of wet waste in decentralized manner as far as possible. In case any HCFs are not able to set up then procure Extended Bulk Waste Generator Responsibility

(EBWGR) certificates from local body.

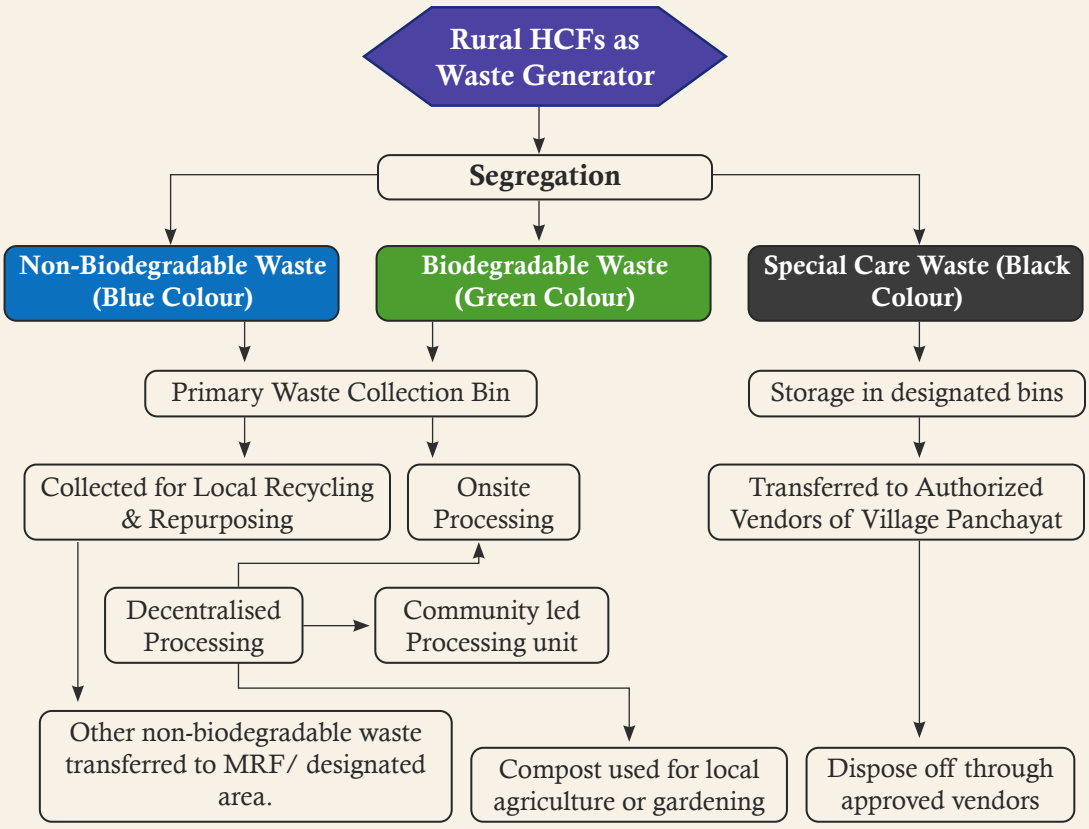
- Meet EBWGR obligations for total generated waste from collection to their scientific management.
- Handover different type of waste including residual waste to registered entity only
- Shall submit annual returns by 30th June of every year on centralized portal.

The proposed implementation plan shall be as follows: -



Note: - The detail about each activity, including the type of waste processing and the location of the existing MRF centre, is delineated in relevant chapters. Please refer to chapter- V Page No.- 24. The state wise MRF details could be accessed through https://sansaadhan.sbmurban.org

Rural Waste Management Flow Chart



DO's

- Development of strategic action plan covering waste types, characteristics, and management strategies.
- Ensure accountability and resource allocation for effective implementation.
- Establish short-term, mid-term, and long-term goals for waste management based on quantification of daily waste generation.
- Promote waste prevention, minimization, recovery, recycling, and reuse.

DON'Ts

- Preparation of waste management plan without considering local regulations and policies.
- Overestimate waste quantification when planning waste management strategies.
- Ignore stakeholder involvement when designing waste management plans.
- Neglect the need for regular evaluation and updates to existing waste management plan.

CHAPTER 3

COLLECTION AND STORAGE

The most effective component for sustainable waste management is segregating waste at source in appropriate coloured bins of adequate capacity. This chapter illustrates the components of biodegradable, non-biodegradable and special care waste and the importance of their segregation at source. The role of placement of appropriate primary bins at strategic locations emphasises the efficient collection of waste in secondary bins through a fixed route. Further, secondary storage facilities and street sweeping has also been covered.

Key factors in HCF Solid Waste Management:

- Minimization of waste generation through promoting the reuse materials
- Primary collection of segregated waste from different bins of adequate capacity
- Secondary storage of segregated waste in appropriate bins and
- Timely collection & transportation
- Scientific transfer from secondary storage with closed lid

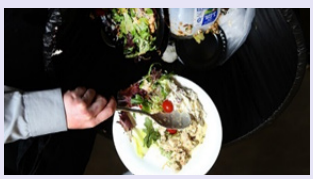
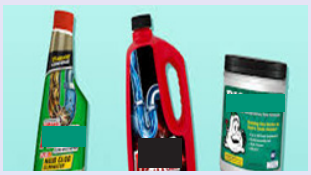
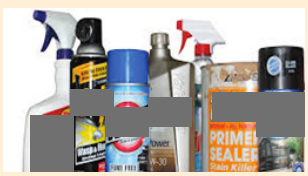
Optimising Waste Management Infrastructure by

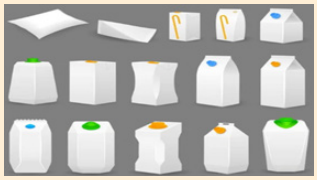
- Providing separate bins with closed lids to prevent spillage and maintain hygiene
- Recording and categorising waste based on activity, technology, and demand variations.
- Bins should be placed in accessible areas to accommodate high foot traffic.
- Implementing strategies to avoid interference from rodents, reptiles, or stray animals

3.1 SOURCE SEGREGATION

Depending upon the physical nature of waste and its degradation criteria the general waste could be categorized into three parts: -

Table 4: Example of different categories of waste

S. No	Nonbiodegradable Waste	Biodegradable Waste	Special Care Waste
1.	Plastic 	Vegetable 	Floor Cleaner 
2.	Wooden Stick 	Left out food 	Drain cleaners 
3.	Cardboard 	Vegetable Peels 	Wood and metal cleaners 

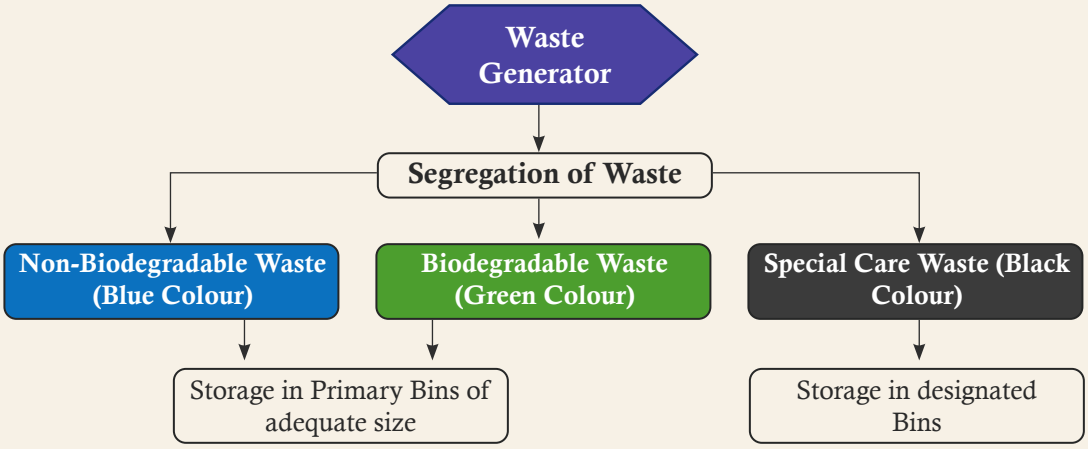
S. No	Nonbiodegradable Waste	Biodegradable Waste	Special Care Waste
4.	Leather 	Eggshells 	Toilet cleaners 
5.	Footwear 	Horticulture Waste 	Tile and shower cleaners 
6.	Rubber 	Sugarcane residues 	
7.	Tetrapack 	Coconut shells 	
8.	Discarded Furniture 	Garden leaves 	Insecticide 
9.	Paper 	Hairs 	Fluorescent light bulbs 

S. No	Nonbiodegradable Waste	Biodegradable Waste	Special Care Waste
10.	Cover of packaging materials 	Cow Dung 	Discarded PVC toys 
11.	Glass 	Green Leaves 	Painting Supplies 
12.	Foam 	Used flower leaf 	Shoe polish 
13.	Plastic carry bags 	Used tea leaves/tea bags 	
14.	Metal 	Rotten fruits and vegetables 	
15.	Nonmetal items 	Fruit peels 	Compressed gas cylinders 

S. No	Nonbiodegradable Waste	Biodegradable Waste	Special Care Waste
16.	Thermocol 	Used Tea Bags 	Battery Waste 
17.	Empty bottles/containers 		
18.	Empty milk pouches 		
19.	Newspaper 		
20.	Metal boxes/containers 		
Storage of Segregated Waste in Suitable bins is a Step towards Sustainable Management			
Source: Internet			

3.2 PRIMARY WASTE COLLECTION

- Involves segregation, collection, transporting, and removing waste directly from its generation source.
- It includes waste from clinical, non-clinical, administrative, and auxiliary areas within the healthcare facility (HCF).
- Ensure waste is taken to a storage area or transfer station for processing & disposal site, depending on HCF size and prevailing waste management system of ULB/ Village Panchayat



Importance of segregated waste collection:

- Inefficient waste collection services can impact HCF's public health and aesthetics.
- Segregated collection of Biodegradable, Nonbiodegradable and Special care waste ensures maximum recyclable recovery
- It enhances the potential for cost-effective recovery, processing & treatment, to meet the minimum quality criteria for desired output products.

Optimizing Bin Placement and their Capacity in Healthcare Facilities:

- Adequate numbers of covered bins should be placed for easy access, based on the potential for waste generation and collection frequency.
- Covered bins should be placed outside the clinical areas (OPDs, Emergencies, IPDs etc.) to accommodate the floating population.
- Bins should be emptied once they reach 80% of capacity or at a predefined schedule to prevent overflow and maintain hygiene. The generated waste should be transferred to secondary point/primary vehicles within 24 hours.

> Adequate Capacity of Bins to be placed at appropriate location to receive their applicable category of Waste.

- Ensure bins are visible and accessible to maximise their use.
- Equip bins with a wheel or trolley for smooth movement
- Consider stakeholders' concerns during the entire planning.
  - » Outdoor bin placement, in the case of the outside clinical area of HCF:
  - » Place bins at optimal distances (10– 50 m) to avoid littering.
- Materials with fire risk (like half-burn residue) should be prohibited in bins. (for example- half burn wood/matchstick, etc)
- Bins used for primary waste collection should have a capacity of at least 100% more than the estimated volume of daily waste generation.

3.3 NETWORK ESTABLISHMENT AMONG PRIMARY BINS

Effective waste collection planning:

- Micro planning involves the route of collection, time & responsibility.
- Primary waste collection should be unidirectional.
- An approved scheduled plan should be followed for waste collection.
- Primary waste could be collected in large capacity covered bins as per applicability
- The identity of each bin should be earmarked based on its location, the type of waste it receives, and the sensitiveness of its catchment area.

Collection of Segregated Waste from Unique bins in Unidirectional leads to Usefulness.

3.4 ADEQUATE INFRASTRUCTURE FOR WASTE COLLECTION

- Each healthcare facility (HCF) is expected to provide sufficient infrastructure for sanitation, including primary bins with capacities aligned to the expected waste quantity. The wheel bins must be designed and aligned to **IS 12402-1 (2022).**[2]
- Extra 100% storage capacity should be allocated to prevent spillage during scheduled collection delays or failures.
- Waste collection bins must be decontaminated after their uses.
- Secondary waste storage containers should be fire-resistant, durable, covered, and designed for mechanical lifting to minimise manual handling.
- Bins must be easily handled, leakproof, properly coloured, and located in designated areas.
- For effective collection of sanitary waste, yellow coloured paddle operated bins with

[2] https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/standard_review/Standard_review/Isdetails?ID=MzcyNw%3D%3D)

closed lid should be placed at potential waste generation point (like geriatric wards, ICU, HDU, Maternity wards, SNCU and Female Toilets) to avoid their mixing with other category of waste.

The requisite infrastructure required to accomplish it shall be as follows: -

Capacity of Bins	Purposes	Exhibit
15 Liters, 30 Liters, 60 Liters, 120 Liters, 240 Liters (Green) as per applicability	Primary Collection Bins for storage of Biodegradable Waste	
15 Liters, 30 Liters, 60 Liters, 120 Liters, 240 Liters (Blue) as per applicability	Primary Collection Bins for storage of Non- biodegradable Waste	
15 Liters, 30 Liters, 60 Liters, 120 Liters, and 240 Liters (Black) as per applicability	Primary Collection Bins for Storage of Special Care Waste	
1100 Liters, (Green)	Secondary Collection Bins for storage of Biodegradable Waste	
1100 Liters (Blue)	Secondary Collection Bins for storage of Non- biodegradable Waste	
1100 Liters (Black)	Secondary Collection Bins for storage of Special Care Waste	
Adequate Size of Bins are Basic of Best Practices to avoid Littering.		

3.5 SWEEPING WASTE

- Sweeping generally refers to cleaning the outdoor areas surrounding the clinical building and its ancillary facilities. .
- Depending on topography, infrastructure, and the type of waste generated, the composition and quantity may vary. However, waste generated from these areas shall be collected in bins of adequate size and transported to SLF or the designated site of ULB/Nagar/Village Panchayat.

The collected street sweeping waste will be stored separately and directly transferred to the SLF/designated waste disposal site. It should always be ensured that infectious waste should NEVER mix with the street sweeping waste.

- Workers should be provided with protective gear such as uniforms, shoes, gloves, and other implements for their safe and easy working.
- Training on safe handling practices
- They should be subjected to immunisation (like Td and Hepatitis B) and periodic health checkups

3.6 COMMON STORAGE FACILITY

Secondary collection Infrastructure:

- A secondary collection system involves transporting waste from primary collection points to the designated secondary point, material recovery facilities, or disposal site.
- The commonly covered bins should be compatible with the primary collection system to avoid multiple waste handling.
- The size and shape of covered bins must be aligned with the primary collection system to prevent fallen materials while transferring the waste.

The secondary collection facility:

Must be fire-resistant, accessible, and approachable in all weather conditions, should be away from low lying areas and be away from stray animals.

- The florescent based display and adequate lighting to enhance visibility and safety should demarcate the waste storage area.
- The storage infrastructure should be shed covered, well-ventilated and fenced.
- Only authorized person/vehicles should be permitted to enter in this premises.
- Water facility for handwashing and cleaning of area must be available nearby this place to avoid infection spread.
- Secondary bins and their surrounding area must be clean with water once the bins get empty or waste transfer to vehicles.

Storage and Transfer Protocols

- Waste should be kept separate during all waste collection, transportation, and processing steps.
- The primary collected waste shall only be transferred to the designated secondary collection points.
- Segregated waste must be stored on-site in separate covered secondary bins or containers of adequate capacity for further processing
- The general waste storage area should be demarcated separately, and it should not be mixed with Bio medical waste (BMW) storage area.
- It's advisable that the transfer of waste from premises of HCF should be practiced during the lean period.

Capacity and maintenance:

- Waste at secondary storage points should be cleared daily or at scheduled intervals to prevent accumulation, ensuring all bins remain below 80% capacity to avoid overflow and contamination.
- A contingency plan should ensure that secondary bins have a reserve capacity of 100% for emergencies where waste collection is delayed.

Color coding for bins:

- The bins for storage of bio-degradable waste shall be painted green
- Storage of non- biodegradable waste shall be painted blue
- Storage of special care waste shall be black
- The size of bins shall be in alignment with the designated waste collection vehicles of ULB/Panchayat or any other authorised vendor for lifting waste/containers.
- The proposed bins must be anticorrosive, durable and fire resistant.

Secondary Storage should ensure to keep Waste Safe from Stray Animals and Fires

3.7 WASTE STORAGE (CAMP/OUTREACH ACTIVITIES)

- Healthcare facilities (HCFs) should maintain sufficient infrastructure to collect waste generated during scheduled health camps or gatherings.
- Adequate numbers of bins (for non-biodegradable and biodegradable waste) should be placed at different locations to prevent littering during these events.
- Organizers must incorporate a waste management plan into their event plans, including the display of Information, Education, and Communication (IEC) materials to encourage proper bin use and minimise littering.

- The Urban Local Body (ULB)/Village Panchayat should be notified of such events at least 3 days in advance to ensure the provision of adequate infrastructure and timely waste transfer.

Place the waste in designated colour coded bins

3 Bins Waste Storage System

Special Care Waste | **Non-Biodegradable Waste** | **Biodegradable Waste**

Source: CPCB

3.8 SPECIAL CARE WASTE

As per the SWM Rules, 2016, each waste generator must comply with safe storage and transportation of special care waste to an authorized special care waste center or as directed by CPCB/PCC.

The generated waste must be collected separately and placed in designated bins to avoid accidents or adverse impacts on stray animals or the nearby environment.

DO's

- Collection and storage of waste in a segregated manner at the source.
- Use of color-coded bins: Green for biodegradable, Blue for non-biodegradable, and Black for special care waste.
- Ensure bins have lids to prevent spillage, pests, and odours.
- Transfer collected waste to the designated storage area or transportation vehicle within 24 hours.
- Ensure that waste handlers use personal protective equipment (PPE) for safety.

DON'Ts

- Mix biodegradable, non-biodegradable, and special care waste in the same bin.
- Use single colour bin for all types of waste, as it affects waste recovery & processing efficiency.
- Leave waste bins uncovered, as it can lead to contamination and hygiene issues.
- Allow waste to accumulate beyond its storage capacity.
- Let waste handlers work without proper PPE

CHAPTER 4

TRANSPORTATION AND TRANSFER OF STORED WASTE

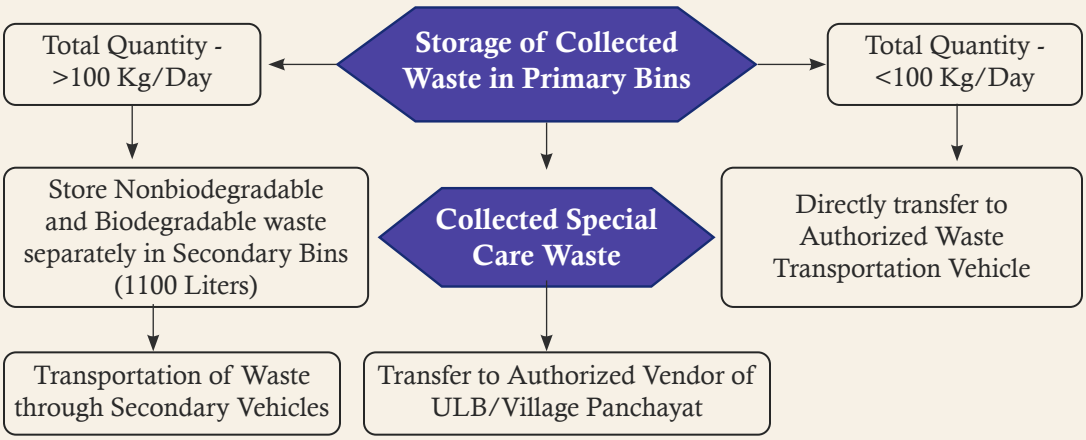
The chapter highlights the importance of transferring general waste from bin to bin or bin to vehicle. To make transportation feasible and viable, different modes of possible engagement of waste vehicles with ULB/ Village Panchayat have been mentioned, which HCF could explore as per their applicability.

The transfer of collected waste aims to eliminate direct contact with the ground by ensuring that biodegradable and Nonbiodegradable waste is separately transferred from primary collection to designated vehicles/ bins.

The waste from the primary collection system must be stored at a designated location marked in the HCF site layout for safe storage and cost-effective onward transport. The following initiatives could be considered :-

- Based on topography and local weather conditions, the type, size and placement of bins should be determined, ensuring they are not in water logging or fire sensitive zones, suitable for all weather, and accessible to four-wheelers.
- Based on the available quantity of deposited waste, the number of secondary storage sites, the type of vehicles, and their number and total trips required should be communicated to the nodal of ULB/Village Panchayat.
- Vehicle schedules should be established to prevent garbage overflow from primary storage or secondary storage facilities.
- Regular transportation of waste stored at waste storage depots is essential to prevent overflow of garbage bins/containers and avoid littering on streets or nearby areas.

Generally, the scenario depends on the existing waste collection system of ULB/Village Panchayat, which may be as follows:



1) Transfer of Waste from Primary Collection Bins to Vehicles

If the waste quantity is minimal and the frequency of vehicle visits at HCFs is fixed, waste from primary bins can be directly transferred to Primary Collection Vehicles.

During waste transfer, compliance with the following is imperative: -

- Utilise tricycles, e-rickshaws, or LMVs to transport waste from HCF to ULB/ Panchayat designated sites and ensure vehicles are in good condition.
- Waste should not touch the ground again.

- Facilities should be accessible to vehicles in all weather conditions.
- The waste must be stored in segregated form, such as biodegradable, nonbiodegradable, and special care waste categories.
- The time of vehicles should be scheduled, and accountability for waste loading should be assigned.
- Ensure the final disposal of waste in covered containers is conducted scientifically to meet compliance standards.

2) Transfer of Waste from Secondary Waste Point

- HCF waste, categorised as Non-biodegradable and biodegradable types, will be collected separately and transported by ULB/ Village Panchayat or their vendors based on predetermined frequency and quantity of waste for their transfer to designated recycling, processing, or disposal sites.
- Transport planning considers factors such as haul distance between the disposal point to HCFs, prevailing road conditions, local weather, and availability of disposal site for effective waste management.
- The provision for collection of special care waste shall be kept separately as per ULB/ Village Panchayat/ SPCB guidelines as applicable.

Option- I: Owned Vehicle for Transportation

- HCF can transfer waste using vehicles based on quantification and transportation feasibility.
- The vehicles must be equipped with two compartments to cater for the transportation needs of segregated waste.

In this case, the vehicles must meet the fitness certificate, equipped with tracking devices at least for cities having population more than 50,000, PUC certificate, and all other compliance certificates applicable to these vehicles.

Option- II: Services from ULB/ authorized vendors

- Coordination with ULB for the arrangement of adequate number and capacity of vehicles for the timely transfer of stored waste.
- Generally, the ULB/ Village Panchayat is responsible for the collection & transportation of waste from various generators and for comprehensive waste disposal.
- In some cases, the ULB hires third-party agencies for waste Collection and Transportation from different waste generators, who will be liable to lift and transport waste from secondary storage or directly from the primary collection system.
- Alternative vehicles must be available for HCF needs to prevent littering or unaesthetic scenarios. In addition, vehicles engaged in transportation must have a separate compartment with covering systems for segregated waste storage.
- To avoid mixing waste, the vehicles' compartments must be painted with the applicable colour to receive the segregated waste from generators/secondary storage systems.
- The following practices should be followed by each stakeholder for effective secondary collection & transportation: -

DO's

- The collected waste must be covered with close lid
- Always close the lid after throwing off the waste
- Ensure non leakage of containers during transportation of waste
- Ensure lifting of waste periodically.
- Minimise the use of polythene within HCF premises

DON'Ts

- Mix general solid waste with
- Biomedical waste at HCF
- Put liquid/ raw chemicals in bins
- Handle waste without PPEs
- Store waste for more than one day
- Practice littering or burning of waste

CHAPTER 5

RECYCLING AND PROCESSING OF WASTE

We understand that resource conservation is a step towards sustainability; hence, the chapter explains the optimum management of Non-biodegradable waste, which includes the benefits of recycling and resource conservation and adaptation of a material recovery system as an integral component. Furthermore, the appropriate technology for biodegradable waste has also been discussed to encourage their on-site processing.

In alignment with the SWM Rules, 2016 recycling and processing of collected waste is a major activity aimed at maximising waste utilisation and transforming it into valuable resources.

To transition from a linear (take-make-dispose) model to a circular model, healthcare facilities must adopt the 5R principles—Refuse, Reduce, Reuse, Recycle, and Repurpose—which extend the traditional 3R approach and provide a more holistic strategy for waste management.

5.1 CIRCULAR ECONOMY IN HEALTHCARE WASTE MANAGEMENT

The implementation of circular economic principles in healthcare facilities involves:

- Selecting sustainable products with longer life cycles and minimal packaging.
- Reducing raw material consumption by promoting reusable and recyclable alternatives.
- Ensuring waste materials are processed and reintegrated into the system.
- Encouraging the adoption of advanced technologies such as composting, biogas generation, and material recovery facilities (MRFs).
- Engaging healthcare workers, waste management personnel, and the community in sustainable practices.
- Understanding the 5R Principles

I. Refuse

- Avoid unnecessary waste generation by choosing sustainable alternatives.
- Minimize single-use plastics and disposable items in healthcare services.
- Adopt eco-friendly procurement practices, emphasizing biodegradable and recyclable materials.

II. Reduce

- Optimize inventory management to reduce excess materials and minimize waste.
- Implement digital solutions to decrease paper consumption in administrative processes.
- Train healthcare staff on efficient use of resources to prevent wastage.

III. Reuse

- Promote the use of reusable medical and non-medical materials where applicable.
- Encourage the reuse of packaging materials for non-contaminated items.
- Implement sterilization techniques to safely extend the usability of certain medical instruments.

IV. Recycle

- Establish segregated waste collection systems to facilitate recycling processes.
- Partner with authorized recyclers for effective waste conversion into raw materials.
- Encourage material recovery through designated MRFs for plastics, glass, paper, and metals.

V. Repurpose

- Adopt waste processing system like compost or biogas production from organic waste.
- Implement composting solutions for biodegradable waste within HCF premises.
- Utilize advanced recovery techniques for extracting valuable by-products from waste streams.

Benefits of Circular Economy & 5R

- Reduction of landfill waste and lower carbon emissions.
- Optimized resource use leads to financial savings in waste disposal and procurement.
- Aligning with national policies and international best practices.
- Minimizing exposure to non-infectious waste and pollutants.
- Development of recycling and waste processing industries within the sector.

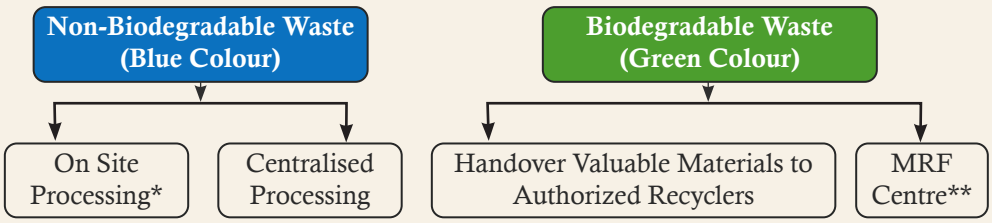
Need of Initiatives

- To institutionalize circular economy practices in healthcare waste management, the following actions are recommended:
- Strengthening policies and regulations to integrate circular economy strategies.
- Capacity building of healthcare staff on sustainable waste management approaches.
- Developing partnerships with recyclers, waste processors, and sustainable product manufacturers.
- Promoting research and innovation for advanced waste recovery technologies.
- Encouraging behavioral change among stakeholders through IEC (Information, Education, and Communication) campaigns.

Integrating the principles of a circular economy and 5R into the solid waste management framework of healthcare facilities is imperative for ensuring a sustainable future. With a structured approach and the right policy interventions, HCFs can significantly reduce waste generation, enhance resource efficiency, and contribute to the broader sustainability goals of the nation.

The reuse of non-infectious material like packaging and containers materials shall be promoted for sustainable waste management.

The flow diagram of proposed processing system is as follows: -



Note:-

**The detail about onsite processing is annexed as Annexure- A*

***The available MRF/RRR Centre across the nation could be assessed from https://sansaadhan.sbmurban.org, https://sbmurban.org/rrr-centers respectively.*

5.2 NON-BIODEGRADABLE WASTE MANAGEMENT

Non-biodegradable waste constitutes recyclable and non-recyclable waste items, combustible waste, etc., including inert street sweepings waste.

HCFs generate significant amounts of such waste through various activities. The valuable materials in this waste can either be stored onsite or transferred to ULB/ Village Panchayat, authorized vendor, or their authorized recycler for further utilisation.

Key factors for maximising and efficiently utilising non-biodegradable waste include source-based segregation and storage in separate areas.

In District Hospitals, Sub District Hospital, Community Heath Centre and AAM-PHC UPHC, the generated Nonbiodegradable waste must be managed as per ULB/ City setup/, while in rural HCF (PHC, AAM-SC) the non-biodegradable waste must be stored separately safely and should be transferred to nearby material recovery facility (MRF) or designated waste disposal site of village panchayat periodically as weekly/ twice in a week/ bimonthly basis.

Source-based segregation, recovery of useful materials, and transfer of non-useful non-biodegradable waste to a nearby designated disposal site daily, weekly, or bimonthly should be adopted.

5.3 RECYCLING AND RESOURCE CONSERVATION

To promote recycling and resource conservation, the SWM Rules 2016 mandate the following for manufacturers or brand owners of disposable products and packaging materials:

- All packaging waste should be stored in appropriate bins and transferred to registered recyclers within a set timeframe to prevent air pollution, drainage blockages, or soil contamination.

5.4 MATERIALS RECOVERY FACILITIES: -

The MRF is being established across the nation with the objective of diverting recyclable and reusable materials from waste disposal sites for their further utilisation as resource recovery, which contains the following attributes: -

- To minimize waste diversion to sanitary landfill sites, the MRF facility is being established as a secondary waste storage facility by ULB/ Village Panchayat.
- MRF temporarily store non-compostable solid waste and facilitates segregation, sorting, and recovery of recyclables by the authorised informal waste pickers, recyclers, or any other workforce before it is sent for further processing or disposal.
- MRF facilities acquired a large space for sorting recyclable materials and easy access to authorised recyclers to collect segregated recyclables.
- Valuable waste materials such as paper, plastic, metal, glass, and textiles could be collected either directly from the source of generation or from material recovery facilities (MRFs).
- The separated biodegradable waste shall be transferred for processing through methods like composting, biomethanation, and other feasible existing processing techniques.
- Further, the potential for non-biodegradable waste generated; the authorized recycler could collect the valuable materials directly from HCF after due approval.
- Moreover, the HCF could tie up with the existing MRF facility/ RRR Facility in their nearby area for Non-biodegradable waste management. The location of existing RRR Facilities across the country can be accessed at https://sbmurban.org/rrr-centers while MRF Could be accessed at https://sansaadhan.sbmurban.org/

5.5 BIODEGRADABLE WASTE

Biodegradable waste consists of organic material that can be degraded by microorganisms into simpler, stable compounds, while the degradation process is influenced by the material's chemical composition.

- **Onsite Processing**

  The onsite processing of segregated biodegradable waste is one of the eco-friendly steps towards sustainable resource recovery and getting desirable output such as compost biogas or similar desirable products. This initiative may be through vermicomposting, aerobic composting, in-vessel, and anaerobic degradation.

  If no onsite biodegradable waste processing system exists, the stored waste could be transferred to ULB/Panchayat or their authorized operator for processing of collected waste within a limited time frame.

5.5.1 Criteria for Selection of Appropriate Technology

The selection of appropriate technology for the processing of segregated biodegradable waste depends on the following:

- The composition of the generated waste (Physical as well as Chemical),
- Quantification
- local weather

The selected technology stands successful when it is:

- Equipped with less manual intervention
- Require minimum footprint are
- Exposure to the minimum open sk
- Need minimum processing time
- Should not contaminate nearby areas
- Byproducts should not cause any harm

- **Scientific Processing, treatment, and Disposal**

  Scientific processing includes the steps of Nonbiodegradable as well as biodegradable waste processing, with an approach that could divert the waste into valuable items and reduce the risk of adverse impact on the nearby environment and stakeholders of HCF. The inert or unusable materials shall be disposed of in sanitary landfills (SLF) scientifically or through other recommended methods as per directions of the ULB/Village Panchayat disposal plan.

5.5.2 Available Technology

- Healthcare facilities should consider implementing decentralised biodegradable waste processing systems, such as pit, vermicomposting, in-vessel composting and biogas, to address their sensitivity towards biodegradable waste management.
- The standards for desired products like composting or byproducts, such as treated leachate, should meet the standard and specifications as per Schedule-II of SWM Rules, 2016.
- Based on local weather, quantification and characterisation of generated waste, the following appropriate technology of biodegradable waste processing could be explored: -

S No.	Name of the Technology	Unit Cost	Suitability (Based on Total Per Day Footfalls)			
			60	61-1800	1801-6000	>6000
1.	Pit Composting	CapEx- 2.5 Lakhs OpEx- Nil	✓	×	×	×
2.	Blue HDPE Digestor	CapEX- INR 8000 OpEX- 500 Per Month	✓	×	×	×

S No.	Name of the Technology	Unit Cost	Suitability (Based on Total Per Day Footfalls)			
			60	61-1800	1801-6000	>6000
3.	Rotary drum composting (Small)	CapEx- INR 5000 OpEx- Nil	✓	×	×	×
4.	Vermi Composting	CapEx- INR 980 to 1400 (25 Liters Capacity)	×	✓	×	×
5.	Organic Waste Composting Machine	CapEx- 40 Lakhs (including Infrastructure) OpEx- 25,000 Per Month	×	✓	✓	×
6.	Windrow Composting	CapEx- Depends upon Size and technology	×	×	×	✓
7.	Biogas Plant*	CapEx- Depends upon Size and technology	×	×	✓	✓
Source : https://sbmurban.org/storage/app/media/pdf/Advisory%20on%20decentralised%20composting.pdf (accessed on 22nd July 2024) *Based on project experience Note: The detail about each technology is annexed as Annexure- A						

For the selection of effective and appropriate technology, the advantages and disadvantages of each technology are listed below: -

Composting Method	Advantages	Disadvantages
Pit Composting	▪ Good for small-scale organic waste processing. ▪ Minimum CapEx and non-skilled labour required. ▪ No additional infrastructure is required. ▪ Reduce odour	▪ Vulnerable to rodents and pest ▪ Water logging affects the degradation ▪ The decomposition of organic matter is a little slow ▪ Could be the source of soil contamination

Composting Method	Advantages	Disadvantages
Blue HDPE Digestor	▪ All-weather facility to decompose organic waste ▪ Minimum CapEx and footprint area required ▪ High degradation rate ▪ Minimum manual intervention	▪ Leachate management is required ▪ Sensitive to weather ▪ Required sawdust for effective output ▪ Need to clean area to maintain aesthetic sense
Rotary drum composting (Small)	▪ High-quality compost ▪ Operational in all weather and at high altitudes also ▪ The leachate could be utilized as liquid fertiliser. ▪ Minimum surface area is required	▪ High CapEx and OPEx ▪ Skilled resource required ▪ Electricity and water are essential ▪ Post-degradation intervention is required to maintain the quality
Vermi Composting	▪ Good nutrient-quality compost gets produced ▪ Low cost and less footprint area ▪ No leaching and soil contamination ▪ Completely organic product	▪ Specific infrastructure is required ▪ Sensitive to quality of substrate and weather ▪ Manual handling and rodent's attractions ▪ Need a little more time and required maintenance
Organic Waste Composting Machine	▪ Degradation rate is very fast ▪ Operational in all weather and high altitudes also ▪ No leachate gets produced ▪ Minimum surface area is required	▪ High CapEx and OPEx ▪ Skilled resources required ▪ Electricity and water are essential ▪ Add other items required to get the desired quality.
Windrow Composting	▪ Able to cater to large quantity of waste ▪ Ease of operation and cost-effective ▪ Good product stabilization ▪ Low-cost investment	▪ Larger area required ▪ Produce odour and sensitive to birds and menace ▪ No control on quality of compost

Composting Method	Advantages	Disadvantages
Biogas Plant*	▪ Renewable source of energy ▪ Eco friendly method of waste decomposition ▪ Less area is required ▪ The byproducts could also be utilized as a soil nutrient	▪ Highly sensitive to substrate and weather ▪ More mechanical items than compost plant ▪ Desired yield contains impurities and releases odours

The generated byproducts as residue from compost/other processing system shall be disposed off to identified site of ULB/Village Panchayat.

DO's

- Implement the 5Rs—Refuse, Reduce, Reuse, Recycle & Repurpose— for sustainable waste management.
- Store and transport recyclables in designated containers to maintain quality.
- Partner with authorized recyclers or waste processors of ULB/ Village Panchayat for proper waste processing, treatment and disposal.
- Promote on-site processing of biodegradable waste as much as possible.

DON'Ts

- Dispose recyclable waste in landfills or mix it with other waste streams.
- Store recyclable and non-recyclable waste together
- Hand over recyclable waste to unauthorized vendors or informal waste collectors.
- Allow the collected recyclable materials get contaminated with Special Care Waste.

CHAPTER 6

MONITORING AND EVALUATION

This chapter discusses data collection in an approved format and the need for record keeping. Moreover, the service level criterion has been suggested to meet the city cleanliness benchmark, which will ensure the cleanliness of HCF in alignment with their outdoor areas. For evaluation purposes, the provision of an assessment has also been suggested.

The performance of all components of general waste management in HCF should be recorded on a daily basis, which would help in data analysis and strengthen quality assurance.

A comprehensive monitoring system shall be adopted to achieve the following objectives:

- Preparation of SoP for effective implementation of the plan.
- Collection of data from a dedicated source in an approved checklist
- Analysis of collected information to assess the efficacy of the overall system, e.g., priority for compliances/improvements.
- Reporting of data and its representation.
- Mechanisms for corrective actions, e.g., collection of valuable material from non-biodegradable waste.

6.1 DATA COLLECTION AND MANAGEMENT

One key aspect of data collection is the outcomes of effective monitoring and evaluation. This information should be appropriately analysed to assess service provision and make requisite improvements.

It's recommended that all HCF maintain a record of data either manually or through the MIS system in an approved format for further analysis. This record could be used to deliver at the state/national level as and when required or utilized in policy formulation and to set the priorities for the initiatives.

The general waste management system has several aspects that need to be monitored daily, weekly, monthly, or annually. It includes:

Aspects	Details
Waste Generating Area	Bed Wise, Ward Wise, Department Wise, OPD, Patient Waiting Area, Ancillary area
Quantity of Waste Generation	Quantification (Per Day) and characterisation of waste
Infrastructure	Type, No. & Capacity of Bins and Placement of bins
Waste Recovery	Amount of waste collected, recycled, and processed at the site
Transfer of Waste	Amount of Waste transferred from Primary to Secondary Storage
Transportation of Waste	Type and No. of Vehicle details (Trip Wise) for transfer of waste from Primary Collection/Secondary Storage/ Premises.
Human Resource	Nos. of engaged Human Resources and their accountability

6.2 ANALYSIS AND REPORTING

- The facility's I/C or nodal officer would be accountable for effective implementation of solid waste in coordination with nodal of ULB/Village Panchayat.
- Facility I/C or nodal officer should thoroughly review all reports in coordination with the quality team.
- Analyzing the gathered data becomes essential for identifying gaps, prioritising work, and addressing issues to enhance performance.
- The appropriate training and strengthening of capacities of concerned staffs are required to ensure accurate data collection and reporting.
- Records of training, immunization, and resource details should be maintained for all staff involved in waste management.
- The waste generated during any campaign or occasion should be recorded appropriately.
- Based on requirements, a checklist for monitoring of effectiveness of ongoing waste management activities has been prepared which is enclosed as Annexure- B.
- Each HCF is responsible for maintaining daily records of activities related to solid waste. The daily waste generation data could be filled in Annexure- C, while the quarterly data could be gathered in Annexure- D
- Based on the total quantity of waste (exceeding 10 TPD), the applicability of reporting as per the prescribed form of SWM Rules, 2016/2024 will be applicable.
- Based on the initiative or alteration undertaken by HCF, the changes in performance must be recorded through framed KPIs.

6.3 SERVICE LEVEL BENCHMARKING

The service level benchmarking could be used as a monitoring tool to assess the performance of each facility, and their progress overtime can be tracked. To monitor the entire aspects of holistic waste management the various KPIs have been framed which is outlined below: -

Table 5: Service Level Criterion for Effective Solid Waste Management

S. No.	Indicators	Aspects	Targeted Value	Current Status
1.	Adequate infrastructure coverage within entire facilities	Each waste generation area should have adequate no. and capacity of bins as per prevailing guidelines.	100 %	
2.	Collection Efficiency of stored Waste among Bins	The % of efficiency of waste from each bin in a periodic time.	100 %	

S. No.	Indicators	Aspects	Targeted Value	Current Status
3.	Extent of Segregation of Generated Solid Waste	The generated waste is stored in a segregated manner in different bins as per regulatory guidelines.	100 %	
4.	Extent of Transfer of Segregated Solid Waste for Scientific processing, treatment, and disposal.	There is a valid contract/MoU/ service agreement with ULB or their authorized vendor for the Collection & Transportation of collected waste from the facility to the designated site for scientific management.	100 %	
5.	Efficiency in Grievance Redressal	The percentage of Grievances recorded related to SWM should be resolved within 24 hours or as per GRM byelaws.	80 %	
6.	Stakeholder meetings and Capacity Development	Induction training apart from twice a year to all waste workers should be provided to all relevant stakeholders.	90 %	
				CPHEEO Manual, 2016

6.4 ENVIRONMENTAL AND OCCUPATIONAL HEALTH MONITORING

- Waste management activities would be operated according to an approved SoP, with a focus on environmental and occupational health, two of the major aspects of sustainable waste management.
- A periodic assessment system consisting of annual assessment should be implemented to identify gaps in waste management practices.
- For each HCF, it's been recommended to carry out at least one third-party assessment through JAS/PSG/MAS/LSGD annually to assess the following aspects of sustainable waste management: -

Resource Assessment	▪ This assessment will reflect the efficiency of resources deployed in the waste management practices of HCF. ▪ The requirement of resources for ancillary facilities and clinical purposes, such as water, electricity, materials, human resources, and fuel, plays a crucial role in smooth operation and long-term sustainability.

	▪ The assessor must check the adequacy and optimum utilisation of each resource in the waste management of the facility.
Operational Risk Assessment	▪ This assessment reveals the consequences of operational risks and the frequency with which they may occur, including constraints on adequate infrastructure, materials supply, environmental damage, and preventive measures. ▪ The risk of operation in terms of overall waste management through policy, planning, design, existing infrastructure, and local weather conditions.
Occupational Risk Assessment	▪ Based on the composition of waste handled, the quantification of waste, and the skill of handling, the operational risk could be assessed, and accordingly, preventive or mitigation measures would be taken. ▪ The monitoring of health conditions of workers engaged in this occupation prior to their engagement and their regular monitoring must be carried out to assess the occupational risk. Further, age and gender could be considered for effective occupational risk assessment.

DO's

- Maintain daily records of waste generation, segregation, collection, and disposal.
- Implement corrective actions based on monitoring data and observations.
- Improve skill of staff on data collection and reporting to improve accuracy.
- Ensure third-party assessments are conducted at least once a year for accountability through JAS/PSG/MAS/LSGD.

DON'Ts

- Conduct waste management activities without periodic evaluations.
- Predict waste management practices are effective without regular evaluation.
- Allow untrained personnel handle monitoring tasks.
- Rely solely on internal monitoring without external validation.

CHAPTER 7

INSTITUTIONAL STRENGTHENING, TRAINING, AND CAPACITY DEVELOPMENT

This chapter illuminates the roles and responsibilities of different stakeholders involved in waste management of HCF. It also covers the type of training needed to strengthen the skills of waste workers. Further, an institutional-based GRM has been proposed for recording complaints and grievances.

To implement waste management effectively, each HCF requires adequate human resources across various hierarchies, possessing diverse educational qualifications and skills. For strengthening the operational framework of the effective implementation of solid waste in any HCF, involves the following aspects: -

7.1 DECENTRALIZATION OF ROLE AND RESPONSIBILITY

From generation to safe transportation of waste, skilled individuals are needed for various waste management tasks, such as primary waste collection from clinical wards, general administrative areas, or other non-clinical areas to primary transportation/ secondary storage. The designated Housekeeping/Sanitary Supervisors are responsible for safe waste transportation from the premises as per scheduled time.

Further, establishing a network of bins based on location, activity, and floor and collecting waste from the ancillary areas, as per the approved plan, requires the decentralised involvement of stakeholders.

7.2 COLLABORATION APPROACH

The approach of collaboration could synergize the objectives of effective general waste management hence

- Collaboration with technical support organizations, NGOs, or other entities can enhance the skills and capacity of HCF in waste management.
- This collaboration can be at local or national or international level, involving suitable individuals or entity.
- Such partnerships provide opportunities to address gaps, share skills, innovations, and ideas, and facilitate knowledge exchange.

7.3 INTER-DEPARTMENT COORDINATION

From generation to safe transportation of waste, skilled individuals are needed for various waste management tasks, such as primary waste collection from clinical wards, general administrative areas, or other non-clinical areas to primary transportation/ secondary storage. The designated Housekeeping/Sanitary Supervisors are responsible for safe waste transportation from the premises as per scheduled time.

Further, establishing a network of bins based on location, activity, and floor and collecting waste from the ancillary areas, as per the approved plan, requires the decentralised involvement of stakeholders.

7.2 COLLABORATION APPROACH

The healthcare facilities are responsible for managing waste from collection to disposal. Collaborating with the Urban Local Body (ULB)/Village Panchayat or authorized vendors ensures safe transportation of waste. This collaboration is also necessary for

disposing of street sweeping and silt waste.

The role and responsibilities of major relevant institutional stakeholders is as follows:

Name of Institutions	Role and Responsibilities
Ministry of Environment Forest and Climate Change (MoEF&CC)	Responsible for overall monitoring the implementation of SWM Rules, 2016 which is applicable to HCFs also.
Central Pollution Control Board (CPCB)	Coordination with SPCBs/PCCs for implementation of rules and adherence to prescribed standards by local authorities
ULB/Village Panchayats/Urban Agglomeration	Preparation of solid waste management plan as per state policy considering HCF as a waste generator. ▪ Arrangement for waste collection from hospitals and other waste generators ▪ Identification of waste pickers/recyclers or formation of SHGs to promote waste collection, resource recovery and recycling ▪ Formulation of byelaws for effective waste management practices, including hospitals ▪ Direct hospitals not for littering and burning of waste ▪ Establishment of MRF for resource recovery of Nonbiodegradable waste collected from HCFs ▪ Ensure facility for scientific management of special care Waste generated from HCF ▪ Provide training to Waste management workers ▪ Provide infrastructure facilities for scientific waste management, from waste collection to scientific treatment and disposal. ▪ Ensure the use of PPEs and appropriate immunization in workers engaged in the collection of waste from hospitals. ▪ Promotion of IEC to minimise waste generation, promote recycling, & collection of user charges and scientific management of waste ▪ Collection and transportation of collected waste from the hospital in the segregated form in covered vehicles

7.4 INVOLVEMENT OF THIRD PARTY

Handling general waste in HCF requires semi-skilled resources that could be retained from NGOs/CBOs or entities with trained resources who are aware of scientific waste management.

Further, local NGOs or such entities could be engaged in worker training, raising stakeholders' awareness, and exchanging knowledge and technology.

7.5 CAPACITY DEVELOPMENT

In the context of prevailing waste management and in alignment with achieving the objective of further strengthening the waste management activities, each facility should frame an agenda of training for its waste stakeholders.

- ***Induction Training***

  Induction training must be provided to Waste handlers, Housekeepers, and Staff involved directly or indirectly in general waste management. It is to be provided to each employee during the joining process, even if he/she has gathered experience in any HCF, to augment his/her skill to perform as per the approved plan/SoP. The training must be in line with their job description.

- ***Scheduled Training***

  Each waste management worker engaged in managing waste at the facility level must receive two training sessions per year. The content of the training should be specific to the HCF plan.

- ***Need-based training***

  Based on identified gaps in skills, the requirement of upgradation, and introduction to a new strategy, the training outline would be framed to deliver it to a targeted audience to fill the gaps and achieve the desired output per the long-term objective. The need-based training must be aligned to IEC activities for the following minimum attributes but not limited to:-

S.No.	Context of Training	Frequency	Targeted Beneficiaries
1.	Importance of Waste Management in HCF	Biannually	All Facility Staffs
2.	Essential Infrastructure Required for Waste Management in HCF	Biannually	Nodal and Waste Management Staffs
3.	Waste Minimization	Quarterly	All Facility Staffs
4.	Waste Segregation	Quarterly	Nodal and Waste Management Staffs
5.	Avoid Littering	Quarterly	All Facility Staffs
6.	Non Burning of waste	Quarterly	All Facility Staffs

S.No.	Context of Training	Frequency	Targeted Beneficiaries
7.	Characterization of Waste	Quarterly	Nodal and Waste Management Staffs
8.	Collection of Segregated Waste	Quarterly	Nodal and Waste Management Staffs
9.	Storage of Collected Waste	Biannually	Nodal and Waste Management Staffs
10.	Secondary Storage	Biannually	Nodal and Waste Management Staffs
11.	Waste Management and Infection Control	Biannually	All Facility Staffs
12.	Recycling and Resource Recovery	Biannually	All Facility Staffs
13.	Decentralised Waste Processing – Opportunities and Challenges	Biannually	Nodal and Waste Management Staffs
14.	Role of PPEs in waste Management	Quarterly	All Facility Staffs
15.	Community participation in waste management of HCF	Biannually	All Facility Staffs
16.	Data Collection and Management	Annually	Nodal and Waste Management Staffs

For effective learning about solid waste management, the digital library of Swachh Bharat Mission could be assessed through (https://sbmurban.org/digital-library-new)

7.6 GRIEVANCES REDRESSAL MECHANISM

The complaint redressal system is one of the integral parts of institutional arrangement, which expedites the registered complaint in a very transparent manner within a limited frame with accountability. The existing GRM system of facility shall cater the need of complaint system however for effective resolution of complaints, the following typical mechanism should be followed :-

- Complaint management system: - A centralised online/offline register should be maintained at the facility level to record all the grievances received from any portal/system. The concerned nodal officer shall be responsible for recording and monitoring the complaints and taking necessary actions for redressal.
- Medium of complaint registration: Walk-in complaints (verbal as well as written mode), Phone calls, SMS, Online complaints (Web or email or social media or such others), and postal service shall be used to register complaints.
- Complaint registration and recording system: - The registration and recording of complaints could be as follows: -
  - » Each complaint should have a unique ID.

» The contact number and Address of the complainant should be recorded.

» The complaint must be assigned to the relevant nodal officer with a stipulated timeline.

» Provide an acknowledgement receipt to the complainant with all the above details in case the complaint is registered manually or online; and

» Provide a complaint reference number with an SMS/WhatsApp of registration to telephone-based complainants.

Moreover, each facility has an active complaint and suggestion box which function is very systematic hence it shall be more effective and convenient to lodge a complaint.

Further, the cloud based multilingual application "Mera Aspataal" could be used to give feedback of cleanliness of each facility.

Complaint Resolution

Each HCF has a functional Grievances Redressal System to address the issues of citizens, beneficiaries, and other stakeholders. Complaints related to waste management shall also be addressed with the existing institutional arrangements within the specified time period, and the acknowledged complaint resolution shall be kept in the record by HCF for reference purposes.

DO's

- Clearly define roles and responsibilities for all stakeholders in waste management.
- Decentralize waste management tasks for better efficiency and accountability.
- Conduct regular training sessions for waste handlers, healthcare staff, and administrators.
- Regularly assess and update training materials based on new regulations and best practices.

DON'Ts

- Leave waste management responsibilities unclear.
- Overlook opportunities for partnerships that can enhance waste management capacity.
- Assume that one-time training is sufficient.
- Use outdated, general content to prepare training material for different stakeholders

CHAPTER 8

INFORMATION EDUCATION AND COMMUNICATION

This chapter covers the purposes of awareness for waste reduction, promotion of recycling, conservation of resources, occupational safety, and aspects-based intervention through effective IEC materials. Considering a wider stakeholder base, the tool for implementation has also been suggested to attract more beneficiaries.

- IEC materials should align with the objective framework for sustainable waste management.
- These materials are crucial in informing, educating, and persuading waste management stakeholders for effective waste management in HCFs.
- Stakeholders are guided to understand their roles, responsibilities, and the benefits of adopting good waste management practices.
- The major component of IEC could be like: -

a. Analysis of Existing Scenario

- Analyse the current scenario to identify the need for IEC to promote best practices for hygiene and cleanliness in the facility.
- Factors such as infrastructure, sociocultural barriers, behaviour, and traditions are to be considered in the analysis.
- The analysis output will tailor applicable tools and strategies for the specific facility.

b. Aspects based on IEC activities.

To achieve sustainable waste management, IEC activities can be designated at different levels as follows: -

Table 6: Aspects, stakeholders, and activities for IEC

Aspects	Relevant Stakeholders	Context of IEC
Waste Generation	All Waste generators of HCF, including floating population	▪ Reduce the amount of waste generated at the source only. ▪ Segregate waste at source and keep it in a separate bin.
Avoid Littering	HCF Staff, Patients, visitors as well as the local Community	▪ Avoid open littering
Prevention of Burning of waste	Relevant HCF Stakeholders, as well as local Community	▪ Prevent the burning of waste as a disposal option. ▪ Adopt no tolerance and prevent open burning of waste for heating (especially in cities with extreme winters)

Aspects	Relevant Stakeholders	Context of IEC
Segregation of Waste	All waste generator units like patients, workers /activities	▪ Importance of waste segregation at source and storage in designated separate bins. ▪ Utilization of color-coded bins. ▪ Nonmixing general waste with biomedical waste, street sweeping or other waste.
Collection of Segregated Waste	Waste Management Staffs/HCF/NGO/ Authorize Vendors	▪ The importance of collecting segregated waste in appropriate bins. ▪ Communication regarding timing and route of primary collection.
Secondary Storage	Waste Management Staff/ HCF/ Agencies involved in the transportation of waste.	▪ Ensuring storage of collected waste without spilling. ▪ Storage of waste in designated bins only. ▪ Timing and vehicles for transportation of collected waste
Transfer of Segregated Waste	Waste Management Staff/ HCF/ Agencies involved in the transportation of waste.	▪ Ensuring segregated transportation of waste as per approved plans
Transportation	Agencies involved in the transportation of waste ULB/Village Panchayat, or their authorised vendor and other solid waste management department staff engaged in providing or monitoring these services	▪ Ensuring timely transportation of waste as per scheduled timing ▪ Adequate vehicles with assurance of no littering on the road

Aspects	Relevant Stakeholders	Context of IEC
Waste Recovery, Processing or Treatment, Disposal	HCF and Recyclers	▪ Segregation and storage of recyclable materials separately. ▪ Handover the recycled materials to an authorised vendor. ▪ Benefits of processing and scientific disposal.

c. Personal Protective Equipment

- Ensure proper use of PPEs according to their intended purpose.
  - » All PPEs should meet standard quality requirements, which include
  - » Heavy Duty Gloves (Workman's Gloves),
  - » Gum Boots or safety shoes for waste collectors
  - » Face mask
  - » Head Cap
  - » Splash Proof Gowns or aprons etc.
  - » Disposal gloves for waste handlers
- The quality of PPEs must be adhered to

SPECIFICATIONS OF PERSONAL PROTECTIVE EQUIPMENT		
ARTICLE	**BIS STANDARDS**	**REMARKS**
Gloves rubber	IS 6994 (pt 1):1973	Household utility gloves can also be used
Gum boots/rubber shoes	IS 13695:1995	----None---
Apron cloth	IS 5029:1979	----None----
Apron rubber	IS 4892:1987/ISO 5235:1977 synthetic rubber aprons (reinforced)	Alternatively, rubber aprons for labour rooms can be used. IS 4501:1981
Face mask	IS 6190:1971	----None----
Respiratory full face masks	IS 14166:1994	For continuous exposure at waste disposal sites/ plants

- Their proper usage is essential to prevent contamination from biological or chemical hazards and ensure protection from cuts, abrasion, and other risks to body parts during occupational practices.

d. Avoid Mixing of Waste

- Provide IEC to all relevant stockholders about the importance of not mixing infectious waste with non-infectious (or general) waste and using bins according to

their color code and applicability.

e. Non-Burning of Waste

- Burning waste should be strictly prohibited.
- It must be communicated to visitors/caretakers and staff.
- There should be effective monitoring to prevent it completely, specifically in winter.

f. Tools for Communication

- Clear communication shall be treated as a pillar for effective outcomes
- The language of communication must be bilingual and preferably in local languages

The following tools are to be used to deliver the messages of IEC to a targeted audience.

a. Media (print/electronic)
b. Guidebook
c. Brochures/Leaflet
d. Posters
e. Bookmarks and Labels
f. Films and Documentary,
g. Traditional folk,
h. Websites,
i. images and Videos etc.

DO's

- Use multiple communication channels (posters, brochures, videos, social media) to reach a wider audience.
- Ensure IEC materials are in simple, understandable language, preferably bilingual/local.
- Train waste handlers on the importance of using Personal Protective Equipment (PPE).
- Highlight the environmental and health benefits of proper waste management.

DON'Ts

- Rely on a single medium for communication, as different stakeholders have different needs.
- Use of overly technical language that may confuse the audience.
- Let waste handlers work without understanding the importance of PPE.
- Focus only on regulations without explaining the real-world impact of poor waste management.

CHAPTER 9

RISK ANALYSIS AND MITIGATION MEASURES

This chapter covers the strategy for assessment and evaluation, envisages the risks (Policy, implementation, environmental and financial) with magnitude and their mitigation measures associated with the integrated waste management system in HCFs.

Effective implementation of Solid Waste Management (SWM) in Health Care Facilities (HCFs) requires an understanding of potential risks that may impact operations.

9.1 ASSESSMENT AND EVALUATION

- The entire aspects of waste management in HCFs do not contain uniform risk hence there is a need to prepare a risk matrix.
- For evaluation of nature and magnitude of risk, the following risk rating matrix should be followed for qualitative and quantitative assessment.
- The overall result will determine the result of a particular aspect or functionality.
- Based on the overall score, the facilities should priorities the evaluated risk and accordingly mitigation measures should be taken.

9.2 RISK MATRIX FOR SOLID WASTE MANAGEMENT IN HCFS:

The major identified risk for waste management in HCFs may include as tabulated below but not limited to:-

Risk Category	Risk Description	Like -lihood	Impact	Mitigation Strategy
Policy Risks	Changes in government policies affecting waste management regulations.	Likely	Catastrophic	Maintain compliance with national and state regulations, engage in policy advocacy, and integrate SWM into health policies.
	Reduction in funding for SWM programs in HCFs.	Likely	Catastrophic	Strengthen financial planning, explore alternative funding sources (e.g., PPP models), and advocate for budget allocation.
Strategic Risks	Lack of awareness or resistance to SWM best practices among HCF staff.	Likely	Catastrophic	Implement continuous training and IEC programs, integrate waste management into hospital policies, and conduct regular audits.
	Limited stakeholder engagement,	Possible	Catastrophic	Establish strong partnerships with ULBs, waste

Risk Category	Risk Description	Like -lihood	Impact	Mitigation Strategy
	including municipal bodies and third-party vendors.			management agencies, and private recyclers. Conduct stakeholder coordination meetings.
Implementation Risks	Inefficient waste segregation leading to contamination of waste streams.	Likely	Catastrophic	Strengthen source segregation policies, enforce strict monitoring, and provide color-coded bins with clear labeling.
	Inadequate infrastructure for waste collection, storage, and transportation.	Possible	Catastrophic	Ensure proper infrastructure planning, periodic assessment, and budget allocation for maintenance and upgrades.
Operational Risks	Non-compliance with SWM Rules, 2016, leading to regulatory penalties.	Almost Certain	Catastrophic	Conduct regular compliance audits, implement corrective actions, and ensure accountability at all levels.
	Occupational health risks for waste handlers due to inadequate PPEs or improper handling.	Likely	Major	Ensure provision of PPE, conduct periodic health check-ups, and enforce occupational safety training.
Environmental Risks	Improper disposal of non-infectious waste contaminating soil and water sources.	Possible	Catastrophic	Strengthen monitoring mechanisms, ensure proper waste disposal in compliance with Solid Waste and Biomedical waste guidelines.

Risk Category	Risk Description	Like -lihood	Impact	Mitigation Strategy
Financial Risks	High cost of decentralised waste processing technologies making it non-sustainable.	Likely	Major	Explore cost-effective and scalable waste processing technologies, such as decentralised composting and resource recovery facilities.

- Proactive approaches including continuous monitoring, policy compliance, capacity building, and stakeholder engagement, will enhance resilience and sustainability in waste management practices.
- Regular assessment and adaptive strategies will ensure long-term effectiveness and environmental protection.

CHAPTER 10

CONCLUSION

- Segregation of waste and a quantification-based action plan is the most holistic approach for effective waste management.
- Consideration of local weather, existing resources, and their effective utilization are important tools for effective waste management.
- General waste management practices must comply with prevailing central and state rules, regulations and policies.
- Segregated waste should be stored in appropriately sized colour bins to prevent littering and ensure timely transfer from HCFs premises for scientific processing & disposal.
- Adopt reduction, resource recovery and recycling options for sustainable and eco-friendly waste management.
- Street sweeping and C&D waste should never be mixed with segregated non-biodegradable, biodegradable, and other wastes. They must be collected separately and transferred to ULB/ Village Panchayat authorised vendors for further processing, treatment, and scientific disposal.
- Maintain updated records of waste flow, adequate infrastructure, workforce, PPEs, and daily activities related to waste management and maintain their record in approved formats only.
- Implement capacity development, training, and effective IEC (Information, Education, and Communication) strategies at each HCF, preferably in local languages.
- Initiate a comprehensive approach encompassing technological, financial, institutional, and legal/policy aspects to address the spectrum of issues related to solid waste management.

REFERENCES

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- Solid Waste Management Rules, 2024
- Municipal Solid Waste Management Manual by Central Public Health and Environmental Engineering Organisation (CPHEEO), MoHUA, GoI 2016
- https://sbmurban.org/
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- WASH and Health Working together: A how to guide for NTD programmes

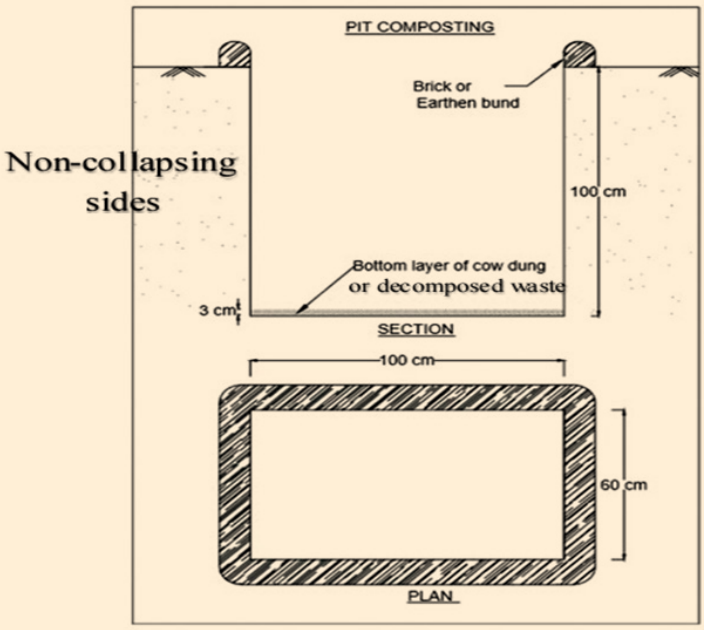
ANNEXURE-A
: LIST OF DECENTRALIZED PROCESSING SYSTEM

Aerobic Digestions

S.No	Parameters	Details
1.	Oxygen concentration	13 to 18%
2.	Free Air Space (FAS)	40 to 60%
3.	Particle Size	A mixture of particles between 3 and 50 mm
4.	Structure	Enough of the particles in the composting pile maintain their structural properties throughout the composting process.
5.	C:N ratio	25:1 to 30:1
6.	Moisture content	55 to 65%
7.	Temperature	55° to 60°C
8.	pH	6.5 to 8.0

a. Pit composting

S.No.	Attributes	Description
1.	Specification and Size	▪ Pits of adequate size to bury bio-degradable waste continuously for about 6 months in each pit. ▪ Pit size of length of 1m and width 60 cm, and depth 1m for a family of 5 or 6 members. Bigger size pits for bigger quantity of waste as according to requirements.
2.	Infrastructure Requirements	▪ Two pits of adequate size to be dug. ▪ Tarpaulin or PVC roofing sheets to cover the pits. ▪ Cow-dung, loose earth. ▪ Tools like shovel, hoe etc.
3.	Operation & Maintenance	▪ Choose an elevated area where water does not get collected. Otherwise make necessary provisions to prevent entry of water into the pit by constructing a small bund around the pits. ▪ Spread a layer of cow dung slurry or decomposed waste at the bottom of the pit before filling the waste for composting. ▪ Spread the waste over the cow dung or decomposed waste layer.

S.No.	Attributes	Description
		▪ Waste of bigger sizes are to be cut into small pieces for easy decomposing. ▪ A thin layer of earth may be sprinkled over the waste daily to avoid bad smell from the pit. ▪ Repeat the procedure daily while depositing more waste. ▪ Once the pit is filled, close the pit by spreading a layer of 15cm of earth. ▪ Once the first pit is closed, use the other pit in the same way. The waste in the first pit becomes compost after a period of 4 to 6 months, empty the pit and make it ready for use. ▪ The compost can be used either as manure or sold or disposed-off in suitable manner. ▪ Protect the pit from rain water. Keep it covered by means of tarpaulin or PVC roofing sheet during rains.
		 *Section and Plan of Pit for Composting*

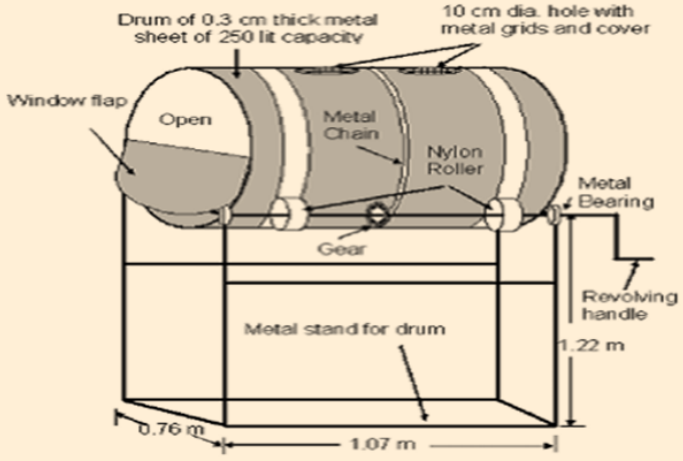
b. Blue HDPE Digestor

S.No.	Attributes	Description
1.	Adopted Process	Aerobic Processing
2.	Processing Time	6 Weeks
3.	Capacity	120 Litres and above
4.	Infrastructure	100 Sq.ft covered space
5.		▪ Initially layering needs to be done inside bin by placing a 5kg coco peat block, 1 or 2 buckets of Browns (Dry Leaves) or ~ 2kg of well done compost. ▪ Layer about 6-8Kgs of Kitchen waste – Ensure this is well segregated waste and is evenly layered. ▪ Add about 100-200 gms of Bioclean powder (coco peat with composting Microbes). ▪ After the above 3 steps, on daily basis add a layer of Kitchen waste (6-8Kgs) and Bioclean Powder (100, 200 gms) and some browns. Each of this should be layered well. ▪ Once a week, soak a handful of Neem powder in water and sprinkle this water into the digester. This will help reduce flies, insects and odor. ▪ Cow dung, Cow urine, panchagavya or sour curd if available, can be added to increase the natural microbial activity and reduce foul smell and insects. ▪ 8-10 weeks is the processing time and the first batch of manure will be ready. ▪ Spread the extracted compost on the plastic sheet and allow it to dry for a day or two in shade. ▪ After the compost is dry, sieve the compost to produce fine manure and store this fine sieved manure in a dry place away from direct sunlight.

S.No.	Attributes	Description
		▪ The left over compost after sieving can be added back to the digester. ▪ From the second batch the compost can be extracted every 2nd/ alternate week.
6.		

c. Drum Composting

S.No.	Attributes	Description
1.	Adopted Process	Aerobic Processing
2.	Processing Time	15-20 Days
3.	Capacity	Batch Rotary drum of 250 L capacity is used for batch composting
4.	Machine Description	▪ The inner side of the drum is covered with anti-corrosive coating. ▪ The drum is mounted on four rubber rollers and attached to metal stand. ▪ The drum is rotated manually. ▪ In order to provide the appropriate mixing of wastes, 40mm long angles are welded longitudinally inside the drum.

S.No.	Attributes	Description
		▪ In addition, two adjacent holes are made on top of the drum to drain excess water.
5.	Operation and Maintenance	▪ Waste mixture is shredded to 1 cm in order to provide better aeration and moisture control. ▪ Once a day clockwise turning was carried out manually by handle, which ensures proper mixing and aeration. Thereafter, aerobic condition is maintained by opening half side doors. ▪ Two to three rotations at a time are made to ensure that the material on the top portion moved to the central portion, where it is subjected to higher temperature. ▪ Primary stabilized compost is achieved within 15-20 days
		

d. Vermi composting

S.No.	Attributes
1.	Specification and Size – Anyone below: a. Two numbers of broad mouth PVC basins of 25 litre capacity each or one PVC basin of 50 litre capacity with a partition at the centre, minimum weight of the combined unit be 2.5kg or b. Two numbers of broad mouth fibre basin 25 litre capacity each or one fibre basin of 50 litre capacity with a partition at the centre (minimum thickness of the fibre body 3mm) or

S.No.	Attributes
	c. Mud pots country burnt two numbers capacity 25 litres each or d. Terracotta jars with lids two numbers, 25 litres capacity each

S.No.	Attributes	Description
1.	Earthworm Species	Eisenia foetida, Lumbricus rubellis, Perionyx excavates and others
2.	Infrastructure Requirements	▪ Base layer with coconut fibre/gravel/sand with cow-dung (5kg) powder. ▪ Wire-mesh lid covers. ▪ 200 earthworms in each tank. ▪ Holes at the bottom of the basin/pot/tank to drain leachate/vermi wash to a vessel if kept below. ▪ Arrangements for protecting the basin/pot/tank from rats, ants, etc. ▪ Thick wet cloth or wet sack piece for covering the waste. ▪ Surgical hand gloves for handling waste & manure. ▪ Vermi wash collection system is optional.
3.	Operation & Maintenance	▪ Chop the waste to size less than 5cm before placing in the Basin/ pot/ tank. ▪ Thickness of waste layer should not exceed 15 cm. ▪ Use one basin/ pot/ tank for the first 15 days and then use the second basin/ pot/ tank after filling the first. ▪ Sprinkle cow-dung powder along with waste. ▪ Protect the vermi basins/ pots/ tanks from rats, ants and other pests. ▪ Keep the waste covered with wet sack or cloth. ▪ Sprinkle water over the cover sack/cloth to maintain moisture of 50-55%. ▪ Avoid over sprinkling of water and stagnation of liquid at the bottom of the basin. ▪ Vermi Basin/pot/tank should not be exposed to direct sun light or rainfall.

S.No.	Attributes	Description
		▪ Prevent introduction of excessive hot, sour and oily substances and also bones, meat & fibre materials. ▪ For removing the vermi compost, expose the basin/ pot/tank with contents in shaded sunlight for 2-4 hours and remove the compost from the top and use the basin/pot/tank with earthworms for further composting of bio-wastes. ▪ Compost taken out should not be dried under sunlight. ▪ Renew the base layer annually. ▪ Collect wash out from the basin in the final stages of composting for vermi wash.
4.	Vermicompost	

e. Organic Waste Converter

S.No.	Attributes	Description
1.	Shredder	Certain shredding machines like bio-waste converting machines which can shred 10, 25, 50, 125, 150 Kg of wastes at a time are available in the market.
2.	Infrastructure Requirements	▪ Compost bags of capacity 20 or 50 Kg. ▪ Racks for the safe keeping of bags containing partially processed waste. ▪ Room/Shed of dimension 3 m × 4 m with proper ventilation for installing machinery and safe storage of racks and baskets is required.

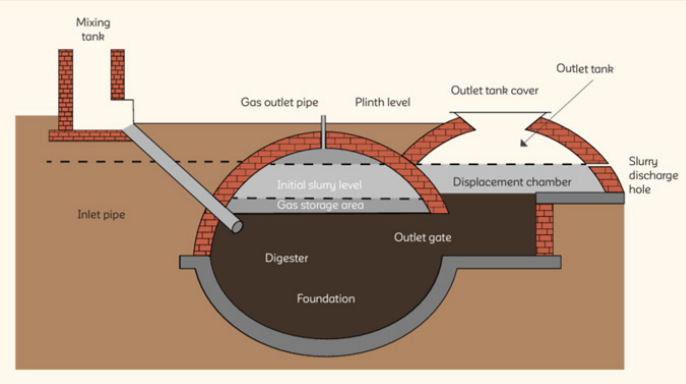
S.No.	Attributes	Description
		▪ An organic solution, power connection of 4 - 10 kW and water connection are required.
3.	Available Capacity	▪ 30 Kg to 5000 Kg per day in different shape and model
		

Table 7: Anaerobic Digestion

S.No	Parameters	Details
1.	Moisture Content	Less than 60%
2.	pH	6.0 to 7.0s
3.	Alkalinity	More than 100 mg/L
4.	Volatile Fatty Acids	Less than 4000 mg/L
5.	Temperature	Mesophilic digesters: 30° to 38°C Thermophilic digesters: 50° to 60°C
6.	Retention Time	14 to 40 days (Depends upon Climate)
7.	C:N Ratio	30:1
8.	Ammonia	200 mg/L
9.	Sulphide	Less than 50 mg/L

e. Biogas Plant

S.No.	Attributes	Description
1.	Pre- treatment	▪ Segregate the organic matter
2.	Dilution	▪ Use clean fresh or recirculated liquid to form the slurry.
3.	Operational Parameters	▪ Feed the slurry into digester periodically to maintain the organic load.

S.No.	Attributes	Description
		▪ The ideal parameters for operation of plant shall be like :- ▪ Temperature – 250 and above ▪ pH- 6.0 to 8.5 ▪ Moisture – More than 15 % ▪ C/N Ratio- 20-30 ▪ Organic Load Rate – Fixed and period feeding with agitation or continuous stirring. ▪ Retention Time – average 10-40 days
4.	Desired output	▪ Bio Slurry » Shall be utilized as a compost ▪ BioGas » Shall be utilized as a source of energy
5.	Consideration	▪ Select the adequate size of plant based on available organic waste ▪ Avoid losses of bigas through their utilization near source only. ▪ Must be exposed to maximum duration of Sun light ▪ Maintain homogeneous slurry like 1:1 (organic waste: water) ▪ Ensure that slurry is free from any non-biodegradable or inert materials like soil. ▪ Take standard precaution and safety from concept to commissioning and O&M ▪ Inlet and outlet must be covered to avoid accidental falling of stary animals and other rodents.
6.		
https://swachhbharatmission.ddws.gov.in/sites/default/files/Technical-Notes/GobardhanTechnicalManual.pdf (accessed on 19.07.2024)		

ANNEXURE- B CHECKLIST FOR EVALUATION OF GENERAL WASTE MANAGEMENT IN HCFS OF INDIA

1.	Name of the HCF:	
2.	District/State:	2.1 Total Area: (In Sq. M)
3.	Type of HCF:	□ DH □ SDH □ CHC □ Sub Centre (AAM)
4.	Name of the Respondents:	

1.	How many primary bins are available to cater need of general waste management?	□ Green □ Blue □ Black
2.	Number of Bins of different capacities	□ 15 Liters □ 60 Liters □ 120 Liters
3.	Is the existing number and size of bins are adequate to meet the requirements?	□ Yes □ No
4.	Have your bin is equipped with cover lid and paddle operated?	□ Yes □ No □ NA
5.	Do you use any plastic bags in bins to collect waste?	□ Yes □ No □ NA
6.	Do you segregate your general waste at source?	□ Yes □ No □ NA
6.1	If yes, then how many types?	□ Wet Waste (Biodegradable) □ Dry Waste (Non-biodegradable) □ Special Care Waste
7.	Are you mixing your general waste with biomedical waste at any stage?	□ Yes □ No □ NA
8.	Are you practicing Material Recovery from dry waste ?	□ Yes □ No □ NA
9.	Have you developed any onsite organic waste processing system?	□ Yes □ No □ NA
10.	If yes, any issue of leachate or odour observed?	□ Yes □ No □ NA
11.	Do you have secondary storage facility?	□ Yes □ No □ NA
11.1	If yes, then capacity of Bins	□ 240 Ltrs □ 600 Ltrs □ 1100 Ltrs
12.	Have you developed infrastructure to manage the waste generated during outreach activities?	□ Yes □ No □ NA
13.	Who is responsible to pick your waste?	□ ULB □ Panchayat □ Own

14.	Is the collection of waste being practiced periodically in dedicated vehicle?	□ Yes □ No □ NA
15.	How many workers are engaged to manage the general waste in facility?	□ Male □ Female
16.	Mode of engagement of workers	□ Temporary □ Permanent
17.	Has the training provided to waste management workers during the time of induction?	□ Yes □ No □ NA
18.	Is the annual training being provided to waste management workers?	□ Yes □ No □ NA
19.	Has adequate PPEs provided to all waste management workers and their associates?	□ Yes □ No □ NA
20.	Are you maintaining the record of general waste management of each category on a daily basis?	□ Yes □ No □ NA
21.	Is there any issue of waste burning recorded in your HCF?	□ Yes □ No □ NA
22.	Have you received any complaint about littering/bad waste management practices?	□ Yes □ No □ NA

Remarks :-

ANNEXURE – C
: DAILY WASTE MANAGEMENT RECORD

Name of Facility:

S.No.	Date	Name of Waste Generator Unit	Total Collected Waste (in Kg) from Primary Bins to Secondary Bins/Primary Vehicles			Handover Materials to Recyclers (in kg.)	Transferred to ULB Vehicles/ authorized vendors
			Nonbiodegradable (Dry Waste)	Biodegradable (Wet Waste)	Special Care		

ANNEXURE- D QUARTERLY REPORT

S.No.	Attributes	Description
1.	Name of Health Care Facility	
2.	Address	
3.	Categorization of HCF	□ Sub Centre □ PHC □ CHC □ SDH □ DH
4.	Bed Capacity	……Nos.
5.	Total Number of Registered Patients	
6.	Total Number of Staffs	
7.	Approx. Number of Floating Population (like Visitors/Attendant/Workers)	
8.	Events/Gatherings	□ No, □ Yes, ……..Nos.
9.	Name of Officer in Charge of the Facility	
10.	Phone No.	
11.	Email	
12.	Total No. of Primary Bins	……..Nos.
13.	Frequency of Waste Collection	**Biodegradable Waste** □ Daily □ Twice in a day □ Twice in a week □ Occasionally **Non-Biodegradable Waste** □ Daily □ Twice in a day □ Twice in a week □ Occasionally
14.	Collection of Waste from Primary Bins	□ Manually □ Mechanically
15.	Quantity of Waste Generation	Biodegradable _____ Kg Non-biodegradable _____ Kg Others _____Kg
16.	Quantity of Waste Collected	Biodegradable _____ Kg Non-biodegradable _____ Kg Others _____Kg
17.	Quantity of Waste Collected	_____Kg/Bed
18.	Quantity of Waste Sale out to Authorized Recycler	_____Kg

S.No.	Attributes	Description
19.	Quantity of Biodegradable Waste Processed onsite	_____Kg
20.	Number of Common Waste Storage Facility	_____Nos
21.	Type of Infrastructure for Secondary Waste Storage Facility	**Bins-** □ 120 Liters, □ 240 Liters □ 1100 Liters, □ 1800 Liters □ 2500 Liters □ >2500 Liters **Civil Structure** □ Dhalao □ Covered shed □ Open Space
22.	Quantity of Waste Transferred to ULB or their Authorized Vendor	Biodegradable _____ Kg Non-biodegradable _____ Kg Others _____Kg
23.	Is there any case of waste burning within your premises?	□ Yes □ No
24.	Are you transferring your collected waste to a ULB/Authorized Vendor? If yes, then please write the name	□ Yes □ No
25.	Are you paying user fee for the services of ULB/Authorized Vendor?	□ Yes □ No
26.	Name of the designated site where the finally collected waste getting disposed of?	
27.	How are you managing your horticulture waste?	□ On-site □ Transfer to ULB/ Authorized Vendor □ Not Applicable
28.	Are you segregating your waste of street sweeping?	□ Yes □ No □ Not Applicable
29.	Are you transferring your Street Sweeping Waste to ULB/Authorized Vendors?	□ Yes □ No
30.	How much training has been provided to waste workers?	…….Nos.
31.	Have appropriate IECs been provided to relevant stakeholders?	□ Yes □ No
32.	Do all waste workers uses adequate PPEs?	□ Yes □ No

BEST PRACTICES[3]

1. **Source based Segregation**
   - Alappuzha, Kerala – Implemented the "Clean Home Clean City" programme focusing on source-based segregation, reducing waste management costs, and creating a revenue source.
   - Indore, Madhya Pradesh – Used a impactful communication strategy and monitoring system to enforce segregation and ensure stakeholder participation.
   - Panaji, Goa – Achieved 99% segregation through multi-bin systems and 16-way segregation at the source, maximizing material recovery.
2. **Biodegradable Waste Management**
   - Bobbili, Andhra Pradesh – Achieved 100% segregation using awareness programs and real-time monitoring. Processing all organic waste through composting and biogas.
   - Mysuru, Karnataka – Established zero-waste management plants at the ward level, converting biodegradable waste into compost for local farmers.
   - Vengurla, Maharashtra – Used a two-bin systems and multiple organic waste processing technologies, achieving 100% processing of organic waste.
3. **Material Processing**
   - Jamshedpur, Jharkhand – Established Dry Waste Collection Centers (DWCCs), employed ragpickers for sorting, and pioneer in manufacturing eco-bricks and plastic roads.
   - Dhenkanal, Odisha – Implemented decentralized waste management with self-help groups, achieving 100% material processing.
4. **Plastic Waste Management**
   - Bicholim, Goa – Managed non-biodegradable waste for neighboring areas and processed waste into usable products.
   - Gangtok, Sikkim – Banned single-use plastics in 1998, extended to packaged drinking water and disposable cutlery, enforced through education. This could be applicable in non-essential items for hospitals.
5. **Sanitary Waste Management**
   - Karad, Maharashtra – Ensured 100% sanitary waste collection and separate processing through a biomedical waste facility.
   - Pune, Maharashtra – Introduced the "Red Dot" campaign for awareness and an integrated collection system for sanitary waste.

[3] WASTE-WISE CITIES, Best practices in municipal solid waste management, Published by NITI Aayog and CSE, 2021

6. **Technological Innovation**
   - Kakinada, Andhra Pradesh – Used RFID and GPS tracking for waste collection efficiency and public engagement.
   - Bengaluru, Karnataka – Implemented geotagging, RFID-based monitoring, and mobile apps to track waste services.
   - Vijayawada, Andhra Pradesh – Deployed QR codes and smart bins for waste collection, integrating real-time monitoring.
   - Keonjhar, Odisha – Utilized GPS and a mobile app (Ama Sahara) for transparency, enabling 100% processing.
7. **Innovative Models**
   - Paradeep, Odisha – Developed a decentralized waste system with self-help groups, achieving financial self-sufficiency.
   - Thiruvananthapuram, Kerala – Created a self-sustaining economic model for waste, generating revenue from recyclables.
8. **Replacement of disposable cutlery with ecofriendly materials**
   - State Pollution Control Board, Punjab has given directions to all civil hospitals of Punjab to replace the disposable cutlery which is being used in langar with eco-friendly/reuseable materials like compostable cutlery/ utensils made of stainless steel.

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