













TECHNICAL MANUAL for Scientific Waste Management

Suchitwa Mission

स्वच्छ भारत
एक कदम स्वच्छता की ओर

മാലിന്യമുക്ത കേരളം

Technical Manual

for Scientific Waste Management



Suchitwa Mission

Local Self Government Department, Government of Kerala

Historic achievement in Sanitation sector



Shri. Pinarayi Vijayan
Hon'ble Chief Minister

OPEN DEFECATION FREE RURAL KERALA



Dr. K. T. Jaleel
Hon'ble Minister for LSGD

- Kerala becomes the largest Indian State to become ODF
- Total Sanitation, an important milestone laid by LDF Government after Total Literacy, Kudumbashree, Democratic Decentalisation and People's Planning
- Our villages become open defecation free on the day Kerala Celeberates

- **Full coverage of sanitation facilities for rural households.**
- **175000 Households provided with individual household Latrines in a short span of four months.**
- **39000 toilet units constructed in difficult and critical areas.**
- **Infrastructure development worth ₹ 300 Crore.**
- **Leadership of empowered Local Self Government Institutions.**
- **People's Participation**



Let's Welcome the Change





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एक कदम स्वच्छता की ओर

മാലിന്യമുക്ത കേരളം

Technical Manual

for Scientific Waste Management

Suchitwa Mission
Local Self Government Department, Government of Kerala

TECHNICAL HANDBOOK
(English)

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CONTENTS

Preface
1. Waste – A comprehensive outlook 5
2. Select the type of composting based on your requirement 9
3. Solid waste Management 12
   3.1. Degradable Waste Management 12
      3.1.1. Aerobic Composting 12
         3.1.1.1. Pit Composting 12
         3.1.1.2. Pot Composting 14
         3.1.1.3. Bio Digester Pots Unit 15
         3.1.1.4. Ring Composting Unit 17
         3.1.1.5. Kitchen Bin Composting Unit 19
         3.1.1.6. Vermi Tank 20
         3.1.1.7. Portable Household Bio Bin Unit 21
         3.1.1.8. Portable Bin/ Bucket Composting Unit 22
         3.1.1.9. Aerobic Bin Composting Unit 24
         3.1.1.10. Windrow Composting 25
      3.1.2. Anaerobic Composting 30
         3.1.2.1. Mose Pit Composting 30
         3.1.2.2. Bio Pedestal Composting Unit 31
         3.1.2.3. Mini Bio Pedestal Composting Unit 32
         3.1.2.4. Biogas Plant (Portable) 34
         3.1.2.5. Centralised Masonary Biotank Composting 36
         3.1.2.6. Organic Waste Composting Machine 37
         3.1.2.7. Toilet Linked Biogas Plant 37
   3.2. Non Degradable Waste Management 39
      3.2.1. MRF 40
   3.3. Other Waste 52
      3.3.1. E- Waste 52
      3.3.2. Hazardous Waste 53
      3.3.3. Bio Medical Waste 55
      3.3.4. Construction and Demolition Waste 56

4. Liquid Waste Management....59
4.1. Liquid Waste....59
4.2. Components of Waste Water and Their Environmental Impact....59
4.3. On-site Sanitation Systems....60
4.3.1. Sanitation System using septic tank and soak pit....60
4.3.1.1. Septic Tank....61
4.3.1.2. Soak Pit....63
4.3.1.3. Dispersion Trenches....64
4.3.2. Leach Pit....65
4.3.3. Sanitation System using twin-pit latrines....65
4.4. Sewer Systems....68
4.4.1. Centralised waste water treatment....68
4.4.2. Decentralised waste water treatment....68
4.5. Waste water treatment plant....69
4.5.1. Sewage Treatment Plant (STP)....69
4.5.2. Effluent Treatment Plant(ETP)....71
4.5.3. Common and Combined Effluent Treatment Plant(ETP)....71
4.6. Septage....72
5. Advanced Waste Management Technologies....75
5.1. Biomethanation....75
5.2. Sanitary Land Filling....79
6. Crematorium....83
7. Case Studies....92
Annexure I - Solid Waste Management Rules, 2016....101
Annexure II - Plastic Waste Management Rules, 2016....149
Annexure III - e-waste Management Rules, 2016....169

1

WASTE
A COMPREHENSIVE OUTLOOK

WASTE

Waste is any material/liquid that is thrown away as unwanted. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded.

As per physical properties, waste can be categorized as

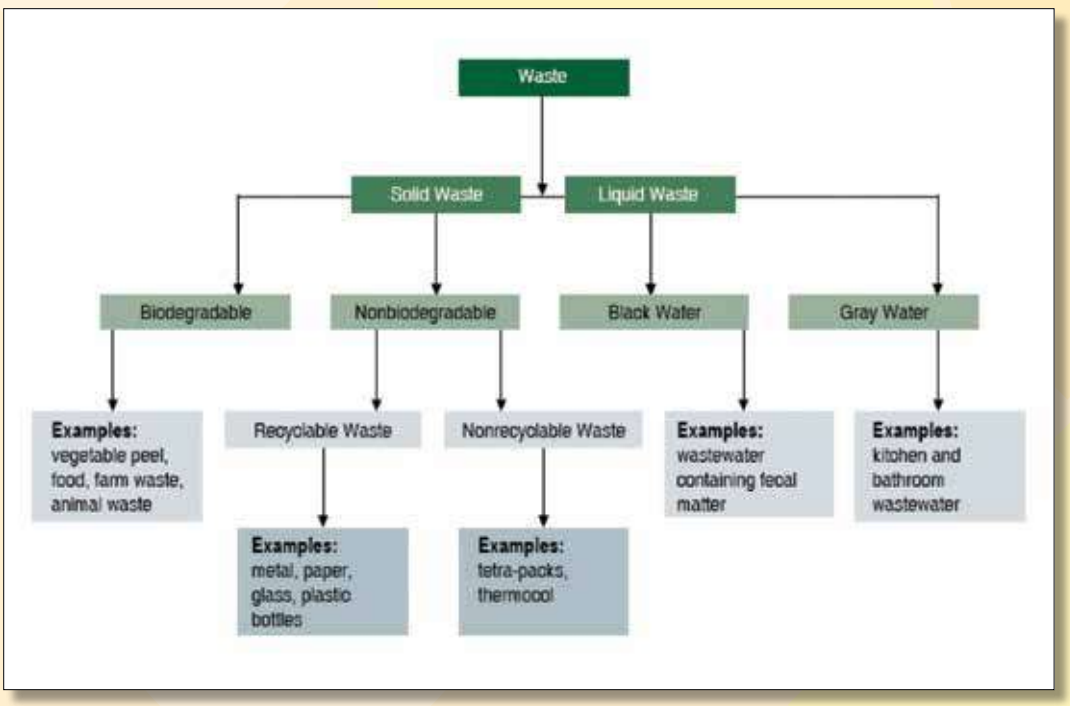


Figure 1.1 Schematic Representation Of Types Of Waste

1.1 SOLID WASTE:

Solid Waste includes solid/semi-solid domestic waste including sanitary waste, commercial waste, institutional waste, catering and market waste and other non residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, construction and demolition waste and treated bio-medical waste excluding industrial hazardous waste, bio-medical waste and e-waste generated in an area under any local body.

As per biodegradability, solid waste can be classified as:

1.1.1 BIODEGRADABLE : It means any organic material that can be degraded by micro organisms into simpler stable compounds;

Biodegradable waste can be decomposed in two ways

i. Aerobic decomposition

ii. Anaerobic decomposition

Aerobic decomposition: Such decomposition process takes place in the presence of air, when the aerobic bacteria act on the complex organic matter and breaks it down into nutrients. In this process primarily carbon-dioxide is produced. Some bacteria in the Pseudomonas species and Bacillus species help in aerobic degradation.

Anaerobic decomposition: Such decomposition process takes place in the absence of air, when the anaerobic bacteria act on the complex organic matter and breaks it down into nutrients. In this process primarily methane and carbon-dioxide gases are produced. Some bacteria in the Clostridium species, Streptococcus species help in anaerobic degradation.

There are four key biological and chemical stages of anaerobic digestion. It is shown in the figure

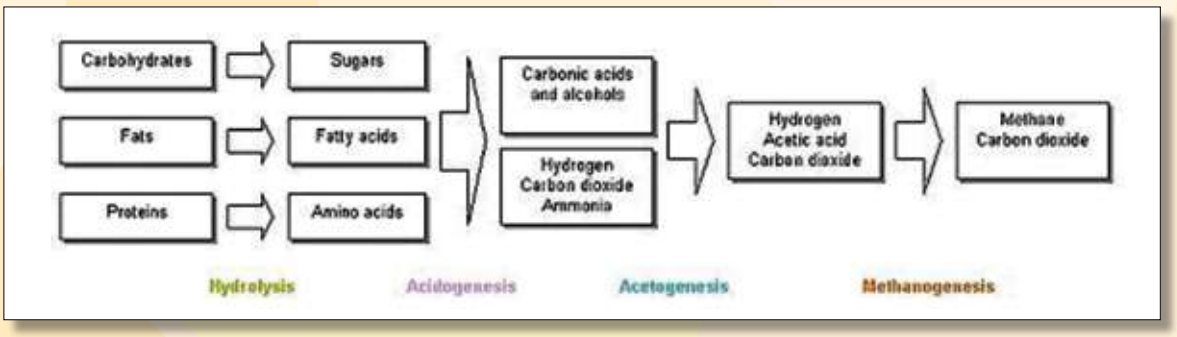


Figure 1.2 The Key Process Stages Of Anaerobic Process.

A simplified generic chemical equation for the overall processes outlined above is as follows:

$$C_6H_{12}O_6 \rightarrow 3CO_2 + 3CH_4$$

1.1.2 NON-BIODEGRADABLE : This includes any waste that cannot be degraded by micro organisms into simpler stable compounds. It is divided into two types

i. Recyclable

ii. Non-recyclable

Recyclable: waste having economic values but destined for disposal can be recovered and used along with their energy value. e.g. plastic, paper, old cloth etc…

Non-recyclable: Waste which do not have economic value of recovery e.g. tetra packs, carbon paper, thermocol etc.

1.2 LIQUID WASTE

Used & unwanted water is called waste water. Liquid waste can be categorized into two

i. Black Water : Waste water generated in the toilet is called "Black water". It contains harmful pathogens.

ii. Grey Water : Waste water generated in the kitchen, bathroom and laundry is called "Greywater". It may also contain pathogens.

1.3 IMPACTS OF WASTE ON ENVIRONMENT :

There are potential risks to environment and health from improper handling of solid wastes.

i. Chemical poisoning through chemical inhalation

ii. Uncollected waste can obstruct the storm water runoff resulting in flood

iii. Cancer, congenital malformations and neurological disease

iv. Mercury toxicity from eating fish with high levels of mercury

v. Degrades water and soil quality

vi. Methane gas from the landfill enhances the greenhouse gas effect and climate change.

vii. Leachate poses a threat to local surface and ground water systems.

1.4 STEPS FOR EFFECTIVE MANAGEMENT OF SOLID WASTE

i. Sorting out or segregation at source level

ii. Treatment/management of biodegradable waste

iii. Treatment/management of non-biodegradable waste

1.5 WASTE MANAGEMENT HIERARCHY

The Integrated Solid Waste Management (**ISWM**) proposes a waste management hierarchy with the aim to reduce the amount of waste being disposed, while maximizing resource conservation and resource efficiency. The ISWM hierarchy ranks waste management operations according to their environmental, economic and energy impacts. The waste management hierarchy is illustrated in the figure

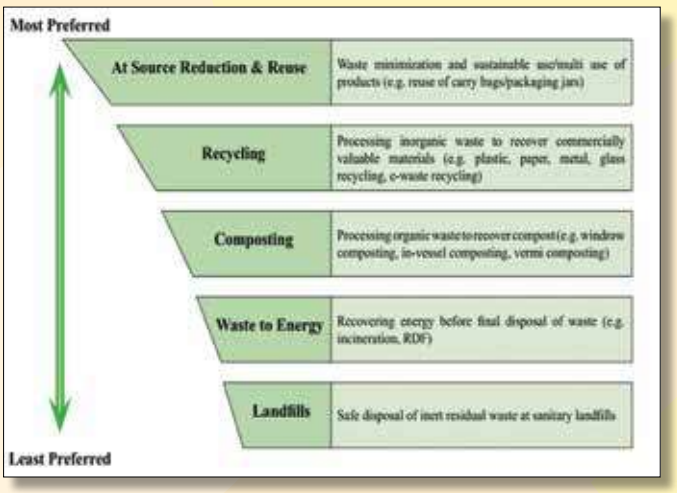


Figure 1.3 Integrated waste management hierarchy

1.6 ZERO WASTE

Zero Waste maximizes recycling, minimizes waste, reduces consumption and ensures that products are made to be reused, repaired or recycled back into nature or the marketplace.

- Redesigns the current, one-way industrial system into a circular system modeled on Nature's successful strategies
- Challenges badly designed business systems that "use too many resources to make too few people more productive"
- Addresses, through job creation and civic participation, increasing wastage of human resources and erosion of democracy
- Helps communities achieve a local economy that operates efficiently, sustains good jobs, and provides a measure of self-sufficiency.
- Aims to eliminate rather than manage waste.

1.7 WASTE MANAGEMENT RULES

- G.S.R. 320 (E) [18-03-2016] : Plastic Waste Management Rules 2016 **
- G.S.R. 338 (E) [23-03-2016] : e-waste (Management) Rules, 2016 ***
- G.S.R. 343(E). [28-03-2016] : Bio-Medical Waste Management Rules,2016
- G.S.R. 317(E). [29-03-2016] : Construction and Demolition Waste Management Rules, 2016
- G.S.R. 395(E). [04-04-2016] : Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
- S.O. 1357(E). [08-04-2016] : Solid Waste Management Rules, 2016 *

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* Refer Annexure I

** Refer Annexure II

*** Refer Annexure III

2

SELECT THE TYPE OF COMPOSTING BASED ON YOUR REQUIREMENT

Some factors that need consideration when selecting a technology option include:

- Characteristics, quantity and frequency of the waste being generated;
- Applicability, availability and affordability of that technology option in that area; and
- Availability of skilled personnel, energy, O&M needs, land requirements, and so on.

Beneficiary Type	Sl No	Technology Options	Factors for Selection	Index No	Page No
Household	1	Pit Composting	✓ Adequate space availability in the backyard, and located away from drinking water source, suitable for small to large families. × Not suitable for areas with higher water table.	3.1.1.1	12
	2	Pot Composting	✓ Compatible – requires less space, suitable for small families generating upto 2kg waste per day × Should be kept away from rain.	3.1.1.2	14
	3	Bio Digester Pots Unit	✓ Can be kept in garden as part of aesthetics, Compatible – requires less space, suitable for small families generating upto 2kg waste per day × Should be kept away from rain.	3.1.1.3	15
	4	Kitchen Bin Composting Unit	✓ Compatible – requires less space, Can be kept in kitchen, suitable for small families generating upto 2kg waste per day, easy to maintain. × Should be kept away from rodent attack.	3.1.1.5	19

Beneficiary Type	Sl No	Technology Options	Factors for Selection	Index No	Page No
Household	5	Vermi Tank	✓ Compost is highly organic and hence it is of higher market value. × Requires continous monitoring and care.	3.1.1.6	20
	6	Portable Household Bio Bin Unit	✓ It is mostly suitable for large households. × Should be kept away from rain.	3.1.1.7	21
	7	Portable Bin/ Bucket Composting Unit	✓ Compatible – requires less space, suitable for small families generating upto 2kg waste per day, easy to maintain. × Should be kept away from rain.	3.1.1.8	22
	8	Ring Composting Unit	✓ Suitable for household and institutions. × Water may enter during flood and heavy rains.	3.1.1.4	17
	9	Mose Pit Composting	✓ Adequate space availability in the backyard, and located away from drinking water source, suitable for small to large families. × Not suitable for areas with higher water table.	3.1.2.1	30
	10	Toilet Linked Biogas Plant	✓ Hygienic and economically efficient management of human night soil, it provides rich manure, reduces cooking time and saves fuel cost. × Lack of skilled laborer, high construction cost.	3.1.2.7	37
	11	Mini Bio Pedestal Composting Unit	✓ Adequate space availability in the backyard, suitable for small families generating upto 2kg waste per day × Suitable only for easily digesting waste, needs to be shifted after a period of time.	3.1.2.3	32
	12	Biogas Plant (Portable)	✓ Biogas and slurry are two byproducts Biogas being a green fuel helps in reducing commercial fuel consumption. Slurry is highly organic manure. × High cost, continuous feeding required, technical knowledge mandatory.	3.1.2.4	38
	13	Bio Pedestal Composting Unit	✓ Adequate space availability in the backyard , suitable for small families generating upto 2kg waste per day × Suitable only for easily digesting waste, waste to be taken out if required.	3.1.2.2	31

Beneficiary Type	Sl No	Technology Options	Factors for Selection	Index No	Page No
Institution/ Community	14	Portable Household Bio Bin Unit	✓ It is mostly suitable for open terraced flats, institutions and large households. × Should be kept away from rain.	3.1.1.7	21
	15	Aerobic Bin Composting Unit	✓ All types of degradable waste including dead animals can be decomposed. × High cost of construction and maintenance, required more space, continuous monitoring by skilled labours required.	3.1.1.9	24
	16	Windrow Composting	✓ Suitable for large scale waste decomposing (in tonnes per day). × Installation and running cost is high(transportation ,heavy machinery and labours), required more space.	3.1.1.10	25
	17	Organic Waste Composting Machine	✓ Easy and convenient technique to handle and convert the biodegradable waste into compost in less space and time, capacities from 10 - 250 kg per day, semi automatic system to maintain moisture and temperature. × High installation and maintenance cost (power and water).	3.1.2.6	37
	18	Toilet Linked Biogas Plant	✓ Hygienic and economically efficient management of human night soil, suitable for areas having high water table. × High installation cost and requires skilled laborer for construction.	3.1.2.7	38
	19	Biogas Plant (Portable)	✓ Biogas and slurry are two byproducts Biogas being a green fuel helps in reducing commercial fuel consumption. Slurry is highly organic manure. × High cost, continuous feeding required, technical knowledge mandatory.	3.1.2.4	34
	20	Centralized Masonry Bio tank Composting	✓ Suitable for areas with higher water table. × Requires more space.	3.1.2.5	36

3

SOLID WASTE MANAGEMENT

As discussed earlier, for management purpose, solid waste may be classified as bio degradable and non biodegradable.

3.1 DEGRADABLE WASTE MANAGEMENT

Waste which can be decomposed by biological processes is known as "Biodegradable waste". Organic waste is biodegradable and recyclable. Biodegradable waste can be decomposed in two ways.

a. Aerobic (with oxygen), and

b. Anaerobic (without oxygen).

3.1.1 AEROBIC COMPOSTING

3.1.1.1 Pit Composting

Sl No	Description	Unit Cost
1	**Specification and Size** - Pits of adequate size to bury the bio-degradable waste of 6 months in each pit. - Pits of length of 1m and width 60 cm and depth 1m for a family of 5 or 6 members. - Bigger size pits for bigger families according to requirements.	The work to be got done through MGNRES scheme
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 showel, mumty etc.	

3	**Operation & Maintenance Protocols** - Choose an elevated area where water doesn't get collected. Otherwise make necessary provision to prevent entry of water into the pit by constructing a small bund around the pits etc. - Spread a layer of cow dung slurry or decomposed waste in the bottom of the pit before dumping the waste. - Spread the waste over the cow dung or decomposed waste layer. - Bigger sizes of the waste are to be cut into small pieces for easy decomposing. - A small layer of earth may be sprinkled over it daily to avoid bad smell from the pit. - Repeat the procedure daily. - Once the pit is filled up fully, 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, clear the pit and make it ready for further use. The compost can be disposed off or used as manure. - Protect the pit from rain water, keep it covered by means of tarpaulin or PVC roofing sheet.

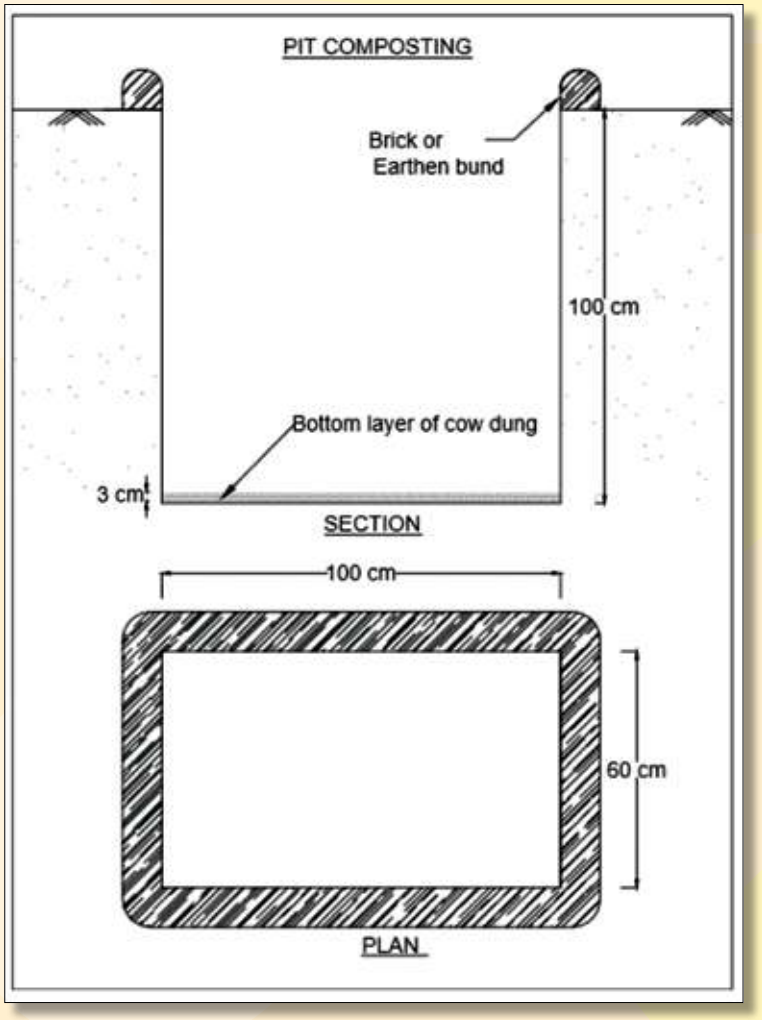


Figure 3.1 Section and Plan of Pit for Composting

3.1.1.2 Pot Composting

Sl No	Description	Unit Cost
1	**Specification and Size** - Mud pots country burnt about 50cm height and about 35cm diameter at the centre with lid covers – 2 nos - Tripod stand 50cm high of appropriate design made of steel, wood, plastic - steel or brick pedestals for keeping the pots – 2 nos.	Rs.500/-
2	**Infrastructure Requirements** - Plastic vessel 10cm high and half liter capacity, for collection of leachate coming out of the pots – 1 Nos - Trowel small size – 1 Nos - Painting brush – ½ size – 1 Nos - 1 brick cut into 2 pieces - Plastic covers – 2 Nos	
3	**Operation & Maintenance Protocols** - Make a small hole in the bottom of the pots. - Place the pots with lids on the tripods at a convenient place. - Place the half litre capacity plastic vessel below the first pot. - Start filling the segregated bio waste (do not put slow degrading items and non degradable items into the pots) daily into one pot and keep the pot closed. This type of waste treatment is capable of treating 1 to 2 Kg of waste per day only. - Leachate coming out of the pot gets collected inside the plastic vessel placed below the pot. - Put some salt powder into the plastic vessel to avoid entry of flies into the vessel. The leachate collected can be diluted with water and used as manure in the garden. - Once the first pot is full start using the second pot - By the time the second pot becomes full the waste in the first pot gets converted into compost. - After first week of commencement, lot of worms will be seen in the pot. Do not try to kill them, they activate the composting process and they die after 3 weeks. - During rainy season spread the plastic sheets over the pots and place the brick pieces over the sheet to protect the pots from rains. - If the quantity of the water inside the pot is more, add some saw dust to absorb the water. - If too much of flies seen around the pot, make a solution of camphor in coconut oil (dissolve 2 tablets in 25ml of oil) and apply it on the bottom and top cover of the pot, by means of the brush. - Sprinkling diluted rotten curd or cow dung solution etc into the waste will speed up the composting process.	

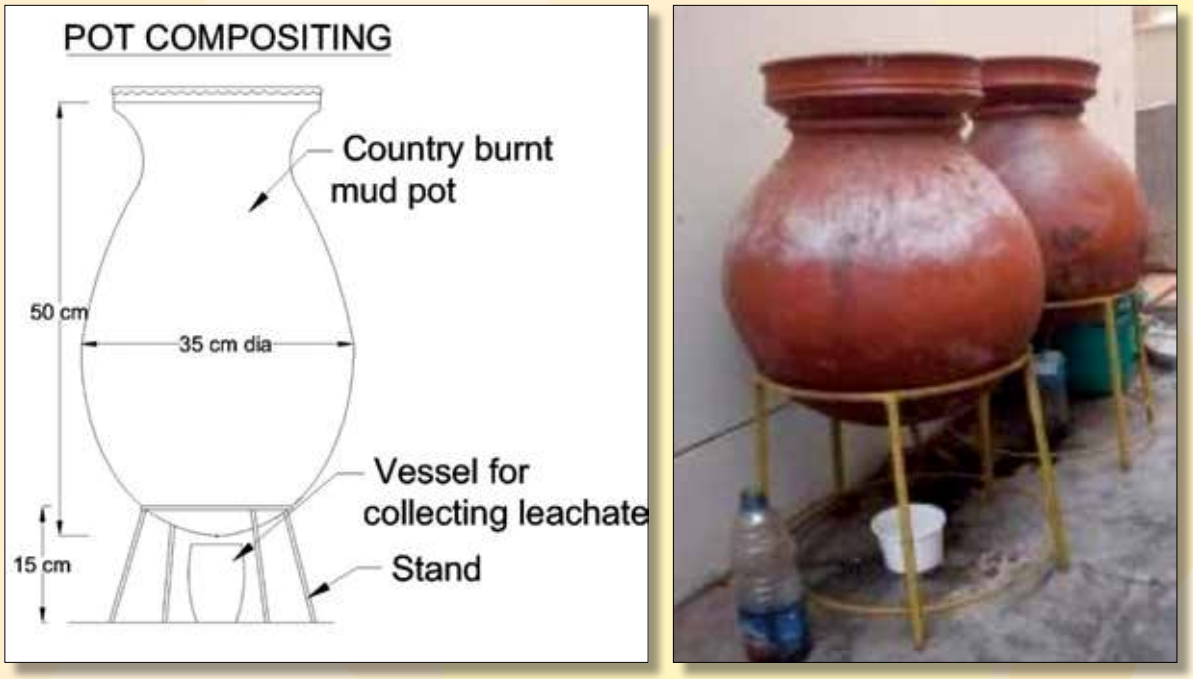


Figure 3.2 Pot Composting

3.1.1.3 Bio Digester Pots Unit

Sl No	Description	Unit Cost
1	**Specification and Size** - The pots are locally molded with clay/terracotta and oven dried to be kept vertically one above the other and the pot on the top is covered by a lid. - The pot number 1 and 2 are kept at the top and middle position and are open on the top as well as bottom. The bottom open portion is weaved with plastic wires. - Pot number 3 is kept at the bottom and is open at the top and closed at the bottom.	Rs.1300/ set
2	**Infrastructure Requirements** - Clay pots of 30cm internal diameter and 30cm high each – 3 Nos. - Earlier lid cover for pot – 1 Nos. - Old news paper - Hand pump (sprayer) - Bio – compost or saw dust (Mavu, Rubber and Aryaveppu dust are not to be used) - Specially prepared bio – culture. - Steel fork.	

3	**Operation & Maintenance Protocols** - Place news paper sheets at the bottom of pot numbers 1 and 2 over the plastic thread to form a bio-platform. - Spread starter material in 1 inch thick layer over the bio-platform (either prepared bio-compost or saw dust treated with bio-culture be used as starter material. Mix saw dust with diluted bio-culture (bio-culture water ratio 1:50) and keep it in a sack bag duly tied. After two days, saw dust mixture becomes hot by the activities of the bacteria. This hot mixture can be used as the starter. - Spread the shredded waste over the starter layer - Spray diluted bio-culture mixture over the waste - Before closing the pot with the lid, sprinkle starter mixture over the waste layer. Ensure water used for mixing the bio culture does not contain chlorine. For that keep the tap water in an open vessel for two days. - Keep spreading the waste daily as above - Third day onwards stir/mix the old waste layer by using a fork without tearing the paper at the bottom, before placing the fresh waste on the top. - Each time spray bio-culture mixture and then sprinkle starter over it before closing the lid. - Once the top pot is full, shift the middle pot to the top and the top pot to the middle portion and repeat the process of spreading the waste into the new pot on the top pot in the same way as done earlier. - Once the second pot also becomes full, clear the paper layer on the first pot (now in the middle position) and push these semi-decomposed waste into the bottom pot. - Shift this emptied pot to the top position and the top pot to the middle position. Continue filling the waste into the top as per the same procedure done earlier. - Now all the pots are full and the waste inside the bottom pot must have become compost and ready for use as manure in the garden. Empty it and continue the process as a routine. - Do not use excess water. - This type of composting is useful for a family of 4 to 5 members, generating 2 kg waste per day.

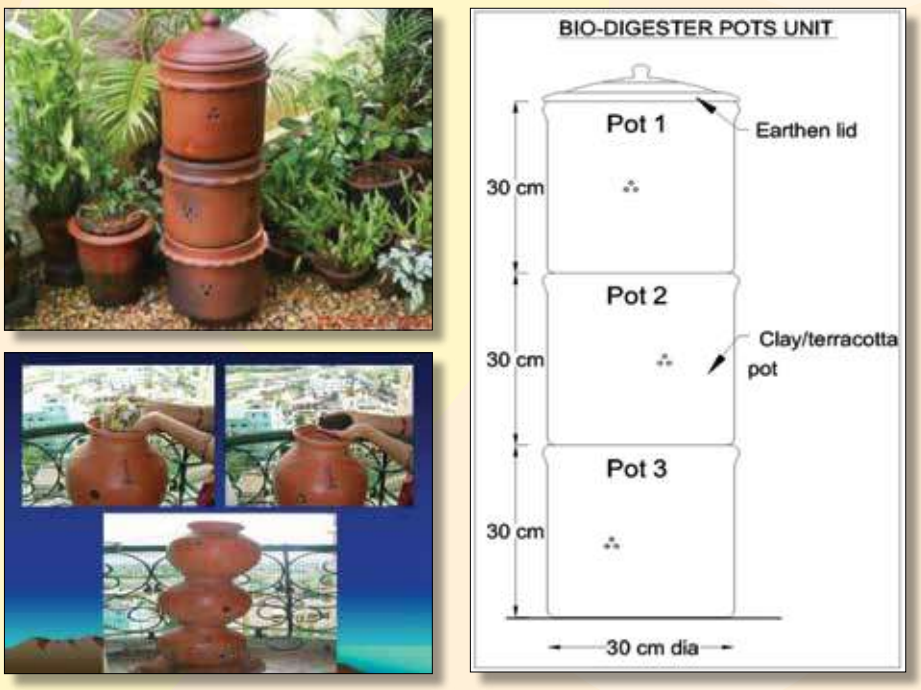


Figure 3.3 Bio – Digester Pots Unit

3.1.1.4 Ring Composting Unit

Sl No	Description	Unit Cost
1	**Specification and Size** - Ferro-cement ring of internal diameter 0.7m, thickness 2.5cm and height 0.5m placed over a circular Ferro cement slab of dia 0.75m and thickness 2.5 cm (without fixing). The ring to have a 30cm x 30cm opening on the side at the bottom with a Ferro-cement slab cover of the same curved shape which can be removed and refitted back tightly with a locking arrangement for removal of compost when ready. The ring will also have a hole of dia 2.5cm at the bottom for the leachate to flow out. - Circular Ferro-cement cover slab of 0.75m diameter and 2.5cm thick with central circular hole of 0.30m diameter to cover the ring. The hole will have a lid cover which can be removed and refitted back for loading the waste into the ring and closing it tightly after loading the waste. - Option to provide HDPE sheet 15mm thickness in lieu of Ferro-cement slab at the base can also be given in such case the cost can be reduced by Rs.350/-	Rs.2500/ set
2	**Infrastructure Requirements** - Two sets of circular Ferro-cement ring resting on circular Ferro cement slabs and covered by another circular Ferro cement slab with provision for loading the waste from the top and removing the Compost from the bottom, when ready. - Base layer with cow-dung (5kg) powder. - Surgical hand gloves for handling waste & manure.	
3	**Operation & Maintenance Protocols** - First apply a base layer with cow-dung (5kg) powder in the ring. - Chop the waste to size less than 5cm before placing in the Basin. - Remove the top central lid cover of the ring and drop the waste inside the ring. - Spread the waste evenly in within the ring. - Use first ring for the first 90 days and then use the second ring after the first ring is filled. - After 175 days, compost from the first ring can be emptied from the side opening and the ring can be used for further waste feeding. - Renew the base layer annually	

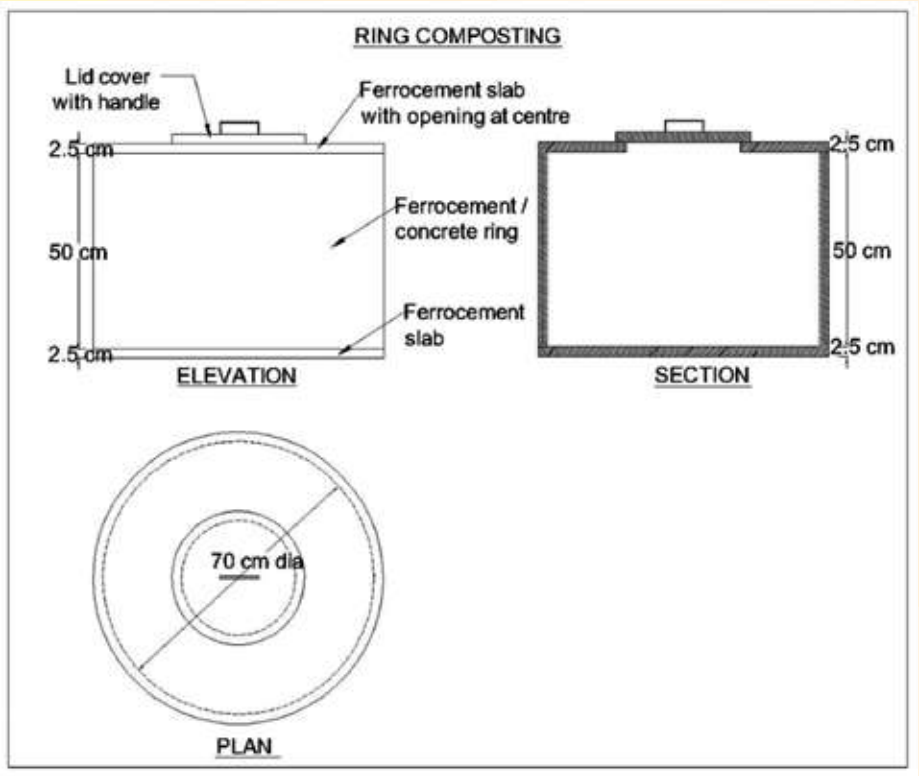




Figure 3.4 Ring Composting Unit

3.1.1.5. Kitchen Bin Composting Unit

Sl No	Description	Unit Cost
1	**Specification and Size** - 25 litre plastic bin with lid – 1 Nos. - Grow bag – 3 Nos	Rs.410/-
2	**Infrastructure Requirements** - Trowel small size - Small fork	
3	**Operation & Maintenance Protocols** - Place the plastic bag inside the bucket - Spread starter material in 1 inch thick layer over the bio-platform (either prepared bio-compost or saw dust treated with bio-culture be used as starter material. Mix saw dust with diluted bio-culture (bio-culture water ratio 1:50) and keep it in a sack bag duly tied. After two days, saw dust mixture becomes hot by the activities of the bacteria. This hot mixture can be used as the starter. - Spread the shredded waste over the starter layer - Spray diluted bio-culture mixture over the waste. After third day, use the fork to mix the contents of old layer and new layer. - Repeat the procedure till the bin is filled. - Tie the grow bag and remove it and store it. - Keep the second grow bag inside the bin and continue the process. - Once the second bag is filled, remove it and store it. Open the first grow bag and remove the contents and start using it again. If the waste quantity is more than 2kg/day increase the number of grow bags to give at least 20 days of storing time for filled grow bag.	



Figure 3.5 Kitchen Bin Composting Unit

3.1.1.6 Vermi Tank

Sl No	Description	Unit Cost
1	**Specification and Size** a) Two numbers of broad mouth PVC basin 25 litre capacities each or one PVC basin of 50 litre capacity with a partition at the centre, minimum weight of the combined unit be 2.5kg. 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). c) Mud pots country burnt two numbers capacity 25 litres each. d) Terracotta jars with lids two numbers, 25 litre capacity each	Rs.1200/- Rs.1400/- Rs.950/- Rs.980/-
2	**Infrastructure Requirements** - Base layer with coconut fiber and gravel/sand with cow-dung (5kg) powder. - Wire-mesh lid covers. - 200 worms 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 mouse, red 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 Protocols** - 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 mouse, ants and other pests. - Keep the waste covered with wet sack or cloth piece. - 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. - Prevent introduction of excessive hot, sour and oily substances and also bones, meat & fiber 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. - Collection of Wash out from the basin in the final stages of composting for vermi wash.	



Figure 3.6 Vermi Composting Unit

3.1.1.7 Portable Household Bio Bin Unit

Sl No	Description	Unit Cost
1	**Specification and Size** - Around 40-45 Kg of kitchen waste can be compostable in the system. Dimension of the bin is in the order of 180 cm, 75 cm of width and height respectively. - Biobin – 2 Nos	Rs.2200/- (For set of 2 bins)
2	**Infrastructure Requirements** - Sprayer: A Sprayer of one litre capacity to spray dung water. - Steel fork: 1 large and 1 small. - Steel pot: A steel pan of 40 cm diameter to draw out the compost. - A 2 m flex sheet to dry out the compost. - A steel cutting knife. - One set of bio bin is required for each 4 person of 40 families producing one kilogram of waste daily. - The size/number of biobins can be increased depending upon the respective increase in the families or the members. - A bin can be easily produced by joining rectangular fiber layers. - More holes must be provided in the sides of the bin for the proper air circulation/ventilation.	

3	**Operation & Maintenance Protocols** - The putrescible waste sorted from the source are cut or chopped into small pieces. - These chopped pieces are then put in the bin (avoid plastics). - Occasionally spray dung water. - Repeat the process daily. - One bin is suitable for 15 days. - After that cover it with a stopper. - When the second bin is full, the waste in the first bin would have become compost. - This compost has to be sowed in the terrace for a day to get it dried and can be used as fertilizer for plants.



Figure 3.7 Portable Household Bio Bin Unit

3.1.1.8 Portable Bin/ Bucket Composting Unit

Sl No	Description	Unit Cost
1	**Specification and Size** - Plastics or HDPE buckets/ Pots 40 litre capacity with lid cover duly fitted with a tap outlet on the side at the bottom most point (The tap should be removable and fitted by means of a socket/coupling) – 2 Nos.	Rs.1000/-

2	**<u>Infrastructure Requirements</u>** - Coconut Shells – Sufficient numbers. - Bricks 4 Nos. for placing the buckets/pot inside the tray. - Small plastic vessel/mug 15 to 20 cm high for collection of leachate. - Plastic net 0.5 m × 0.5 m size. - Plastic tray approximately 0.5 m diameter to keep the bucket inside. - Wooden spoon (Thavi)
3	**<u>Operation & Maintenance Protocols</u>** - Stock a layer of coconut shells in inverted position at the bottom of the bucket/pot. Place the plastic net cut to the shape over the layer of coconut shell. - Place two sets of bricks inside plastic tray and keep the prepared bucket/pot as above over the bricks for convenience of draining the leachate into a plastic vessel to be placed inside the plastic tray just below the tap outlet. Placing the bucket inside the tray is optional. - Start loading the bio waste into the bucket/pot on the layer of coconut shells daily. - Occasionally mix the fresh waste with the old waste by using the wooden spoon. Keep the bucket/pot closed with the lid cover. - One bucket/pot will be filled in 25 to 30 days time in a family of 5 members. - Close the bucket/pot with lid cover and start using the second set. - Keep sprinkling a mug of water into the waste inside the bucket once in a week. Drain the leachate as it comes out. The drained leachate can be used as manure in the garden. - Once the second bucket gets filled, the waste in the first one will be ready as compost. Empty it and reuse the bucket/pot for further storing the waste.

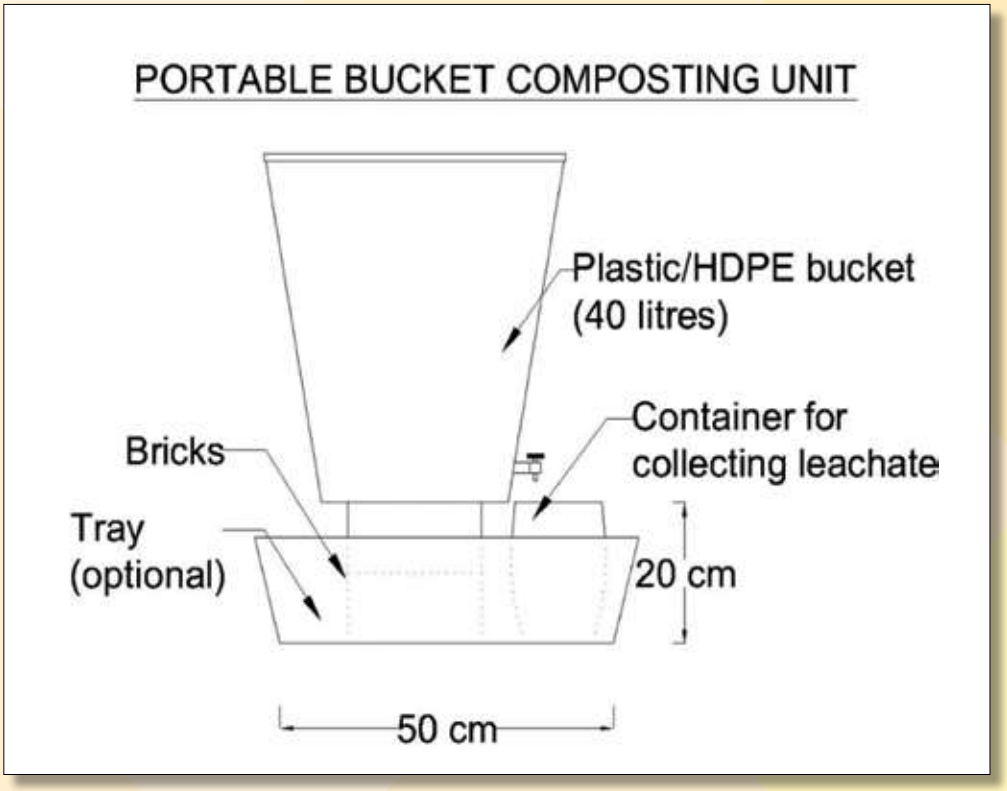


Figure 3.8 Portable Bin/ Bucket Composting Unit

3.1.1.9 Aerobic Bin Composting Unit

The composting unit includes a box like structure with Ferro cement floor. Layers of cow dung, carbon source and waste materials are subjected to composting in presence of oxygen. The temperature rises rapidly in the waste to almost 70˚C, the peak temperature with pathogens. An aerobic compost bin, under the correct conditions creates a lot of heat; this can kill all sorts of seeds and pathogens. An efficient aerobic compost bin does not emit foul ammonia like smell. An aerobic compost bin reduces the biomass to usable compost quicker than its anaerobic counterpart

Technical Aspects:

Aerobic cluster is an eco friendly waste management system consisting of two units. Each unit is a 120cm x 120cm x 120cm ferro cement bin with airspace and grooves utilizing bacteria consortium from cow dung and carbon source from dry leaves and paper bits with a roof to prevent rain water during monsoon. 6" layer of fresh cow dung as the first layer with 6" layer of dried leaves provided the carbon source for the bacteria to flourish, above that another six inch layer waste is converted into compost.

The core temperature built up in this layering is 70 - 75˚C which prevents the breeding of flies and parasites. Moreover due to aerobic functioning no putrid smell is there. About 2000kg waste can be managed in a bin. We can get compost with carbon nitrogen ratio 20 - 30% after 90 days.

Operation & Maintenance Protocols :

- A 6 inch layer of fresh cow dung is laid as the first layer.
- A 6 inch layer of dried leaves is laid on top of the cow dung layer.
- Above that 6 inch layer waste is added and inoculum containing enzymes made from cow dung is sprayed, this hastens composting.
- Alternate, 6 inch layers of dried leaves and waste sprayed with inoculum is repeated till the bin is filled.
- Once the first bin is filled, start using the second bin. By the time the second bin is filled the contents in the first bin will turn into compost. If not, take it out and dry it in dry beds.

Unit Cost

A unit with two aerobic bins will cost Rs.41,000. Providing enclosed shed with provision for drainage and soak pit for leachate, ramp for trolley etc. will cost Rs 1,40,000.

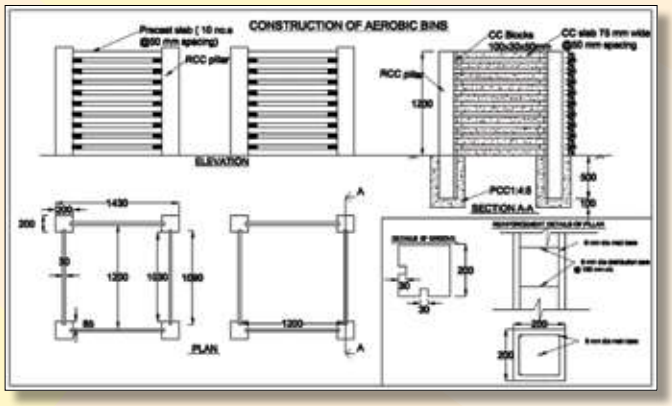


Figure 3.9 Plan, Section and Elevation of Aerobic Bin Composting Unit



Figure 3.10 Aerobic Bin Composting Unit

3.1.1.10 Windrow Composting

Specification and Size

- Windrows are typically trapezoidal in cross section. The average windrow shape is between an oval and trapezoidal. A factor of 0.66 is assumed to estimate windrow volumes

(Volume = Height x Width x Length x 0.66)

- Typically windrows can vary from 6 to 10 feet in height and 6 to 10 feet wide at the base.
- The space between windrows should be sufficient for movement of the windrow turning machine to be employed in the plant. Normally it is 1-3 meters.
- Windrow dimensions should allow conservation of heat generated during composting process while also maintaining diffusion of air to the deeper portions of the windrow.

Infrastructure Requirements

- The compost pad (platform is to be constructed with an appropriately designed combination of RCC and PCC. The compost pad shall have a slope of about 1% to drain the excess water (storm water or leachate) from the windrows into a leachate collection tank. The leachate tank is placed in the lowest corner of the compost pad area.
- Factors to be considered in the location and design of the composting pad:
  a) The base has to provide a barrier to prevent the percolation of leachate and/or nutrients to the sub-soil and groundwater.
  b) The surface has to facilitate equipment movement even during wet weather conditions.
  c) The surface area has to accommodate waste for 5 weeks, with sufficient room for equipment to maneuver and an area to establish a static pile for curing compost.
- Loader: Tractor mounted front-end loaders or pay loaders are used to deliver the pre-processed feedstock to form windrows. They can be used for site maintenance, piling the cured compost and loading the finished compost product into trucks or trailers for sale in the market.
- Windrow Turner: Generally, pay loaders (wheel or tracked) or tractors with hydraulic attachments are used to scoop the material from one windrow to make a new pile in an adjacent location on the compost pad, while placing and mixing the material. Other equipment such as front end loaders/ windrows re-shifters may also be used for turning windrows.

- Screener: A trommel screen is desired at the end of the curing process to screen the finished compost for a suitable particle size. This will remove any larger undesirable items and will fluff up the finished product to ensure a suitable compost quality.
- Bagging: Bulk supply of compost is usually through 50 kg bags.

Operation & Maintenance Protocols

- The pre-processed MSW is transferred onto the compost pad (platform) into windrows.
- Windrow Formation: Windrows can be formed by means of bucket loaders or by manual labour, depending on the size, shape, and spacing of windrows
- Windrow Turning: The outer layers of piles are moved to inner layers by turning the windrows. This process is repeated once every week for 5 weeks, high temperatures within the windrow (55 to 65°C) sanitize the material. During the rainy season where the interstitial spaces are filled with water, more frequent turning is necessary (interval of 3-4 days).
- A turning schedule should be established based on the rate of decomposition, moisture content, porosity of the material, and the desired composting time (often a function of land availability).
- Each windrow should be allowed to stay on the compost pad for 35 days and at the end of the 35th day the compost is ready for sieving.
- Each windrow should have a flag board depicting the age of the waste.
- Fresh incoming waste is always depicted by "Age 1". The numbering on the windrow changes from Age 1 to Age 2 on the second day; Age 2 should be changed to Age 3 on the third day and so on.
- Each windrow may be turned manually or mechanically. This turning process has to be done every 7th day. Hence, only those windrows having a flag board showing Age 7, 14, 21 and 28 should be turned.

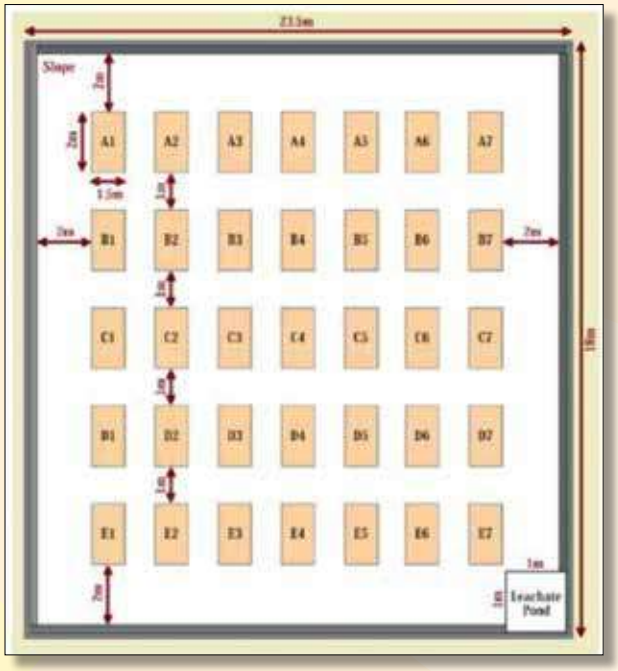


Figure 3.11 Chart showing arrangement of windrow

- Fresh water or leachate stored in the leachate tank should be sprinkled during the turning process to maintain the moisture content of the waste. Figure below shows a quick and simple method to test moisture content.

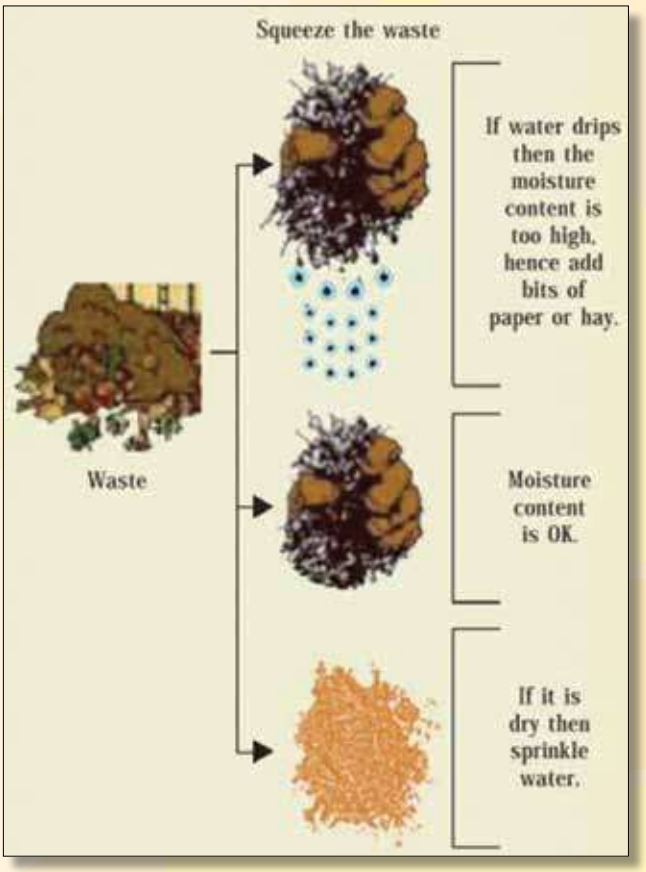


Figure 3.12 Moistuure Content Test

- Temperature should also be monitored and maintained within 55-60°C.
- On the 35th day, the compost is successively sieved through two stage screening system of 35mm followed by 16mm. Screened material coming out of this section is uniform in texture but contains semi-solid organic compost, which requires further stabilization. The rejects from the 35 mm screen are sent to the RDF and the 35mm – material is sent to the 16 mm screen. The rejects from the 16mm (16mm+) screen are to be put back on the windrow as protective covering from bird menace, vermin and for odour control.
- Curing: Screened material coming out of the coarse segregation section requires further maturation and moisture control for producing a product that is beneficial for plants and soil. The curing piles are placed either in a storage area or covered area for a minimum duration of 2 weeks. In general, the area needed for the curing process is one quarter of the size needed for the windrow/composting process. The completely cured well composted material does not release foul odour and is ready for final screening and for the preparation of the finished product for marketing.
- The degree of maturity is determined through either oxygen uptake or carbon dioxide production rate. (Determination of maturity is explained in Municipal Solid Waste Management Manual of CPHEEO)

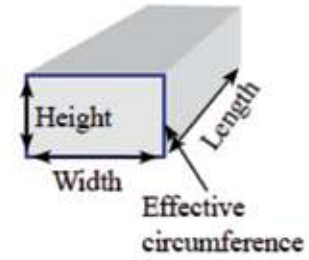
- Compost Refinement: At the end of composting phase, the material usually contains 30 to 35% moisture. The composting is normally taken to be complete when the active decomposition stage is over and the C/N ratio is around 20:1. The refinement section also consists of a feeder conveyer and a trommel with 4mm perforations. The screened product which is less than 4mm is passed through ADS (air density separator or de-stoner) to remove sand and grit. Then the compost can be put in bags and stored for sale. The remaining material greater than 4 mm in size should be put on top of the fresh incoming waste heap, to speed up the process of composting and for absorbing excess leachate. The residue material from the ADS is inert laced with fine organic material. This should be kept out of the composting stream. The finished product is dark brown with an earthy smell, fragile and rich in organic matter content and nutrients.
- Leachate Management: Leachate generated during composting varies with seasons. The compost pad surface should be designed with proper gradient and surface drainage system so that the entire leachate from windrows is directed through drainage pipes to collection tank. This leachate can be utilized for moistening the waste placed in the windrows, as required. In case leachate production is higher than consumption, the leachate tank should be provided with treatment facilities for treating before disposal. Normally, the leachate tank is provided with a surface aerator for reducing the BOD content. Treated leachate could be subsequently used for irrigation as a fertiliser.

(Detailed design of aerobic windrow composting plants from 50 – 500 TPD MSW input capacity is available in the 'Inter-Ministerial Task Force on Integrated Plant Nutrient Management using City Compost', Government of India, 2005.)



Figure 3.13 Windrow Composting

Windrow Size Calculation :

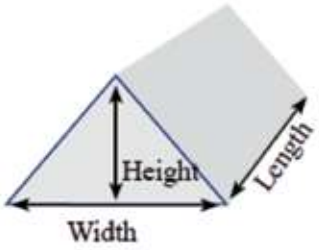


Rectangle

Volume = Height x Width x Length

Effective circumference= 2x height + width

Mass = Volume x Bulk Density

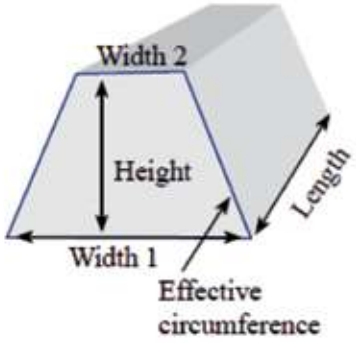


Triangle

Volume = Height x Width x Length x 0.5

Effective circumference= $2x\sqrt{height^2 + (width/2)^2}$

Mass = Volume x Bulk Density



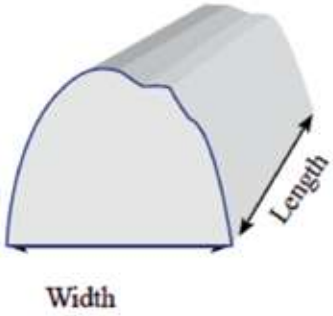
Trapezoid

Volume= Height x (Width1+Width2) x Length x 0.5 *1

Effective circumference =

$2 \times (\sqrt{((width2-width1)/2))^2 + height^2}) + width2$

Mass = Volume x Bulk Density



Oval

Approximations:

Volume = Height x Width x Length x 0.75 *1

Effective circumference= $2.3\sqrt{height^2 + (width/2)^2}$

Mass = Volume x Bulk Density

3.1.2 ANAEROBIC COMPOSTING

3.1.2.1 Mose Pit Composting

Sl No	Description	Unit Cost
1	**Specification and Size** - Pit of size 60cm diameter and depth 1m for a family of 5 members. - Diameter of the pit may go up to 1.5m for institutions - Restrict the depth to 1m in all cases as methanogenic activities get reduced at lower depth. - The bottom of the pit of oval shape. - The cover slab of size 75cm diameter (for a pit of 60cm diameter) and thickness 7.5cm. PVC pipe of 100mm dia for domestic type and can be upto 200mm diameter for bigger size pits. - Cover the pit with the cover slab and spread earth over the slab. Only the pipe will be visible above the ground. - This method is not suitable where strata are loose.	Rs.900/- (For family of five members)
2	**Infrastructure Requirements** - Circular pits of required diameter and depth 1m in a convenient location – 2 Nos - Circular/ rectangular slabs to fully cover the pit, with PVC pipe of required diameter, 50cm long, vertically placed centrally into the slabs - 2 sets. - PVC caps to close opening of the pipe – 2 Nos	
3	**Operation & Maintenance Protocols** - Ensure methanisation before putting the waste into the pit by sprinkling cow-dung/ decomposed waste into the pit. - Drop the shredded bio-waste into the pit through the pit through the pipe opening daily and keep the pipe end closed always. - Pouring of warm water of 35˚ to 45˚C temperatures once in a week will accelerate the decomposing. - Occasionally pouring of cow-dung mixture or any methanogenic seed into the pit will also be helpful - Keep using the pits alternately for six months each.	

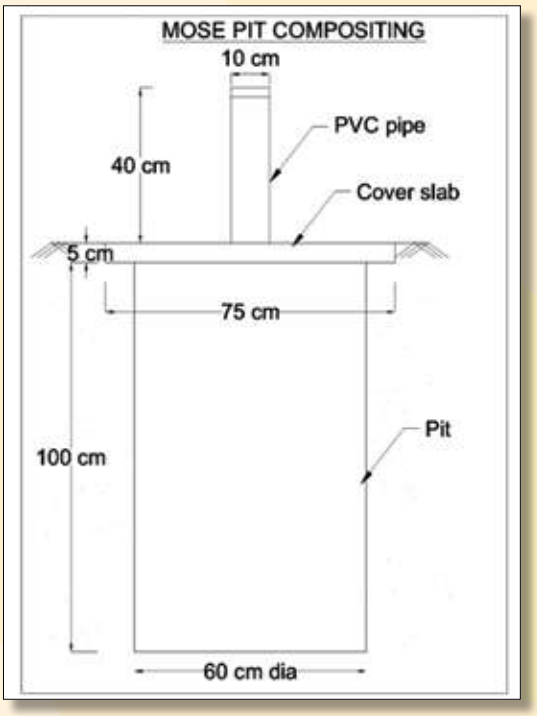


Figure 3.14 Mose Pit Composting

3.1.2.2 Bio Pedestal Composting Unit

Sl No	Description	Unit Cost
1	**Specification and Size** - Plastic bucket or vessel with open mouth around 25 litre capacity – 2 Nos. - PVC Pipe of 2.5 Kgf/cm^2, ISI marked 200 mm diameter - 1 m long – 2 Nos. - A plastic/ferro cement lid cover for closing the open end of the pipe – 2 Nos.	Rs.1150/-
2	**Operation & Maintenance Protocols** - Take a pit bigger than the size of the plastic bucket/vessel. - Keep the plastic bucket/vessel inside the pit. - Fill the plastic bucket/vessel with earth upto half the height. - Place the pipe vertically into the vessel/bucket above the earth filling. - Fill up the bucket/vessel and the pit with earth keeping pipe portion inside. - Keep the open end of the pipe seen above ground, closed with cover. - Keep putting the bio waste (easily digesting items only) into the pipe. - Occasional sprinkling of cow dung solution or approved inoculums into the waste will be good. - The bio-waste gets digested inside the vessel and gets distributed evenly into the ground. Plant a tree by the side of the pit which will absorb manure. - Shift the Bio- Pedestal column to a different to a different location after a year or so, if required.	

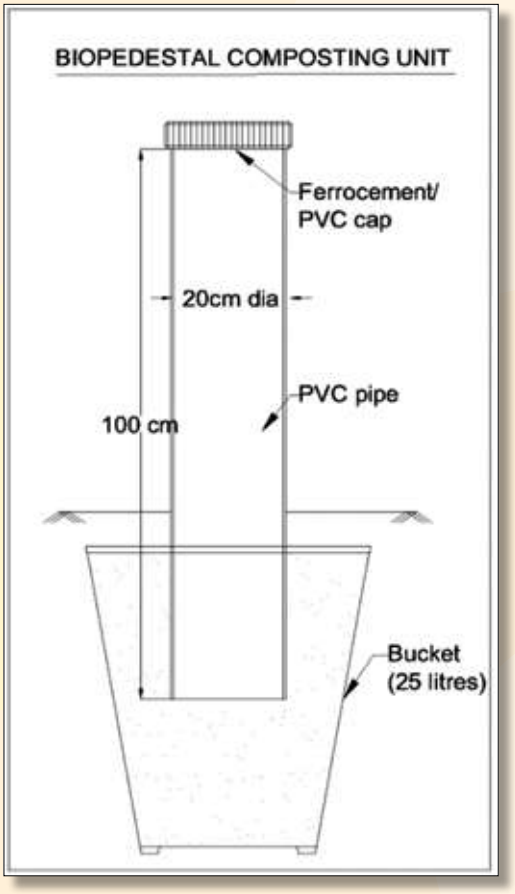


Figure 3.15 Bio Pedestal Composting Unit

3.1.2.3. Mini Bio Pedestal Composting Unit

Sl No	Description	Unit Cost
1	**Specification and Size** - House hold waste basket with perforations – 2 Nos. - PVC Pipe 2.5 Kgf/cm2 ISI marked 1 m long 20 cm diameter – 2 Nos. - PVC/Ferro cement cap for 20 cm pipe – 2 Nos. - Tripod – Top circular ring with 30 cm high 3 legs fabricated out of 8 mm TMT bar ,three 3 mm thick flat iron pieces 30 × 30 mm welded to the ring for fixing of the 200 mm pipe by means of screws – duly painted.	Rs.1500/-
2	**Infrastructure Requirements** - Pit size sufficient to bury a domestic type waste basket – 2 Nos. - House hold waste basket with perforations – 2 Nos. - PVC pipe 1m long 20cm diameter – 2 Nos. - PVC/Ferro cement cap for 20 cm pipe – 2 Nos. - Broken stone 12/20 mm size. - Tripod stand.	

3	**<u>Operation & Maintenance Protocols</u>** - Cut a hole 20 cm diameter on the bottom of the waste basket. - Place the waste basket upside down into the pit. - Insert the pipe into the basket by 10cm, the pipe has to be tightly fitting into the basket. (fix the tripod to hold the pipe centrally after filling up the pit) - Fill up the gaps between the basket and the pit sides with broken metal. - Close the pit with earth and only the pipe with the lid cover and the tripod will be seen outside. - Two sets of such mini – pedestals for a household. - Keep dropping the waste into the pipe and keep the open end closed with the lid after dropping the waste. - Use one pedestal for one week and second pedestal for next week. - Keep using the pedestals alternately. - Taking out the waste may be done only if required. - Grow a plant near to the pit 1.0

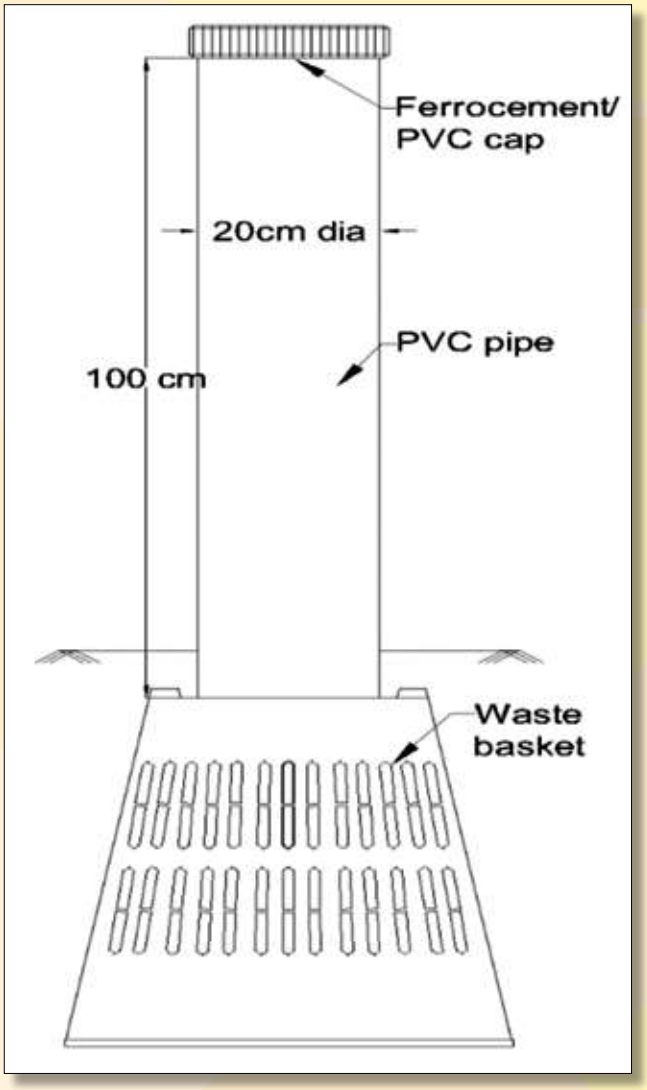


Figure 3.16 Mini Bio Pedestal Composting Unit

3.1.2.4. Biogas Plant (Portable)

<table>
<tr><th>Sl No</th><th colspan="5">Description</th></tr>
<tr><td rowspan="13">1</td><td colspan="5"><u>Specification and Size</u></td></tr>
<tr><td>Size</td><td>Capacity</td><td colspan="2">Model</td><td>Unit Cost</td></tr>
<tr><td rowspan="4">0.5m^3</td><td rowspan="4">2.5kg/day</td><td rowspan="2">FRP</td><td>Without water Jacket</td><td>Rs.8500/-</td></tr>
<tr><td>With water Jacket</td><td>Rs.10500/-</td></tr>
<tr><td rowspan="2">PVC</td><td>Without water Jacket</td><td>Rs.8000/-</td></tr>
<tr><td>With water Jacket</td><td>Rs.9000/-</td></tr>
<tr><td rowspan="4">0.75m^3</td><td rowspan="4">5kg/day</td><td rowspan="2">FRP</td><td>Without water Jacket</td><td>Rs.10500/-</td></tr>
<tr><td>With water Jacket</td><td>Rs.12000/-</td></tr>
<tr><td rowspan="2">PVC</td><td>Without water Jacket</td><td>Rs.10000/-</td></tr>
<tr><td>With water Jacket</td><td>Rs.11000/-</td></tr>
<tr><td rowspan="4">1 m^3</td><td rowspan="4">7. 5kg/ day</td><td rowspan="2">FRP</td><td>Without water Jacket</td><td>Rs.12500/-</td></tr>
<tr><td>With water Jacket</td><td>Rs.13500/-</td></tr>
<tr><td rowspan="2">PVC</td><td>Without water Jacket</td><td>Rs.12000/-</td></tr>
<tr><td>With water Jacket</td><td>Rs.13000/-</td></tr>
<tr><td>2</td><td colspan="5"><u>Infrastructure Requirements</u>
- Unit without water jacket: PVC/LLDPE/HDPE tanks with circular shape as digester and floating gas holder
- Unit with water jacket: PVC/LLDPE/HDPE tanks with water jacket in between the digester and the gas holder.
- Inlet device with PVC pipe of diameter 110mm
- Inlet chamber with a plastic/FRP mug having circular shape and with a lid.
- Outlet device wit PVC pipe of 63 mm.
- A plastic can of 10 litre capacity to be used for collecting slurry/effluent for safe disposal.
- Rubber hose of 25 mm diameter for conveyance of biogas for use with maximum length of 10m.
- Stove wit single burner.
- Control valve for regulating gas.</td></tr>
</table>

3	**<u>Operation & Maintenance Protocols</u>** - The initial filling for a new biogas plant should if possible consist of either slurry from another plant or fresh cattle dung. - After removing straw and waste fodder from the dung, it should be mixed sufficiently with water to avoid separation of solid and liquid material inside the digester. The amount of cattle dung should be 2-3% of the total amount of slurry for initial loading; it can be diluted with water. As a thump rule, 1kg of dung requires 1liter of water. - The substrate should be free of stalks and other impurities in order to avoid scum formation and blockage of the inlet and outlets pipes. - Cow dung, waste from kitchen, water from rubber sheet and other degradable waste can be filled in the Plant. - Egg shell, coconut shell, orange, lime, pickles, disinfectants, dettol, soap water, plastic, wood pieces, metal and sand cannot be put in the plant. - Chopping of the fodder into pieces of 3-5 cm length for fast digestion. - The plant must be fed regularly in order to achieve regular gas production. - For units with water jacket, add a little kerosene or oil or aqua culture to the water or else use mosquito net for preventing the possibility of mosquito growth. - The overflowing slurry should be removed from the outlet. Otherwise it can block the flow and the gas pressure might increase until it escapes through the inlet pipe or blows off the water trap. Therefore the outlet and the slurry canal must be cleaned. - Cleaning the slurry and feeding the plant should be a part of daily routine. The problem becomes less, if a proper slope is maintained and the slurry canal is shaded off from direct sunshine. - The slurry can be directed towards the plants for fertilization. - Depending on the type of waste, the plant may need several days to weeks to achieve a stable digesting process. Cattle dung can be expected to yield good gas production within one or two days. - Maintenance cost: Rs.200/- per annum per unit.



Figure 3.17 Portable Household Biogas Plant

3.1.2.5. Centralised Masonary Biotank Composting

Sl No	Description
1	**Specification and Size** - For a flat of 40 units, a 2m × 1.2 × 1 m tank is required. - It is recommended to build the tank at the central part of the flat with RR masonary foundation and a brick wall.
2	**Infrastructure Requirements** - A temporary roofing to be provided for protection from rains. - A net to avoid birds/insects attack. - A dung mixture comprising of cow dung, Jaggery, condiments, yeast and fiber.
3	**Operation & Maintenance Protocols** - Put the bio degradable wastes in the tank. - Spray the organic mixture of cow dung, Jaggery, condiments, yeast and fibre above the waste. - Once the first tank is full, use the second tank and then the third tank. - The leachate from the tank can be collected through a tap provided at the bottom of the tank and can be used as manure for plants or can be ejected out via Septic tank/Soakpit - Once the third tank is filled, the compost from tank 1 is emptied and can be used again and the entire process gets repeated.

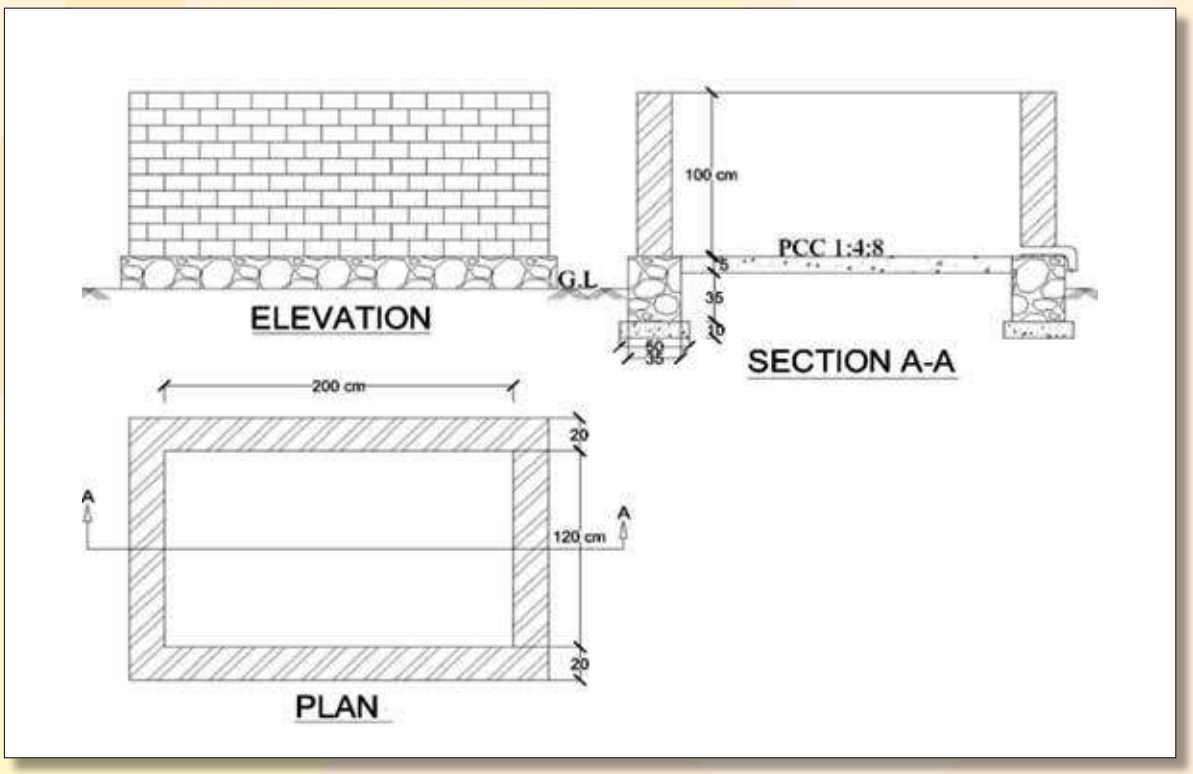


Figure 3.18 Centralized Masonry Biotank Composting

3.1.2.6. Organic Waste Composting Machine

Sl No	Description
1	**Specification and Size** - At present, certain grinding machines like biowaste converting machines which can grind 10, 25, 50, 125, 150 Kgm of wastes simultaneously are available in the market.
2	**Infrastructure Requirements** - Working process includes three batches per hour or 1 to 8 hours per day. - Plastic bags of capacity 20 Kg. - Racks for the safe keeping of the bags containing partially processed waste. - Room of dimension 3 m × 4 m with proper ventilation for installing machinery and safe storage of racks and baskets is required. - An organic solution, power connection of 4 - 10 KW and water connection required.
3	**Operation & Maintenance Protocols** - Mix cow dung water or any other rapid composting materials with one kilo segregated waste. - Put this mixture in the machine and run the machine for 15 minutes. - Transfer the partially composted waste to basket and store in the rack. - The moisture content should not be less than 40%. - In 15 days, waste will become compost.



Figure 3.19 Organic Waste Composting Machine

3.1.2.7. Toilet Linked Biogas Plant

Human excreta is an alternative feed material to biogas plant. At present, human excreta treatment is a major sanitation problem in the country. If it is used imaginatively in biogas plant, it can become an asset instead of a nuisance. Human excreta management in a bio gas plant will give three benefits – health, energy and organic manure. Thus the waste can turn into wealth.

Technical Aspects

General:

- Excreta has physical, chemical and microbial characteristics which markedly differ from those of cattle dung. Therefore the parameters, design criteria etc fixed for cattle dung biogas plants were found not valid for human excreta based biogas plant.
- There should not be any direct handling of human excreta.
- Undigested excreta should not get exposed to surroundings and should be inaccessible to insects and animals.
- Aesthetically there should be freedom from odour.
- Quantity of human excreta : 200 to 300gm/person/day
- Quantity of gas generated from the night soil produced by one person is about 30 to 40liters per day
- Optimum temperature range for effective digestion and optimum economic viability : 25 to 30˚C
- Solid content for optimum biogas generation : 5%
- Hydraulic retention time (HRT) : 45 days for destruction of all pathogens.

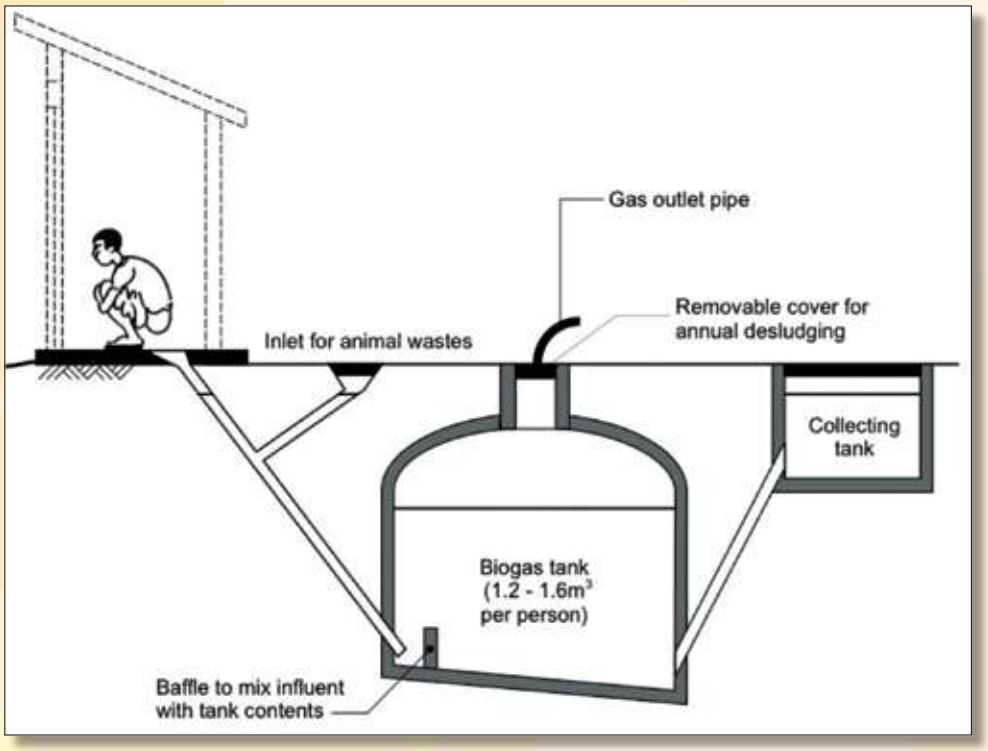


Figure 3.20 Schematic representation of Toilet Linked Biogas Plant

Operation & Maintenance Protocols

- Toilet connected to the Biogas plant should be kept clean and used regularly
- Scum formation creates problem in the digester .To minimize scum formation,it is necessary to prevent entry of undesirable foreign material into the digester except human excreta.

- It is necessary to remove sludge from the digester once in 5 to 10 years by suitable pumping arrangement.
- Effluent from the plant should preferably be disposed of in a compost unit
- Antiseptic and disinfectants should not be used for cleaning the toilets. Occasionally organic soap/organic detergents may be used.
- Top of the vent pipe provided at the point of inlet chamber need to be covered with nylon mesh so as to prevent the passage of mosquito or any insects.

3.2. NON DEGRADABLE WASTE MANAGEMENT

Non-biodegradable waste is a type of waste that cannot be broken down into its base compounds by micro-organisms, air, moisture or soil in a reasonable amount of time. It includes items like plastic, rubber, Styrofoam, fiberglass and metals. Because non-biodegradable waste cannot be broken down, recycling is the best option for managing it.

Recycling & Recovery

Recycling is the process by which materials that are otherwise destined for disposal are collected, processed and remanufactured or reused. Recycling diverts a significant fraction of municipal, institutional and business waste away from disposal and, thereby, saves scarce resources as well as reduces environmental impacts and the burden of waste management on public authorities. If appropriate market mechanisms are established, recycling can generate revenues, contributing to the overall cost recovery for municipal solid waste service provision. According to the integrated solid waste management hierarchy, recycling is a preferred waste management strategy and recycling systems should be adopted before planning for any waste processing/treatment facilities. Recyclables mainly consist of paper, plastic, metal, and glass.

Material	Recycling Potential	Special Conditions
Glass	Moderate market value - Sorted into colours and melted - Saves energy compared with processing raw material - Can be recycled indefinitely because it does not deteriorate by reprocessing	Broken glass can contaminate and eliminate opportunities for recycling of other materials such as paper
Paper and cardboard	Easily recycled - Paper or cardboard from recycled paper requires less energy during production and helps protect forests	Recycling potential is reduced with each recycling cycle through deterioration of fibres.
Polyethylene Terephthalate (PET)	PET can be recycled if segregated from other waste	Quality of recycled product decreases with every processing cycle Recycled products have specific designated uses and cannot be used for all purposes
Other Plastics	Other plastics, such as polyethylene or polyvinyl chloride, can be recycled but have less value in the market than PET; the value depends on recycling and manufacturing options in the vicinity.	Clean segregated plastics, are subjected to mechanical recycling into the same plastic type.Where recycling is not possible due to mixed plastics, these are then co-processed for energy recovery or used as aggregates in road material

Electronic Waste	Electronic wastes contain high-value metals. Electronic items can be dismantled and components reused or recycled	Metals are often covered with polyvinyl chloride or resins, which are often smelted or burned, causing toxic emissions, if recycling is not carried out under controlled conditions. Disaggregation of electronic waste for recycling can be costly.
Metals (steel, copper, zinc, nickel, silver etc.)	Scrap metal has a high market value (especially steel, copper and silver) Can be recycled indefinitely because it does not deteriorate through reprocessing	High value metals (such as copper and silver) are incorporated in electronic devices, but extraction can cause severe environmental impacts, if uncontrolled.
Aluminium	High Market Value - Easily recycled by shredding and Melting. - Can be recycled indefinitely because it does not deteriorate through reprocessing. - Requires significantly less energy than producing aluminium ore	Separate collection is Important
Batteries	- Recovers valuable metals. - Protects environment from heavy metals such as lead, cadmium and mercury.	Large variation in type and size of batteries. Only some types allow adequate material recovery.
Construction and Demolition Waste	- Demolition waste can be sorted, crushed and reused for production of pavement material, flooring tiles, road construction, landscaping and other purposes. - Due to the amounts of demolition waste, its recycling allows significant reduction of otherwise required disposal capacities.	Standards for recycled products are yet to be stipulated

3.2.1 Material Recovery Facility

A Material Recovery Facility (MRF) accepts mixtures of waste fractions for the purpose of separating and diverting recyclable materials and transferring the remaining waste for disposal.

The configuration of an MRF processing line is critical to the overall quality of the segregated material. It depends upon numerous factors including the types and quantities of materials to be processed, quality and quantity of incoming waste, desired processing rates, and required specifications for the end products. While no two MRFs are identical, they generally employ common design principles and sequencing in the configuration of equipment and labour.

3.2.1.1 Stages of material recovery

Material recovery starts at the primary level, by households which segregate recyclables like newspapers, cardboard, plastics, bottles etc. from waste, to sell such material to local recyclers/ scrap dealers / haulers or kabali system. Well segregated recyclables can directly be transferred to a processing site or to the recyclable market depending on local conditions. The dry fraction of

the waste can be segregated at the ward level, where waste from one or more wards is collected and segregated. Different recyclables are sent either directly to locally available recycling facilities or are sold to wholesale dealers. Dry waste fraction may also be transported to the waste transfer station, where it is further segregated. Segregation at the transfer station is through manual and or mechanized segregation.

Depending on the scale of the operations employed and the level of mechanization in the facility, MRFs may be classified as manual or mechanized facilities. Manual MRFs are usually small scale units, typically owned, managed and operated by the informal sector and largely employ manual sorting practices. Material is segregated based on the types of wastes (paper, plastic, metal, glass etc.) and gradation of material within each waste type (paper: news print, office paper, packaging paper, printed books etc.).Segregated material is then sold on to intermediaries, who supply material in bulk to the recycling industry. Mechanized facilities are large scale units where recyclables are sorted by using automated machines when quantities to be handled are large.

3.2.1.2 MRF Unit Processes

MRF units employ varying combinations of manual and mechanical processes, based on the type of facility, easy availability of equipment, labour availability and associated cost implications. MRF units employing manual labour for sorting operations have relatively lower costs, but may also operate at lower efficiencies compared to mechanical sensor based sorting facilities

Pre-Sorting: Bulky and contaminated wastes hamper further sorting/processing in the facility; mechanical or manual pre-sorting is essential to separate out these wastes.

Mechanical Sorting: Mechanical processes based on principles of electro-magnetic fluid mechanics, pneumatics etc. are used to segregate the different waste streams in the pre-sorted waste. Mechanical processes require specialized equipment for segregation of co-mingled municipal waste. Mechanical sorting typically employs the following processes:

- Screening
- Ferrous Metal separation
- Air Classification
- Non-ferrous metal separation
- Detect and Route system
- Size reduction
- Baling

The unit processes in a MRF is schematically shown in the figure

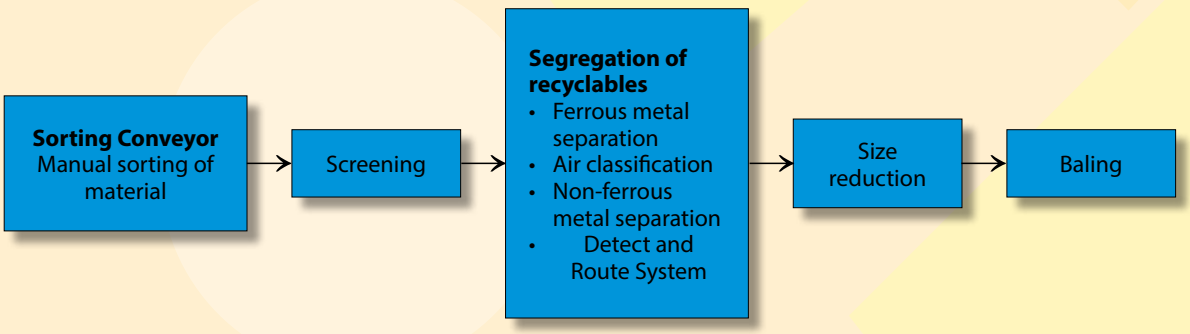


Figure 3.21 Schematic representation of unit processes in a MRF

3.2.1.3 Indicative unit process in a Material Recovery Facility

A MRF facility is also equipped with suitable environmental pollution control and monitoring equipment. At a minimum a waste recycling facility should consist of the following equipment:

- Dust Collection System
- Noise Suppression Devices
- Odour Control System
- Heating, Ventilating& Air Conditioning

Note: The plastic waste management is dealt in the" Plastic Waste (Management and Handling) Rules 2011".



Figure 3.22 (a) A small model of MRF



Figure 3.22 (b) Segregated storage in a MRF Unit

3.2.1.4 MRF as a business model for a block with 5 Panchayaths

Objective :

• To reduce, reuse, and recycle the plastic with the coorperation of public as to cultivate it as part of culture and to facilitate a trained community of self help groups for the same. To facilitate compulsory use of plastic for construction of roads within the block.

• Phase 1 – To train a Kudumbhashree unit in each Panchayath to collect all non degradable waste

from 5 Panchayaths of the block (51013 households, 1526 shops, 58 educational institutions, 34 hospitals and other organisations) and to sort and redistribute for the needful or supply as raw material to industry.

• A sevice charge of Rs 30/- from households, Rs 50/- from shops, Rs 100/- from hospitals is to be levied and also the collected material can be sold to the needful to create an income for the Kudumbhashree unit. A maximum time of 6 months is to be provided for these units to attain self sufficiency and for that time they can be given a fixed salary as viability gap fund (as per MGNRGES criteria).

• Provide facilities such as vehicle for collection, uniforms, gloves for hands and legs, shed for storing the collected materials, introducing organizations for collecting the sorted materials and to scientifically manage the leftover materials.

• To bring behavioral change to the community with the help of kudumbashree members to facilitate the reuse of plastic covers, to provide clean and dry waste, to give these at free of cost and to prevent throwing of waste in public areas.

• Do awareness programs for all sectors of people, organize seminars and quiz programs in school and colleges.

• Train Block, Grama, Jilla – Panchayath members, VEO's, CDS – ADS chairperson's, Asha workers, Saksharatha Prerakh's, MGNREGS mate's , Aganvadi teachers and SC/ST promoters.

• Phase 2 – To analyze and increase the facility to collect more plastics to start a shredding unit and to use the same for road constructions and to recycle.

• Phase 3 - To train self help groups to start small scale manufacturing units for making plastic toys.

• Identify a locality within the Block area where people dump waste and convert that area to a 'Model clean locality' by clearing the area and creating a garden/ park.

Details of expenses for setting up of MRF.

Sl No	Item	Unit/No
1.	Pamphlet preparation	25000 (5000 per Panchayath)
2.	One day workshop – Phase 1 (Block, Grama, Jilla – Panchayath members, Implementing Offiicer)	(100 person x Rs 120/–)
3.	One day workshop – Phase 2 (CDS – ADS chairperson, Asha workers, Saksharatha Prerakh, MGNREGS mate)	(200 person x Rs 120/–)
4.	Honorarium for workshop faculties	(500 x 4 section)
5.	School level seminars (Implementing officer – VEO) LP/ UP/ High School/ Higher Secondary School within block area (11 schools per Panchayath, likewise 55 schools in 5 Panchayaths)	(Rs 1000 per school)

6.	College level seminar (3 Colleges) (Short film depicting environmental issues due to unscientific disposal of waste into public areas, agricultural fields, water bodies etc can be exhibhited with the help of Swachh Bharath Mission at the School – College level seminars).	(Rs 1000 per college)
7.	School – College Level Quiz Competitions (Institutions has to conduct school – college level competitions and all first prize winners should participate in the block level Quiz competition. The first and second prize winners should be awarded trophies and certificate)	
8.	Training for Kudumbhashree members (classes on types of various plastics and other non degradable materials, sorting, storing, organizations accepting collected materials, cost index of items, procedures for organizing meetings and accounts keeping)	Rs.50/– per person for notebook, pen etc. Rs.100/– per person per day for food, tea and snacks. Rs. 100/– per person for TA/DA.
9.	Honorarium for faculties/ TA/DA	Rs 1000 per section x 20 sections
10.	Field visit to successful projects of same type to study the processes. (Try to organise as part of Deen Dayal Upadhyaya Grameen Kaushalya Yojana)	Rent of vehicle, food for 25 members etc
11.	Vehicle for collection and transportation of materials (Try to utilize MLA/ MP local development fund)	5 (one per each Panchayath)
12.	Uniforms, gloves for hands and legs, baskets and other miscellaneous items for Kudumbhashree members (Try for Sponsorship)	
13.	Identify a locality within the Block area where people dump waste and convert that area to a 'Model clean locality' by clearing the area and creating a garden/ park. (As a part of MGNREGS project)	1
14.	Facility for sorting and storing the collected materials safe from rain and sun, providing facility for primary needs of Kudumbhashree members. (construction of shed of minimum 5000 sq.ft area (using iron mesh for covering as required), well, toilet construction, electricity and plumbing works, crushing machine, waterless cleaning machine) (Trivandrum Technopark Model)	
15.	Providing a payment of Rs 229/- to Kudubhashree members until they generate income by themselves, (as per MGNREGS criteria) for a maximum of 180 days.	(25 x 229 x 180)
16.	Initial expenditure (for 6 months) Fuel charges for vehicles, Electricity charges, Registers and other necessary expenses.	• Fuel Charges – Rs 4000/- per vehicle per month • Electricity charges – Rs 3000/- per month • Registers and other necessary expenses – Rs12000/-

Fund Details :

• Fund for printing pamphlet, conducting awareness classes, seminars and quiz programs can be taken from Swachh Bharath Mission fund.

• Fund for identifying a locality within the Block area where people dump waste and to convert that area to a 'Model clean locality' by clearing the area and creating a garden/ park can be taken from Block – Panchayath- Swachh Bharath Mission - MGNREGS programs.

• Funds for giving driving classes for kudumbhashree members, classes on types of various plastics and other non degradable materials, sorting, storing, cost index of items, procedures for organizing meetings, accounts keeping and Field visit to successful projects of same type to study the processes can be found from Block, Grama, Jilla – Panchayath plan fund or Deen Dayal Upadhyaya Grameen Kaushalya Yojana.

• Fund for purchasing vehicle for collection and transportation of materials can be from MLA/ MP local development fund and given to kudumbhashree units on contract basis and expenses like maintenance and fuel charges for vehicles can be from Block, Grama, Jilla – Panchayath plan fund.

• Initial expenditure like Uniforms, gloves for hands and legs, baskets and other miscellaneous items for Kudumbhashree members can be given one time from Block, Grama, Jilla – Panchayath plan fund and later it is to be found from their inccome.

• A sevice charge of Rs 30/- from households, Rs 50/- from shops, Rs 100/- from hospitals is to be levied and it can be an income for the Kudumbhashree unit. A maximum time of 6 months is to be provided for these units to attain self sufficiency and for that time they can be given a fixed salary as viability gap fund as per MGNRGES criteria from Block, Grama, Jilla – Panchayath plan fund.

• Details of income of kudumbhashree unit from service charge obtained from households, shops and hospitals and sale of collected materials of each panchayath is given below.

Panchayath 1 – Total households – 6500 nos

(Per day – 90 households) X (1 month (24 days)) = 2160 households
(collection from a household in every 3 months)
Shops – 80 nos (collection from a shop in every one month)
Hospitals – 4 nos (collection from a hospital in every one month)

Service charge income – from - households - 2160 x 30	=	Rs 64800/-
Shops - 80 x 50	=	Rs 4000/-
Hospitals - 4 x 100	=	Rs 400/-

		Rs 69200/-

Per month income of a member - Rs 69200/ 5 = Rs 13840/- + (income from sale of collected materials)

Panchayath 2 – Total households – 12000 nos
(Per day – 120 households) X (1 month (24 days)) = 2880 households
(collection from a household in every 4 months)
Shops – 500 nos (collection from a shop in every one month)
Hospitals – 7 nos (collection from a hospital in every one month)

Service charge income – from - households - 2880 x 30	=	Rs 86400/-
Shops - 500 x 50	=	Rs 25000/-
Hospitals - 7 x 100	=	Rs 700/-

		Rs 112100/-

Per month income of a member - Rs 112100/ 5 = Rs 22420/- + (income from sale of collected materials)

Panchayath 3 – Total households – 11000 nos

(Per day – 115 households) X (1 month (24 days)) = 2760 households

(collection from a household in every 4 months)

Shops – 220 nos (collection from a shop in every one month)

Hospitals – 8 nos (collection from a hospital in every one month)

Service charge income – from - households - 2760 x 30 = Rs 82800/-

Shops - 220 x 50 = Rs 11000/-

Hospitals - 8 x 100 = Rs 800/-

Rs 94600/-

Per month income of a member - Rs 94600/ 5 = Rs 18920/- + (income from sale of collected materials)

Panchayath 4– Total households – 13500 nos

(Per day – 140 households) X (1 month (24 days)) = 3360 households

(collection from a household in every 4 months)

Shops – 500 nos (collection from a shop in every one month)

Hospitals – 8 nos (collection from a hospital in every one month)

Service charge income – from - households - 3360 x 30 = Rs 100800/-

Shops - 500 x 50 = Rs 25000/-

Hospitals - 8 x 100 = Rs 800/-

Rs 126600/-

Per month income of a member - Rs 126600/ 5 = Rs 25320/- + (income from sale of collected materials)

Panchayath 5 – Total households – 7000 nos

(Per day – 97 households) X (1 month (24 days)) = 2330 households

(collection from a household in every 4 months)

Shops – 200 nos (collection from a shop in every one month)

Hospitals – 8 nos (collection from a hospital in every one month)

Service charge income – from - households - 2330 x 30 = Rs 69900/-

Shops - 200 x 50 = Rs 10000/-

Hospitals - 8 x 100 = Rs 800/-

Rs 80700/-

Per month income of a member - Rs 82700/ 5 = Rs 16140/- + (income from sale of collected materials)

After deducting the fund available from Swachh Bharath mission and planning board from the total project cost, the rest of the amount is to be obtained as 40:30:30 from Block, Grama, Jilla – Panchayath plan fund.

3.2.1.5 MRF - Technical Aspects:

a. Plan, elevation and cost of construction of 500 sqft MRF

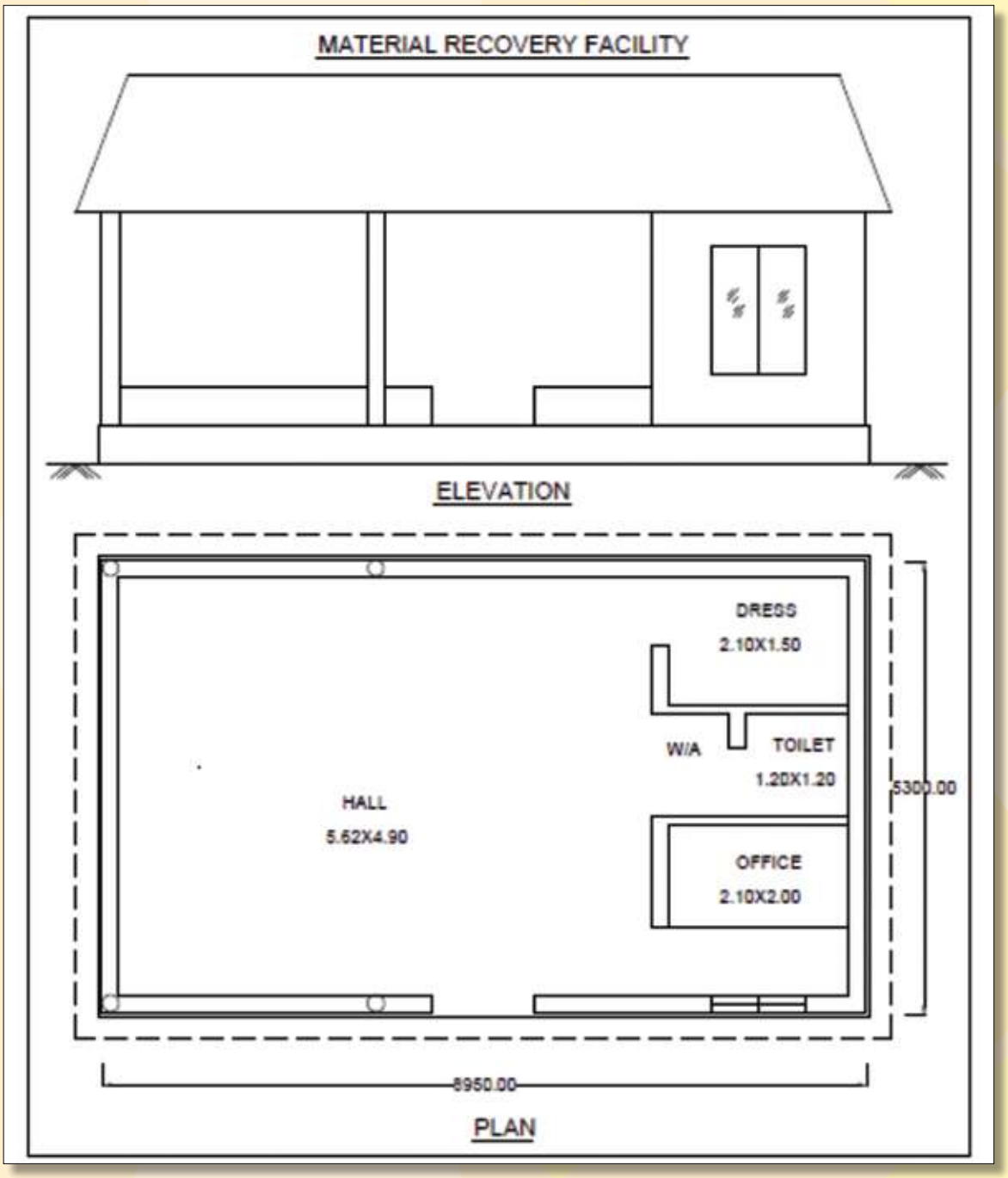


Figure 3.23 Plan and Elevation of MRF

The estimated cost of construction of the above given MRF is Rs 7,40,000/-.

b. Plan, elevation and cost of construction of 1000 sqft MRF

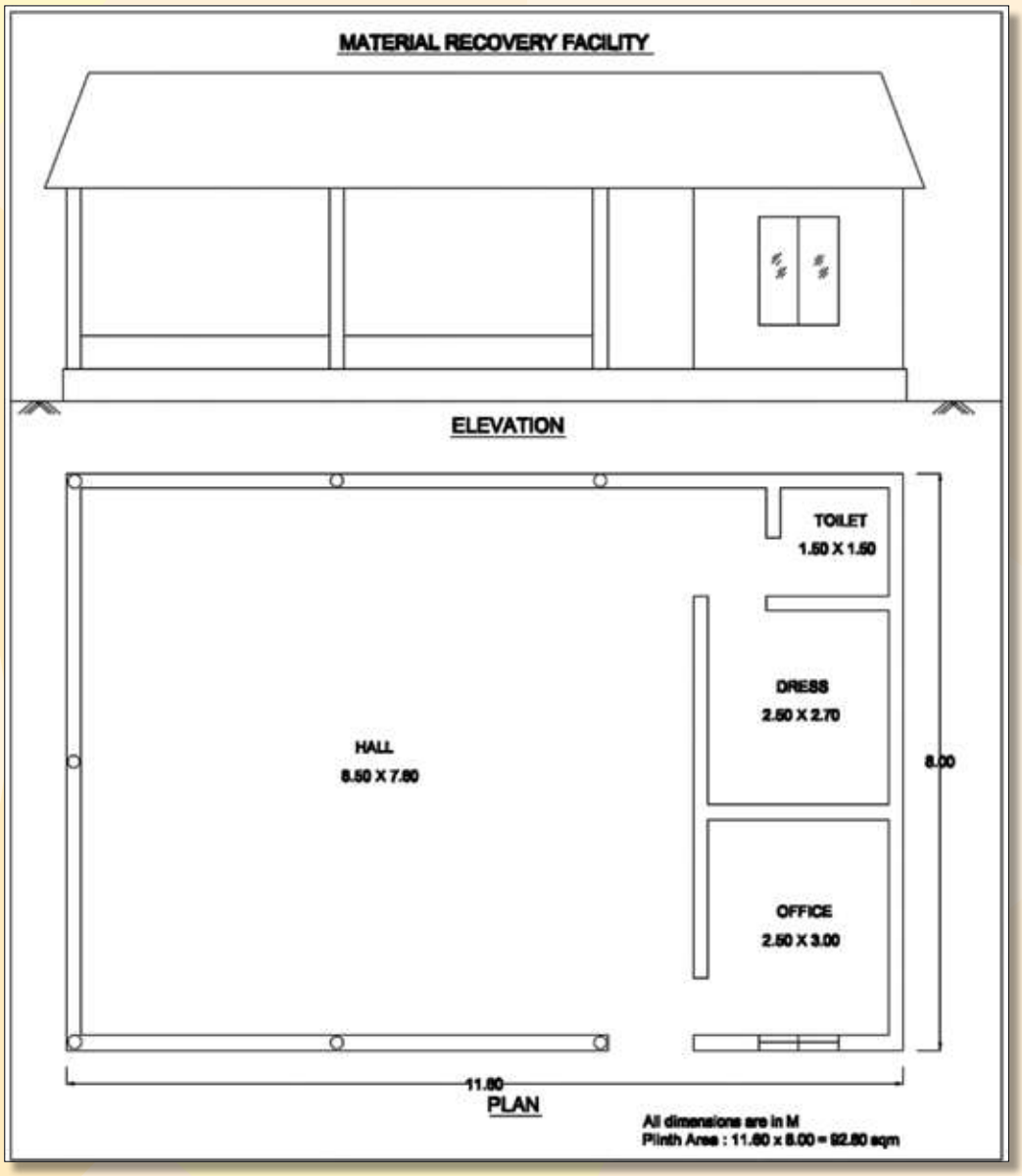


Figure 3.24 Plan and Elevation of MRF

The estimated cost of construction of the above given MRF is Rs 9,25,000/-.

c. Plan, elevation and cost of construction of 1500 sqft MRF

The specifications are only indicative as per requirement, the size of the MRF can increase/ decrease as considered fit by the LSGI & its engineering wing and estimate prepared accordingly. An indicative rule of thumb would 1 Sq.feet per door number (that includes domestic as well as commercial).

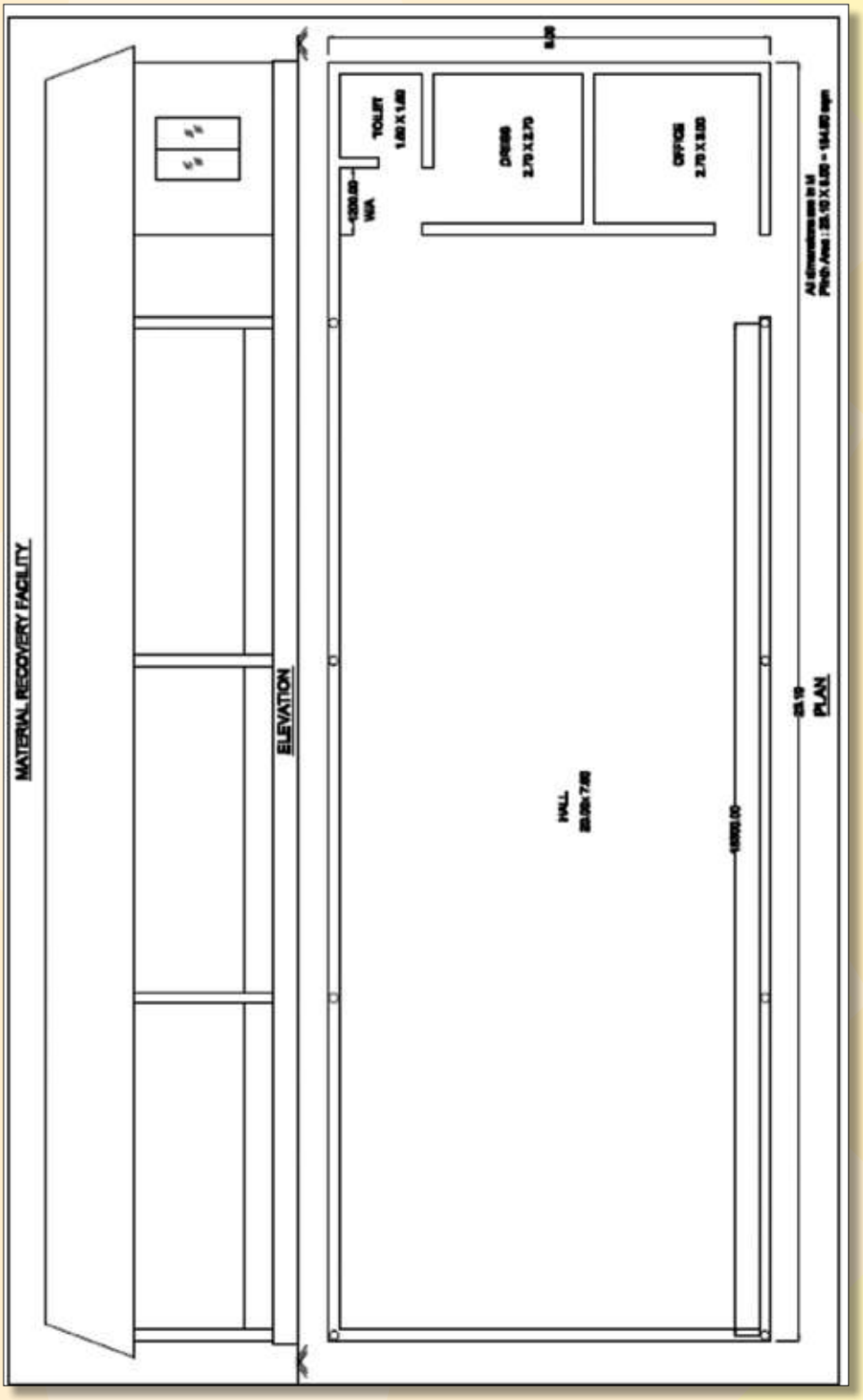


Figure 3.25 Plan and Elevation of MRF

The estimated cost of construction of the below given MRF is Rs 10,75,000/-.

3.2.2 Baling Machine



Figure 3.26 Pet Bottle Baling Machine

Balers are typically used to compact similar types of waste, such as office paper, Corrugated fiberboard, plastic, foil and cans, for sale to recycling companies. These balers are made of steel with a hydraulic ram to compress the material loaded.

3.2.3 Plastic Shredding Unit

Plastic shredder is a machine used for cutting the plastic in small pieces to make waste management easier.

Shredding and size reduction is most commonly utilized in the materials recovery sector of integrated solid waste management, i.e. recycling. Historically the major benefits of size reduction are threefold. First, shredding the bulk waste stream breaks the raw MSW into its basic components by tearing and breaking open paper, plastic, and glass containers such that material recovery and separation will be more effective. Secondly, shredding the MSW reduces the average particle size to a more workable size that can be better handled by any subsequent processing equipment or personnel. Lastly, and most importantly for material recovery facilities (MRF's), shredding produces different size distributions for the different material components, allowing for automated material separation such as air classifiers, screens and optical sorters.



Figure 3.27 Plastic shredding Machine



Figure 3.28 Various stages from plastic shredding to pellet making

For setting up a plastic shredding unit, a covered shed is required. The main machinery that is required for a shredder unit is a shredding machine, the specification of which is as follows.

Approximate Technical specification for a plastic shredder is given below.

Capacity	:	7.5 HP
Thickness of blade	:	12mm
Qty. of rotating knives	:	4 sets
Speed of knives axis	:	1440 rpm
Qty. of stationery knives	:	1 set
Size of mouth	:	15-20 inches
Motor power	:	7.5 hp (440/220v – 3 Phase)
Weight	:	500-600 Kg
Height	:	5'
Hopper Opening	:	15"

Budgetary Requirements

Capital Cost

Sl. No	Items	Cost (Rs. in Lakh)
1.	Shredding Machine (7.5 hp)	2.00
2.	Blade sharpening machine with 2 hp motor	0.30
3.	Tools and Weighing Machine	0.15
4.	Electrification	0.50
5.	Building (shed area- 45 m^2 (for storage & machineries, water facility, toilet, resting room)	2.25
6	Miscellaneous	0.05
	packing & forwarding and Taxes for machineries extra	
	Total	**5.25**

Note:- The above budget is with the assumption that the LSGI has sufficient land with compound wall and gate.

3.3. OTHER WASTE

3.3.1.E-WASTE

"Electronic waste" may be defined as discarded computers, office electronic equipment, entertainment device electronics, phones, television sets, and refrigerators. This includes used electronics which are destined for reuse, resale, salvage, recycling, or disposal. Others are re-usables (working and repairable electronics) and secondary scrap (copper, steel, plastic, etc.) to be "commodities", and reserve the term "waste" for residue or material which is dumped by the

buyer rather than recycled, including residue from reuse and recycling operations. Because loads of surplus electronics are frequently commingled (good, recyclable, and non-recyclable), several public policy advocates apply the term "e-waste" broadly to all surplus electronics.

The processes of dismantling and disposing of electronic waste in the third world lead to a number of environmental impacts. Liquid and atmospheric releases end up in bodies of water, groundwater, soil, and air, and therefore in land and sea animals – both domesticated and wild, in crops eaten by both animals and human, and in drinking water.

Some computer components can be reused in assembling new computer products, while others are reduced to metals that can be reused in applications as varied as construction, flatware, and jewelry.

The environmental impact of the processing of different electronic waste components

E-Waste Component	Process Used	Potential Environmental Hazard
Cathode ray tubes (used in TVs, computer monitors, ATM, video cameras, and more)	Breaking and removal of yoke, then dumping	Lead, barium and other heavy metals leaching into the ground water and release of toxic phosphor
Printed circuit board (image behind table – a thin plate on which chips and other electronic components are placed)	De-soldering and removal of computer chips; open burning and acid baths to remove final metals after chips are removed.	Air emissions as well as discharge into rivers of glass dust, tin, lead, brominated dioxin, beryllium cadmium, and mercury
Chips and other gold plated components	Chemical stripping using nitric and hydrochloric acid and burning of chips	Hydrocarbons, heavy metals, brominated substances discharged directly into rivers acidifying fish and flora. Tin and lead contamination of surface and groundwater. Air emissions of brominated dioxins, heavy metals and hydrocarbons
Plastics from printers, keyboards, monitors, etc.	Shredding and low temp melting to be reused	Emissions of brominated dioxins, heavy metals and hydrocarbons
Computer wires	Open burning and stripping to remove copper	Hydrocarbon ashes released into air, water and soil.

3.3.2. HAZARDOUS WASTE

Hazardous waste is waste that possesses substantial or potential threats to public health or the environment. Hazardous wastes are divided into two major categories:

i. Characteristic wastes
ii. Listed wastes

i. Characteristic wastes

Characteristic hazardous wastes are materials that are known or tested to exhibit one or more of the following four hazardous traits:

- Ignitability
- Reactivity
- Corrosivity
- Toxicity

ii. Listed wastes

Listed hazardous wastes are materials specifically listed by regulatory authorities as a hazardous waste which are from non-specific sources, specific sources, or discarded chemical products.

Many types of businesses generate hazardous waste. For example, dry cleaners, automobile repair shops, hospitals, exterminators, and photo processing centers may all generate hazardous waste. Some hazardous waste generators are larger companies such as chemical manufacturers, electroplating companies, and oil refineries.

These wastes may be found in different physical states such as gaseous, liquids, or solids. A hazardous waste is a special type of waste because it cannot be disposed of by common means like other by-products of our everyday lives. Depending on the physical state of the waste, treatment and solidification processes might be required.

Household Hazardous Waste

Household Hazardous Waste (HHW) (also referred to as domestic hazardous waste or home generated special materials) is waste that is generated from residential households. HHW only applies to wastes that are the result of the use of materials that are labeled for and sold for "home use". Wastes generated by a company or at an industrial setting are not HHW.

The following list includes categories often applied to HHW. It is important to note that many of these categories overlap and that many household wastes can fall into multiple categories:

- Paints and solvents • Automotive wastes (used motor oil, antifreeze, etc.) • Pesticides (insecticides, herbicides, fungicides, etc.)
- Mercury-containing wastes (thermometers, switches, fluorescent lighting, etc.)
- Electronics (computers, televisions, cell phones)
- Aerosols / Propane cylinders
- Caustics / Cleaning agents
- Refrigerant-containing appliances
- Some specialty Batteries (e.g. lithium, nickel cadmium, or button cell batteries)
- Ammunition
- Radioactive waste (some home smoke detectors are classified as radioactive waste because they contain very small amounts of a radioactive isotope of americium –

3.3.2.1 Disposal of Hazardous Waste

Historically, some hazardous wastes were disposed of in regular landfills. This resulted in unfavorable amounts of hazardous materials seeping into the ground. These chemicals eventually entered natural hydrologic systems. Many landfills now require countermeasures against groundwater contamination, an example being installing a barrier along the foundation of the landfill to contain the hazardous substances that may remain in the disposed waste. Currently, hazardous wastes must often be stabilized and solidified in order to enter a landfill and many hazardous wastes undergo different treatments in order to stabilize and dispose of them. Most flammable materials can be recycled. One example they can be recycled into is industrial fuel. Some materials with hazardous constituents can be recycled, lead acid batteries are one example.

A. Recycling

Many hazardous wastes can be recycled into new products. Examples might include lead-acid batteries or electronic circuit boards. Where the heavy metals, these types of ashes go through the proper treatment, they could bind to other pollutants and convert them into easier-to-dispose solids, or they could be used as pavement filling. Such treatments reduce the level of threat of harmful chemicals, like fly and bottom ash, while also recycling the safe product.

B. Incineration, destruction and waste-to-energy

A HW may be "destroyed" for example by incinerating it at a high temperature, flammable wastes can sometimes be burned as energy sources. For example, many cement kilns burn HWs like used oils or solvents. Today, incineration treatments not only reduce the amount of hazardous waste, but also they generate energy from the gases released in the process. It is known that this particular waste treatment releases toxic gases produced by the combustion of byproduct or other materials, and this can affect the environment. However, current technology has developed more efficient incinerator units that control these emissions to a point where this treatment is considered a more beneficial option. There are different types of incinerators and they vary depending on the characteristics of the waste. Starved air incineration is another method used to treat hazardous wastes. Just like in common incineration, burning occurs, however controlling the amount of oxygen allowed proves to be significant to reduce the amount of harmful byproducts produced. Starved air incineration is an improvement of the traditional incinerators in terms of air pollution. Using this technology, it is possible to control the combustion rate of the waste and therefore reduce the air pollutants produced in the process.

C. Hazardous waste landfill (sequestering, isolation, etc.)

A HW may be sequestered in a HW landfill or permanent disposal facility. "In terms of hazardous waste, a landfill is defined as a disposal facility or part of a facility where hazardous waste is placed or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit (40 CFR 260.10)."

3.3.3. BIOMEDICAL WASTE

Biomedical waste is waste that is either putrescible or potentially infectious. Biomedical waste may also include waste associated with the generation of biomedical waste that visually appears to be of medical or laboratory origin (e.g., packaging, unused bandages, infusion kits, etc.), as well research laboratory waste containing biomolecules or organisms that are restricted from environmental release. Biomedical waste is a type of biowaste. Biomedical waste may be solid or liquid. Examples of infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human or animal tissue, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids, and laboratory waste that exhibits the characteristics described above. Waste sharps include potentially contaminated used (and unused discarded) needles, scalpels, lancets and other devices capable of penetrating skin.

Biomedical waste is generated from biological and medical sources and activities, such as the diagnosis, prevention, or treatment of diseases. Common generators (or producers) of biomedical waste include hospitals, health clinics, nursing homes, medical research laboratories, offices of physicians, dentists, and veterinarians, home health care, and funeral homes. In healthcare facilities (i.e., hospitals, clinics, doctors offices, veterinary hospitals and clinical laboratories), waste with these characteristics may alternatively be called medical or clinical waste.

Risk to human health

Biomedical waste from those settings may pose an injury and exposure risks via occupational contact with medical waste for doctors, nurses, and janitorial, laundry and refuse workers. Further, there are opportunities for the general public to come into contact with medical waste, such as needles used illicitly outside healthcare settings, or biomedical waste generated via home health care.

Management

Biomedical waste must be properly managed and disposed of to protect the environment, general public and workers, especially healthcare and sanitation workers who are at risk of exposure to biomedical waste as an occupational hazard. Steps in the management of biomedical waste include generation, accumulation, handling, storage, treatment, transport and disposal.

- Biomedical waste should be collected in containers that are leak-proof and sufficiently strong to prevent breakage during handling. Containers of biomedical waste are marked with a biohazard symbol. The container, marking, and labels are often red.
- Handling refers to the act of manually moving biomedical waste between the point of generation, accumulation areas, storage locations and on-site treatment facilities. Workers who handle biomedical waste should observe standard precautions.
- The goals of biomedical waste treatment are to reduce or eliminate the waste's hazards, and usually to make the waste unrecognizable. Treatment should render the waste safe for subsequent handling and disposal. There are several treatment methods that can accomplish these goals.
- Biomedical waste is often incinerated. An efficient incinerator will destroy pathogens and sharps. Source materials are not recognizable in the resulting ash.
- An autoclave may also be used to treat biomedical waste. An autoclave uses steam and pressure to sterilize the waste or reduce its microbiological load to a level at which it may be safely disposed of.
- For liquids in small quantities, a 1–10% solution of bleach can be used to disinfect biomedical waste. Solutions of sodium hydroxide and other chemical disinfectants may also be used, depending on the waste's characteristics.
- Other treatment methods include heat, alkaline digesters and the use of microwaves.

3.3.4 Construction and Demolition waste

Construction and demolition waste is generated whenever any construction/demolition activity takes place, such as, building roads, bridges, flyover, subway, remodelling etc. It consists mostly of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics etc.

These wastes are heavy, having high density, often bulky and occupy considerable storage space either on the road or communal waste bin/container. It is not uncommon to see huge piles of such waste, which is heavy as well, stacked on roads especially in large projects, resulting in traffic congestion and disruption. Waste from small generators like individual house construction or demolition, find its way into the nearby municipal bin/vat/waste storage depots, making the municipal waste heavy and degrading its quality for further treatment like composting or energy recovery. Often it finds its way into surface drains, choking them.

While retrievable items such as bricks, wood, metal, titles are recycled, the concrete and masonry waste, accounting for more than 50% of the waste from construction and demolition activities,

are not being currently recycled in India. Concrete and masonry waste can be recycled by sorting, crushing and sieving into recycled aggregate. This recycled aggregate can be used to make concrete for road construction and building material.

3.3.4.1 Components of construction and demolition waste

The major components of C & D wastes are Cement concrete, Bricks, Cement plaster, Steel, Rubble, Stone, and Timber/wood.

The minor components of C & D wastes are Conduits (iron, plastic)**.** Pipes (GI, iron, plastic)**,** Electrical fixtures, Panels (wooden, laminated) and others (glazed tiles, glass panes).

3.3.4.2 Storage of construction and demolition waste

These wastes are best stored at source, i.e., at the point of generation. If they are scattered around or thrown on the road, they not only cause obstruction to traffic but also add to the workload of the local body. All attempts should be made to stick to the following measures:

- All construction/demolition waste should be stored within the site itself. A proper screen should be provided so that the waste does not get scattered and does not become an eyesore.
- Attempts should be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated. Material, which can be reused at the same site for the purpose of construction, leveling, making road/pavement etc. should also be kept in separate heaps from those, which are to be sold or send to landfill.
- The local body or a private company may arrange to provide appropriate number of skip containers/trolleys on hire which may be parked at the site and removed with skip lifters or tractors as the case may be.
- Whenever a new streamlined system is introduced in a municipality, the local body may consider using its old vehicles, especially, tractors and trailers or old lorries or tippers for this purpose.
- For large projects involving construction of bridges, flyovers, subways etc., special provision should be made for storage of waste material.

3.3.4.3 Collection and transportation

If the construction debris is stored in skips, then skip lifters fitted with hydraulic hoist system should be used for efficient and prompt removal. In case, trailers are used, then tractors may remove these. For handling very large volumes, front-end loaders in combination with sturdy tipper trucks may be used so that the time taken for loading and unloading is kept to the minimum.

In case of small towns where skips and tipping trailers are not available, manual loading and unloading should be permitted.

3.3.4.4 Recycling and reuse

The use of these materials basically depends on their separation and condition of the separated material. A majority of these materials are durable and therefore, have a high potential of reuse. It would, however, be desirable to have quality standards for the recycled materials. Construction and demolition waste can be used in the following manner:

- Reuse (at site) of bricks, stone slabs, timber, conduits, piping railings etc. to the extent possible and depending upon their condition.
- Sale/auction of material which cannot be used at the site due to design constraint or change in design.

- Plastics, broken glass, scrap metal etc. can be used by recycling industries.
- Rubble, brick bats, broken plaster/concrete pieces etc. can be used for building activity, such as, leveling, under coat of lanes where the traffic does not constitute of heavy moving loads.
- Larger unusable pieces can be sent for filling up low-lying areas.
- Fine material, such as, sand, dust etc. can be used as cover material over sanitary landfill.

Metropolitan and mega cities usually generate huge quantities of wastes because of large-scale building and other developmental activities. They may identify suitable sites where such waste can be temporarily stored and some physical treatment can be carried out.

3.3.4.5 Disposal

Being predominantly inert in nature, construction and demolition waste does not create chemical or biochemical pollution. Hence maximum effort should be made to reuse and recycle them. The material can be used for filling/leveling of low-lying areas. In the industrialized countries, special landfills are sometimes created for inert waste, which are normally located in abandoned mines and quarries. The same can be attempted in our country also for cities, which are located near open mining quarries or mines where normally sand is used as the filling material.

4

LIQUID WASTE MANAGEMENT

4.1 LIQUID WASTE

The liquid waste or waste water is essentially the water supply of the community after it has been used in a variety of applications. From the standpoint of sources of generation, waste water may be defined as a combination of the liquid or water-carried wastes removed from residences, institutions, and commercial and industrial establishments, together with such groundwater, surface water, and storm water as may be present.

The wastewater from various household activities can be classified into;

i. Grey water: Wastewater generated from bathing, kitchen and other household activities except toilet.

ii. Backwater: Wastewater generated from toilets.

4.2 COMPONENTS OF WASTEWATER AND THEIR ENVIRONMENTAL IMPACTS

Components of wastewater have the potential to cause disease or detrimental environmental effects.

Pathogens: Many disease-causing viruses, parasites, and bacteria are present in wastewater. Some illnesses from wastewater-related sources are Hepatitis A, typhoid, cholera, and dysentery Gastroenteritis etc.

Organic Matter: Organic materials in wastewater originate from plants, animals, or synthetic organic compounds, and enter wastewater in human wastes, paper products, detergents, cosmetics, foods, and from agricultural, commercial, and industrial sources.

Oils and greases: When large amounts of oils and greases are discharged to receiving waters from community systems, they increase BOD and they may float to the surface, causing aesthetically unpleasing conditions.

Inorganics: Inorganic minerals, metals, and compounds, such as sodium, potassium, calcium, magnesium, cadmium, copper, lead, nickel, and zinc are common in wastewater from both residential and nonresidential sources. Large amounts of many inorganic substances can

contaminate soil and water. Some are toxic to animals and humans and may accumulate in the environment.

Nutrients: Waste water often contains large amounts of the nutrients nitrogen and phosphorus in the form of nitrate and phosphate, which promote plant growth. In severe cases, excessive nutrients in receiving waters cause algae and other plants to grow quickly depleting oxygen in the water. Deprived of oxygen, fish and other aquatic life die, emitting foul odors.

Solids: Solid materials in wastewater can consist of organic and/or inorganic materials and organisms.

- Settleable solids—Certain substances, such as sand, grit, and heavier organic and inorganic materials settle out from the rest of the wastewater stream during the preliminary stages of treatment.
- Suspended solids— Materials that resist settling may remain suspended in waste water. Suspended solids in wastewater must be treated, or they will clog soil absorption systems or reduce the effectiveness of disinfection systems.
- Dissolved solids—Small particles of certain wastewater materials can dissolve like salt in water. Some dissolved materials like heavy metals are consumed by microorganisms in wastewater, but others, such as, are difficult to remove by conventional treatment. Excessive amounts of dissolved solids in wastewater can have adverse effects on the environment.

4.3 ON-SITE SANITATION SYSTEMS

When sewage is collected, treated and/or disposed off at, or near the point of generation, without the use of an underground sewerage system, the system is called "on-site sanitation" (OSS) system. OSS systems are sanitation facilities provided for the use of individual households, community and the floating population. There are a number of situations when an underground sewerage system may not be feasible or desirable. For example, for smaller cities where construction of sewerage infrastructure may be expensive, or those cities that are in hilly areas or in undulating terrain where it may not be practical to construct a sewer network, or even in many cities that have grown organically and where not all households are connected to the existing sewerage network. OSS systems consists of two main structures, the toilet (superstructure, including the pan and water closet) and the treatment unit. OSS retains waste in the vicinity of the toilet either in a pit, tank. The treatment ranges from a basic sanitary facility such as twin-pit latrines, to a simple type of treatment system by combining a septic tank and a soak pit.

4.3.1 Sanitation system using septic tank and soak pit

Most common treatment system in India is the sanitation system using septic tank and soak pit for black water and grey water. It is depicted in the figure

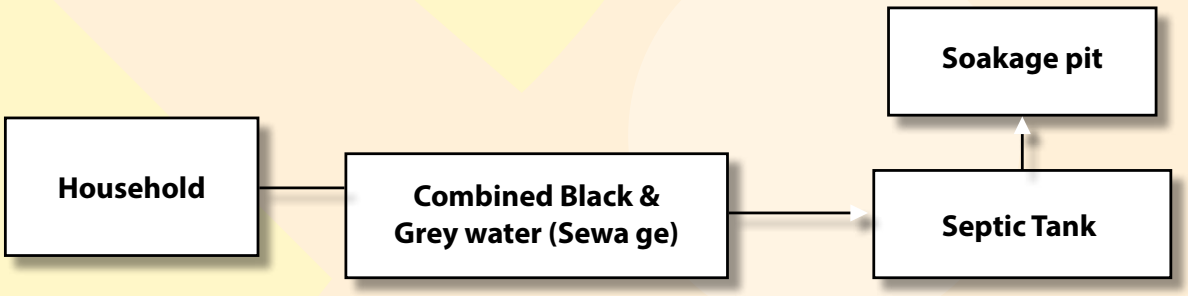


Figure 4.1 Sanitation system with Septic Tank

4.3.1.1 Septic Tanks

A septic tank is a combined sedimentation and digestion tank where the sewage is held for one to two days. `During this period, the suspended solids settle down to the bottom. This is accompanied by anaerobic digestion of settled solids (sludge) and liquid, resulting in reasonable reduction in the volume of sludge, reduction in biodegradable organic matter and release of gases like carbon dioxide, methane and hydrogen sulphide. Because of the unsatisfactory quality of the effluent and also the difficulty in providing a proper effluent disposal system, septic tanks are recommended only for individual homes and small communities and institutions whose contributory population does not exceed 300. For larger communities, septic tanks may be adopted with appropriate effluent treatment and disposal facilities. However, in both cases the sewage from the septic tank should be discharged into a lined channel constructed along with storm water drain as an interim measure till a proper sewerage system is laid. The outfall from such drains should be connected to a decentralized or centralized sewage collection system.

Design

For the septic tank to be an efficient suspended solids remover, it should be of sufficient capacity with proper inlet and outlet arrangements. It should be designed in such a way that the sludge can settle at the bottom and scum accumulates at the surface, while enough space is left in between, for the sewage to flow through without dislocating either the scum or the sludge. Normally sufficient capacity is provided to the extent that the accumulated sludge and scum occupy only half or maximum two-thirds the tank capacity, at the end of the design storage period. For effective sedimentation of the suspended solids, the minimum liquid retention time should be 24 hours. Therefore, considering the volume required for sludge and scum accumulation, the septic tank may be designed for 1 to 2 days of sewage retention. The septic tanks are normally rectangular in shape and can either be a single tank or a double tank. In case of double tank, the effluent solids concentration is considerably lower and the first compartment is usually twice the size of the second. The liquid depth is 1-2 m and the length to breadth ratio is 2-3 to 1. Recommended sizes of septic tanks for individual households (up to 20users) and for housing colonies (up to 300 users) are given below in Table 4.1 and Table 4.2 respectively.

Table 4.1
Recommended size of septic tank up to 20 users

No. of users	Length (m)	Breadth (m)	Liquid depth (m)	
			Cleaning interval of	
			2 years	3 years
5	1.5	0.75	1.0	1.05
10	2.0	0.90	1.0	1.40
15	2.0	0.90	1.3	2.00
20	2.3	1.10	1.3	1.80

Note 1. The capacities are recommended on the assumption that discharge from only WC will he treated in the septic tank

2. A provision of 300 mm should be made for free broad.

3. The sizes of septic tank are based on certain assumption on peak discharges, as estimated in IS:2470 (Part 1) - 1985 and while choosing the size of septic tank exact calculations shall be made.

Table 4.2
Recommended sizes of septic tank for residential colonies

No. of users	Length (m)	Breadth (m)	Liquid depth (m)	
			Cleaning interval of	
			2 years	3 years
50	5.0	2.00	1.0	1.24
100	7.5	2.65	1.0	1.24
150	10.0	3.00	1.0	1.24
200	12.0	3.00	1.0	1.24
300	15.0	4.00	1.0	1.24

Note 1. A provision of 300 mm should be made for free board.
2. The sizes of septic tank are based on certain assumptions on peak discharges, as estimated in IS: 2470(Part 1)-1985 and while choosing the size of septic tank exact calculations shall be made.
3. For population over 100, the tank may be divided into independent parallel chambers for maintenance and cleaning.

Construction Details

The inlet and outlet should not be located at such levels where the sludge or scum is formed as otherwise, the force of water entering or leaving the tank will unduly disturb the sludge or scum. Further, to avoid short circuiting, the inlet and outlet should be located as far away as possible from each other and at different levels. Baffles are generally provided at both inlet and outlet and should dip 25 to 30 cm into and project 15 cm above the liquid. The baffles should be placed at a distance of one-fifth of the tank length from the mouth of the straight inlet pipe. The invert of the outlet pipe should be placed at a level 5 to 7 cm below the invert level of inlet pipe. Baffled inlet will distribute the flow more evenly along the width of the tank and similarly a baffled outlet pipe will serve better than a tee-pipe. For larger capacities, a two-compartment tank constructed with the partition wall at a distance of about two-thirds the length from the inlet gives a better performance than a single compartment tank. The two compartments should be interconnected about the sludge storage level by means of pipes or square openings of diameter or side length respectively of not less than 75mm.

Every septic tank should be provided with ventilation pipes; the top being covered with a suitable mosquito proof wire mesh. The height of the pipe should extend at least 2 m above the top of the highest building within a radius of 20 m.

Septic tanks may either be constructed in brick work, stone masonry or concrete cast in situ or pre-cast materials. Pre-cast household tank made of materials such as asbestos cement could also be used, provided they are watertight and possess adequate strength in handling and installing and bear the static earth and superimposed loads.

All septic tanks shall be provided with watertight covers of adequate strength. Access manholes of adequate size shall also be provided for purposes of inspection and desludging of tanks. The floor of the tank should be of cement concrete and sloped towards the sludge outlet. Both the floor and side wall shall be plastered with cement mortar to render the surfaces smooth and to make them water tight. Atypical two compartment septic tank is shown in Figure.

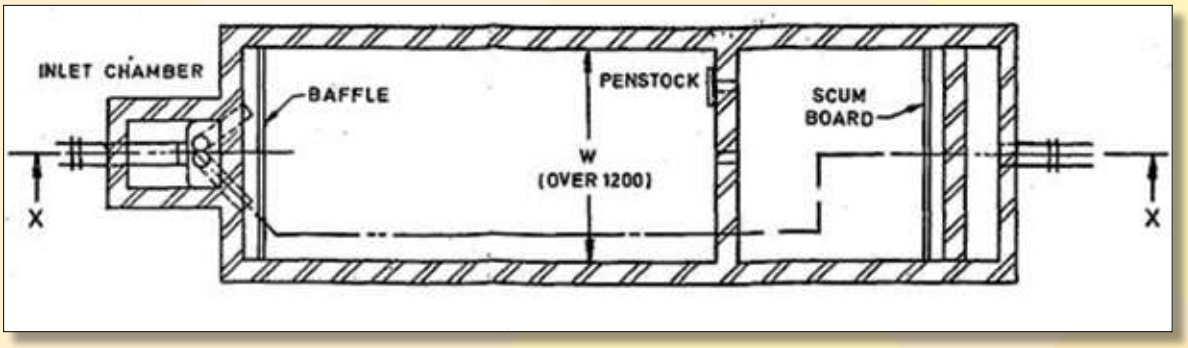


Figure 4.2 Typical sketch of two-compartment septic tank for 5 users

Applicability

The conventional septic tank system is particularly applicable for:

i. Primary treatment of wastewater from individual houses.

ii. It is suitable even for high water table areas where drainage facility for effluent discharge is available.

iii. Septage/Sludge collection and treatment facility is available nearby.

Secondary Treatment and Disposal of Effluent

The septic tank effluent will be malodorous, containing sizable portion of dissolved organic content and pathogenic organisms and hence need to be treated before its final, safe disposal. Depending upon the situation-the size, treatment objective, resources available etc., the extent and type of secondary treatment facility can vary from the most conventional land disposal methods like soak pits or dispersion trenches to additional secondary biological treatment systems.

4.3.1.2 Soak Pit

Soakage pit is a covered, porous-walled chamber that allows water to slowly soak into the ground. They do not provide any direct treatment and are based on the principle that the effluent gets treated as it passes through the surrounding soil before entering the ground water table or other water body. It is only applicable for highly permeable sandy soil with deep groundwater table. If the ground is not sandy and water logged during wet season the soakage pit may not work. Soakage pits, although easy to construct, is usually an inadequate means of disposing the wastewater because it releases the effluent over a small area which may get clogged or lose its ability to treat the wastewater. Many cases of groundwater bacterial pollution are reported in shallow aquifer near the soakage pits. The problems are aggravated due to as septic tanks are not desludged regularly in the country. Since, it is one of the cheapest alternative for disposal of septic tank effluent, it should be

- 20 m away from drinking water source and 20m away from another soakage pit
- Adequate contact area with the surrounding soil to absorb the effluent in to the soil. In case of less permeable soils, larger pits will be needed.
- Adequate openings shall be left in the walls of the pit to have the contact with the surrounding soil.

Design

Soak pits are cheap to construct. They need no media when lined or filled with rubble or brick bats. Minimum horizontal dimension of soak pit should be 1 m, the depth below the invert level or inlet pipe being at 1 m. The pit should be covered and the top raised above the adjacent ground to prevent damage by flooding. A typical soak pit is depicted in the figure

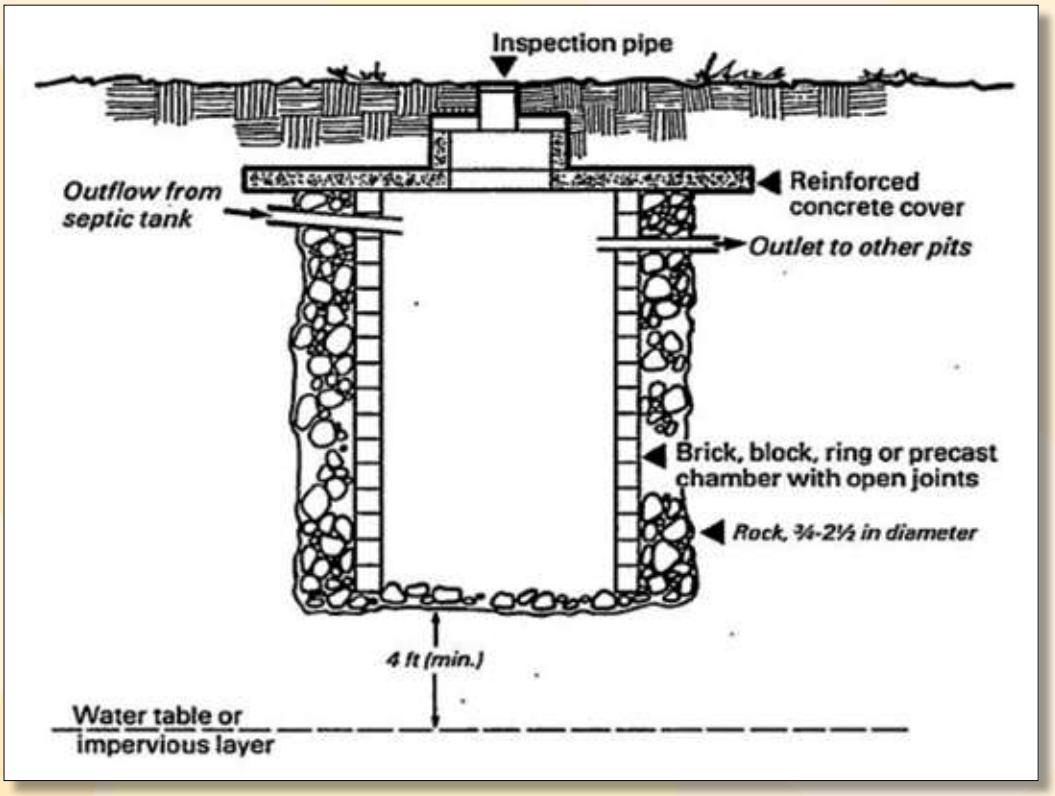


Figure 4.3 Soak pit

Applicability

i. Where ground is permeable.
ii. Population density is less & plot sizes are large
iii. Water is supplied through pipelines.
iv. Deep water table (at least 5 m below the bottom of soakage pit).
v. Septic tanks are well maintained and desludged regularly

4.3.1.3 Dispersion Trenches

Dispersion trenches consist of relatively narrow and shallow trenches about 0.5 to 1 m deep and 0.3 to 1 m wide excavated to a slight gradient of about 0.25%. Open joined earthenware or concrete pipes of 80 to 100 mm size are laid in the trenches over a bed of 15 to 25 cm of washed gravel or crushed stone. The top of pipes shall be covered by coarse gravel and crushed stone to a minimum depth of 15 cm and the balance depth of trench filled with excavated earth and finished with a mound above the ground level to prevent direct flooding of trench during rains. The effluent from the septic tank is led into a small distribution box from which several such trenches could radiate out.

4.3.2 Leach Pits

Leaching pits are used to treat and dispose of grey water sewage only: They are not to be used for the disposal of toilet waste. This type of system can only be used to treat and dispose water wastes, which come from plumbing fixtures such as sinks, showers, or laundry machines.

This method of wastewater disposal is only recommended if there is no pressurized water supply and the daily volume of grey water waste is small. Normally a leaching pit can be used if the daily grey water flow is less than 1,000 liters per day.

When considering the location of a leaching pit, caution must be taken to ensure that the minimum setbacks are strictly adhered to. The minimum distances are: 15m from any lake, pond. river, stream or any watercourse, 15m from any dug well, sand point well, spring or any source of potable water. These distances are stated as minimum requirements and may have to increase if the soil conditions are not ideal. Grey water sewage will contaminate the ground water if it is not properly located and constructed. The leaching pit should be constructed in area that is elevated and well drained. Low lying areas are subjected to excessive surface runoff which will over load the leaching pit and saturate the soils. This will result in very poor treatment and increases the possibility of ground water contamination.

4.3.3 Sanitation system using Twin pit latrine

Twin pit latrine

It consists of superstructure (Toilet) and treatment units (two chambers). The two underground chambers (pits) are provided to hold fecal sludge. These are normally offset from the toilet and should be at least 1 meter apart. A single pipe leads from the toilet to a small diversion chamber, from which separate pipes lead to the two underground chambers. The pits should be lined with open jointed brickwork. Each pit should be designed to hold at least 12 months accumulation of fecal sludge. Wastewater is discharged to one chamber until it is full of fecal sludge. Discharge is then switched to the second chamber. Just before the second chamber is full of fecal sludge, the contents of the first pit are dug out. During the time of storage, digestion should ensure that it is odorless and free of pathogens.

O&M Requirements

The pits must be used alternately and the diversion chamber must be accessible so that flow can be diverted between chambers. Wastewater should never be diverted back to the first chamber before digested sludge has been removed from it. Responsibility for O&M of the twin-pit latrine rests primarily with the householder, who needs to ensure that the pits are used in the correct sequence and are emptied at the appropriate time. However, ULB utility or private contractors are required for emptying and to ensure safe disposal of septage at a treatment plant.

Additional Infrastructure / treatment requirements

If digested material cannot be used in local fields and gardens, provision will have to be made for transportation to areas outside the city for reuse on agricultural land.

Limitations

- Households may not understand the system and as a result may not use the pits alternately, or may omit to rest the filled pit at least for one year so that the contents degrade and become harmless.
- Explanation of the operation and maintenance requirements is therefore essential at the time of installation.

- Water may percolate through the soil surrounding the pit and pollute groundwater, which is a potential problem if water is used for drinking.

Specifications

(a) Size options for Toilet/ Super Structure: 750 mm x 900 mm x 1900mm

(b) Material – Brick work / FRP/ Pre-cast Cylindrical Unit

(c) Minimum Land Requirement – 40 Sq. ft. - 60 Sq. ft. (depending upon the location of superstructure and distance between two pits)

(d) Size of Pits is shown in Table 4.3 given below

Table 4.3
Size of Pits

	5 users		10 users		15 users	
	Dia	Depth (A)	Dia	Depth (A)	Dia	Depth (A)
Pit size	900	1000	1100	1300	1300	1400

Cost

Tentative cost varies from Rs. 15,000/- to Rs. 20,000/- depending upon the construction material (for 5 users).

Design

The design of two pit latrine is shown in the drawing (source: http://sbm.gov.in)

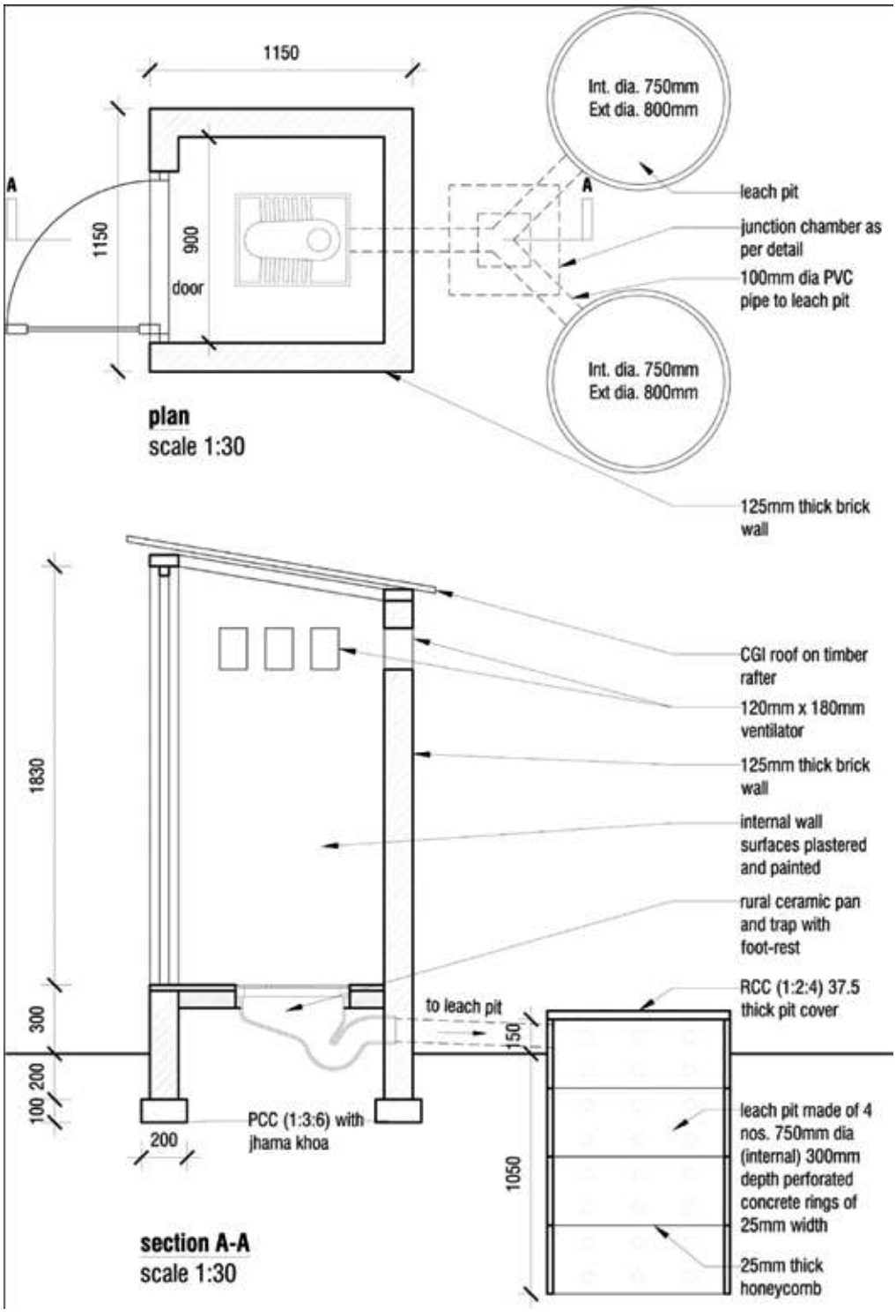


Figure 4.4 Section and Plan of Two Pit latrine

4.4 SEWER SYSTEMS

A sanitary sewer is an underground carriage system specifically for transporting sewage from houses and commercial buildings through pipes to treatment or disposal. Sewage may be treated to control water pollution before discharge to surface waters. The main function of a sanitary sewer system is to convey waste water through a series of underground pipes and manholes to waste water treatment plants where it is cleaned and returned to the environment.There are several designs, depending on topography, amount and kind of wastewater, size of community, etc.

There exist several different sewer systems:

- Conventional Sewers
- Separate Sewers
- Simplified Sewers
- Solids-free Sewers
- Pressurised Sewers
- Vacuum Sewers
- Channels

Some of them require supporting elements such as:

- Sewer Pumping Stations
- Transfer Stations

Treatment can be roughly divided into centralized and decentralized systems

4.4.1 Centralized wastewater treatment

Centralized gravity sewers are large networks of underground pipes that convey black water, grey water and, in many cases, storm water to a Centralized treatment facility, using gravity (and pumps when necessary). The conventional sewer is an example of this technology.

4.4.2 Decentralized wastewater treatment

Decentralized wastewater management (DWWM) may be defined as the collection, treatment, and disposal/reuse of wastewater from individual homes, clusters of homes, isolated communities, industries, or institutional facilities, as well as from portions of existing communities at or near the point of waste generation. In case of decentralized systems, both solid and liquid fractions of the wastewater are utilized near their point of origin, except in some cases when a portion of liquid and residual solids may be transported to a centralized point for further treatment and reuse. The centralized and decentralized waste water treatment is depicted in the figure

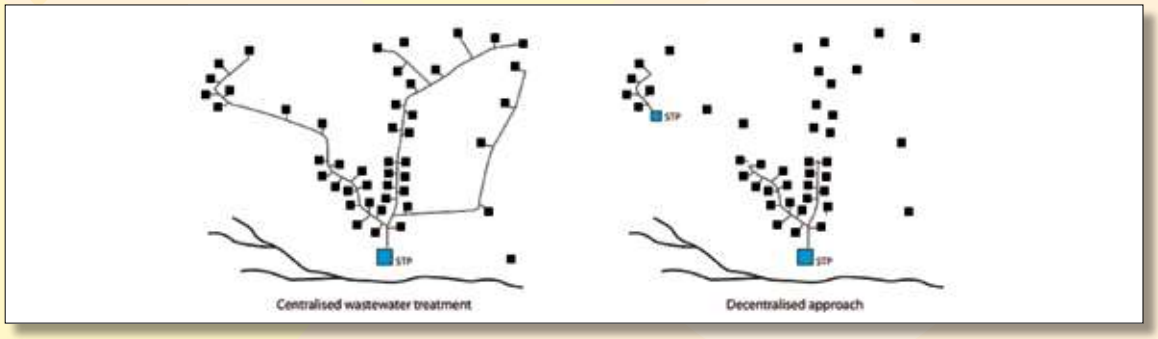


Figure 4.5 Centralized and decentralized approach

Table 4.4
Advantages and disadvantages of centralized and decentralized plants

Centralized wastewater treatment plant		**Decentralized wastewater treatment plant**	
Advantages	Disadvantages	Advantages	Disadvantages
It can be used to convey black water, grey water and storm water.	High cost in investment and operation	Quality of treatment is more efficient due to lower quantity of wastewater;	Improper maintenance of the treatment plant will have significant environmental consequences.
Suitable for urban areas	Operation and maintenance is difficult.	Lesser investment is required for the sewer pipelines	Standardization of the systems is difficult due to the local geography and climatic conditions.
Users are not responsible for the operation and maintenance of the facilities	Energy consumption is more due to large machinery	Treatment units are close knit and are free from odor and insects	Local people will have to bear all by themselves the O&M of the treatment plant
Convenient for the users.	Requires highly skilled personal	Maintenance of the sewerage system is easier.	Getting a site for the STP may be difficult.

4.5 WASTEWATER TREATMENT PLANTS

The important types of wastewater treatment plants are as follows

4.5.1 Sewage Treatment Plants (STP)

Sewage treatment is the process of removing contaminants from wastewater and household sewage, both runoff (effluents), domestic, commercial and institutional. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally safe treated effluent and treated sludge suitable for disposal or reuse (usually as farm fertilizer).The sewage treatment processes are depicted in the figure

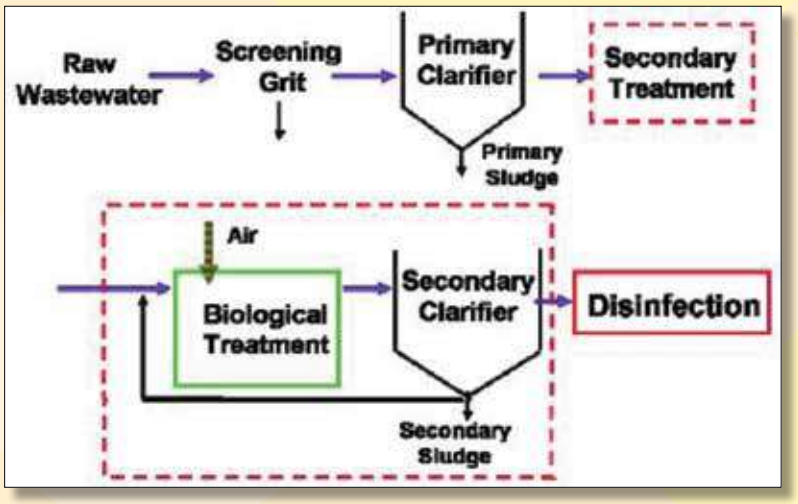


Figure 4.6 Schematic representation of STP

Sewage treatment generally involves the following stages

a)Pre-treatment: It removes materials that can be easily collected from the raw wastewater before they damage or clog the pumps and skimmers of primary treatment clarifiers, for example, trash, tree limbs, leaves, etc.,

The influent sewage water is strained to remove all large objects carried in the sewage stream. This is most commonly done with an automated mechanically raked bar screen in modern plants serving large populations, whilst in smaller or less modern plants a manually cleaned screen may be used this is called as screening.

The raking action of a mechanical bar screen is typically paced according to the accumulation on the bar screens and/or flow rate. The solids are collected and later disposed off in a landfill or incinerated. Pre-treatment may include Grit removal in which, a sand or grit channel or chamber where the velocity of the incoming wastewater is carefully controlled to allow sand, grit and stones to settle.

b) **Primary treatment**: In the primary sedimentation stage, sewage flows through large tanks, commonly called "primary clarifiers" or "primary sedimentation tanks". The tanks are large enough that sludge can settle and floating material such as grease and oils can rise to the surface and be skimmed off. The main purpose of the primary sedimentation stage is to produce both a generally homogeneous liquid capable of being treated biologically and a sludge that can be separately treated or processed.

Primary settling tanks are usually equipped with mechanically driven scrapers that continually drive the collected sludge towards a hopper in the base of the tank from where it can be pumped to further sludge treatment stages. Grease and oil from the floating material can sometimes be recovered for specifications.

a) Secondary treatment: Secondary treatment is designed to substantially degrade the biological content of the sewage which is derived from human waste, food waste, soaps and detergent. The majority of municipal plants treat the settled sewage liquor using aerobic biological processes. For this to be effective, the biota requires both oxygen and a substrate on which to live.

There are a number of ways in which this is done. In all these methods, the bacteria and protozoa consume biodegradable soluble organic contaminants (e.g. sugars, fats, organic short-chain carbon molecules, etc.) and bind much of the less soluble fractions into floe. Secondary treatment systems are classified as fixed-film or Suspended- growth.

Fixed-film or attached growth system treatment process including trickling filter and rotating biological contactors where the biomass grows on media and the sewage passes over its surface. In suspended-growth systems, such as activated sludge, the biomass is well mixed with the sewage and can be operated in a smaller space than fixed-film systems that treat the same amount of water.

However, fixed-film systems are more able to cope with drastic changes in the amount of biological material and can provide higher removal rates for organic material and suspended solids than suspended growth systems. Roughing filters are intended to treat particularly strong or variable organic loads, typically industrial, to allow them to then be treated by conventional secondary treatment processes.

Characteristics include typically tall, circular filters filled with open synthetic filter media to which wastewater is applied at a relatively high rate. They are designed to allow high hydraulic loading and a high flow-through of air. On larger installations, air is forced through the media using

blowers. The resultant wastewater is usually within the normal range for conventional treatment processes.

d) **Tertiary treatment:** It is sometimes defined as anything more than primary and secondary treatment in order to allow rejection into a highly sensitive ecosystem.

The major **Unit operations** in the sewage treatment plant are

i. Screening: to retain solids found in wastewater

ii. Grit chamber: to remove grit

iii. Flow equalization: to overcome flow-rate variations

iv. Primary treatment - Mixing & Flocculation: to enhance floc formation – gravityseparation leads to settling

v. Aeration systems: oxygen transfer is a vital part of waste water treatment.

vi. Chemical unit processes: coagulation, precipitation, oxidation, disinfection & stabilization etc.

vii. Secondary treatment: transform or remove nutrients

   – Aerobic: Activated Sludge Process, Moving Bed Biofilm Reactor (MBBR), Trickling Filter, Rotating Biological Contactor, aerobic digestion

   – Anaerobic: Upflow Anaerobic Sludge Blanket (UASB), anaerobic digestion

viii. Disinfection: to remove pathogens

The sludge disposal from the STP is dealt in 4.7.5

The design of STP is detailed in CPHEEO manual.

4.5.2 Effluent Treatment Plants (ETP):

Effluent Treatment Plants or (ETPs) are used by leading companies in the pharmaceutical and chemical industry to purify water and to remove any toxic and non toxic materials or chemicals from it. These plants are used by all companies for environment protection.

An ETP is a plant where the treatment of industrial effluents and waste waters is done. The ETP plants are used widely in industrial sector, for example, pharmaceutical industry, to remove the effluents from the bulk drugs.

During the manufacturing process, varied effluents and contaminants are produced. The ETP plants use evaporation and drying methods, and other auxiliary techniques such as centrifuging, filtration, incineration for chemical processing and effluent treatment.

The treatment of effluents is essential to prevent pollution of the receiving water. The effluent water treatment plants are installed to reduce the possibility of pollution; biodegradable organics if left unsolved, the levels of contamination in the process of purification could damage bacterial treatment beds and lead to pollution of controlled waters. The ETPs can be established in the industrial sectors like Pharmaceuticals, Chemicals and Leather industry and tanneries.

4.5.3 Common and Combined Effluent Treatment Plants (CETP):

Many of the Small Scale Industries (SSI) are unable to put up the treatment systems individually, the concept of CETP's (Common Effluent Treatment Plants) is envisaged to benefit such industries in treating its effluent before disposal whether it is in stream, land, sewerage system or in rivers and seas. CETP's are set up in the industrial estates where there are clusters of small scale industrial units and where many polluting industries are located.

The Ministry of Environment & Forest, Govt. of India has launched the centrally sponsored scheme, namely, Common Effluent Treatment Plant (CETP) in order to make a cooperative movement of pollution control especially to treat the effluent, emanating from the clusters of compatible Small-Scale Industries. The major objective of the CETP is therefore, to reduce the treatment cost to be borne by an individual member unit to a maximum while protecting the water environment to a maximum.

The proposal for setting up of CETP's by such industries is to be submitted by the CETP Association to the respective State Pollution Control Board, which after examining the proposal and obtaining commitment from the concerned State Government regarding its contribution will give their recommendation to the Ministry of Environment & Forests for consideration , the Ministry examines the proposal and takes the decision through a Screening Committee constituted in this regard for providing support from the Central Government.

The Ministry releases the funds for the approved projects which is the matching grant to the amount released by the concerned State Government, subject to the bank guarantee to be taken from the CETP associations for the amount released by the Central Government, The CETP Company should meet the remaining cost by equity contribution by the industries and loans from financial institutions. Funds released for the CETP's should be utilized for the CETP only and not for payment for any debts/bank loans, etc.

4.6 SEPTAGE

Septage is the sludge generated from septic tanks, advanced-on-site systems, package plants, which is a fluid mixture of untreated and partially treated sewage solids, liquids and sludge of human or domestic origin. It has an offensive odour, appearance and contains significant levels of oil, grit, hair, debris and pathogenic microorganisms.

4.6.1 Source

Septic tanks are the primary source of septage generation. A septic tank for the treatment of household wastewater is a horizontal continuous flow type sedimentation tank. The solids in the wastewater settle to the bottom of the tank where they undergo anaerobic degradation along with the organic matter in the wastewater. There will be a buildup of solids in the settling tank, which if not removed frequently will affect the performance of the settling tank.

4.6.2 Characteristics

Table 4.5
Physical and chemical characteristics of Septage

Constituent (all units but for pH are in mg/l)	Average	Range
Biochemical Oxygen Demand	6,480	440 –78,600
Chemical Oxygen Demand	31,900	1,500– 703,000
Total solids	34,106	1,132-130,745
Total Volatile Solids	23,100	353- 71,402
Total Suspended Solids	12,862	310-93,378

Constituent (all units but for pH are in mg/l)	Average	Range
Volatile Suspended Solids	9,027	95 – 51,500
Total Kjeldahal Nitrogen	588	66 – 1,060
Ammonia-Nitrogen	97	3-116
Total Phosphorus	210	20-760
Alkalinity	970	522-4,190
Grease	5,600	208 – 23,368
pH	-	1.5 – 12.6

4.6.3 Desludging of Septic Tanks and Advanced On-Site Systems

In most of the cases the septic tanks are desludged manually. This is considered as an unpleasant and repulsive job since the sludge (including fresh excreta) generally gets spilled around the tank during emptying, and poses a risk of transmission of diseases of faecal origin. The most satisfactory method of sludge removal is by vacuum tankers. Though desludging frequencies vary, it is generally recommended to desludge tanks once every three to five years, or when the tank becomes one third full. Frequent desludging also helps reduce the pollution levels in the liquid effluent, which normally enters waterways untreated.

4.6.4 Treatment of Septage

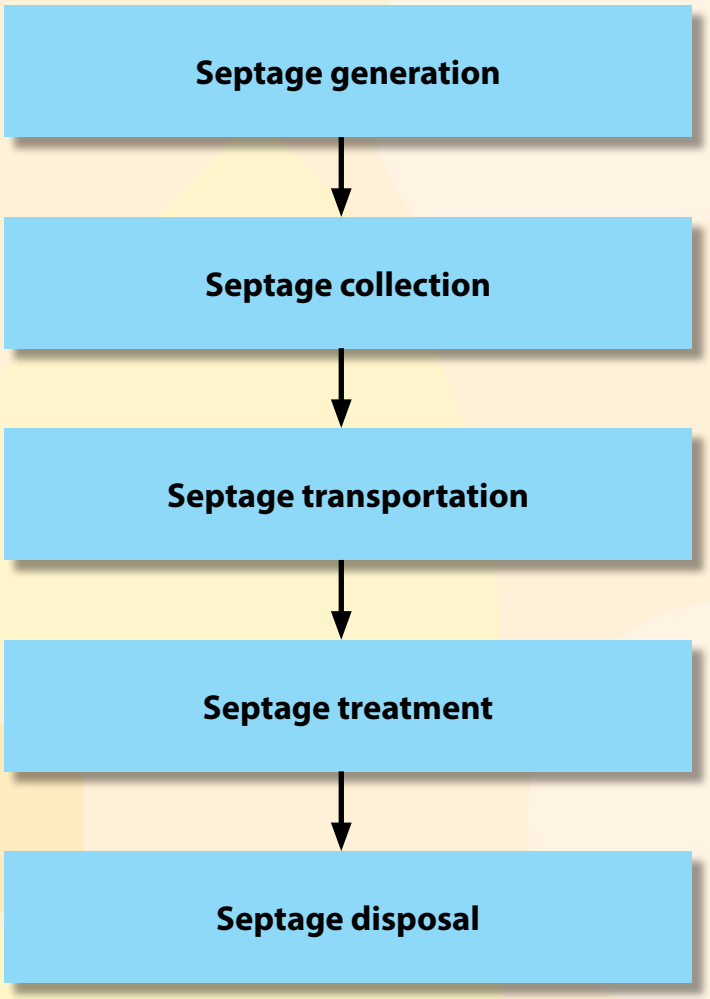
Co-treatment of septage along with domestic sewage at a sewage treatment plant (STP) of a nearby city is a feasible and acceptable alternative for septage treatment. Though septage is much concentrated in its strength than the domestic sewage, its constituents are similar to municipal wastewater. Sewage treatment plant should have an adequate capacity in order to accept the septage without hampering the normal functioning of other processes. The nearby city municipality should check the incoming load to the STP.. When the distance or the capacity of the plant becomes a limiting factor, it is not a feasible option to transport and treat the septage to the sewage treatment facilities. In this case treatment plants specially meant for septage treatment becomes an attractive option. Independent septage treatment plants are designed specifically for septage treatment and usually have separate unit processes to handle both the liquid and solid portions of septage. The benefit of using these treatment plants is that they provide a regional solution to septage management. The septage management process is shown the figure

Figure 4.7 Stages of Septage Management

4.6.5 Sludge Management

Disposal of Sludge or biosolids:

The sludge generated as a result of septage treatment and sewage treatment require proper disposal.



Sludge can be:

(1) dewatered, stabilized and applied to approved land application sites;

(2) dewatered and composted at an approved facility;

(3) incinerated at an approved facility;

(4) disposed at an approved landfill if there are contaminants present in the material that would preclude the ability to meet compost guidelines

(5) processed into a fertilizer at an approved facility

5

ADVANCED WASTE MANAGEMENT TECHNOLOGIES

5.1 BIOMETHANATION

Biomethanation is the anaerobic digestion of biodegradable organic waste in an enclosed space under controlled conditions of temperature, moisture, pH, etc. It is a human engineered decomposing system wherein - depending on the waste characteristics – the waste mass undergoes decomposition thereby generating biogas comprising mainly of methane and carbon dioxide. Biomethanation could be considered as one of the most technically viable options for the solid waste due to the presence of high organic and moisture content.

Generally the overall process can be divided into four stages:

a. **Pre-treatment**: Most digestion systems require pre-treatment of waste to obtain homogeneous feedstock. The pre-processing involves separation of non-digestible materials either through segregation at source or through mechanical sorting; the former leads to less contaminated sludge compost. This segregation ensures the removal of undesirable or recyclable materials such as glass, metals, stones etc. The waste is shredded before it is fed into the digestor.

b. **Waste digestion**: Inside the digester, the feed is diluted to achieve desired solids content and remains in the digester for a designated retention time. For dilution, a varying range of water sources can be used such as clean water, sewage sludge, or re-circulated liquid from the digester effluent.

c. **Gas recovery and usage**: The biogas obtained is scrubbed to ensure pipeline quality gas. Biogas may also be further used for generating electricity.

d. **Residue treatment**: In case of residue treatment, the effluent from the digester is dewatered and the liquid recycled for use in the dilution of incoming feed. The bio solids are dewatered to 50-55% Total Solids (TS) with a screw press, filter press or other types of dewatering systems and aerobically cured to obtain a compost product.

Important operating parameters for biomethanation

a. Temperature: Temperature affects bacterial growth and hence amount of biogas produced. Treatment of waste in anaerobic reactors is normally carried out within two ranges: around 25-40°C known as mesophilic range and higher than 45 °C known as thermophilic range.

At higher temperatures:

- the rate of digestion is faster, and thus shorter retention times are required
- smaller reactor volumes are required for treating the same amount of waste
- higher rate and efficiency of particulate matter hydrolysis
- more efficient destruction of pathogens

b. pH: The anaerobic digestion process is limited to a relatively narrow pH interval from approximately 6.0 to 8.5 pH.

c. Moisture: The moisture content of waste should not be less than 15% as it can prevent decomposition of waste.

d. Toxicity: A number of compounds are toxic to anaerobic microorganisms. Methanogens are commonly considered to be the most sensitive to toxicity.

e. C/N Ratio: Optimum C/N ratio in anaerobic digesters is between 20–30. A high C/N ratio is an indication of rapid consumption of nitrogen by methanogens and results in lower gas production. On the other hand, a lower C/N ratio causes ammonia accumulation and pH values exceeding 8.5, which is toxic to methanogenic bacteria. Optimum C/N ratios of the digester materials can be achieved by mixing materials of high and low C/N ratios, such as organic solid waste (high in Carbon) and sewage or animal manure (high in Nitrogen).

f. Organic Loading Rate: Organic loading rate is the frequency and speed at which the substrate is added to the digester. For each plant of a particular size, there is an optimal rate at which the substrate should be loaded. Beyond this optimal rate, further increases in the feeding rate will not lead to a higher rate of gas production. Agitation or consistent stirring of the contents in the digester also plays an important role in determining the amount of biogas produced.

g. Retention time: The required retention time for completion of the reactions varies with differing technologies, process temperature, and waste composition. The retention time for wastes treated in a mesophilic digester range from 10 to 40 days. Lower retention times are required in digesters operated in the thermophilic range. A high solids reactor operating in the thermophilic range has a retention time of 14 days.

Advantages

1. Energy generation
2. Reduction in land requirement for MSW disposal
3. Reduction of environmental impacts from landfilling by avoiding contamination of land and water sources from leachate
4. Biomethanation of biodegradable organic material would ultimately result in stabilized sludge which can be used as a soil conditioner.

Disadvantages

1. In case of digesters operated under mesophilic temperatures, destruction of pathogenic organisms may be less than that in aerobic Composting.
2. It is more capital intensive compared to composting and landfill;
3. Not suitable for wastes containing less biodegradable matter.

Example:

A comparison of 0.5 m^3 and 1 m^3 portable biogas plant used by household of 4 – 8 persons, producing 2.5 – 7.5kg kitchen waste per day is given below.

Characters	Bigger size biogas plant	Smaller size biogas plant
Size	1 m^3 digester	0.5 m^3 digester
Capacity	Upto 7.5 kg kitchen waste	upto 2.5 kg itchen waste
Quantity of gas produced	upto 1 kg biogas, capable of replacing 250 gm of LPG	upto 0.5 kg biogas, capable of replacing 100 gm of LPG
Uses under cooking purposes	either breakfast or one meal can be cooked entirely on biogas	about 15-20 min of cooking (tea, snacks, etc.) can be done

Properties of different feed materials and Gas yield

The following table generalises the amount of biogas produced from different feed materials

animal species/ feed material	daily manure yield			fresh manure solids		liveweight	C/N	gas yield	
	manure		urine	DM	ODM			range	average
	[kg/d]	[%/w]	[%/w]	[%]	[%]	[kg]	[-]	[1/kg ODM]	
Cattle manure	8	5	4-5	16	13	135-800	10-25	150-350	250
buffalo manure	12	5	4-5	14	12	340-420	20		
pig manure	2	2	3	16	12	30-75	9-13	340-550	450
sheep/got droppings	1	3	1-2	30	20	30-100	30	100-310	200
chicken manure	0.08	45	-	25	17	1.5-2	5-8	310-620	460
human excreta	0.5	1	2	20	15	50-80	8		
corn straw	-	-	-	80	73	-	30-65	350-480	410
water hyacinths	-	-	-	7	5	-	20-30	300-350	325
vegetable residues	-	-	-	12	10	-	35	300-400	350
fresh grass	-	-	-	24	21	-	12	280-550	410

(Source: ÖKOTOP in [10]. [11])

5.1.1 Bottling Of Biogas

Biogas comprises of 60-65% methane, 35-40% carbon dioxide, 0.5-1.0% hydrogen sulphide, rests of water vapors etc. Biogas is non-toxic, color less and flammable gas. It has an ignition temperature of 650 - 750˚C. Its density is 1.214kg/ m3 (assuming about 60% Methane and 40% CO2). Its calorific value is 20 MJ/m3 (or 4700 kcal.). It is almost 20% lighter than air. Biogas, like Liquefied Petroleum Gas (LPG) cannot be converted into liquid state under normal temperature and pressure. It liquefies at a pressure of about 47.4 Kg/cm2 at a critical temperature of -82.10 c. Removing carbon dioxide, Hydrogen Sulfide, moisture and compressing it into cylinders makes it easily usable for transport applications & also for stationary applications. Already CNG technology has become easily available and therefore, bio-methane (purified biogas) which is nearly same as CNG, can be used for all applications for which CNG are used. Purified biogas (bio-methane) has a high calorific value in comparison to raw biogas.

The purified biogas is filled in CNG cylinder and supplied to mid-day meal scheme, mess, Hotel, industries etc. for various purposes such as cooking & heating etc.. Calorific value of purified biogas is equivalent / similar to CNG. As a matter of fact, the biogas bottling plants are one of the most potent tools for mitigating climatic change by preventing black carbon emission from biomass chulha since biogas is used as a cooking fuel and methane emissions from untreated cattle dung and biomass wastes are also avoided. The purified biogas can be bottled in CNG cylinders and wherever CNG is currently used, compressed biogas (CBG) can be used as an alternative.

The slurry which comes out of the biogas plant is directly or after drying used as bio/organic manure for improving soil-fertility and reducing use of chemical fertilizers. It is also non-pollutant because it is free from weed-seeds, foul smell and pathogens. The slurry is rich in main nutrients such as Nitrogen, Potassium and Sodium (NPK) alongwith micronutrients - Iron & Zinc etc. As such there is no pollution from biogas plant. The slurry/manure of biogas plant is being sold to the farmers and used in liquid/solid form by them in agricultural crops.

In addition to the energy production, biogas plants also provide bio-manure and are helpful in dealing with the problems of waste management, providing clean environment and mitigating pollution in urban, industrial and rural areas. Biogas is also a prominent alternative to petroleum fuel like LPG, CNG and diesel.

5.1.2 Electricity from Biogas

Various technologies to generate electricity from biogas on a household level are available. In principle, the chemical energy of the combustible gases is converted to mechanical energy in a controlled combustion system by a heat engine. This mechanical energy then activates a generator to produce electrical power. In most cases, biogas is used as fuel for combustion engines, which convert it to mechanical energy, powering an electric generator to produce electricity. The most common heat engines used in for biogas energy conversion are gas turbines and combustion engines. Combustion engines can be either internal combustion engine (e.g. reciprocating engine) or external combustion engine (e.g. Stirling engine).

The average calorific value of biogas is about 21-23.5 MJ/m^3, so that 1 m^3 of biogas corresponds to 0.5-0.6 l diesel fuel or about 6 kWh (FNR, 2009). Normally, after conversion loses, 1.5 kilo watt electricity can be produced from 1 m^3 of biogas.

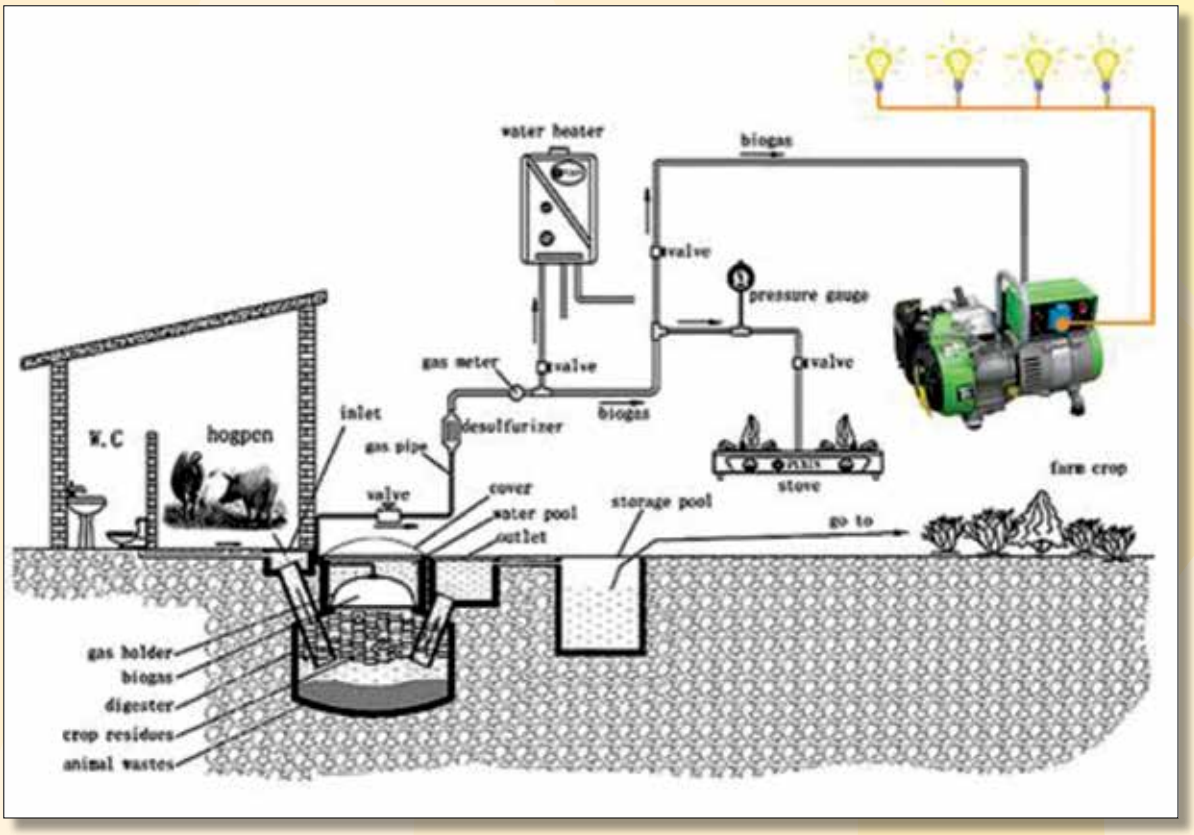


Figure 5.1: Electricity generation from biogas plant

Advantages

1. Generation of renewable, green electricity
2. Low operating costs
3. Underground construction minimizes land use
4. Long life span
5. Reduces greenhouse gases
6. Increases family income by selling back electric energy to the electric power grid
7. On site use of heat

Disadvantages

1. Requires expert design, skilled construction and expert maintenance required
2. Biogas production below 15°C, is no longer economically feasible
3. High capital costs

5.2 SANITARY LANDFILLS

Sanitary landfills are facilities for final disposal of Municipal Solid Waste on land, designed and constructed with the objective of minimizing impacts to the environment. This term encompasses other terms such as 'secured landfill' and 'engineered landfills' which are also sometimes applied to municipal solid waste (MSW) disposal units.

5.5.1 Wastes suitable for landfilling

(a) Landfilling will be done for the following types of waste:
   i. Comingled waste (mixed waste) not found suitable for waste processing
   ii. Pre-processing and post-processing rejects from waste processing plants
   iii. Non-hazardous waste not being processed or recycled

(b) Sanitary landfilling is not allowed for the following waste streams in the municipal solid waste:
   i. bio-degradable waste/garden waste (it should preferably be composted)
   ii. dry recyclables (it should preferably be recycled)
   iii. hazardous wastes (needs hazardous waste sites with special equipment)

(c) Landfilling of hazardous waste stream in the municipal waste will be done at a hazardous waste landfill site; such a site will be identified by the State Government and is likely to be operated by industries of a district/state. If such a landfill is not available, municipal authorities will dispose the hazardous waste in a special hazardous waste cell in the MSW landfill. Such a cell will be designed as per Ministry of Environment and Forests (MoEF) guidelines for hazardous waste disposal.

(d) Landfilling of construction and demolition waste will be done in a separate landfill where the waste can be stored and mined for future use in earthwork or road projects. If such a landfill site is not available, the waste will be stored in a special cell at a MSW landfill from where it can be mined for future use. Construction and demolition waste can be used as a daily cover at MSW landfills; however only minimum thickness of cover should be provided. All excess construction waste should be stored in the separate landfill cell.

(e) All existing and old landfills will be inspected and boreholes will be drilled for (i) recovery of leachate samples from the base of the landfill, (ii) recovery of subsoil samples beneath the base of the landfill for evaluation of permeability and soil properties and (iii) recovery of waste samples for waste characterisation. The quality of leachate samples will be compared with (a) the ground water quality in existing bore wells 2 km away from the landfill and (b) the Central Pollution Control Board (CPCB) norms for limits of contaminants in leachate. If the leachate quality and the permeability of the subsoil strata is observed to be satisfactory, the existing landfill can continue to operate with bi-annual monitoring of leachate quality in the drilled boreholes.

(f) If the leachate quality is observed to be of poor quality with respect to the local ground water quality or with respect to the CPCB norms, steps will be taken to close the existing landfill site and remedial measures adopted. All future landfilling will be undertaken in properly designed and constructed new landfills.

(g) The landfill site shall be large enough to last for 20-25 years.

5.5.2 Environmental impact and its minimization

The impact of dumping municipal solid waste on land without any containment cause the following problems:

(a) Groundwater contamination through leachate

(b) Surface water contamination through runoff

(c) Air contamination due to gases, litter, dust, bad odour

(d) Other problems due to rodents, pests, fire, bird menace, slope failure, erosion etc.

Landfills minimise the harmful impact of solid waste on the environment by the following mechanisms

(a) isolation of waste through containment;

(b) elimination of polluting pathways;

(c) controlled collection and treatment of products of physical, chemical and biological changes within a waste dump – both liquids and gases; and

(d) environmental monitoring till the waste becomes stable.

The urban local body shall adhere to the following compliance criteria in the matter of solid waste disposal -

(1) land filling or dumping of mixed waste shall be stopped soon after the timeline as specified in Rule 10 for setting up and operationalisation of sanitary landfill is over;

(2) landfill shall only be permitted for non-usable, non-recyclable, nonbiodegradable, non-combustible and non-reactive inert waste and other wastes such as residues of waste processing facilities as well as preprocessing rejects from waste processing facilities and the landfill sites shall meet the specifications as given in Schedule–I of Solid Waste Management Rules, 2016, however every effort shall be made to recycle or reuse the rejects to achieve the desired objective of zero waste going to landfill;

(3) landfill site shall provide an appropriate facility for sorting, storing and transportation of recyclable material to the processing facility and ensure that such wastes do not get land filled;

(4) all old open dumpsites and existing operational dumpsites shall be carefully investigated and analyzed about their potential of bio-mining and bio-remediation and actions shall be taken accordingly in cases where such course of action is found feasible; and

(5) in absence of potential of bio-mining and bio-remediation of dumpsite, it shall be scientifically capped as per landfill capping norms to prevent further damage to the environment.

5.5.3 Essential components of sanitary landfill

The seven essential components of a MSW landfill are:

(a) A liner system at the base and sides of the landfill which prevents migration of leachate or gas to the surrounding soil.

(b) A leachate collection and control facility which collects and extracts leachate from within and from the base of the landfill and then treats the leachate.

(c) A gas collection and control facility (optional for small landfills) which collects and extracts gas from within and from the top of the landfill and then treats it or uses it for energy recovery.

(d) A final cover system at the top of the landfill which enhances surface drainage, prevents infiltrating water and supports surface vegetation.

(e) A surface water drainage system which collects and removes all surface runoff from the landfill site.

(f) An environmental monitoring system which periodically collects and analyses air, surface water, soil-gas and ground water samples around the landfill site.

(g) A closure and post-closure plan which lists the steps that must be taken to close and secure a landfill site once the filling operation has been completed and the activities for long-term monitoring, operation and maintenance of the completed landfill.

The components of sanitary landfill is represented in the figure

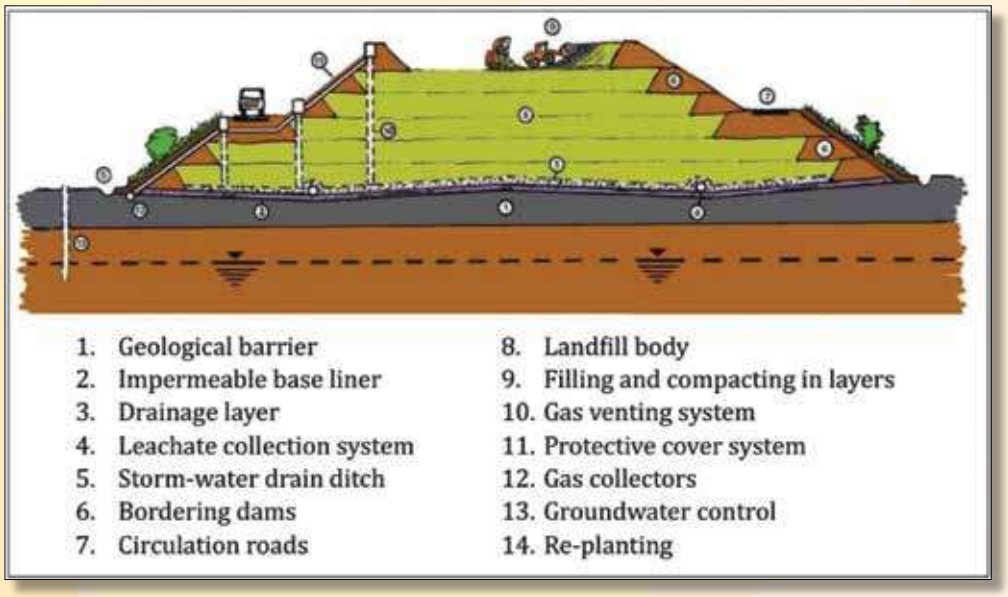


Figure 5.6 Components of sanitary landfill

5.5.4 Landfill capping

Landfill capping is a containment technology that forms a barrier between the contaminated media and the surface, thereby shielding humans and the environment from the harmful effects of its contents and perhaps limiting the migration of the contents.

5.5.5 Objectives of capping

The main objectives in designing a capping system are to:

- minimize infiltration of water into the waste;
- promote surface drainage and maximize run off;
- control gas migration; and
- provide a physical separation between waste and plant and animal life.

The components of a landfill capping system may include:

- topsoil;
- subsoil;
- drainage layer;
- barrier (infiltration) layer;
- gas drainage layer; and
- system for leachate recirculation

5.5.6 Limitations

1. Landfill caps are most effective where most of the underlying waste is above the water table.
2. Landfill caps have a limited life span. They are estimated to last from 50 to 100 years. In areas with high rates of subsidence and regions prone to earthquakes, the cap and its foundation should be designed appropriately.

6

CREMATORIUM

6.1 GAS CREMATORIUM

Gas Crematorium should be designed to have a cremation of one body at a time and the time taken for the completion of one cremation is approximately one to one and half-hour time.

6.1.1 Cremation Process

After the rituals the body is kept in a moveable trolley and finally places the body in the cremation platform in cremation furnace. Combustion blowers and air blowers are switched on and then the primary and secondary burners in the cremation chambers switched on to get the furnace temperature at about 900˚C. By the moveable trolley the body will be placed upon the cremation platform in the cremation chamber. The cremation door would then keep closed.

The body would incinerate in the primary and in the secondary chamber between the temperature 800 and 1100˚C and the cremation get completed in about 60 to 90 minutes maximum depend upon the body size and other biological reasons.

The hazardous gas and other substances are piped out from cremation chamber and cleaned by ventury scrubber with water treatment and finally the hot air is being discharged in to 30m height chimney. ETP system takes care of treated water. The system has the ash removal system to collect the ash and remains for further custom. The system also have necessary controls, auto on-off, cutoff switches and other necessary controls for a safety operation.

6.1.2 Principle of Operation

Cremation is the process of reducing dead bodies to basic chemical compounds in the form of gases and bone fragments. This is accomplished through burning at high temperatures, vaporization and oxidation.

Chemical Composition of the Body and the composition can also be expressed in terms of chemicals, such as:

- Water

- Proteins - including those of hair, connective tissue, etc.
- Fats (or lipids)
- Apatite in bones
- Carbohydrates such as glycogen and glucose
- DNA
- Dissolved inorganic ions such as sodium, potassium, chloride, bicarbonate, Phosphate.
- Gases such as oxygen, carbon dioxide, nitrogen oxide, hydrogen, carbon monoxide, methanethiol. These may be dissolved or present in the gases in the lungs or intestines. Ethane and pentane are produced by oxygen free radicals.
- Many other small molecules, such as amino fatty acids, nucleobasesacids, nucleosides, nucleotides, vitamins, cofactors, hydrogen peroxide, and waste products like indole and skatole (in the intestinal contents).
- Free radicals such as superoxide, hydroxyl, and hydroperoxyl.

Besides these our bodies contain trace quantities of most other elements, including some that are harmful, such as mercury, cadmium, and lead.

6.1.3 Furnace Components

Furnace System comprises of

1. Primary Combustion Chamber
2. Body Loading Trolley
3. Hot Duct
4. Secondary Combustion Chamber
5. Cloud Chamber
6. Ventury Wet Scrubber
7. Mist Eliminator
8. Dilution System
9. Stack
10. Control Panel
11. Ash Chamber

6.1.4 Functions of the cremation system

1. Primary Combustion Chamber

Primary Combustion Chamber is for the incineration of Human dead Body. The Incineration is achieved by maintaining the temperature of the Chamber and also supplying air for combustion. The moment the body is introduced, it catches fire and incineration process starts

2. Body Loading Trolley

For loading and transferring the body to furnace, a trolley that moves on rails is provided.

3. Hot Duct

The Duct connecting the Primary Combustion Chamber to Secondary Combustion chamber will always be hot during operation, enabling the hot air to enter inside the Secondary Combustion chamber during the cremations process

4. Secondary Combustion Chamber

Secondary combustion chamber to incinerate the emissions of gas again during cremation process. Secondary burning helps in converting Hydrocarbons to compound forms, removal of foul odor, conversion of certain gaseous elements to soluble emission gases.

5. Cloud Chamber

The chamber enables the removal of sub-micron particulates from emissions so that the fine particulates are not thrown to atmosphere along with the treated emission gases.

6. Ventury Wet Scrubber

Ventury wet Scrubber system is for the removal of soluble emissions, particulate matter and also for the removal of emissions of acid in nature.

7. Mist Separator

Mist separator takes care of the removal of carried over mist from emissions prior to entrance of the emissions to the Chimney

8. Dilution System

Dilution System provides will dilute the emissions so that the concentration of emissions is brought down prior to letting out to atmosphere.

9. Stack

Stack having a height of 30 Meters from the ground level is for the safe disposal of treated emissions to atmosphere

10. Ash Chamber

The burnt out ashes from the primary burning chamber will fall to the chamber provided beneath the primary chamber from where the ash is collected by opening the ash door by means of the scrapper provided.

6.1.5 Technical Specification

Chamber width	:	6ft (180cm)
Chamber Length	:	9ft (270cm)
Chamber Height	:	5ft (150cm)
Maximum Temperature	:	1100˚C
Fuel	:	L.P. Gas
Door	:	Front Opening
Burner System	:	Full length Burners on either side (3ft x 4nos.)
Fresh air missing		
Gas Pipe Line	:	Unit made out of Copper/Ms with pressure gauge.

Insulation Kit	:	Withstanding 1100˚C with Special Cement.
Coating for durability		
Operation	:	Manual operation
Chimney/Flue Gas	:	30 Meter height
Lighting Arrestor	:	Yes.
Filtering System	:	Water Impingent
Emission Standard	:	As per KSPCB Norms
Power	:	5.2 KW, 3 phase power connection
Cylinder	:	8 Nos Minimum
Exhaust Pipe	:	Sufficient length with heat resistant insulated pipe.
Control Panel	:	Manual with sufficient features including temperature with monitoring device
Bed	:	Stainless Steel with additional M.S, Hospital trolley.
Structure	:	Heavy duty steel fabrication with required thickness of steel materials with additional re-enforcement and supports, front door with eye piece, Body covered with CRCA sheet and inside filled with ISI insulation bricks with Trolley to lay the body inside the chamber.

The following are the basic requirements;

- Furnace structure fabricated using heat resistant structural steel plates.
- Front door provided with view port.
- Chamber totally covered.
- Fire resistant coating over firebricks.
- Emission within PCB's norms.
- Chimney : 30 meters.
- Burner : Full length Burners on either side.
- Process Duration : 50 ± 5 minutes
- LPG consumption : 12 ± 2 kg.

The unit is to be placed in North south basis where door to be on North.

Additional offer	:	Training of 2 personnel.
Warranty	:	1 year from the date of installation
Combustion chamber	:	800±50˚ C
Post combustion chamber	:	1050±50˚ C
Temperature control and Indication AC	:	Solid state Digital type temperature indicating controller 0 - 12000˚C in each chamber.
Safety to control activity	:	olid state non indicating controller 0 - 1200˚C in each chamber.
Temperature sensor	:	Cr / Al Thermocouple – 1No. in each chamber.

Combustion air supply	:1 No Blower for the supply of Oxygen for incineration of the body in combustion chamber and supply of excess air to post combustion chamber for re-incineration of emissions.
Casing	:	Mild steel construction – outer with glazed tiles.
Thermal Insulation	:	Ceramic board backed with energy efficient ceramic fibers of various grades on sides and top and refractory high alumina tiles backed up with ceramic fibers at the bottom of the Furnace Chamber.
Primary Door	:	Vertical sliding type, counter weight balanced, motorized movement.
Trolley	:	Modern stretcher type trolley with rollers moving on ball bearings for the easy sliding in of the body for cremation inside the chamber. The stretcher is having wheels and can be kept anywhere after loading.
Ash removal	:	Rear side of the combustion chamber scraping by manual operation.
Ash door	:	hinged type, manually operated.
Control panel	:	A floor mounting control cubical fabricated out of mild steel sheets and angle frame, housing indicating lamps, ON – OFF switches, contractors, HRC fuses, temperature indicating controllers, safety controllers, Ammeter with selector switch, volt meter with selector switch, push button etc. will be provided. The control panel will be neatly wired and ferruled as per standard norms. The electrical components used for panel will be of reputable make.
Secondary combustion chamber	:	for re-incineration of emissions – conversion of emissions to compound soluble forms.
Excess air purging system	:	for achieving cent percent combustion efficiency.
Wet scrubber Ventury type	:	to remove carried over particulates and soluble emissions such as HCl, NOX etc. as over mist from the Scrubber.
Dilution systems	:	to bring down further the concentration of detrimental emissions prior to letting out to atmosphere.
Negative pressure creation system	:	for efficient drawing of emissions from the combustion chamber formed during incineration of body.

6.1.6 Safety Measures

1. Safety Controller - To take care of control activity in case of failure of main controllers.
2. Thermocouple failure safety device - Incorporated in the controllers to cut off the power supply to the burners in case of failure of Thermocouple.
3. Earthing – Proper earthing will have to be provided for electrical circuits as per the norms of Electricity Board.

6.1.7 Painting

The system steel items will be painted with attractive enamel paint. The control panel will be painted with attractive enamel, painted after making surface operation. The chimney will be painted as per the colour code requirement as per ICAO regulations, with enamel.

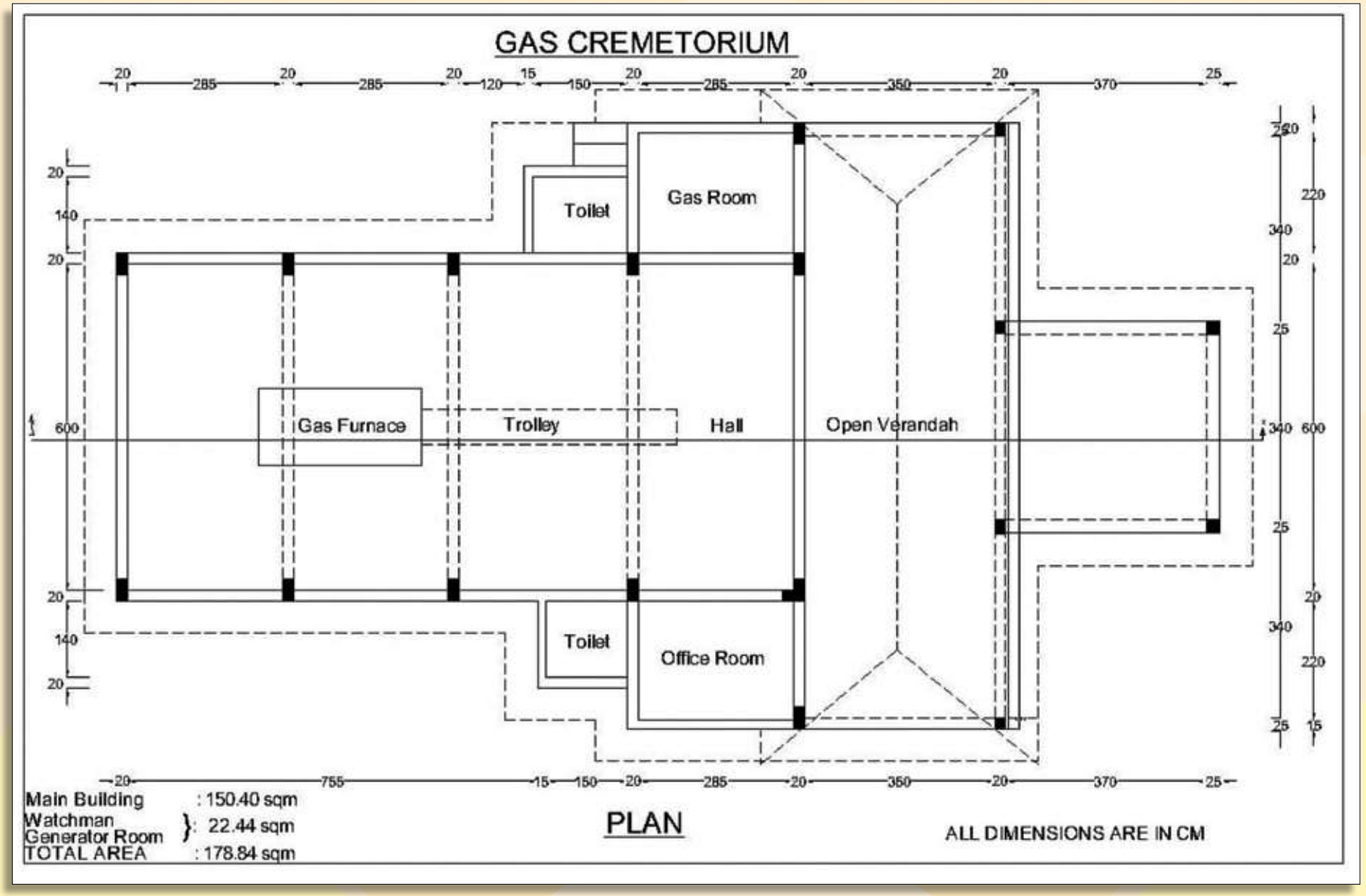
6.1.8 Other Requirements

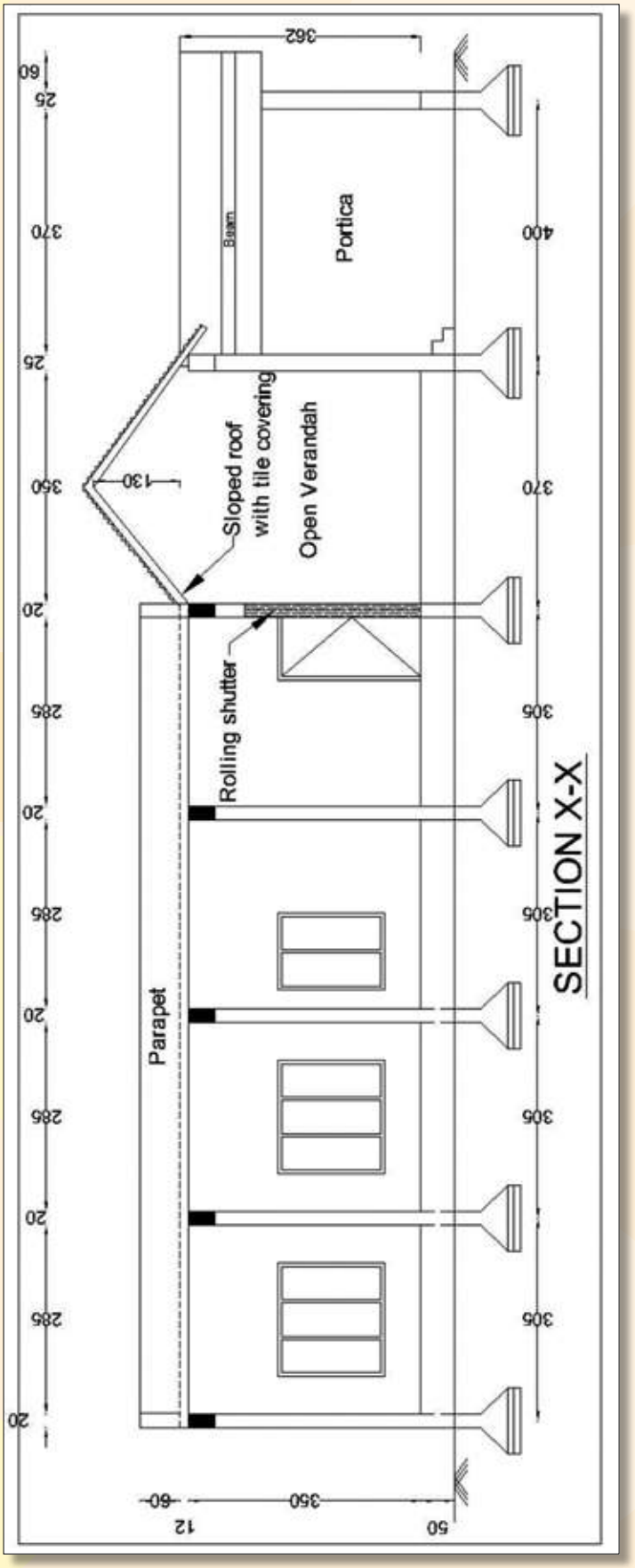
1. Required numbers of LPG cylinders
2. Obtaining explosive certificate if required.
3. Storage facility for materials.
4. Pollution Control Board approval.
5. Light, fan, exhaust for the building.
6. Land

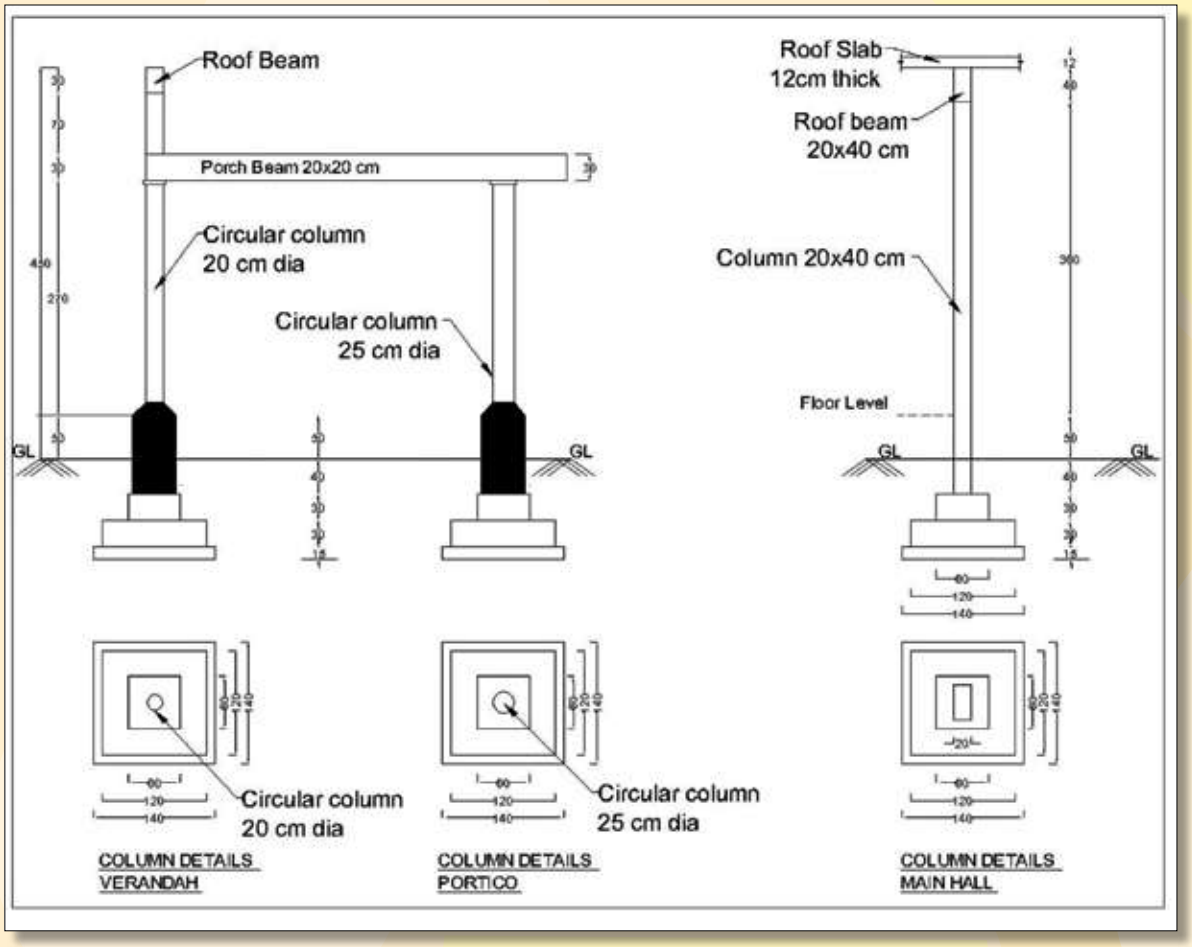
Minimum of 50 cents of land is the basic requirement for Gas Crematorium. The Plant should be established at the center portion of the land. A garden or lawn may be developed in the front portion. A minimum of 50m distance may be maintained with nearest house in order to minimize nuisance to nearby inhabitants.

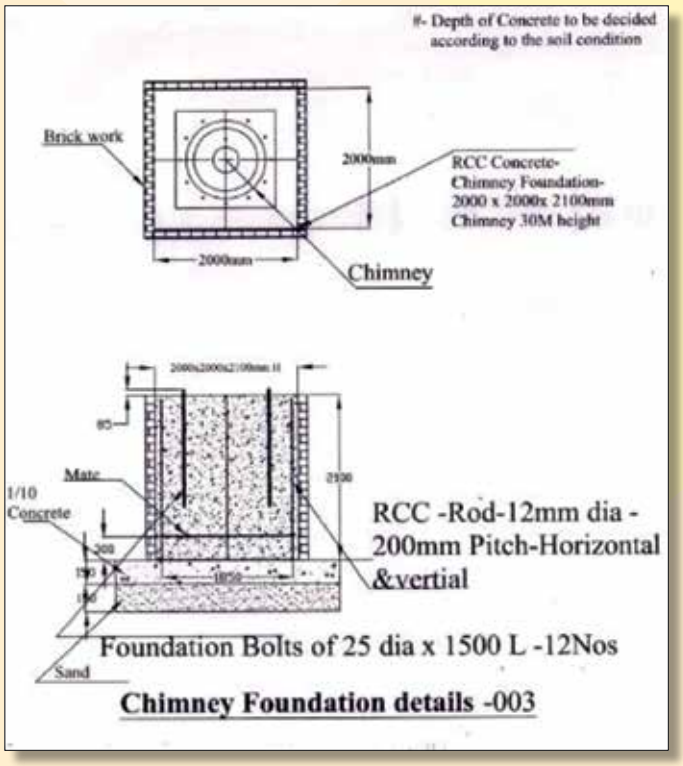
6.1.9 Operation and Maintenance

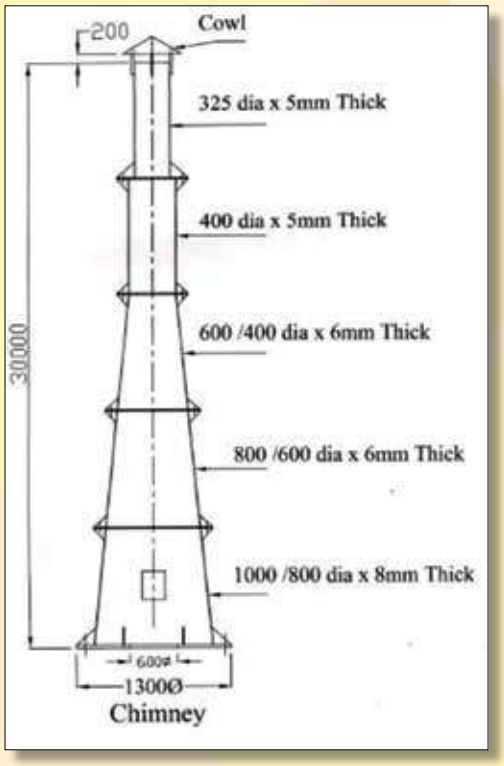
The selected agency should be given six months free Operation and Maintenance of the facility including training to local body engaged personnel within the period. The agency should also provide AMC for a period of 3 years after the six months trial run period. Supply of electricity and Gas for Crematorium should be provided by the Local Body. Man power for operation of the facility after trial run period should be provided by the Local Body.


GAS CREMETORIUM
Toilet
Gas Room
Gas Furnace
Trolley
Hall
Open Verandah
Toilet
Office Room
Main Building : 150.40 sqm
Watchman
Generator Room : 22.44 sqm
TOTAL AREA : 178.84 sqm
PLAN
ALL DIMENSIONS ARE IN CM


SECTION X-X
Portica
Beam
Sloped roof
with tile covering
Open Verandah
Rolling shutter
Parapet
362
60
25
370
25
350
130
20
285
20
285
20
285
20
285
20
400
370
305
305
305
305
350
60
12
50


Roof Beam
Porch Beam 20x20 cm
Circular column
20 cm dia
Circular column
25 cm dia
GL
GL
Roof Slab
12cm thick
Roof beam
20x40 cm
Column 20x40 cm
Floor Level
GL
GL
Circular column
20 cm dia
Circular column
25 cm dia
COLUMN DETAILS
VERANDAH
COLUMN DETAILS
PORTICO
COLUMN DETAILS
MAIN HALL


#- Depth of Concrete to be decided
according to the soil condition
Brick work
2000mm
RCC Concrete-
Chimney Foundation-
2000 x 2000x 2100mm
Chimney 30M height
Chimney
Mate
1/10
Concrete
RCC -Rod-12mm dia -
200mm Pitch-Horizontal
&vertial
Foundation Bolts of 25 dia x 1500 L -12Nos
Sand
Chimney Foundation details -003


200
Cowl
325 dia x 5mm Thick
400 dia x 5mm Thick
600 /400 dia x 6mm Thick
800 /600 dia x 6mm Thick
1000 /800 dia x 8mm Thick
30000
1300Ø
Chimney

7

CASE STUDIES

7.1 ADAT MODEL (THRISSUR DISTRICT)

Adat grama panchyat in Thrissur district has developed a multi-dimensional project for the disposal of solid waste, which also generates income for a self-help group (SHG) of 15 members. The project for the collection, segregation, and manufacturing of bio-fertilizer is run by a group of women members of Kudumbasree unit. In the available government land of 90 cents in the Parikkad location, the unit has separate sheds for dumping and processing of waste, separate sheds for manufacturing and storage of compost, a crusher unit for the processing of plastic, and retiring rooms for workers. 7 cows are being reared for the cow dung. The cow dung is used for the manufacturing of compost. The plant has a capacity of processing one ton of waste per day.

The process starts early at 4 a.m. in a tipper lorry owned by the panchayat. Solid waste is collected by tipper lorry from the waste bins placed at 11 locations of the grama panchayat and also collected from vegetable shops and hotels. The biodegradable waste is deposited in specially designed boxes and then mixed with the cow dung and water. Within 45 days the waste is completely converted into organic manure. Compost produced is sold at a rate of Rs. 2500 per tipper. Some portion of the biodegradable waste is used for the production of biogas in the biogas plant. The biogas produced is being used for boiling water and making tea in the plant premise.

The segregated plastic and bottles are turned to granules in a crushing machine. The product has good demand for use in the construction of black top roads. Sanitary napkins, diapers are incinerated in the incinerator.



Plastic shredding unit



Shredded plastic

Collection charge of Rs.300 for vegetable shops, Rs.2500 for hotel form the basic sources of income. An amount of Rs.82440 from the Plan fund is allotted to the unit for the proper management of the plant. Each SHG members will get an average income of Rs.1000 a month. The whole area of the panchayat is now free from waste and 15 women from below poverty line (BPL) families are getting a decent income for work every day.

7.2 ILCS SUCCESS STORY KOYILANDY MUNCIPALITY (KOZHIKODE DISTRICT)

Koyilandy (or Quilandy/Quilandi) is a taluk and a Municipality town in the Kozhikode district in the North Malabar region, state of Kerala. This town is between Kozhikode and Vatakara (Badagara) and is on NH 66 (previously NH 17). It is sometimes identified with Tyndis in Periplus of the Erythraean Sea. Municipality has 44 wards in total.

Waste management

Geographically, Koyilandy has more coastal area with very high-water table. Hence waste management is very difficult. The municipality brought forward waste management initiatives through a campaign called ` Change Koyilandy'. As a part of this campaign, the concept of ` Toilet Linked Biogas Plant' was implemented with the help of Suchitwa Mission and service provider MYTHRI. 40 of the 44 wards decided to be a part of this campaign and 1555 units were identified. In this 936 were biotoilet (ILCS – Integrated Low-Cost Sanitation) and 619 were toilet linked biogas plants. Once the beneficiaries saw the merits of the system, more applications for the same started coming to Muncipality..





7.3 NIRMALA NAGARAM NIRMALA BHAVANAM (ALAPPUZHA DISTRICT)

Introduction:

Alappuzha is situated in the coastal part of mid Kerala and topographically divided into three regions: the eastern midland, the vast low lying Kuttanad and the coastal area extending upto 82km.The district has an area of 1414km2 (smallest in the state) and a population of 2127789.It is second most densely populated District in the State with 1504 peoples per square kilometer.54% of people live in Urban and 46% live in Rural areas. Administratively it is divided into 72 Grama Panchayats, 12 Blocks Panchayats and 6 Municipalities.

With less land availability managing Solid waste was a major challenge for Alappuzha Municipality. Prior to 2013 waste management was being done at a centralized plant situated in 12 acres of land located at Sarvodayapuram. However due to local resistance the plant had to be shutdown in 2010.It was in this backdrop a project named "Nirmala Nagaram Nirmala Bhavanam" supported by Suchitwa Mission was launched for proper and scientific disposal of waste in Alappuzha.

WATSAN Park:

Here the methodology is decentralized waste management and technology adopted is the Aerobic decomposition. In Alappuzha municipality 166 aerobic plants named "Thumboor Muzhi" have been developed in 12 WATSAN Parks (Water & Sanitation Parks).These plants were commissioned in 2013 and have capacity to receive and manage 8000kg solid waste per day and manufactured above 2500kg of compost per day.

Watsan Park was envisaged as a permanent Exhibition cum learning centre for environment friendly waste management and water conservation techniques.

Apart from the above in household, were waste management was possible at household level Bio gas plants and pipe compost was taken up. About 786 families have set up bio gas plants and 525 household have set up pipe compost units. This has reduced the quantum of waste being brought to the WATSAN Park.

Working models of all the techniques used under Nirmala Nagaram Nirmala Bhavanam project such as pipe compost, vermi compost, pot compost, windrow compost, Biogas plants (both portable and fixed),aerobic units (using cowdung, enoculam and coir pith),roof water harvesting, water purification methods etc exhibited at the WATSAN Park.







Aerobic Cluster

- The six inch layer of fresh cow dung as the first layer with six inch layer of dried leaves provided the carbon source for the bacteria to flourish. Above that another six inch layer waste is converted into compost
- The core temperature built up in this layering is 65-70°c, which prevents the breeding of flies and parasites. Moreover due to aerobic functioning no putrid smell was there. We can manage about 2000 kg waste in a bin. We could get compost with Carbon-Nitrogen ratio 20 to 30:1 after 90 days

7.4 THE SOLID WASTE MANAGEMENT AND TREATMENT FACILITY IN ATTINGAL MUNICIPALITY (THIRUVANANTHAPURAM DISTRICT)

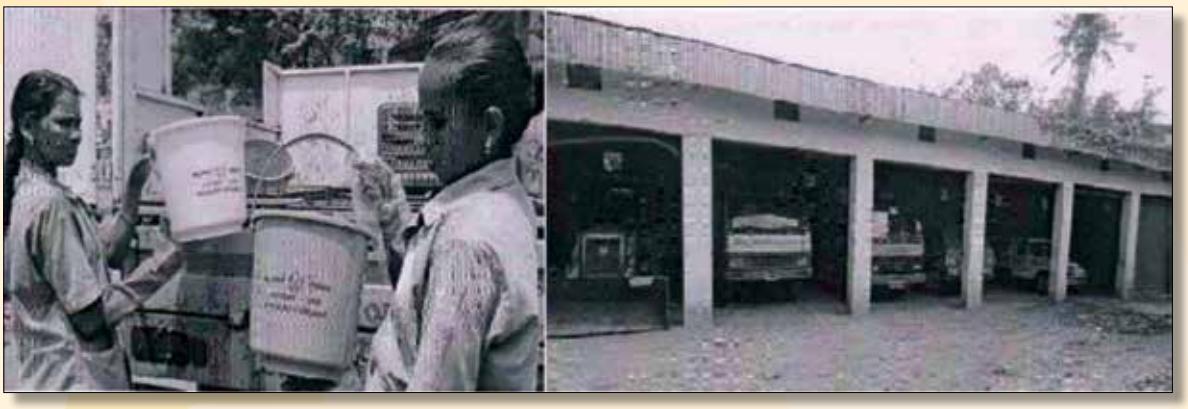
From time immemorial, Attingal has been centre of administration and various historic events. Attingal is one among four Municipalities in the Thiruvanathapuram District. The local body is running a solid waste treatment and management facility. The successful operation of the plant is due to joint and active participation of people, local body and service provider.

The Solid Waste Management and Treatment Facility in Attingal Municipality is located in Chudukadu. The facility is an scientifically integrated unit consisting of Windrow composting, Vermi composting, Biogas Plant, Plastic shredding unit, e-waste collection centre and a sanitary land fill. The unit started working in 2003 under Kudubashree as a colletion centre of solid waste. Later in 2005 with the approval of Clean Kerala Mission and funds from UIDSSMT, Suchitwa Mission and own fund, a windrow composting unit aiming at the management of 5.5 tons of solid waste per day as first stage was constructed. By 2010, it was expanded to take 15 tons of solid waste per

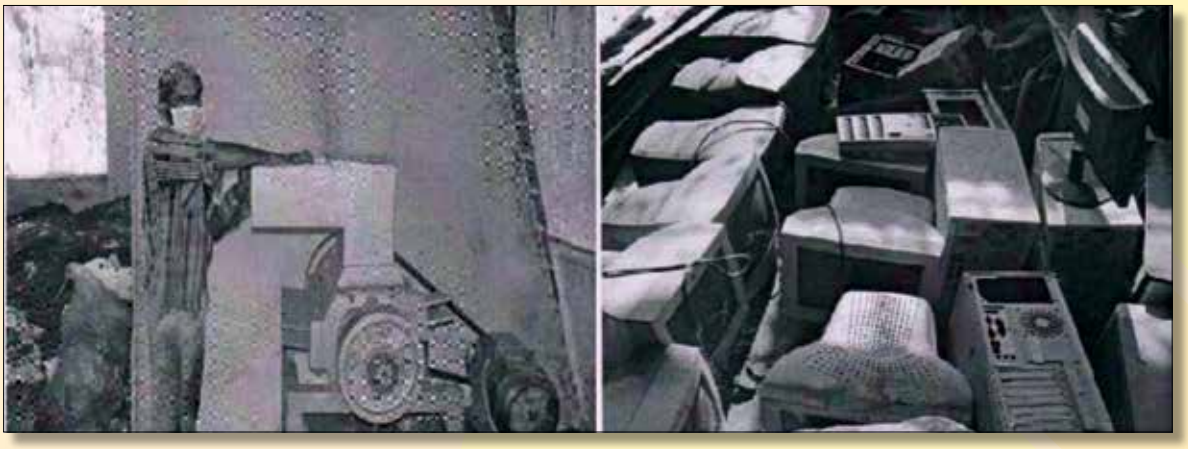
day. Also, there is a Vermi composting plant with capacity of taking 1 tons of waste per day and a plastic shredding unit for segregated plastic waste and the rest of the waste is send to a sanitary landfill, constructed as per MSW 2000 rules. Neither the composting facility nor the landfill accept any hazardous, liquid, medical, chemical, flammable, explosive or radioactive wastes. Kasaragod Social Service Society, a veteran in this field, is the service provider for this plant.

The solid waste composting process includes the following phases:

- Waste Receiving;
  - o Municipality has provided green and white plastic bins to collect segregated waste.
  - o Waste bins are being provided in schools for collecting waste and creating awareness among younger generation.
  - o Workers segregate and collect the waste daily from the municipality cleaners after they finish cleaning the roads, market area and other common areas.



  - o Municipality Cleanwell Unit (Kudumbhasree) collects source segregated degradable and non degradable waste from households and various shopping centres. Around 14 to 16 tons of waste reach the plant every day.
  - o The facility has 5 Vehicles for waste collection purpose and a jeep model vehicle for supervision and other purposes.
  - o The workforce is composed of 37 permanent staff of cleaning section of municipality, 10 temporary staff and 24 staffs of Kudumbashree Unit.
- Management of Non Degradable waste;
  - o The recyclables are sorted and plastics are shredded using plastic shredding machine and packed in sacks and sold to needy or collected by the Clean Kerala Company.
  - o A resource recovery centre for collection and storage of e-waste has been started in the facility. Municipality has taken necessary actions to collect and transfer e-waste from educational institutions, Government and Non- Government organizations and other institutions and offices in IT sectors.
  - o The remaining reject is transferred to the landfill.



- Management of Degradable waste;
  - o Windrow Composting

    The segregated waste reaching the unit is further scrutinized and converted to windrows. Two sheds of 1300 sq metres is used for this purpose. Composting is done under the strict guidelines of MSW 2000 and Pollution control Board Rules. The waste is turned over at scheduled time intervals with help of machinery and compost produced from this is further crushed and sieved with the help of modern sieving mechanisms. The compost thus produced is of size 3mm and they are packed and stored for sale.



  - o Vermi Composting

    Vegetable waste, Food waste and market waste is used in vermi composting. Tanks of size 10ft x 2ft x 1.5ft is used for this purpose. Eudrilus Eugeniae earthworm species (African Night Crawler) is used for vermi composting. Compost is sieved and packed for sale.





- Biogas Plant

  The leechate produced from the windrow plant is collected through underground pipe system and connected to biogas plant. The gas generated is used for various purposes in the plant. In doing so, a major issue of public protest due to leechate percolation to water bodies which has lead to failure of various other plants is productively solved.

7.5 A NATIONALLY ACCEPTED MODEL IN PLASTIC WASTE MANAGEMENT – KATHIRUR GRAMA PANCHAYATH (KANNUR DISTRICT)

Kathirur Grama panchayath in Kannur district has a success story in Plastic Waste Management. Kathirur model of Plastic Waste Management is selected as the one of the best practice in the country itself.

About Kathirur

28000 peoples are living in 18 wards of kathirur. There are 5,100 households, 4 market, 15 schools, 35 Anganwadis etc in kathirur. Plastic Waste from the above mentioned places of Kathirur Grama Panchayath is managed in the following way.

Process followed for Plastic waste collection:

- Mapping done for plastic collection
- Demarcated into zones
- Total Households are divided into groups of 70 each
- Zone 1:Households
- Zone 2:Market
- Zone 3:Schools
- Zone 4:Public Institutions
- Zone 5:Public Places and roads
- KUDUMBASHREE Entrepreneur Groups (Green volunteers)are deployed for collection

Bins Provided:

- Separate Bins are put up for each group
- Bins are put up at Houses, markets, schools, institutions and shops

- The Bins are kept locked
- Once in a week the Bin shall be kept open.
- People dispose clean Plastic waste in to the Bins



Waste collection and transportation:

- Collection of the Waste from Bins are done by the Green Volunteers.
- 5 member groups are engaged for collection
- Vehicle provided for transportation

Resource Recovery Centre:

- Collected waste are temporarily stored in RRC
- Then secondary segregation is done at the RRC
- Bundled/Shredded to reduce volume
- Volunteers are engaged at RRC



Resource:

- Panchayat Development fund
- SBM funds

- Public contribution
- User fee

Monitoring:

- Monitoring at each group is done by SHGs
- Ward Level Committees
- GP Level Committee

Those who violate shall be fined by the committee

Outcome:

- Informed community.
- Scientific dry waste management practices by villagers.
- No littering, No burning.
- Usage of alternate articles like cloth bags.
- Reduction of plastic waste.
- Eco friendly environment.

Rules Related To Waste Management

ANNEXURE-I
Solid Waste Management Rules, 2016

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
NOTIFICATION

New Delhi, the 8th April, 2016

S.O. 1357(E).—Whereas the draft of the Solid Waste Management Rules, 2015 were published under the notification of the Government of India in the Ministry of Environment, Forest and Climate Change number G.S.R. 451 (E), dated the 3rd June, 2015 in the Gazette of India, part II, Section3, sub- section (i) of the same date inviting objections or suggestions from the persons likely to be affected thereby, before the expiry of the period of sixty days from the publication of the said notification on the Solid Waste Management Rules, 2015 in supersession of the Municipal Solid Waste (Management and Handling) Rules, 2000;

And whereas, copies of the said Gazette were made available to the public on the 3rd June, 2015;

And whereas, the objections or comments received within the stipulated period were duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by sections 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986) and in supersession of the Municipal Solid Waste (Management and Handling) Rules, 2000, except as respect things done or omitted to be done before such supersession, the Central Government hereby makes the following rules for management of Solid Waste, namely:-

1. **Short title and commencement.-**
   (1) These rules may be called the Solid Waste Management Rules, 2016.
   (2) They shall come into force on the date of their publication in the Official Gazette.
2. **Application.-** These rules shall apply to every urban local body, outgrowths in urban agglomerations, census towns as declared by the Registrar General and Census Commissioner of India, notified areas, notified industrial townships, areas under the control of Indian Railways, airports, airbases, Ports and harbours, defence establishments, special economic zones, State and Central government organisations, places of pilgrims, religious and historical importance as may be notified by respective State government from time to time and to every domestic, institutional, commercial and any other non residential solid waste generator situated in the areas except industrial waste, hazardous waste, hazardous chemicals, bio medical wastes, e-waste, lead acid batteries and radio-active waste, that are covered under separate rules framed under the Environment (Protection) Act, 1986**.**

3. Definitions – (1) In these rules, unless the context otherwise requires,-

1. **"aerobic composting"** means a controlled process involving microbial decomposition of organic matter in the presence of oxygen;
2. **"anaerobic digestion"** means a controlled process involving microbial decomposition of organic matter in absence of oxygen;
3. "authorisation" means the permission given by the State Pollution Control Board or Pollution Control Committee, as the case may be, to the operator of a facility or urban local suthority, or any other agency responsible for processing and disposal of solid waste;
4. "biodegradable waste " means any organic material that can be degraded by micro-organisms into simpler stable compounds;
5. "bio-methanation" means a process which entails enzymatic decomposition of the organic matter by microbial action to produce methane rich biogas;
6. "brand owner" means a person or company who sells any commodity under a registered brand label.
7. "buffer zone" means zone of no development to be maintained around solid waste processing and disposal facility, exceeding 5 TPD of installed capacity. This will be maintained within total and area allotted for the solid waste processing and disposal facility.
8. "bulk waste generator" means and includes buildings occupied by the Central government departments or undertakings, State government departments or undertakings, local bodies, public sector undertakings or private companies, hospitals, nursing homes, schools, colleges, universities, other educational institutions, hostels, hotels, commercial establishments, markets, places of worship, stadia and sports complexes having an average waste generation rate exceeding 100kg per day;
9. "bye-laws" means regulatory framework notified by local body, census town and notified area townships for facilitating the implementation of these rules effectively in their jurisdiction.
10. "census town" means an urban area as defined by the Registrar General and Census Commissioner of India;
11. "combustible waste" means non-biodegradable, non-recyclable, non-reusable, non hazardous solid waste having minimum calorific value exceeding 1500 kcal/kg and excluding chlorinated materials like plastic, wood pulp, etc;
12. "composting" means a controlled process involving microbial decomposition of organic matter;
13. "contractor" means a person or firm that undertakes a contract to provide materials or labour to perform a service or do a job for service providing authority;
14. "co-processing" means use of non-biodegradable and non recyclable solid waste having calorific value exceeding 1500k/cal as raw material or as a source of energy or both to replace or supplement the natural mineral resources and fossil fuels in industrial processes;
15. "decentralised processing" means establishment of dispersed facilities for maximizing the processing of bio- degradable waste and recovery of recyclables closest to the source of generation so as to minimize transportation of waste for processing or disposal;

16. "disposal" means the final and safe disposal of post processed residual solid waste and inert street sweepings and silt from surface drains on land as specified in Schedule I to prevent contamination of ground water, surface water, ambient air and attraction of animals or birds;
17. “domestic hazardous waste” means discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., generated at the household level;
18. "door to door collection" means collection of solid waste from the door step of households, shops, commercial establishments, offices, institutional or any other non residential premises and includes collection of such waste from entry gate or a designated location on the ground floor in a housing society, multi storied building or apartments, large residential, commercial or institutional complex or premises;.
19. “dry waste” means waste other than bio-degradable waste and inert street sweepings and includes recyclable and non recyclable waste, combustible waste and sanitary napkin and diapers, etc;
20. “dump sites” means a land utilised by local body for disposal of solid waste without following the principles of sanitary land filling;
21. “extended producer responsibility” (EPR) means responsibility of any producer of packaging products such as plastic, tin, glass and corrugated boxes, etc., for environmentally sound management, till end-of-life of the packaging products;
22. “facility” means any establishment wherein the solid waste management processes namely segregation, recovery, storage, collection, recycling, processing, treatment or safe disposal are carried out;
23. "fine" means penalty imposed on waste generators or operators of waste processing and disposal facilities under the bye-laws for non-compliance of the directions contained in these rules and/or bye- laws
24. "Form" means a F8orm appended to these rules;
25. “handling” includes all activities relating to sorting, segregation, material recovery, collection, secondary storage, shredding, baling, crushing, loading, unloading, transportation, processing and disposal of solid wastes;
26. “inerts” means wastes which are not bio-degradable, recyclable or combustible street sweeping or dust and silt removed from the surface drains;
27. “incineration” means an engineered process involving burning or combustion of solid waste to thermally degrade waste materials at high temperatures;
28. “informal waste collector” includes individuals, associations or waste traders who are involved in sorting, sale and purchase of recyclable materials;
29. "leachate" means the liquid that seeps through solid waste or other medium and has extracts of dissolved or suspended material from it;
30. "local body” for the purpose of these rules means and includes the municipal corporation, nagar nigam, municipal council, nagarpalika, nagar Palikaparishad, municipal board, nagar panchayat and town panchayat, census towns, notified areas and notified industrial townships with whatever name they are called in different States and union territories in India;

31. “materials recovery facility” (MRF) means a facility where non-compostable solid waste can be temporarily stored by the local body or any other entity mentioned in rule 2 or any person or agency authorised by any of them to facilitate segregation, sorting and recovery of recyclables from various components of waste by authorised informal sector of waste pickers, informal recyclers or any other work force engaged by the local body or entity mentioned in rule 2for the purpose before the waste is delivered or taken up for its processing or disposal;
32. “non-biodegradable waste” means any waste that cannot be degraded by micro organisms into simpler stable compounds;
33. "operator of a facility" means a person or entity, who owns or operates a facility for handling solid waste which includes the local body and any other entity or agency appointed by the local body;
34. primary collection" means collecting, lifting and removal of segregated solid waste from source of its generation including households, shops, offices and any other non-residential premises or from any collection points or any other location specified by the local body;
35. "processing" means any scientific process by which segregated solid waste is handled for the purpose of reuse, recycling or transformation into new products;
36. "recycling" means the process of transforming segregated non-biodegradable solid waste into new material or product or as raw material for producing new products which may or may not be similar to the original products;
37. “redevelopment” means rebuilding of old residential or commercial buildings at the same site, where the existing buildings and other infrastructures have become dilapidated;
38. "refused derived fuel"(RDF) means fuel derived from combustible waste fraction of solid waste like plastic, wood, pulp or organic waste, other than chlorinated materials, in the form of pellets or fluff produced by drying, shredding, dehydrating and compacting of solid waste ;
39. “residual solid waste” means and includes the waste and rejects from the solid waste processing facilities which are not suitable for recycling or further processing;
40. "sanitary land filling " means the final and safe disposal of residual solid waste and inert wastes on land in a facility designed with protective measures against pollution of ground water, surface water and fugitive air dust, wind-blown litter, bad odour, fire hazard, animal menace, bird menace, pests or rodents, greenhouse gas emissions, persistent organic pollutants slope instability and erosion;
41. “sanitary waste” means wastes comprising of used diapers, sanitary towels or napkins, tampons, condoms, incontinence sheets and any other similar waste;
42. "Schedule" means the Schedule appended to these rules;
43. "secondary storage" means the temporary containment of solid waste after collection at secondary waste storage depots or MRFs or bins for onward transportation of the waste to the processing or disposal facility;
44. "segregation" means sorting and separate storage of various components of solid waste namely biodegradable wastes including agriculture and dairy waste, non biodegradable wastes including recyclable waste, non- recyclable combustible waste, sanitary waste and non recyclable inert waste, domestic hazardous wastes, and construction and demolition wastes;

45. “service provider” means an authority providing public utility services like water, sewerage, electricity, telephone, roads, drainage, etc;
46. "solid waste" means and includes solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and 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;
47. “sorting” means separating various components and categories of recyclables such as paper, plastic, card- boards, metal, glass, etc., from mixed waste as may be appropriate to facilitate recycling;
48. “stabilising” means the biological decomposition of biodegradable wastes to a stable state where it generates no leachate or offensive odours and is fit for application to farm land ,soil erosion control and soil remediation;
49. “street vendor” means any person engaged in vending of articles, goods, wares, food items or merchandise of everyday use or offering services to the general public, in a street, lane, side walk, footpath, pavement, public park or any other public place or private area, from a temporary built up structure or by moving from place to place and includes hawker, peddler, squatter and all other synonymous terms which may be local or region specific; and the words “street vending” with their grammatical variations and cognate expressions, shall be construed accordingly;
50. “tipping fee” means a fee or support price determined by the local authorities or any state agency authorised by the State government to be paid to the concessionaire or operator of waste processing facility or for disposal of residual solid waste at the landfill;
51. “transfer station” means a facility created to receive solid waste from collection areas and transport in bulk in covered vehicles or containers to waste processing and, or, disposal facilities;
52. "transportation" means conveyance of solid waste, either treated, partly treated or untreated from a location to another location in an environmentally sound manner through specially designed and covered transport system so as to prevent the foul odour, littering and unsightly conditions;
53. “treatment” means the method, technique or process designed to modify physical, chemical or biological characteristics or composition of any waste so as to reduce its volume and potential to cause harm;
54. “user fee” means a fee imposed by the local body and any entity mentioned in rule 2 on the waste generator to cover full or part cost of providing solid waste collection, transportation, processing and disposal services.
55. "vermi composting" means the process of conversion of bio-degradable waste into compost using earth worms;
56. “waste generator” means and includes every person or group of persons, every residential premises and non residential establishments including Indian Railways, defense establishments, which generate solid waste;
57. “waste hierarchy” means the priority order in which the solid waste is to should be managed by giving emphasis to prevention, reduction, reuse, recycling, recovery and disposal, with prevention being the most preferred option and the disposal at the landfill being the least;

58. "waste picker" means a person or groups of persons informally engaged in collection and recovery of reusable and recyclable solid waste from the source of waste generation the streets, bins, material recovery facilities, processing and waste disposal facilities for sale to recyclers directly or through intermediaries to earn their livelihood.

(2) Words and expressions used herein but not defined, but defined in the Environment (Protection) Act, 1986, the Water (Prevention and Control of Pollution) Act, 1974, Water (Prevention and Control of Pollution) Cess Act, 1977 and the Air (prevention and Control of Pollution) Act, 1981 shall have the same meaning as assigned to them in the respective Acts.

4 Duties of waste generators.- (1) Every waste generator shall,-

(a) segregate and store the waste generated by them in three separate streams namely bio-degradable, non bio- degradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time;

(b) wrap securely the used sanitary waste like diapers, sanitary pads etc., in the pouches provided by the manufacturers or brand owners of these products or in a suitable wrapping material as instructed by the local authorities and shall place the same in the bin meant for dry waste or non- bio-degradable waste;

(c) store separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the Construction and Demolition Waste Management Rules, 2016; and

(d) store horticulture waste and garden waste generated from his premises separately in his own premises and dispose of as per the directions of the local body from time to time.

(2) No waste generator shall throw, burn or burry the solid waste generated by him, on streets, open public spaces outside his premises or in the drain or water bodies.

(3) All waste generators shall pay such user fee for solid waste management, as specified in the bye-laws of the local bodies.

(4) No person shall organise an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organiser of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the local body.

(5) Every street vendor shall keep suitable containers for storage of waste generated during the course of his activity such as food waste, disposable plates, cups, cans, wrappers, coconut shells, leftover food, vegetables, fruits, etc., and shall deposit such waste at waste storage depot or container or vehicle as notified by the local body.

(6) All resident welfare and market associations shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

(7) All gated communities and institutions with more than 5,000 sqm area shall, within one year from the date of notification of these rules and in partnership with the local body, ensure segregation of waste at source by the generators as prescribed in these rules, facilitate

collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorizsd recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

(8) All hotels and restaurants shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.

5. Duties of Ministry of Environment, Forest and Climate Change.- (1) The Ministry of Environment, Forest and Climate Change shall be responsible for over all monitoring the implementation of these rules in the country. It shall constitute a Central Monitoring Committee under the Chairmanship of Secretary, Ministry of Environment, Forest and Climate Change comprising officer not below the rank of Joint Secretary or Advisor from the following namely,-

1) Ministry of Urban Development
2) Ministry of Rural Development
3) Ministry of Chemicals and Fertilizers
4) Ministry of Agriculture
5) Central Pollution Control Board
6) Three State Pollution Control Boards or Pollution Control Committees by rotation
7) Urban Development Departments of three State Governments by rotation
8) Rural Development Departments from two State Governments by rotation
9) Three Urban Local bodies by rotation
10) Two census towns by rotation
11) FICCI, CII
12) Two subject experts

2. This Central Monitoring Committee shall meet at least once in a year to monitor and review the implementation of these rules. The Ministry of Environment, Forest and Climate Change may co-opt other experts, if needed. The Committee shall be renewed every three years.

6. Duties of Ministry of Urban Development.- (1) The Ministry of Urban Development shall coordinate with State Governments and Union territory Administrations to,-

(a) take periodic review of the measures taken by the states and local bodies for improving solid waste management practices and execution of solid waste management projects funded by the Ministry and external agencies at least once in a year and give advice on taking corrective measures;

(b) formulate national policy and strategy on solid waste management including policy on waste to energy in consultation with stakeholders within six months from the date of notification of these rules;

(c) facilitate States and Union Territories in formulation of state policy and strategy on solid management based on national solid waste management policy and national urban sanitation policy;

(d) promote research and development in solid waste management sector and disseminate information to States and local bodies;

(e) undertake training and capacity building of local bodies and other stakeholders;and

(f) provide technical guidelines and project finance to states, Union territories and local bodies on solid waste management to facilitate meeting timelines and standards.

7 **Duties of Department of Fertilisers, Ministry of Chemicals and Fertilisers.-** (1) The Department of Fertilisers through appropriate mechanisms shall,-

(a) provide market development assistance on city compost; and

(b) ensure promotion of co-marketing of compost with chemical fertilisers in the ratio of 3 to 4 bags: 6 to 7 bags by the fertiliser companies to the extent compost is made availablefor marketing to the companies.

8. **Duties of Ministry of Agriculture, Government of India.-** The Ministry of Agriculture through appropriate mechanisms shall,-

(a) provide flexibility in Fertiliser Control Order for manufacturing and sale of compost;

(b) propagate utlisation of compost on farm land;

(c) set up laboratories to test quality of compost produced by local authorities or their authorised agencies; and

(d) issue suitable guidelines for maintaining the quality of compost and ratio of use of compost visa-a-vis chemical fertilizers while applying compost to farmland.

9. **Duties of the Ministry of Power**.-The Ministry of Power through appropriate mechanisms shall,-

(a) decide tariff or charges for the power generated from the waste to energy plants based on solid waste.

b) compulsory purchase power generated from such waste to energy plants by distribution company.

10. **Duties of Ministry of New and Renewable Energy Sources**- The Ministry of New and Renewable Energy Sources through appropriate mechanisms shall,-

(a) facilitate infrastructure creation for waste to energy plants; and

(b) provide appropriate subsidy or incentives for such waste to energy plants.

11. **Duties of the Secretary–in-charge, Urban Development in the States and Union territories.-** (1) The Secretary, Urban Development Department in the State or Union territory through the Commissioner or Director of Municipal Administration or Director of local bodies shall,-

(a) prepare a state policy and solid waste management strategy for the state or the union territory in consultation with stakeholders including representative of waste pickers, self help group and similar groups working in the field of waste management consistent with these rules, national policy on solid waste management and national urban sanitation policy of the ministry of urban development, in a period not later than one year from the date of notification of these rules;

(b) while preparing State policy and strategy on solid waste management, lay emphasis on waste reduction, reuse, recycling, recovery and optimum utilisation of various components of solid waste to ensure minimisation of waste going to the landfill and minimise impact of solid waste on human health and environment;

(c) state policies and strategies should acknowledge the primary role played by the informal sector of waste pickers, waste collectors and recycling industry in reducing waste and provide broad guidelines regarding integration of waste picker or informal waste collectors in the waste management system.

(d) ensure implementation of provisions of these rules by all local authorities;

(e) direct the town planning department of the State to ensure that master plan of every city in the State or Union territory provisions for setting up of solid waste processing and disposal facilities except for the cities who are members of common waste processing facility or regional sanitary landfill for a group of cities; and

(f) ensure identification and allocation of suitable land to the local bodies within one year for setting up of processing and disposal facilities for solid wastes and incorporate them in the master plans (land use plan) of the State or as the case may be, cities through metropolitan and district planning committees or town and country planning department;

(h) direct the town planning department of the State and local bodies to ensure that a separate space for segregation, storage, decentralised processing of solid waste is demarcated in the development plan for group housing or commercial, institutional or any other non-residential complex exceeding 200 dwelling or having a plot area exceeding 5,000 square meters;

(i) direct the developers of Special Economic Zone, Industrial Estate, Industrial Park to earmark at least five percent of the total area of the plot or minimum five plots or sheds for recovery and recycling facility.

(j) facilitate establishment of common regional sanitary land fill for a group of cities and towns falling within a distance of 50 km (or more) from the regional facility on a cost sharing basis and ensure professional management of such sanitary landfills;

(k) arrange for capacity building of local bodies in managing solid waste, segregation and transportation or processing of such waste at source;

(l) notify buffer zone for the solid waste processing and disposal facilities of more than five tons per day in consultation with the State Pollution Control Board; and

(m) start a scheme on registration of waste pickers and waste dealers.

12. Duties of District Magistrate or District Collector or Deputy Commissioner.- The District Magistrate or District Collector or as the case may be , the Deputy Commissioner shall, -

(a) facilitate identification and allocation of suitable land as per clause (f) of rules 11 for setting up solid waste processing and disposal facilities to local authorities in his district in close coordination with the Secretary-in-charge of State Urban Development Department within one year from the date of notification of these rules;

(b) review the performance of local bodies, at least once in a quarter on waste segregation, processing, treatment and disposal and take corrective measures in consultation with the Commissioner or Director of Municipal Administration or Director of local bodies and secretary-in-charge of the State Urban Development.

13. Duties of the Secretary–in-charge of Village Panchayats or Rural Development Department in the State and Union territory.- (1) The Secretary–in-charge of Village Panchayats or Rural Development Department in the State and Union territory shall have the same duties as the Secretary–in-charge, Urban Development in the States and Union territories, for the areas which are covered under these rules and are under their jurisdictions.

14. Duties of Central Pollution Control Board.-The Central Pollution Control Board shall, -

(a) co-ordinate with the State Pollution Control Boards and the Pollution Control Committees for implementation of these rules and adherence to the prescribed standards by local authorities;

(b) formulate the standards for ground water, ambient air, noise pollution, leachate in respect of all solid waste processing and disposal facilities;

(c) review environmental standards and norms prescribed for solid waste processing facilities or treatment technologies and update them as and when required;

(d) review through State Pollution Control Boards or Pollution Control Committees, at least once in a year, the implementation of prescribed environmental standards for solid waste processing facilities or treatment technologies and compile the data monitored by them;

(e) review the proposals of State Pollution Control Boards or Pollution Control Committees on use of any new technologies for processing, recycling and treatment of solid waste and prescribe performance standards, emission norms for the same within 6 months;

(f) monitor through State Pollution Control Boards or Pollution Control Committees the implementation of these rules by local bodies;

(g) prepare an annual report on implementation of these rules on the basis of reports received from State Pollution Control Boards and Committees and submit to the Ministry of Environment, Forest and Climate Change and the report shall also be put in public domain;

(h) publish guidelines for maintaining buffer zone restricting any residential, commercial or any other construction activity from the outer boundary of the waste processing and disposal facilities for different sizes of facilities handling more than five tons per day of solid waste;

(i) publish guidelines, from time to time, on environmental aspects of processing and disposal of solid waste to enable local bodies to comply with the provisions of these rules; and

(j) provide guidance to States or Union territories on inter-state movement of waste.

15 Duties and responsibilities of local authorities and village Panchayats of census towns and urban agglomerations.- The local authorities and Panchayats shall,-

(a) prepare a solid waste management plan as per state policy and strategy on solid waste management within six months from the date of notification of state policy and strategy and submit a copy to respective departments of State Government or Union territory Administration or agency authorised by the State Government or Union territory Administration;

(b) arrange for door to door collection of segregated solid waste from all households including slums and informal settlements, commercial, institutional and other non residential premises. From multi-storage buildings, large commercial complexes, malls, housing complexes, etc., this may be collected from the entry gate or any other designated location;

(c) establish a system to recognise organisations of waste pickers or informal waste collectors and promote and establish a system for integration of these authorised waste-pickers and waste collectors to facilitate their participation in solid waste management including door to door collection of waste;

(d) facilitate formation of Self Help Groups, provide identity cards and thereafter encourage integration in solid waste management including door to door collection of waste;

(e) frame bye-laws incorporating the provisions of these rules within one year from the date of notification of these rules and ensure timely implementation;

(f) prescribe from time to time user fee as deemed appropriate and collect the fee from the waste generators on its own or through authorised agency;

(g) direct waste generators not to litter i.e throw or dispose of any waste such as paper, water bottles, liquor bottles, soft drink canes, tetra packs, fruit peel, wrappers, etc., or burn or burry waste on streets, open public spaces, drains, waste bodies and to segregate the waste at source as prescribed under these rules and hand over the segregated waste to authorised the waste pickers or waste collectors authorised by the local body;

(h) setup material recovery facilities or secondary storage facilities with sufficient space for sorting of recyclable materials to enable informal or authorised waste pickers and waste collectors to separate recyclables from the waste and provide easy access to waste pickers and recyclers for collection of segregated recyclable waste such as paper, plastic, metal, glass, textile from the source of generation or from material recovery facilities; Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black;

(i) establish waste deposition centres for domestic hazardous waste and give direction for waste generators to deposit domestic hazardous wastes at this centre for its safe disposal. Such facility shall be established in a city or town in a manner that one centre is set up for the area of twenty square kilometers or part thereof and notify the timings of receiving domestic hazardous waste at such centres;

(j) ensure safe storage and transportation of the domestic hazardous waste to the hazardous waste disposal facility or as may be directed by the State Pollution Control Board or the Pollution Control Committee;

(k) direct street sweepers not to burn tree leaves collected from street sweeping and store them separately and handover to the waste collectors or agency authorised by local body;

(l) provide training on solid waste management to waste-pickers and waste collectors;

(m) collect waste from vegetable, fruit, flower, meat, poultry and fish market on day to day basis and promote setting up of decentralised compost plant or bio-methanation plant at suitable locations in the markets or in the vicinity of markets ensuring hygienic conditions;

(n) collect separately waste from sweeping of streets, lanes and by-lanes daily, or on alternate days or twice a week depending on the density of population, commercial activity and local situation;

(o) set up covered secondary storage facility for temporary storage of street sweepings and silt removed from surface drains in cases where direct collection of such waste into transport vehicles is not convenient. Waste so collected shall be collected and disposed of at regular intervals as decided by the local body;

(p) collect horticulture, parks and garden waste separately and process in the parks and gardens, as far as possible;

(q) transport segregated bio-degradable waste to the processing facilities like compost plant, bio-methanation plant or any such facility. Preference shall be given for on site processing of such waste;

(r) transport non-bio-degradable waste to the respective processing facility or material recovery facilities or secondary storage facility;

(s) transport construction and demolition waste as per the provisions of the Construction and Demolition Waste management Rules, 2016;

(t) involve communities in waste management and promotion of home composting, bio-gas generation, decentralised processing of waste at community level subject to control of odour and maintenance of hygienic conditions around the facility;

(u) phase out the use of chemical fertilizer in two years and use compost in all parks, gardens maintained by the local body and wherever possible in other places under its jurisdiction. Incentives may be provided to recycling initiatives by informal waste recycling sector.

(v) facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure on their own or with private sector participation or through any agency for optimum utilisation of various components of solid waste adopting suitable technology including the following technologies and adhering to the guidelines issued by the Ministry of Urban Development from time to time and standards prescribed by the Central Pollution Control Board. Preference shall be given to decentralised processing to minimize transportation cost and environmental impacts such as-

a) bio-methanation, microbial composting, vermi-composting, anaerobic digestion or any other appropriate processing for bio-stabilisation of biodegradable wastes;

b) waste to energy processes including refused derived fuel for combustible fraction of waste or supply as feedstock to solid waste based power plants or cement kilns;

(w) undertake on their own or through any other agency construction, operation and maintenance of sanitary landfill and associated infrastructure as per Schedule 1 for disposal of residual wastes in a manner prescribed under these rules;

(x) make adequate provision of funds for capital investments as well as operation and maintenance of solid waste management services in the annual budget ensuring that funds for discretionary functions of the local body have been allocated only after meeting the requirement of necessary funds for solid waste management and other obligatory functions of the local body as per these rules;

(y) make an application in Form-I for grant of authorisation for setting up waste processing, treatment or disposal facility, if the volume of waste is exceeding five metric tones per day including sanitary landfills from the State Pollution Control Board or the Pollution Control Committee, as the case may be;

(z) submit application for renewal of authorisation at least sixty days before the expiry of the validity of authorisation;

(za) prepare and submit annual report in Form IV on or before the 30th April of the succeeding year to the Commissioner or Director, Municipal Administration or designated Officer;

(zb) the annual report shall then be sent to the Secretary -in-Charge of the State Urban Development Department or village panchayat or rural development department and to the respective State Pollution Control Board or Pollution Control Committee by the 31st May of every year;

(zc) educate workers including contract workers and supervisors for door to door collection of segregated waste and transporting the unmixed waste during primary and secondary transportation to processing or disposal facility;

(zd) ensure that the operator of a facility provides personal protection equipment including uniform, fluorescent jacket, hand gloves, raincoats, appropriate foot wear and masks to all workers handling solid waste and the same are used by the workforce;

(ze) ensure that provisions for setting up of centers for collection, segregation and storage of segregated wastes, are incorporated in building plan while granting approval of building plan of a group housing society or market complex; and

(zf) frame bye-laws and prescribe criteria for levying of spot fine for persons who litters or fails to comply with the provisions of these rules and delegate powers to officers or local bodies to levy spot fines as per the bye laws framed; and

(zg) create public awareness through information, education and communication campaign and educate the waste generators on the following; namely:-

(i) not to litter;

(ii) minimise generation of waste;

(iii) reuse the waste to the extent possible;

(iv) practice segregation of waste into bio–degradable, non-biodegradable (recyclable and combustible), sanitary waste and domestic hazardous wastes at source;

(v) practice home composting, vermi-composting, bio-gas generation or community level composting;

(vi) wrap securely used sanitary waste as and when generated in the pouches provided by the brand owners or a suitable wrapping as prescribed by the local body and place the same in the bin meant for non- biodegradable waste;

(vii) storage of segregated waste at source in different bins;

(viii) handover segregated waste to waste pickers, waste collectors, recyclers or waste collection agencies; and

(ix) pay monthly user fee or charges to waste collectors or local bodies or any other person authorised by the local body for sustainability of solid waste management.

(zh) stop land filling or dumping of mixed waste soon after the timeline as specified in rule 23 for setting up and operationalisation of sanitary landfill is over;

(zi) allow only the non-usable, non-recyclable, non-biodegradable, non-combustible and non-reactive inert waste and pre-processing rejects and residues from waste processing facilities to go to sanitary landfill and the sanitary landfill sites shall meet the specifications as given in Schedule–I, however, every effort shall be made to recycle or reuse the rejects to achieve the desired objective of zero waste going to landfill;

(zj) investigate and analyse all old open dumpsites and existing operational dumpsites for their potential of bio- mining and bio-remediation and wheresoever feasible, take necessary actions to bio-mine or bio-remediate the sites;

(zk) in absence of the potential of bio-mining and bio-remediation of dumpsite, it shall be scientifically capped as per landfill capping norms to prevent further damage to the environment.

16. Duties of State Pollution Control Board or Pollution Control Committee.-

(1) The State Pollution Control Board or Pollution Control Committee shall,-

(a) enforce these rules in their State through local bodies in their respective jurisdiction and review implementation of these rules at least twice a year in close coordination with concerned Directorate of Municipal Administration or Secretary-in-charge of State Urban Development Department;

(b) monitor environmental standards and adherence to conditions as specified under the Schedule I and Schedule II for waste processing and disposal sites;

(c) examine the proposal for authorisation and make such inquiries as deemed fit, after the receipt of the application for the same in Form I from the local body or any other agency authorised by the local body;

(d) while examining the proposal for authorisation, the requirement of consents under respective enactments and views of other agencies like the State Urban Development Department, the Town and Country Planning Department, District Planning Committee or Metropolitan Area Planning Committee, as may be applicable, Airport or Airbase Authority, the Ground Water Board, Railways, power distribution companies, highway department and other relevant agencies shall be taken into consideration and they shall be given four weeks time to give their views, if any;

(e) issue authorisation within a period of sixty days in Form II to the local body or an operator of a facility or any other agency authorised by local body stipulating compliance criteria and environmental standards as specified in Schedules I and II including other conditions, as may be necessary;

(f) synchronise the validity of said authorisation with the validity of the consents;

(g) suspend or cancel the authorization issued under clause (a) any time, if the local body or operator of the facility fails to operate the facility as per the conditions stipulated: provided that no such authorization shall be suspended or cancelled without giving notice to the local body or operator, as the case may be; and

(h) on receipt of application for renewal, renew the authorisation for next five years, after examining every application on merit and subject to the condition that the operator of the facility has fulfilled all the provisions of the rules, standards or conditions specified in the authorisation, consents or environment clearance.

(2) The State Pollution Control Board or Pollution Control Committee shall, after giving reasonable opportunity of being heard to the applicant and for reasons thereof to be recorded in writing, refuse to grant or renew an authorisation.

(3) In case of new technologies, where no standards have been prescribed by the Central Pollution Control Board, State Pollution Control Board or Pollution Control Committee, as the case may be, shall approach Central Pollution Control Board for getting standards specified.

(4) The State Pollution Control Board or the Pollution Control Committee, as the case may be, shall monitor the compliance of the standards as prescribed or laid down and treatment technology as approved and the conditions stipulated in the authorisation and the standards specified in Schedules I and II under these rules as and when deemed appropriate but not less than once in a year.

(5) The State Pollution Control Board or the Pollution Control Committee may give directions to local bodies for safe handling and disposal of domestic hazardous waste deposited by the waste generators at hazardous waste deposition facilities.

(6) The State Pollution Control Board or the Pollution Control Committee shall regulate Inter-State movement of waste.

17. Duty of manufacturers or brand owners of disposable products and sanitary napkins and diapers.-

(1) All manufacturers of disposable products such as tin, glass, plastics packaging, etc., or brand owners who introduce such products in the market shall provide necessary financial assistance to local authorities for establishment of waste management system.

(2) All such brand owners who sell or market their products in such packaging material which are non- biodegradable shall put in place a system to collect back the packaging waste generated due to their production.

(3) Manufacturers or brand owners or marketing companies of sanitary napkins and diapers shall explore the possibility of using all recyclable materials in their products or they shall provide a pouch or wrapper for disposal of each napkin or diapers along with the packet of their sanitary products.

(4) All such manufacturers, brand owners or marketing companies shall educate the masses for wrapping and disposal of their products.

18. Duties of the industrial units located within one hundred km from the refused derived fuel and waste to energy plants based on solid waste- All industrial units using fuel and located within one hundred km from a solid waste based refused derived fuel plant shall make arrangements within six months from the date of notification of these rules to replace at least five percent of their fuel requirement by refused derived fuel so produced.

19. Criteria for Duties regarding setting-up solid waste processing and treatment facility.-

(1) The department in- charge of the allocation of land assignment shall be responsible for providing suitable land for setting up of the solid waste processing and treatment facilities and notify such sites by the State Government or Union territory Administration.

(2) The operator of the facility shall design and set up the facility as per the technical guidelines issued by the Central Pollution Control Board in this regard from time to time and the manual on solid waste management prepared by the Ministry of Urban Development.

(3) The operator of the facility shall obtain necessary approvals from the State Pollution Control Board or Pollution Control Committee.

(4) The State Pollution Control Board or Pollution Control Committee shall monitor the environment standards of the operation of the solid waste processing and treatment facilities.

(5) The operator of the facility shall be responsible for the safe and environmentally sound operations of the solid waste processing and or treatment facilities as per the guidelines issued by the Central Pollution Control Board from time to time and the Manual on

Municipal Solid Waste Management published by the Ministry of Urban Development and updated from time to time.

(6) The operator of the solid waste processing and treatment facility shall submit annual report in Form III each year by 30th April to the State Pollution Control Board or Pollution Committee and concerned local body.

20. Criteria and actions to be taken for solid waste management in hilly areas.- In the hilly areas, the duties and responsibilities of the local authorities shall be the same as mentioned in rule 15 with additional clauses as under:

(a) Construction of landfill on the hill shall be avoided. A transfer station at a suitable enclosed location shall be setup to collect residual waste from the processing facility and inert waste. A suitable land shall be identified in the plain areas down the hill within 25 kilometers for setting up sanitary landfill. The residual waste from the transfer station shall be disposed of at this sanitary landfill.

(b) In case of non-availability of such land, efforts shall be made to set up regional sanitary landfill for the inert and residual waste.

(c) Local body shall frame Bye-laws and prohibit citizen from littering wastes on the streets and give strict direction to the tourists not to dispose any waste such as paper, water bottles, liquor bottles, soft drink canes, tetra packs, any other plastic or paper waste on the streets or down the hills and instead direct to deposit such waste in the litter bins that shall be placed by the local body at all tourist destinations.

(d) Local body shall arrange to convey the provisions of solid waste management under the bye-laws to all tourists visiting the hilly areas at the entry point in the town as well as through the hotels, guest houses or like where they stay and by putting suitable hoardings at tourist destinations.

(e) Local body may levy solid waste management charge from the tourist at the entry point to make the solid waste management services sustainable.

(f) The department in- charge of the allocation of land assignment shall identify and allot suitable space on the hills for setting up decentralised waste processing facilities. Local body shall set up such facilities. Step garden system may be adopted for optimum utilisation of hill space.

21. Criteria for waste to energy process.-

(1) Non recyclable waste having calorific value of 1500 K/cal/kg or more shall not be disposed of on landfills and shall only be utilised for generating energy either or through refuse derived fuel or by giving away as feed stock for preparing refuse derived fuel.

(2) High calorific wastes shall be used for co-processing in cement or thermal power plants.

(3) The local body or an operator of facility or an agency designated by them proposing to set up waste to energy plant of more than five tones per day processing capacity shall submit an application in Form-I to the State Pollution Control Board or Pollution Control Committee, as the case may be, for authorisation.

(4) The State Pollution Control Board or Pollution Control Committee, on receiving such application for setting up waste to energy facility, shall examine the same and grant permission within sixty days.

22. Time frame for implementation.- Necessary infrastructure for implementation of these rules shall be created by the local bodies and other concerned authorities, as the case may be, on their own, by directly or engaging agencies within the time frame specified below:

Sl. No.	Activity	Time limit from the date of notification of rules
(1)	(2)	(3)
1.	identification of suitable sites for setting up solid waste processing facilities	1 year
2.	identification of suitable sites for setting up common regional sanitary landfill facilities for suitable clusters of local authorities under 0.5 million population and for setting up common regional sanitary landfill facilities or stand alone sanitary landfill facilities by all local authorities having a population of 0.5 million or more .	1 year
3.	procurement of suitable sites for setting up solid waste processing facility and sanitary landfill facilities	2 years
4.	enforcing waste generators to practice segregation of bio degradable, recyclable, combustible, sanitary waste domestic hazardous and inert solid wastes at source ,	2 years
5.	Ensure door to door collection of segregated waste and its transportation in covered vehicles to processing or disposal facilities.	2 years
6.	ensure separate storage, collection and transportation of construction and demolition wastes	2 years
7.	setting up solid waste processing facilities by all local bodies having 100000 or more population	2 years
8.	Setting up solid waste processing facilities by local bodies and census towns below 100000 population.	3 years
9	setting up common or stand alone sanitary landfills by or for all local bodies having 0.5 million or more population for the disposal of only such residual wastes from the processing facilities as well as untreatable inert wastes as permitted under the Rules	3 years
10.	setting up common or regional sanitary landfills by all local bodies and census towns under 0.5 million population for the disposal of permitted waste under the rules	3years
11.	bio-remediation or capping of old and abandoned dump sites	5years

23. State Level Advisory Body. –

(1) Every Department in-charge of local bodies of the concerned State Government or Union territory administration shall constitute a State Level Advisory Body within six months from the date of notification of these rules comprising the following members, namely:-

Sl. No	Designation	Member
(1)	(2)	(3)
1.	Secretary, Department of Urban Development orLocal self government department of the State	Chairperson, ex- officio
2.	One representative of Panchayats or Rural development Department not below the rank of Joint Secretary to State Government	Member, ex-officio
3.	one representative of Revenue Department of State Government	Member, ex-officio
4.	One representative from Ministry of Environment, Forest and Climate Change Government of India	Member, ex-officio
5.	One representative from Ministry of Urban Development, Government of India	Member, ex-officio
6.	One representative from Ministry of Rural Development, Government of India	Member, ex-officio
7.	One representative from the Central Pollution Control Board	Member, ex-officio
8.	One representative from the State Pollution Control Board or Pollution Control Committee	Member, ex-officio
9.	One representative from Indian Institute of Technology or National Institute of Technology	Member,Ex-officio
10.	Chief town planner of the state	Member
11.	Three representatives from the local bodies by rotation	Member
12.	Two representatives from census towns or urban agglomerations by rotation.	Member
13.	One representative from reputed Non-Governmental Organisation or Civil Society working for the waste pickers or informal recycler or solid waste management	Member
14.	One representative from a body representing Industries at the State or Central level	Member
15.	one representative from waste recycling industry	member
16.	Two subject experts	Member
17.	Co-opt one representative each from agriculture department, and labour department of State Government.	Member

(2) The State Level Advisory Body shall meet at least one in every six months to review the matters related to implementation of these rules, state policy and strategy on solid waste management and give advice to state government for taking measures that are necessary for expeditious and appropriate implementation of these rules.

(3) The copies of the review report shall be forwarded to the State Pollution Control Board or Pollution Control Committee for necessary action.

24. Annual report.-

(1) The operator of facility shall submit the annual report to the local body in Form-III on or before the 30th day of April every year.

(2) The local body shall submit its annual report in Form-IV to State P Control Board or P Committee and the Secretary-in-Charge of the Department of Urban Development of the concerned State or Union Territory in case of metropolitan city and to the Director of Municipal Administration or Commissioner of Municipal Administration or Officer in -Charge of Urban local bodies in the state in case of all other local bodies of state on or before the 30th day of June every year

(3) Each State Pollution Control Board or Pollution Control Committee as the case may be, shall prepare and submit the consolidated annual report to the Central Pollution Control Board and Ministry of Urban Development on the implementation of these rules and action taken against non complying local body by the 31stday of July of each year in Form-V.

(4) The Central Pollution Control Board shall prepare a consolidated annual review report on the status of implementation of these rules by local bodies in the country and forward the same to the Ministry of Urban Development and Ministry of Environment, Forest and Climate Change, along with its recommendations before the 31stday of August each year.

(5) The annual report shall be reviewed by the Ministry of Environment, Forest and Climate Change during the meeting of Central Monitoring Committee.

25. Accident reporting- In case of an accident at any solid waste processing or treatment or disposal facility or landfill site, the Officer- in- charge of the facility shall report to the local body in Form-VI and the local body shall review and issue instructions if any, to the in- charge of the facility.

SCHEDULE I

[see rule 15 (w),(zi), 16 (1) (b) (e), 16 (4)]

Specifications for Sanitary Landfills

(A) Criteria for site selection.-

(i) The department in the business allocation of land assignment shall provide suitable site for setting up of the solid waste processing and treatment facilities and notify such sites.

(ii) The sanitary landfill site shall be planned, designed and developed with proper documentation of construction plan as well as a closure planin a phased manner. In case a new landfill facility is being established adjoining an existing landfill site, the closure plan of existing landfill should form a part of the proposal of such new landfill.

(iii) The landfill sites shall be selected to make use of nearby wastes processing facilities. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.

(iv) Landfill sites shall be set up as per the guidelines of the Ministry of Urban Development, Government of India and Central Pollution Control Board.

(v) The existing landfill sites which are in use for more than five years shall be improved in accordance with the specifications given in this Schedule.

(vi) The landfill site shall be large enough to last for at least 20-25 years and shall develop 'landfill cells' in a phased manner to avoid water logging and misuse.

(vii) The landfill site shall be 100 meter away from river, 200 meter from a pond, 200 meter from Highways, Habitations, Public Parks and water supply wells and 20 km away from Airports or Airbase. However in a special case, landfill site may be set up within a distance of 10 and 20 km away from the Airport/Airbase after obtaining no objection certificate from the civil aviation authority/ Air force as the case may be. The Landfill site shall not be permitted within the flood plains as recorded for the last 100 years, zone of coastal regulation, wetland, Critical habitat areas, sensitive eco-fragile areas..

(viii) The sites for landfill and processing and disposal of solid waste shall be incorporated in the Town Planning Department's land-use plans.

(ix) A buffer zone of no development shall be maintained around solid waste processing and disposal facility, exceeding five Tonnes per day of installed capacity. This will be maintained within the total area of the solid waste processing and disposal facility. The buffer zone shall be prescribed on case to case basis by the local body in consultation with concerned State Pollution Control Board.

(x) The biomedical waste shall be disposed of in accordance with the Bio-medical Waste Management Rules, 2016, as amended from time to time . The hazardous waste shall be managed in accordance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended from time to time. The E- waste shall be managed in accordance with the e-Waste (Management) Rules, 2016 as amended from time to time.

(xi) Temporary storage facility for solid waste shall be established in each landfill site to accommodate the waste in case of non- operation of waste processing and during emergency or natural calamities.

(B) Criteria for development of facilities at the sanitary landfills.-

(i) Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles, to prevent entry of unauthorised persons and stray animals

(ii) The approach and / internal roads shall be concreted or paved so as to avoid generation of dust particles due to vehicular movement and shall be so designed to ensure free movement of vehicles and other machinery.

(iii) The landfill site shall have waste inspection facility to monitor waste brought in for landfilling h, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipment. The operator of the facility shall maintain record of waste received, processed and disposed.

(iv) Provisions like weigh bridge to measure quantity of waste brought at landfill site, fire protection equipment and other facilities as may be required shall be provided.

(v) Utilities such as drinking water and sanitary facilities (preferably washing/bathing facilities for workers) and lighting arrangements for easy landfill operations during night hours shall be provided.

(vi) Safety provisions including health inspections of workers at landfill sites shall be carried out made.

(vii) Provisions for parking, cleaning, washing of transport vehicles carrying solid waste shall be provided. The wastewater so generated shall be treated to meet the prescribed standards.

(C) Criteria for specifications for land filling operations and closure on completion of land filling.-

(i) Waste for land filling shall be compacted in thin layers using heavy compactors to achieve high density of the waste. In high rainfall areas where heavy compactors cannot be used, alternative measures shall be adopted.

(ii) Till the time waste processing facilities for composting or recycling or energy recovery are set up, the waste shall be sent to the sanitary landfill. The landfill cell shall be covered at the end of each working day with minimum 10 cm of soil, inert debris or construction material..

(iii) Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. Proper drainage shall be constructed to divert run-off away from the active cell of the landfill.

(iv) After completion of landfill, a final cover shall be designed to minimise infiltration and erosion. The final cover shall meet the following specifications, namely :--

a) The final cover shall have a barrier soil layer comprising of 60 cm of clay or amended soil with permeability coefficient less than 1 x 10-7 cm/sec.

b) On top of the barrier soil layer, there shall be a drainage layer of 15 cm.

c) On top of the drainage layer, there shall be a vegetative layer of 45 cm to support natural plant growth and to minimise erosion.

(D) Criteria for pollution prevention.-In order to prevent pollution from landfill operations, the following provisions shall be made, namely:-

(i) The storm water drain shall be designed and constructed in such a way that the surface runoff water is diverted from the landfilling site and leachates from solid waste locations do not get mixed with the surface runoff water. Provisions for diversion of storm water discharge drains shall be made to minimise leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions.

(ii) Non-permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) shall have liner of composite barrier of 1.5 mm thick high density polyethylene (HDPE) geo-membrane or geo-synthetic liners, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1 x 10-7 cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer provided at the bottom of landfills.

(iii) Provisions for management of leachates including its collection and treatment shall be made. The treated leachate shall be recycled or utilized as permitted, otherwise shall be released into the sewerage line, after meeting the standards specified in Schedule- II.. In no case, leachate shall be released into open environment.

(iv) Arrangement shall be made to prevent leachate runoff from landfill area entering any drain, stream, river, lake or pond. In case of mixing of runoff water with leachate or solid waste, the entire mixed water shall be treated by the concern authority.

(E) Criteria for water quality monitoring.-

(i) Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 meter of the periphery of landfill site shall be periodically monitored covering different seasons in a year that is, summer, monsoon and post-monsoon period to ensure that the ground water is not contaminated.

(ii) Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) shall be considered only after ensuring its quality. The following specifications for drinking water quality shall apply for monitoring purpose, namely :-

S. No.	Parameters	IS 10500:2012, Edition 2.2(2003-09) Desirable limit (mg/l except for pH)
(1)	(2)	(3)
	Arsenic	0.01
	Cadmium	0.01
	Chromium(as Cr6+)	0.05
	Copper	0.05
	Cyanide	0.05
	Lead	0.05
	Mercury	0.001
	Nickel	-
	Nitrate as NO3	45.0
	pH	6.5-8.5
	Iron	0.3
	Total hardness (as CaCO3)	300.0
	Chlorides	250
	Dissolved solids	500
	Phenolic compounds (as C6H5OH)	0.001
	Zinc	5.0
	Sulphate (as SO4)	200

(F) Criteria for ambient air quality monitoring.-

(i) Landfill gas control system including gas collection system shall be installed at landfill site to minimize odour, prevent off-site migration of gases, to protect vegetation planted on the rehabilitated landfill surface. For enhancing landfill gas recovery, use of geomembranes in cover systems along with gas collection wells should be considered.

(ii) The concentration of methane gas generated at landfill site shall not exceed 25 per cent of the lower explosive limit (LEL).

(iii) The landfill gas from the collection facility at a landfill site shall be utilized for either direct thermal applications or power generation, as per viability. Otherwise, landfill gas shall be burnt (flared) and shall not be allowed to escape directly to the atmosphere or for illegal tapping. Passive venting shall be allowed in case if its utilisation or flaring is not possible.

(iv) Ambient air quality at the landfill site and at the vicinity shall be regularly monitored. Ambient air quality shall meet the standards prescribed by the Central Pollution Control Board for Industrial area.

G. Criteria for plantation at landfill Site.- A vegetative cover shall be provided over the completed site in accordance with the following specifications, namely:-

(a) Locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be planted;

(b) The selection of plants should be of such variety that their roots do not penetrate more than 30 cms. This condition shall apply till the landfill is stabilized;

(c) Selected plants shall have ability to thrive on low-nutrient soil with minimum nutrient addition;

(d) Plantation to be made in sufficient density to minimise soil erosion.

(e) Green belts shall be developed all around the boundary of the landfill in consultation with State Pollution Control Boards or Pollution Control Committees .

H. Criteria for post-care of landfill site.-

(1) The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following, namely :-'

(a) Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(b) Monitoring leachate collection system in accordance with the requirement;

(c) Monitoring of ground water in and around landfill;

(d) Maintaining and operating the landfill gas collection system to meet the standards.

(2) Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous emission and leachate quality analysis complies with the specified standards and the soil stability is ensured.

I. Criteria for special provisions for hilly areas.-Cities and towns located on hills shall have location-specific methods evolved for final disposal of solid waste by the local body with the approval of the concerned State Pollution Control Board or the Pollution Control Committee. The local body shall set up processing facilities for utilisation of biodegradable organic waste. The non-biodegradable recyclable materials shall be stored and sent for recycling periodically. The inert and non-biodegradable waste shall be used for building roads or filling-up of appropriate areas on hills. In case of constraints in finding adequate land in hilly areas, waste not suitable for road-laying or filling up shall be disposed of in regional landfills in plain areas.

J. Closure and Rehabilitation of Old Dumps- Solid waste dumps which have reached their full capacity or those which will not receive additional waste after setting up of new and

properly designed landfills should be closed and rehabilitated by examining the following options:

(i) Reduction of waste by bio mining and waste processing followed by placement of residues in new landfills or capping as in (ii) below.

(ii) Capping with solid waste cover or solid waste cover enhanced with geomembrane to enable collection and flaring / utilisation of greenhouse gases.

(iii) Capping as in (ii) above with additional measures (in alluvial and other coarse grained soils) such as cut-off walls and extraction wells for pumping and treating contaminated ground water.

(iv) Any other method suitable for reducing environmental impact to acceptable level.

SCHEDULE II

[see rule 16 (1), (b), (e), 16 (4))

Standards of processing and treatment of solid waste

A. Standards for composting.- The waste processing facilities shall include composting as one of the technologies for processing of bio degradable waste. In order to prevent pollution from compost plant, the following shall be complied with namely :-

(a) The incoming organic waste at site shall be stored properly prior to further processing. To the extent possible, the waste storage area should be covered. If, such storage is done in an open area, it shall be provided with impermeable base with facility for collection of leachate and surface water run-off into lined drains leading to a leachate treatment and disposal facility;

(b) Necessary precaution shall be taken to minimise nuisance of odour, flies, rodents, bird menace and fire hazard;

(c) In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of waste to the temporary processing site or temporary landfill sites which will be again reprocessed when plant is in order;

(d) Pre-process and post-process rejects shall be removed from the processing facility on regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclable high calorific fractions to be segregated and sent to waste to energy or for RDF production, co-processing in cement plants or to thermal power plants. Only rejects from all processes shall be sent for sanitary landfill site(s).

(e) The windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay of 50 cm thick having permeability coefficient less than 10–7 cm/sec. The base shall be provided with 1 to 2 per cent slope and circled by lined drains for collection of leachate or surface run-off;

(f) Ambient air quality monitoring shall be regularly carried out. Odurnuisance at down-wind direction on the boundary of processing plant shall also be checked regularly.

(g) Leachate shall be re-circulated in compost plant for moisture maintenance.

(h) The end product compost shall meet the standards prescribed under Fertilizer Control Order notified from time to time.

(i) In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:-

Parameters	Organic Compost (FCO 2009)	Phosphate Rich Organic Manure (FCO 2013)
(1)	(2)	(3)
Arsenic (mg/Kg)	10.00	10.00
Cadmium (mg/Kg)	5.00	5.00
Chromium (mg/Kg)	50.00	50.00
Copper (mg/Kg)	300.00	300.00
Lead (mg/Kg)	100.00	100.00
Mercury (mg/Kg)	0.15	0.15
Nickel (mg/Kg)	50.00	50.00
Zinc (mg/Kg)	1000.00	1000.00
C/N ratio	<20	Less than 20:1
pH	6.5-7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum	15.0-25.0	25.0
Bulk density (g/cm3)	<1.0	Less than 1.6
Total Organic Carbon, per cent by weight, minimum	12.0	7.9
Total Nitrogen (as N), per cent by weight, minimum	0.8	0.4
Total Phosphate (as P205) percent by weight, minimum	0.4	10.4
Total Potassium (as K20), percent by weight, minimum	0.4	-
Colour	Dark brown to black	-
Odour	Absence of foul Odor	-
Particle size	Minimum 90% material should pass through 4.0 mm IS sieve	Minimum 90% material should pass through 4.0 mm IS sieve
Conductivity (as dsm-1), not more than	4.0	8.2

* Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.

B. Standards for treated leachates.-The disposal of treated leachates shall meet the following standards, namely:-

S. No	Parameter	Standards (Mode of Disposal)		
		Inland surface water	Public sewers	Land disposal
(1)	(2)	(3)	(4)	(5)
1.	Suspended solids, mg/l, max	100	600	200
2.	Dissolved solids (inorganic) mg/l, max.	2100	2100	2100
3	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4	Ammonical nitrogen (as N), mg/l, max.	50	50	-
5	Total Kjeldahl nitrogen (as N), mg/l, max.	100	-	-
6	Biochemical oxygen demand (3 days at 27^0 C) max. (mg/l)	30	350	100
7	Chemical oxygen demand, mg/l, max.	250	-	-
8	Arsenic (as As), mg/l, max	0.2	0.2	0.2
9	Mercury (as Hg), mg/l, max	0.01	0.01	-
10	Lead (as Pb), mg/l, max	0.1	1.0	-
11	Cadmium (as Cd), mg/l, max	2.0	1.0	-
12	Total Chromium (as Cr), mg/l, max.	2.0	2.0	-
13	Copper (as Cu), mg/l, max.	3.0	3.0	-
14	Zinc (as Zn), mg/l, max.	5.0	15	-
15	Nickel (as Ni), mg/l, max	3.0	3.0	-
16	Cyanide (as CN), mg/l, max.	0.2	2.0	0.2
17	Chloride (as Cl), mg/l, max.	1000	1000	600
18	Fluoride (as F), mg/l, max	2.0	1.5	-
19	Phenolic compounds (as C_6H_5OH) mg/l, max.	1.0	5.0	-

Note : While discharging treated leachates into inland surface waters, quantity of leachates being discharged and the quantity of dilution water available in the receiving water body shall be given due consideration.

C. Standards for incineration: The Emission from incinerators /thermal technologies in Solid Waste treatment/disposal facility shall meet the following standards, namely:-

Parameter	Emission standard	
(1)	(2)	(3)
Particulates	50 mg/Nm3	Standard refers to half hourly average value
HCl	50 mg/Nm3	Standard refers to half hourly average value
SO2	200 mg/Nm3	Standard refers to half hourly average value
CO	100 mg/Nm3	Standard refers to half hourly average value
	50 mg/Nm3	Standard refers to daily average value
Total Organic Carbon	20 mg/Nm3	Standard refers to half hourly average value
HF	4 mg/Nm3	Standard refers to half hourly average value
NOx (NO and NO2 expressed as NO2)	400 mg/Nm3	Standard refers to half hourly average value
Total dioxins and furans	0.1 ng TEQ/Nm3	Standard refers to 6-8 hours sampling. Please refer guidelines for 17 concerned congeners for toxic equivalence values to arrive at total toxic equivalence.
Cd + Th + their compounds	0.05 mg/Nm3	Standard refers to sampling time anywhere between 30 minutes and 8 hours.
Hg and its compounds	0.05 mg/Nm3	Standard refers to sampling time anywhere between 30 minutes and 8 hours.
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V + their compounds	0.5 mg/Nm3	Standard refers to sampling time anywhere between 30 minutes and 8 hours.
Note.- All values corrected to 11% oxygen on a dry basis.		

Note:

(a) Suitably designed pollution control devices shall be installed or retrofitted with the incinerator to achieve the above emission limits..

(b) Waste to be incinerated shall not be chemically treated with any chlorinated disinfectants.

(c) Incineration of chlorinated plastics shall be phased out within two years.

(d) if the concentation of toxic metals in incineration ash exceeds the limits specified in the Hazardous Waste (Management, Handling and Trans boundary Movement) Rules, 2008, as amended from time to time, the ash shall be sent to the hazardous waste treatment, storage and disposal fcaility.

(e) Only low sulphur fuel like LDO, LSHS, Diesel, bio-mass, coal, LNG, CNG, RDF and bio-gas shall be used as fuel in the incinerator.

(f) The CO2 concentration in tail gas shall not be more than 7%.

(g) All the facilities in twin chamber incinerators shall be designed to achieve a minimum temperature of 9500C in secondary combustion chamber and with a gas residence time in secondary combustion chamber not less than 2 (two) seconds.

(h) Incineration plants shall be operated (combustion chambers) with such temperature, retention time and turbulence, as to achieve total Organic Carbon (TOC) content in the slag and bottom ash less than 3%, or the loss on ignition is less than 5% of the dry weight.

(i) Odour from sites shall be managed as per guidelines of CPCB issued from time to time

FORM – I

[see rule 15 (y) 16 (1) (c), 21(3)]

Application for obtaining authorisation under solid waste management rules for processing/recycling/treatment and disposal of solid waste

To,

The Member Secretary,

State Pollution Control Board or Pollution Control Committee,

of…....

Sir,

I/We hereby apply for authorisation under the Solid Waste Management Rules, 2016 for processing, recycling, treatment and disposal of solid waste.

1.	Name of the local body/agency appointed by them/ operator of facility	
2.	Correspondence address Telephone No. Fax No. ,e-mail:	
3.	Nodal Officer & designation(Officer authorised by the local body or agency responsible for operation of processing/ treatment or disposal facility)	
4.	Authorisation required for setting up and operation of the facility (Please tick mark)	waste processing recycling treatment disposal at landfill

5.	Attach copies of the Documents Site clearance (local body) Proof of Environmental Clearance Consent for establishment Agreement between municipal authority and operating agency Investment on the project and expected return	
6.	**Processing/recycling/treatment of solid waste** (i) Total Quantity of waste to be processed per day Quantity of waste to be recycled Quantity of waste to be treated Quantity of waste to be disposed into landfill (ii) Utilisation programme for waste processed (Product utilisation) (iii) Methodology for disposal (attach details) Quantity of leachate Treatment technology for leachate (iv) Measures to be taken for prevention and control of environmental pollution (v) Measures to be taken for safety of workers working in the plant (vi) Details on solid waste processing/recycling/ treatment/disposal facility (to be attached)	
7.	**Disposal of solid waste** Number of sites identified Quantity of waste to be disposed per day Details of methodology or criteria followed for site selection (attach) Details of existing site under operation Methodology and operational details of landfilling Measures taken to check environmental pollution	
8	Any other information.	

Date: Signature:

Place: Designation

FORM- II

[see rule 16 (1) (e)]

Format for issue of authorisation

File No.: _____

Dated:_____

Authorisation No _____

To

Ref: Your application number _____dt. _____

The _____ State Pollution Control Board/Pollution Control Committee after examining the proposal hereby authorises_____ having administrative office at _____ to set up and operate waste processing/recycling/ treatment/disposal facility at_____

The authorisation is hereby granted to operate the facility for processing, recycling, treatment and disposal of solid waste. The authorisation is subject to the terms and conditions stated below and such conditions as may be otherwise specified

in these rules and the standards laid down in Schedules I and II under these rules.

The _____ State Pollution Control Board/Pollution Control Committees of the UT may, at any time, revoke any of the conditions applicable under the authorisation and shall communicate the same in writing.

Any violation of the provision of the Solid Waste Management Rules, 2016will attract the penal provision of the Environment (Protection) Act, 1986 (29 of 1986).

(Member Secretary)

State Pollution Control Board/Pollution Control Committee of the U

(Signature and designation)

Date:

Place:

FORM – III

[see rule 19 (6), 24 (1)]

Format of annual report to be submitted by the operator of facility to the local body

1	Name of the City/Town and State	
2	Population	
3	Area in sq. kilometers	
4	Name & Address of the local body Telephone No. Fax No. E-mail:	
5	Name and address of operator of the facility	
6	Name of officer in-charge of the facility Phone No: Fax No: E-mail:	
7	Number of households in the city/town , Number of non-residential premises in the city Number of election/ administrative wards in the city/town	
8	Quantity of Solid waste	
	Estimated Quantity of solid waste generated in the local body area per day in metric tones	/tpd
	Quantity of solid waste collected per day	/tpd
	Per capita waste collected per day	/gm/day
	Quantity of solid waste processed	/tpd
	Quantity of solid waste disposed at landfill	/tpd

9	Status of Solid Waste Management (SWM) service	
	Segregation and storage of waste at source Whether solid waste is stored at source in domestic/commercial/ institutional bins If yes, Percentage of households practice storage of waste at source in domestic bins Percentage of non-residential premises practice storage of waste at source in commercial / institutional bins Percentage of households dispose of throw solid waste on the streets Percentage of non-residential premises dispose of throw solid waste on the streets Whether solid waste is stored at source in a segregated form If yes, Percentage of premises segregating the waste at source	 Yes/No % % % % Yes/No %
	Door to Door Collection of solid waste	
	Whether door to door collection (D2D) of solid waste is being done in the city/town	Yes/No
	if yes	
	Number of wards covered in D2D collection of waste	
	No. of households covered	
	No. of non-residential premises including commercial establishments, hotels, restaurants educational institutions/ offices etc covered	
	Percentage of residential and non-residential premises covered in door to door collection through : Motorized vehicle Containerized tricycle/ handcart Other device	% % %
	If not, method of primary collection adopted	
	Sweeping of streets	
	Length of roads, streets, lanes, bye-lanes in the city that need to be cleaned	km

	Frequency of street sweepings and percentage of population covered	fre-quen-cy	Dai-ly	Alter-nate days	Twice a week	Occa-sion-ally
		% of popu-lation cov-ered				
	Tools used					
	Manual sweeping	%				
	Mechanical sweeping	%				
	Whether long handle broom used by sanitation workers	Yes/No				
	Whether each sanitation worker is given handcart/tricycle for collection of waste	Yes/No				
	Whether handcart / tricycle is containerized	Yes/No				
	Whether the collection tool synchronizes with collection/ waste storage containers utilized	Yes/No				
.	Secondary Waste Storage facilities					
	No. and type of waste storage depots in the city/ town	No.	Capacity in m3			
	Open waste storage sites					
	Masonry bins					
	Cement concrete cylinder bins Dhalao/covered rooms/space Covered metal/plastic containers Upto 1.1 m3 bins					
	2 to 5 m3 bins					
	Above 5m3 containers					
	Bin-less city					
	Bin/ population ratio					

	Ward wise details of waste storage depots (attach) : Ward No: Area: Population: No. of bins placed Total volume of bins placed	
	Total storage capacity of waste storage facilities in cubic meters	

	Total waste actually stored at the waste storage depots daily		
	Give frequency of collection of waste from the depots Number of bins cleared	Frequency	No. of bins
		Daily	
		Alternate day	
		Twice a week	
		Once a week	
		Occasionally	
	Whether storage depots have facility for storage of segregated waste in green, blue and black bins	Yes/ No (if yes, add details) No. of green bins: No. of blue bins: No. of black bins:	
	Whether lifting of solid waste from storage depots is manual or mechanical. Give percentage	(%) of Manual Lifting of SOLID WASTE	%
		(%) of Mechanical lifting	%
	If mechanical – specify the method used	front-end loaders/ Top loaders	
	Whether solid waste is lifted from door to door and transported to treatment plant directly in a segregated form	Yes/ No (if yes, specify)	

	Waste Transportation per day Type and Number of vehicles used (pl tick or add)	No. Trips made waste transported
	Animal cart Tractors Non tipping Truck Tipping Truck Dumper Placers Refuse collectors Compactors Others JCB/loader	
	Frequency of transportation of waste	Frequency (%) of waste transported Daily Alternate day Twice a week Once a week Occasionally

	Quantity of waste transported each day	/tpd
	Percentage of total waste transported daily	%
	Waste Treatment Technologies used	
	Whether solid waste is processed	Yes/No
	If yes, Quantity of waste processed daily	/tpd
	Land(s) available with the local body for waste processing (in Hectares)	
	Land currently utilized for waste processing	
	Solid waste processing facilities in operation	
	Solid waste processing facilities under construction	
	Distance of processing facilities from city/town boundary	
	Details of technologies adopted	
	Composting ,	Qty. raw material processed Qty. final product produced Qty. sold Qty. of residual waste landfilled
	vermi composting	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Bio-methanation	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Refuse Derived Fuel	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Waste to Energy technology such as incineration, gasification, pyrolysis or any other technology (give detail)	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled

	Co-processing	Qty. raw material processed
	Combustible waste supplied to cement plant	
	Combustible waste supplied to solid waste based power plants	
	Others	Qty.
	Solid waste disposal facilities	
	No. of dumpsites sites available with the local body	
	No. of sanitary landfill sites available with the local body	
	Area of each such sites available for waste disposal	
	Area of land currently used for waste disposal	
	Distance of dumpsite/landfill facility from city/ town	kms
	Distance from the nearest habitation	kms
	Distance from water body	kms
	Distance from state/national highway	kms
	Distance from Airport	kms
	Distance from important religious places or historical monument	kms
	Whether it falls in flood prone area	Yes/No
	Whether it falls in earthquake fault line area	Yes/No
	Quantity of waste landfilled each day	tpd
	Whether landfill site is fenced	Yes / No
	Whether Lighting facility is available on site	Yes / No
	Whether Weigh bridge facility available	Yes / No

	Vehicles and equipments used at landfill (specify)	Bulldozer, Compacters etc. available
	Manpower deployed at landfill site	Yes/No (if yes, attach details)
	Whether covering is done on daily basis	Yes/No
	If not, Frequency of covering the waste deposited at the landfill	
	Cover material used	
	Whether adequate covering material is available	Yes/No
	Provisions for gas venting provided	Yes/No, (if yes, attach technical data sheet)
	Provision for leachate collection	Yes/No, (if yes, attach technical data sheet)
10	Whether an Action Plan has been prepared for improving solid waste management practices in the city	Yes/No (if Yes attach Action Plan details)
11	What separate provisions are made for : Dairy related activities : Slaughter houses waste : C&D waste (construction debris) :	Attach details on Proposals, Steps taken, Yes/No Yes/No Yes/No
12	Details of Post Closure Plan	Attach Plan
13	How many slums are identified and whether these are provided with Solid Waste Management facilities :	Yes/ No (if Yes, attach details)
14	Give details of manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste	
15	Mention briefly, the difficulties being experienced by the local body in complying with provisions of these rules	
16	Mention briefly, if any innovative idea is implemented to tackle a problem related to solid waste, which could be replicated by other local bodies.	

Dated : Signature of Operator

Place:

FORM – IV

[see rules 15(za), 24(2)]

Format for annual report on solid waste management to be submitted by the local body

CALENDAR YEAR:	**DATE OF SUBMISSION OF REPORT:**

1	Name of the City/Town and State	
2	Population	
3	Area in sq. kilometers	
4	Name & Address of local body Telephone No. Fax No. E-mail:	
5	Name of officer in-charge dealing with solid waste management (SOLID WASTEM)Phone No: Fax No: E-mail:	
6	Number of households in the city/town Number of non-residential premises in the city Number of election/ administrative wards in the city/town	
7	Quantity of Solid waste (solid waste)	
	Estimated Quantity of solid waste generated in the local body area per day in metric tones	/tpd
	Quantity of solid waste collected per day	/tpd
	Per capita waste collected per day	/gm/day
	Quantity of solid waste processed	/tpd
	Quantity of solid waste disposed at dumpsite/ landfill	

8	Status of Solid Waste Management service	/tpd
	Segregation and storage of waste at source	
	Whether SOLID WASTE is stored at source in domestic/commercial/ institutional bins, If yes,	Yes/No
	Percentage of households practice storage of waste at source in domestic bins	%
	Percentage of non-residential premises practice storage of waste at source in commercial /institutional bins	%
	Percentage of households dispose or throw solid waste on the streets	%
	Percentage of non-residential premises dispose of throw solid waste on the streets	%
	Whether solid waste is stored at source in a segregated form, If yes,	Yes/No
	Percentage of premises segregating the waste at source	%
	Door to Door Collection of solid waste	
	Whether door to door collection (D2D) of solid waste is being done in the city/town	Yes/No
	if yes	
	Number of wards covered in D2D collection of waste	
	No. of households covered	
	No. of non-residential premises including commercial establishments ,hotels, restaurants educational institutions/ offices etc covered	
	Percentage of residential and non-residential premises covered in door to door collection through :	%
	Motorized vehicle Containerized tricycle/handcart	%
	Other device	%
	If not, method of primary collection adopted	
	Sweeping of streets	
	Length of roads, streets, lanes, bye-lanes in the city that need to be cleaned	km

	Frequency of street sweepings and percentage of population covered	frequency	Daily	Alternate days	Twice a week	Occasionally
		% of population covered				
	Tools used					
	Manual sweeping			%		
	Mechanical sweeping			%		
	Whether long handle broom used by sanitation workers			Yes/No		
	Whether each sanitation worker is given handcart/ tricycle for collection of waste			Yes/No		
	Whether handcart / tricycle is containerized			Yes/No		
	Whether the collection tool synchronizes with collection/ waste storage containers utilized			Yes/No		
	Secondary Waste Storage facilities					
	No. and type of waste storage depots in the city/town	No.	Capacity in m3			
	Open waste storage sites					
	Masonry bins					
	Cement concrete cylinder bins					
	Dhalao/covered rooms/ space					
	Covered metal/plastic containers					
	pto 1.1 m3 bins					
	2 to 5 m3 bins					
	Above 5m3 containers					
	Bin-less city					
	Bin/ population ratio					

	Ward wise details of waste storage depots (attach) : Ward No: Area: Population: No. of bins placed Total volume of bins placed	
	Total storage capacity of waste storage facilities in cubic meters	
	Total waste actually stored at the waste storage depots daily	

	Give frequency of collection of waste from the depots Number of bins cleared	Frequency	No. of bins
		Daily	
		Alternate day	
		Twice a week	
		Once a week	
		Occasionally	
	Whether storage depots have facility for storage of segregated waste in green, blue and black bins	Yes/ No (if yes, add details) No. of green bins: No. of blue bins: No. of black bins:	
	Whether lifting of solid waste from storage depots is manual or mechanical. Give percentage (%) of Manual Lifting of solid waste (%) of Mechanical lifting	 % %	
	If mechanical – specify the method used	front-end loaders/ Top loaders	

	Whether solid waste is lifted from door to door and transported to treatment plant directly in a segregated form	Yes/ No (if yes, specify)
	Waste transportation per day Type and Number of vehicles used	No. Trips made waste transported
	Animal cart Tractors Non tipping Truck Tipping Truck Dumper Placers Refuse collectors Compactors Others JCB/loader	

	Frequency of transportation of waste	Frequency (%) of waste transported Daily Alternate day Twice a week Once a week Occasionally
	Quantity of waste transported each day	/tpd
	Percentage of total waste transported daily	%
	Waste Treatment Technologies used	
	Whether solid waste is processed	Yes/No
	If yes, Quantity of waste processed daily	/tpd
	Whether treatment is done by local body or through an agency	
	Land(s) available with the local body for waste processing (in Hectares)	
	Land currently utilized for waste processing	
	Solid waste processing facilities in operation	

	Solid waste processing facilities under construction	
	Distance of processing facilities from city/ town boundary	
	Details of technologies adopted	
	Composting ,	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Vermi composting	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Bio-methanation	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled

	Refuse Derived Fuel	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Waste to Energy technology such as incineration, gasification, pyrolysis or any other technology (give detail)	Qty. raw material processed Qty. final product produced Qty. sold Quantity of residual waste landfilled
	Co-processing	Qty. raw material processed
	Combustible waste supplied to cement plant	
	Combustible waste supplied to solid waste based power plants	
	Others	Qty.
	Solid waste disposal facilities	
	No. of dumpsites sites available with the local body	
	No. of sanitary landfill sites available with the local body	

	Area of each such sites available for waste disposal	
	Area of land currently used for waste disposal	
	Distance of dumpsite/landfill facility from city/town	kms
	Distance from the nearest habitation	kms
	Distance from water body	kms
	Distance from state/national highway	kms
	Distance from Airport	kms
	Distance from important religious places or historical monument	kms
	Whether it falls in flood prone area	Yes/No
	Whether it falls in earthquake fault line area	Yes/No
	Quantity of waste landfilled each day	tpd
	Whether landfill site is fenced	Yes / No
	Whether Lighting facility is available on site	Yes / No
	Whether Weigh bridge facility available	Yes / No
	Vehicles and equipments used at landfill (specify)	Bulldozer, Compacters etc. available
	Manpower deployed at landfill site	Yes/No (if yes, attach details)
	Whether covering is done on daily basis	Yes/No
	If not, Frequency of covering the waste deposited at the landfill	
	Cover material used	
	Whether adequate covering material is available	Yes/No
	Provisions for gas venting provided	Yes/No (if yes, attach technical data sheet)
	Provision for leachate collection	Yes/No (if yes, attach technical data sheet)

9	Whether an Action Plan has been prepared for improving solid waste management practices in the city	Yes/No (if Yes attach Action Plan details)
10	What separate provisions are made for : Dairy related activities : Slaughter houses waste : C&D waste (construction debris) :	Attach details on Proposals,Steps taken, Yes/No Yes/No Yes/No
11	Details of Post Closure Plan	Attach Plan
12	How many slums are identified and whether these are provided with Solid Waste Management facilities :	Yes/ No (if Yes, attach details)
13	Give details of: Local body's own manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste	
14	Give details of: Contractor/ concessionaire's manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste	
15	Mention briefly, the difficulties being experienced by the local body in complying with provisions of these rules	
16	Mention briefly, if any innovative idea is implemented to tackle a problem related to solid waste, which could be replicated by other local bodies	

Signature of CEO/Municipal Commissioner/

Executive Officer/Chief Officer

Date:

Place:

FORM – V

[see rule 24(3)]

Format of annual report to be submitted by the state pollution control board or pollution control committee committees to the central pollution control board

PART A

To,

The Chairman
Central Pollution Control Board
Parivesh Bhawan, East Arjun Nagar
DELHI- 110 0032

1.	Name of the State/Union territory	:	
2.	Name & address of the State Pollution Control	:	
3.	Number of local bodies responsible for management of solid waste in the State/Union territory under these rules	:	
4.	No. of authorisation application Received	:	
5.	A Summary Statement on progress made by local body in respect of solid waste management	:	Please attach as Annexure-I
6.	A Summary Statement on progress made by local bodies in respect of waste collection, segregation, transportation and disposal	:	Please attach as Annexure-II
7.	A summary statement on progress made by local bodies in respect of implementation of Schedule II	:	Please attach as Annexure-III

Date: …….
Place: ……..

Chairman or the Member Secretary
State Pollution Control Board/
Pollution Control Committee

PART B

Towns/cities

Total number of towns/cities

Total number of ULBs

Number of class I & class II cities/towns Authorisation status (names/number) Number of applications received

Number of authorisations granted Authorisations under scrutiny SOLID WASTE Generation status

Solid waste generation in the state (TPD)

collected

treated

landfilled

Compliance to Schedule I of SW Rules (Number/names of towns/capacity)

Good practices in cities/towns House-to-house collection Segregation

Storage

Covered transportation

Processing of SW (Number/names of towns/capacity)

Solid Waste processing facilities setup:

Sl. No.	Composting	Vermi-composting	Biogas	RDF/Pelletization

Processing facility operational:

Sl. No.	Composting	Vermi-composting	Biogas	RDF/Pelletization

Processing facility under installation/planned:

Sl. No.	Composting	Vermi-composting	Biogas	RDF/Pelletization

Waste-to-Energy Plants: (Number/names of towns/capacity)

Sl. No.	Plant Location	Status of operation	Power generation (MW)	Remarks

Disposal of solid waste (number/names of towns/capacity):

Landfill sites identified

Landfill constructed

Landfill under construction

Landfill in operation

Landfill exhausted

Landfilled capped

Solid Waste Dumpsites (number/names of towns/capacity):

Total number of existing dumpsites

Dumpsites reclaimed/capped

Dumpsites converted to sanitary landfill

Monitoring at Waste processing/Landfills sites

Sl. No.	Name of facilities	Ambient air	Groundwater	Leachate quality	Compost quality	VOCs
1.						
2.						
3.						

Status of Action Plan prepared by Municipalities

Total number of municipalities: Number of Action Plan submitted:

FORM – VI [see rule 25]

Accident Reporting

1.	Date and time of accident	:	
2.	Sequence of events leading to accident	:	
3.	The waste involved in accident	:	
4.	Assessment of the effects of the accidents on human health and the environment	:	
5.	Emergency measures taken	:	
6.	Steps taken to alleviate the effects of accidents	:	
7.	Steps taken to prevent the recurrence of such an accident	:	

Date: ……

Signature:……..……

Place: ……

Designation: ……

[F. No. 18-3/2004-HSMD] BISHWANATH SINHA, Jt. Secy.

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ANNEXURE-II
Plastic Waste Management Rules, 2016

[PUBLISHED IN THE GAZETTE OF INDIA, PART-II, SECTION-3, SUB-SECTION (I)]
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 18th March, 2016

G.S.R 320(E).— Whereas the Plastic Waste (Management and Handling) Rules, 2011 published vide notification number S.O 249 (E), dated 4th February, 2011 by the Government of India in the erstwhile Ministry of Environment and Forests, as amended from time to time, provided a regulatory frame work for management of plastic waste generated in the country;

And whereas, to implement these rules more effectively and to give thrust on plastic waste minimization, source segregation, recycling, involving waste pickers, recyclers and waste processors in collection of plastic waste fraction either from households or any other source of its generation or intermediate material recovery facility and adopt polluter's pay principle for the sustainability of the waste management system, the Central Government reviewed the existing rules;

And whereas, in exercise of the powers conferred by sections 6, 8 and 25 of the Environment (Protection) Act, 1986 (29 of 1986),the draft rules, namely, the Plastic Waste Management, Rules, 2015 were published by the Government of India in the Ministry of Environment, Forest and Climate Change *vide* number G.S.R. 423(E), dated the 25th May,

2015 in the Gazette of India, inviting objections and suggestions from all persons likely to be affected thereby, before the expiry of a period of sixty days from the date on which copies of the Gazette containing the said notification were made available to the public;

And Whereas copies of the said Gazette were made available to the public on the 25th May, 2015;

And Whereas the objections and suggestions received within the said period from the public in respect of the said draft rules have been duly considered by the Central Government**;**

NOW, Therefore, in exercise of the powers conferred by sections 3,6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), and in super-session of the Plastic Waste (Management and Handling) Rules, 2011, except as respects things done or omitted to be done before such super-session, the Central Government hereby makes the following rules, namely:-

1. **Short title and commencement.-**(1)These rules shall be called the Plastic Waste Management Rules, 2016.

(1) Save as otherwise provided in these rules, they shall come into force on the date of their publication in the Official Gazette.

2. Application.-(1) These rules shall apply to every waste generator, local body, Gram Panchayat, manufacturer, Importers and producer.

(2) The rule 4 shall not apply to the export oriented units or units in special economic zones, notified by the Central Government, manufacturing their products against an order for export: Provide this exemption shall not apply to units engaged in packaging of gutkha, tobacco and pan masala and also to any surplus or rejects, left over products and the like.

3. Definitions.- In these rules, unless the context otherwise requires.-

(a) **"Act"** means the Environment (Protection) Act, 1986 (29 of 1986);

(b) **"brand owner"** means a person or company who sells any commodity under a registered brand label.

(c) **"carry bags"** mean bags made from plastic material or compostable plastic material, used for the purpose of carrying or dispensing commodities which have a self carrying feature but do not include bags that constitute or form an integral part of the packaging in which goods are sealed prior to use.

(d) **"commodity"** means tangible item that may be bought or sold and includes all marketable goods or wares;

(e) "**compostable plastics**" mean plastic that undergoes degradation by biological processes during composting to yield CO2, water, inorganic compounds and biomass at a rate consistent with other known compostable materials, excluding conventional petro-based plastics, and does not leave visible, distinguishable or toxic residue;

(f) **"consent"** means the consent to establish and operate from the concerned State Pollution Control Board or Pollution Control Committee granted under the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974), and the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981);

(g) "**disintegration**" means the physical breakdown of a material into very small fragments;

(h) **"extended producer's responsibility "** means the responsibility of a producer for the environmentally sound management of the product until the end of its life;

(i) **"food-stuffs"** mean ready to eat food products, fast food, processed or cooked food in liquid, powder, solid or semi-solid form;

(j) **"facility"** means the premises used for collection, Storage, recycling, processing and disposal of plastic waste;

(k) **"importer"** means a person who imports or intends to import and holds an Importer - Exporter Code number, unless otherwise specifically exempted.

(l) **"institutional waste generator"** means and includes occupier of the institutional buildings such as building occupied by Central Government Departments, State Government Departments, public or private sector companies, hospitals, schools, colleges, universities or other places of education, organisation, academy, hotels, restaurants, malls and shopping complexes;

(m) "**manufacturer"** means and include a person or unit or agency engaged in production of plastic raw material to be used as raw material by the producer.

(n) **"multilayered packaging"** means any material used or to be used for packaging and having at least one layer of plastic as the main ingredients in combination with one or more layers of

materials such aspaper, paper board, polymeric materials, metalised layers or aluminium foil, either in the form of a laminate or co-extruded structure;

(o) **"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;

(p) **"plastic sheet"** means Plastic sheet is the sheet made of plastic;

(q) **"plastic waste"**means any plastic discardedafter use or after their intended use is over;

(r) **"prescribed authority"** means the authorities specified in rule 12;

(s) **"producer"** means persons engaged in manufacture or import of carry bags or multilayered packaging or plastic sheets or like, and includes industries or individuals using plastic sheets or like or covers made of plastic sheets or multilayered packaging for packaging or wrapping the commodity;

(i) **"recycling"** means the process of transforming segregated plastic waste into a new product or raw material for producing new products;

(t) **"registration"** means registration with the State Pollution Control Board or Pollution Control Committee concerned, as the case may be;

(u) **"street vendor"** shall have the same meaning as assigned to it in clause (l) of sub- section (1) of Section 2 of the Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014 (7 of 2014);

(v) **"local body"** means urban local body with different nomenclature such as municipal corporation, municipality, nagarpalika, nagarnigam, nagarpanchayat, municipal council including notified area committee (NAC) and not limited to or any other local body constituted under the relevant statutes such as gram panchayat, where the management of plastic waste is entrusted to such agency;

(w) **"virgin plastic"** means plastic material which has not been subjected to use earlier and has also not been blended with scrap or waste;

(x) **"waste generator"** means and includes every person or group of persons or institution, residential and commercial establishments including Indian Railways, Airport, Port and Harbour and Defense establishments which generate plastic waste;

(y) **"waste management"** means the collection, storage, transportation reduction, re-use, recovery, recycling, composting or disposal of plastic waste in an environmentally safe manner;

(z) **"waste pickers"** mean individuals or agencies, groups of individuals voluntarily engaged or authorised for picking of recyclable plastic waste.

4. Conditions.- (1) The manufacture,importer stocking, distribution, sale and use of carry bags, plastic sheets or like, or cover made of plastic sheet and multilayered packaging, shall be subject to the following conditions, namely:-

a) carry bags and plastic packaging shall either be in natural shade which is without any added pigments or made using only those pigments and colourants which are in conformity with Indian Standard : IS 9833:1981 titled as "List of pigments and colourants for use in plastics in contact with foodstuffs, pharmaceuticals and drinking water", as amended from time to time;

b) Carry bags made of recycled plastic or products made of recycled plastic shall not be used for storing, carrying, dispensing or packaging ready to eat or drink food stuff';

c) carry bag made of virgin or recycled plastic, shall not be less than fifty microns in thickness;

d) plastic sheet or like, which is not an integral part of multilayered packaging and cover made of plastic sheet used for packaging, wrapping the commodity shall not be less than fifty microns in thickness except where the thickness of such plastic sheets impair the functionality of the product;

e) the manufacturer shall not sell or provide or arrange plastic to be used as raw material to a producer, not having valid registration from the concerned State Pollution Control Boards or Pollution Control Committee;

f) sachets using plastic material shall not be used for storing, packing or selling gutkha, tobacco and pan masala;

g) recycling of plastic waste shall conform to the Indian Standard: IS 14534:1998 titled as Guidelines for Recycling of Plastics, as amended from time to time;

h) The provision of thickness shall not be applicable to carry bags made up of compostable plastic. Carry bags made from compostable plastics shall conform to the Indian Standard: IS 17088:2008 titled as Specifications for Compostable Plastics, as amended from time to time. The manufacturers or seller of compostable plastic carry bags shall obtain a certificate from the Central Pollution Control Board before marketing or selling; and

i) plastic material, in any form including Vinyl Acetate - Maleic Acid - Vinyl Chloride Copolymer, shall not be used in any package for packaging gutkha, pan masala and tobacco in all forms.

5. Plastic waste management.-

(1) The plastic waste management by the urban local bodies in their respective jurisdiction shall be as under:-

(a) plastic waste, which can be recycled, shall be channelized to registered plastic waste recycler and recycling of plastic shall conform to the Indian Standard: IS 14534:1998 titled as Guidelines for Recycling of Plastics, as amended from time to time.

(b) local bodies shall encourage the use of plastic waste (preferably the plastic waste which cannot be further recycled) for road construction as per Indian Road Congress guidelines or energy recovery or waste to oil etc. The standards and pollution control norms specified by the prescribed authority for these technologies shall be complied with.

(c) Thermo set plastic waste shall be processed and disposed off as per the guidelines issued from time to time by the Central Pollution Control Board.

(d) The inert from recycling or processing facilities of plastic waste shall be disposed of in compliance with the Solid Waste Management Rules, 2000 or as amended from time to time.

6. Responsibility of local body.-

(1) Every local body shall be responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of the plastic waste either on its own or by engaging agencies or producers.

(2) The local body shall be responsible for setting up, operationalisation and co- ordination of the waste management system and for performing the associated functions, namely:-

(a) Ensuring segregation, collection, storage, transportation, processing and disposal of plastic waste;

(b) ensuring that no damage is caused to the environment during this process;

(c) ensuring channelization of recyclable plastic waste fraction to recyclers;

(d) ensuring processing and disposal on non-recyclable fraction of plastic waste in accordance with the guidelines issued by the Central Pollution Control Board;

(e) creating awareness among all stakeholders about their responsibilities;

(f) engaging civil societies or groups working with waste pickers; and

(g) ensuring that open burning of plastic waste does not take place.

(3) The local body for setting up of system for plastic waste management shall seek assistance of producers and such system shall be set up within one year from the date of final publication of these rules in the Official Gazaette of India.

(4) The local body to frame bye-laws incorporating the provisions of these rules.

7. Responsibility of Gram Panchayat.-

(1) Every gram panchayat either on its own or by engaging an agency shall set up, operationalise and co-ordinate for waste management in the rural area under their control and for performing the associated functions, namely,-

(a) ensuring segregation, collection, storage, transportation, plastic waste and channelization of recyclable plastic waste fraction to recyclers having valid registration; ensuring that no damage is caused to the environment during this process;

(b) creating awareness among all stakeholders about their responsibilities; and

(c) ensuring that open burning of plastic waste does not take place

8. Responsibility of waste generator.-

(1) The waste generator shall.-

(a) take steps to minimize generation of plastic waste and segregate plastic waste at source in accordance with the Solid Waste Management Rules, 2000 or as amended from time to time.

(b) not litter the plastic waste and ensure segregated storage of waste at source and handover segregated waste to urban local body or gram panchayat or agencies collection agencies;

(2) All institutional generators of plastic waste, shall segregate and store the waste generated by them in accordance with the Municipal Solid Waste (Management and Handling) Rules, 2000 notified vide S.O 908(E) dated the 25th September, 2000 under the Act or amendment from time to time and handover segregated wastes to authorized waste processing or disposal facilities or deposition centers either on its own or through the authorized waste collection agency.

(3) All waste generators shall pay such user fee or charge as may be specified in the bye- laws of the local bodies for plastic waste management such as waste collection or operation of the facility thereof, etc.;

(4) Every person responsible for organising an event in open space, which involves service of food stuff in plastic or multilayered packaging shall segregate and manage the waste generated during such events in accordance with the Municipal Solid Waste (Management and Handling) Rules, 2000 notified vide S.O 908(E) dated the 25th September, 2000 under the Act or amendment from time to time.

9. Responsibility of producers, Importers and Brand Owners.-

(1) The producers, within a period of six months from the date of publication of these rules, shall work out modalities for waste collection system based on Extended Producers Responsibility and involving State Urban Development Departments, either individually or collectively, through their own distribution channel or through the local body concerned.

(2) Primary responsibility for collection of used multi-layered plastic sachet or pouches or packaging is of Producers, Importers and Brand Owners who introduce the products in the market. They need to establish a system for collecting back the plastic waste generated due to their products. This plan of collection to be submitted to the State Pollution Control Boards while applying for Consent to Establish or Operate or Renewal. The Brand Owners whose consent has been renewed before the notification of these rules shall submit such plan within one year from the date of notification of these rules and implement with two years thereafter.

(3) manufacture and use of non- recyclable multilayered plastic if any should be phased out in Two years time.

(4) The producer, within a period of three months from the date of final publication of these rules in the Official Gazette shall apply to the Pollution Control Board or the Pollution Control Committee, as the case may be, of the States or the Union Territories administration concerned, for grant of registration.

(5) No producer shall on and after the expiry of a period of Six Months from the date of final publication of these rules in the Official Gazette manufacture or use any plastic or concerned State Pollution Control Board or the Pollution Control Committees.

(6) Every producer shall maintain a record of details of the person engaged in supply of plastic used as raw material to manufacture carry bags or plastic sheet or like or cover made of plastic sheet or multilayered packaging.

10. Protocols for compostable plastic materials.-Determination of the degree of degradability and degree of disintegration of plastic material shall be as per the protocols of the Indian Standards listed in Schedule-I to these rules.

11. Marking or labelling.-

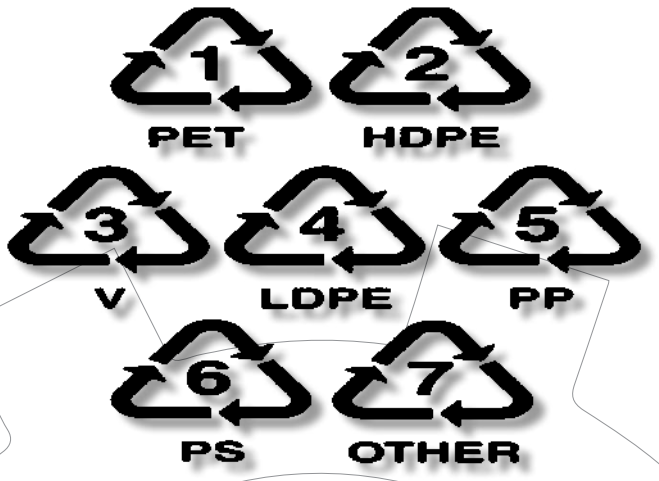
(1) Each plastic carry bag and multilayered packaging shall have the following information printed in English namely,-

(a) name, registration number of the manufacturer and thickness in case of carry bag;

(b) name and registration number of the manufacturer in case of multilayered packaging; and

(c) name and certificate number [Rule 4(h)] in case of carry bags made from compostable plastic

(2) Each recycled carry bag shall bear a label or a mark "recycled" as shown below and shall conform to the Indian Standard: IS 14534: 1998 titled as "Guidelines for Recycling of Plastics", as amended from time to time;



NOTE: PET-Polyethylene terephthalate, HDPE-High density polyethylene, V-Vinyl (PVC), LDPE-Low density polyethylene, PP-Polypropylene, PS-Polystyrene and Other means all other resins and multi-materials like ABS (Acrylonitrile butadiene styrene), PPO (Polyphenylene oxide), PC (Polycarbonate), PBT (Polybutylene terephalate) etc.

Each carry bag made from compostable plastics shall bear a label "compostable" and shall conform to the Indian Standard : IS or ISO 17088:2008 titled as Specifications for "Compostable Plastics".

12. Prescribed authority.-

(1) The State Pollution Control Board and Pollution Control Committee in respect of a Union territory shall be the authority for enforcement of the provisions of these rules relating to registration, manufacture of plastic products and multilayered packaging, processing and disposal of plastic wastes.

(2) The concerned Secretary-in-charge of Urban Development of the State or a Union Territory shall be the authority for enforcement of the provisions of these rules relating to waste management by waste generator, use of plastic carry bags, plastic sheets or like, covers made of plastic sheets and multilayered packaging.

(3) The concerned Gram Panchayat shall be the authority for enforcement of the provisions of these rules relating to waste management by the waste generator, use of plastic carry bags, plastic sheets or like, covers made of plastic sheets and multilayered packaging in the rural area of the State or a Union Territory.

(4) The authorities referred to in sub-rules (1) to (3) shall take the assistance of the District Magistrate or the Deputy Commissioner within the territorial limits of the jurisdiction of the concerned district in the enforcement of the provisions of these rules.

13. Registration of producer, recyclers and manufacturer,-

(1) No person shall manufacture carry bags or recycle plastic bags or multilayered packaging unless the person has obtained a registration from the State Pollution Control Board or the Pollution Control Committee of the Union Territory concerned, as the case may be, prior to the commencement of production;

(2) Every producer shall, for the purpose of registration or for renewal of registration, make an application to the State Pollution Control Board or the Pollution Control Committee of the Union territory concerned, in Form I

(3) Every person recycling or processing waste or proposing to recycle or process plastic waste shall make an application to the State Pollution Control Board or the Pollution Control Committee, for grant of registration or renewal of registration for the recycling unit, in Form II.

(4) Every manufacturer engaged in manufacturer of plastic to be used as raw material by the producer shall make an application to the State Pollution Control Board or the Pollution Control Committee of the Union territory concerned, for the grant of registration or for the renewal of registration, in Form III.

(5) The State Pollution Control Board or the Pollution Control Committee shall not issue or renew registration to plastic waste recycling or processing units unless the unit possesses a valid consent under the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981) along with a certificate of registration issued by the District Industries Centre or any other Government agency authorised in this regard.

(6) The State Pollution Control Board or the Pollution Control Committee shall not renew registration of producer unless the producer possesses and action plan endorsed by the Secretary in charge of Urban Development of the concerned State or Union Territory for setting of plastic waste management system.

(7) On receipt of the application complete in all respects for the registration for recycling or processing of plastic waste under sub-rule (3), the State Pollution Control Board may, after such inquiry as it considers necessary and on being satisfied that the applicant possesses appropriate facilities, technical capabilities and equipment to handle plastic waste safely, may grant registration to the applicant on fulfilment of the conditions as may be laid down in terms of registration.

(8) Every State Pollution Control Board or Pollution Control Committee shall take a decision on the grant of registration within ninety days of receipt of an application which is complete in all respects.

(9) The registration granted under this rule shall initially be valid for a period of one year, unless revoked, suspended or cancelled and shall subsequently be granted for three years.

(10) State Pollution Control Board or the Pollution Control Committees shall not revoke, suspend or cancel registration without providing the opportunity of a hearing to the producer or person engaged in recycling or processing of plastic wastes.

(11) Every application for renewal of registration shall be made at least one hundred twenty days before the expiry of the validity of the registration certificate.

14. Responsibility of retailers and street vendors-

(1) Retailers or street vendors shall not sell or provide commodities to consumer in carry bags or plastic sheet or multilayered packaging, which are not manufactured and labelled or marked, as per prescribed under these rules.

(2) Every retailers or street vendors selling or providing commodities in, plastic carry bags or multilayered packaging or plastic sheets or like or covers made of plastic sheets which are not manufactured or labelled or marked in accordance with these rules shall be liable to pay such fines as specified under the bye-laws of the local bodies.

15. Explicit pricing of carry bags.- (1) The shopkeepers and street vendors willing to provide plastic carry bags for dispensing any commodity shall register with local body. The local

body shall, within a period of six months from the date of final publication of these rules ion the Official Gazette of India notification of these rules, by notification or an order under their appropriate state statute or byelaws shall make provisions for such registration on payment of plastic waste management fee of minimum rupees forty eight thousand @ rupees four thousand per month. The concerned local body may prescribe higher plastic waste management fee, depending upon the sale capacity. The registered shop keepers shall display at prominent place that plastic carry bags are given on payment.

(2) Only the registered shopkeepers or street vendors shall be eligible to provide plastic carry bags for dispensing the commodities.

(3) The local body shall utilize the amount paid by the customers for the carry bags exclusively for the sustainability of the waste management system within their jurisdictions.

16. State Level Monitoring Committee.-

(1) The State government or the union Territory shall, for the purpose of effective monitoring of implementation of these rules, constitute a State Level Advisory Committee consisting of the following persons, namely;-

(a)	the Secretary, Department of Urban Development	-	Chairman
(b)	Director from State Department of Environment	-	Member
(c)	Member Secretary from State Pollution Control Board or Pollution Control Committee	-	Member
(d)	Municipal Commissioner	-	Member
(e)	one expert from Local Body	-	Member
(f)	one expert from Non-Governmental involved in Waste Management	-	Member
(g)	Commissioner, Value Added Tax or his nominee,	-	Member
(h)	Sales Tax Commissioner or Officer	-	Member
(i)	representative of Plastic Association, Drug Manufacturers Association, Chemical Manufacturers Association	-	Member
(j)	one expert from the field of Industry	-	Member and
(k)	one expert from the field of academic institution	-	Member
(l)	Director, Municipal Administration	-	Convener

The State Level Advisory Body shall meet at least once in Six Month and may invite experts, if it considers necessary.

17. Annual reports.-

(1) Every person engaged in recycling or processing of plastic waste shall prepare and submit an annual report in Form-IV to the local body concerned under intimation to the concerned State Pollution Control Board or Pollution Control Committee by the 30th April, of every year.

(2) Every local body shall prepare and submit an annual report in Form –V to the concerned Secretary-in-charge of the Urban Development Department under intimation to the concerned State Pollution Control Board or Pollution Control Committee by the 30th June, everyyear.

(3) Each State Pollution Control Board or Pollution Control Committee shall prepare and submit an annual report in Form VI to the CPCB on the implementation of these rules by the 31st July, of every year.

(4) The CPCB shall prepare a consolidated annual report on the use and management of plastic waste and forward it to the Central Government along with its recommendations before the 31st August of every year.

Schedule-I

[See rule 10]

1.	IS / ISO 14851: 1999 Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium-Method by measuring the oxygen demand in a closed Respirometer
2.	IS / ISO 14852: 1999 Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium-Method by analysis of evolved carbon dioxide
3.	IS / ISO 14853: 2005 Plastics- Determination of the ultimate anaerobic biodegradation of plastic materials in an aqueous system-Method by measurement of biogas production
4.	IS /ISO 14855-1: 2005 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions-Method by analysis of evolved carbon dioxide (Part-1 General method)
5.	IS / ISO 14855-2: 2007 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions-Method by analysis of evolved carbon dioxide (Part-2: Gravimetric measurement of carbon dioxide evolved in a laboratory- scale test)
6.	IS / ISO 15985: 2004 Plastics- Determination of the ultimate anaerobic biodegradation and disintegration under high-solids anaerobic digestion conditions- Methods by analysis of released biogas
7.	IS /ISO 16929: 2002 Plastics- Determination of degree of disintegration of plastic materials under defined composting conditions in a pilot - scale test
8.	IS/ISO17556:2003 Plastics- Determination of ultimate aerobic biodegradability in soil by measuring the oxygen demand in a Respirometer or the amount of carbon dioxide evolved
9.	IS / ISO 20200:2004 Plastics- Determination of degree of disintegration of plastic materials under simulated composting conditions in a laboratory - scale test

FORM - I

[See rules 13 (2)]

APPLICATION FOR REGISTRATION FOR PRODUCERS OR BRAND OWNERS

From: ……

……

…….(Name and full address of the occupier)

To

The Member Secretary,

…… Pollution Control Board or Pollution Control Committee

……

……

Sir,

I /We hereby apply for registration under rule 9 of the Plastic Waste Management Rules, 2015

1. Producers

	PART – A GENERAL	
1. (a)	Name and location of the unit	
(b)	Address of the unit	
(c)	Registration required for manufacturing of: (i) Carry bags; (a) petro- based, (b) Compostable (ii) Multilayered plastics	
(d)	Manufacturing capacity	
(e)	In case of renewal, previous registration number and date of registration	
2.	Is the unit registered with the District Industries Centre of the State Government or Union territory? If yes, attach a copy.	
3. (a)	Total capital invested on the project	
(b)	Year of commencement of production	

4. (a)	List and quantum of products and by-products	
(b)	List and quantum of raw materials used	
5.	Furnish a flow diagram of manufacturing process showing input and output in terms of products and waste generated including for captive power generation and water.	
6.	Status of compliance with these rules- Thickness – fifty micron (Yes/No)	
	PART – B PERTAINING TO LIQUID EFFLUENT AND GASEOUS EMISSIONS	
7.	(a) Does the unit have a valid consent under the Water (Prevention and control of Pollution) Act, 1974 (6 of 1974)? If yes, attach a copy	
	(b) Does the unit have a valid consent under the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981)? If yes, attach a copy	
	PART – C PERTAINING TO WASTE	
8.	Solid Wastes or rejects: (a) Total quantum of waste generated (b) Mode of storage within the plant (c) Provision made for disposal of wastes	
9.	Attach or Provide list of person supplying plastic to be used as raw material to manufacture carry bags or plastic sheet of like or multilayered packaging	
10.	Attach or provide list of personnel or brand Owners to whom the products will be supplied	
11.	Action plan on collecting back the plastic wastes	

Name and Signature

Designation

Date :

Place :

II. Brand Owners:

PART – A GENERAL		
1.	Name, address and Contact number	
2	In case of renewal, previous registration number and date of registration	
3	Is the unit registered with the District Industries Centre of the State Government or Union territory? If yes, attach a copy.	
4. (a)	Total capital invested on the project	
(b)	Year of commencement of production	
5. (a)	List and quantum of products and by-products	
(b)	List and quantum of raw materials used	
PART – B PERTAINING TO LIQUID EFFLUENT AND GASEOUS EMISSIONS		
5	Does the unit have a valid consent under the Water (Prevention and control of Pollution) Act, 1974 (6 of 1974)? If yes, attach a copy	
6	Does the unit have a valid consent under the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981)? If yes, attach a copy	
PART – C PERTAINING TO WASTE		
7.	Solid Wastes or rejects: (c) Total quantum of waste generated (d) Mode of storage within the plant (d) Provision made for disposal of wastes	
8.	Attach or Provide list of person supplying plastic material	
9	Action plan on collecting back the plastic wastes	

Name and Signature

Designation

Date :

Place :

FORM - II

[see rule 13 (3)]

APPLICATION FORM FOR REGISTRATION OF UNITS ENGAGED IN PROCESSING OR RECYCLING OF PLASTIC WASTE

1.	Name and Address of the unit				
2.	Contact person with designation, Tel./Fax / email				
3.	Date of commencement				
4.	No. of workers (including contract labour)				
5.	Consents Validity	a. Water (Prevention & Control of Pollution) Act, 1974; Valid up to _____ b. Air (Prevention & Control of Pollution) Act, 1981; Valid up to_____ c. Authorization ; valid up to			
6.	Manufacturing Process	Please attach a flow diagram of the manufacturing process flow diagram for each product.			
7.	Products and installed capacity of production (MTA)	Products			Installed capacity
8.	Waste Management:	S No	Type	Category	Qty.
	a. Waste generation in processingplastic-waste	(i)			
		(ii)			
		(iii)			
	b. Waste Collection and transportation (attach details)				
	c. Waste Disposal details	S No	Type	Category	Qty
		(i)			
		(ii)			

	d. Provide details of the disposal facility, whether the facility is authorized by SPCB or PCC	
	e. Please attach analysis report of characterization of waste generated (including leachate test if applicable)	
9.	Details of plastic waste proposed to be acquired through sale, auction, contract or import, as the case may be, for use as raw material	(i) Name (ii) Quantity required /year
10.	Occupational safety and health aspects	Please provide details of facilities
11.	Pollution Control Measures	
	Whether the unit has adequate pollution control systems or equipment to meet the standards of emission or effluent.	If Yes, please furnish details
	Whether unit is in compliance with conditions laid down in the said rules.	Yes/No
	Whether conditions exist or are likely to exist of the material being handled or processed posing adverse immediate or delayed impacts on the environment.	Yes/No
	Whether conditions exist (or are likely to exist) of the material being handled or processed by any means capable of yielding another material (e.g. leachate) which may possess eco-toxicity.	Yes/No
12.	Any other relevant information including fire or accident mitigative measures	
13.	List of enclosures as per rule	

Name and Signature

Designation

Date :

Place :

FORM - III

[See rules 13(4)]

APPLICATION FOR REGISTRATION FOR MANUFACTURERS OF PLASTIC RAW MATERIALS

From: ……

……

…….(Name and full address of the occupier)

To

The Member Secretary,

…… Pollution Control Board or Pollution Control Committee

……

……

Sir,

I/We hereby apply for registration under the Plastic Waste Management Rules, 2011

PART – A GENERAL		
1. (a)	Name and location of the unit	
(b)	Address of the unit	
(c)	In case of renewal, previous registration number and date of registration	
2.	Is the unit registered with the DIC or DCSSI of the State Government or Union territory? If yes, attach a copy.	
3. (a)	Total capital invested on the project	
(b)	Year of commencement of production	
(c)	List of producers and quantum of raw materials supplied to producers	

Name and Signature

Designation

Date :

Place :

FORM - IV

[See rules 17 (1)]

FORMAT OF ANNUAL REPORT BY OPERATOR OF PLASTIC WASTE PROCESSING OR RECYCLING FACILITY TO THE LOCAL BODY

Period of Reporting:

(1)	Name and Address of operator of the facility	
(2)	Name of officer in-charge of the facility (Telephone/Fax/Mobile/ E-mail)	
(3)	Capacity:	
(4)	Technologies used for management of plastic waste:	
(5)	Quantity of plastic waste received during the year being reported upon along with the source	
(6)	Quantity of plastic waste processed (in tons): - Plastic waste recycled(in tons) - Plastic waste processed (in tons) - Used (in tons)	
(7)	Quantity of inert or rejects sent for final disposal to landfill sites:	
(8)	Details of land fill facility to which inert or rejects were sent for final disposal: - Address -Telephone	
(9)	Attach status of compliance to environmental conditions, if any specified during grant of Consent or registration	

Signature of Operator

Designation

Date :

Place :

FORM - IV

[See rules 17(2)]

FORMAT FOR ANNUAL REPORT ON PLASTIC WASTE MANAGEMENT TO BE SUBMITTED BY THE LOCAL BODY

Period of Reporting:

(1)	Name of the City or Town and State:	
(2)	Population	
(3)	Area in sq. kilometers	
(4)	Name & Address of Local body Telephone No. Fax No. E-mail:	
(5)	Total Numbers of the wards in the area under jurisdiction	
(6)	Total Numbers of Households in the area under jurisdiction	
(7)	Number of households covered by door to door collection	
(8)	Total number of commercial establishments and Institutions in the area under jurisdiction -Commercial establishments - Institutions	
(9)	Number of commercial establishments and Institutions covered by door to door collection -Commercial establishments - Institutions	
(10)	Summary of the mechanisms put in place for management of plastic waste in the area under jurisdiction along with the details of agencies involved in door to door collection	
(11)	Attach details of infrastructure put in place for management of plastic waste generated in the area under jurisdiction	
(12)	Attach details of infrastructure required, if any along with justification	
(13)	Quantity of Plastic Waste generated during the year from area under jurisdiction (in tons)	

(14)	Quantity of Plastic Waste collected during the year from area under jurisdiction (in tons)	
(15)	Quantity of plastic waste channelized for recycling during the year (in tons)	
(16)	Quantity of plastic waste channelized for use during the year (in tons)	
(17)	Quantity of inert or rejects sent to landfill sites during the year (in tons)	
(18)	Details of each of facilities used for processing and disposal of plastic waste **Facility-I** i) Name of operator ii) Address with Telephone Number or Mobile iii) Capacity iv) Technology Used v) Registration Number vi) Validity of Registration (up to) **Facility-II** i) Name of operator ii) Address with Telephone Number or Mobile iii) Capacity iv) Technology Used v) Registration Number Validity of Registration (up to)	
(19)	Give details of: Local body's own manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste.	
(20)	Give details of: Contractor or concessionaire's manpower deployed for collection including street sweeping, secondary storage, transportation, processing and disposal of waste.	
(21)	Mention briefly, the difficulties being experienced by the local body in complying with provisions of these rules including the financial constrains, if any	
(22)	Whether an Action Plan has been prepared for improving solid waste management practices in the city? If yes (attach copy) Date of revision:	

Signature of CEO or Municipal Commissioner or
Executive Officer or Chief Officer

Date :

Place :

Form-VI

STATE-WISE STATUS OF IMPLEMENTATION OF PLASTIC WASTE MANAGEMENT RULES, 2016 FOR THE YEAR …
ANNUAL REPORT FORMAT

Name of the SPCB or PCC	Estimated Plastic Waste generation Tons Per Annum (TPA)	No. Of registered Plastic Manufacturing or Recycling (including multilayer, compostable) units. (Rule 9)			No. of Unregistered plastic manufacturing Recycling units. (in residential or unapproved areas)	Details of Plastic Waste Management (PWM) e.g. Collection, Segregation, Disposal (Co-processing road construction etc.) (Rules 6) (Attach separate sheet)	Partial or complete ban on usages of Plastic Carry Bags (through Executive Order) (Attach copy of notification or executive order)	Status of Marking Labelling on carry bags (Rule 8) [Specify the number of units or not complied)complied	Explicit Pricing of carry bags (Rule 10)	Details of the meeting of State Level Advisory Body (SLA) along with its recommendations on Implementation (Rule 11)	No. of violations and action taken on non-compliance of provisions of these Rules	Number of Municipal Authority or Gram Panchayat un der jurisdiction and Submission of Annual Report to CPCB (Rule 12)
		Plastic units	Compostable Plastic Units	Multilayer Plastic units								
(1)	(2)	(3)			(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

[F.No. 17-2/2001-HSMD]

Bishwanath Sinha
Joint Secretary to Government of India

ANNEXURE-III
e-waste Management Rules, 2016

[PUBLISHED IN THE GAZETTE OF INDIA, EXTRAORDINARY PART-II, SECTION-3, SUB-SECTION (i)]
GOVERNMENT OF INDIA

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
NOTIFICATION

New Delhi, the 23rd March , 2016

G.S.R 338(E). - Whereas the draft rules, namely the e-waste (Management) Rules, 2015, were published by the Government of India in the Ministry of Environment, Forest and Climate Change *vide* number G.S.R. 472(E), dated the 10th June, 2015 in the Gazette of India, Extraordinary Part II, section 3, sub-section (ii) inviting objections and suggestions from all persons likely to be affected thereby, before the expiry of the period of sixty days from the date on which copies of the Gazette containing the said notification were made available to the public;

AND WHEREAS the copies of the Gazette containing the said notification were made available to the public on the 10th day of June, 2015;

AND WHEREAS the objections and suggestions received within the specified period from the public in respect of the said draft rules have been duly considered by the Central Government;

NOW, THEREFORE, in exercise of the powers conferred by sections 6, 8 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), and in supersession of the e- waste (Management and Handling) Rules, 2011, published in the Gazette of India, section 3, sub-section (ii), *vide* number S.O. 1035(E), dated the 12th May, 2011, except as respects things done or omitted to be done before such supersession, the Central Government hereby makes the following rules, namely:-

CHAPTER I
PRELIMINARY

1. Short title and commencement. -

(1) These rules may be called the E-Waste (Management) Rules, 2016.

(2) They shall come into force from the 1st day of October, 2016.

2. Application. - These rules shall apply to every manufacturer, producer, consumer, bulk consumer, collection centres, dealers, e-retailer, refurbisher**,** dismantler and recycler involved in manufacture, sale, transfer, purchase, collection, storage and processing of e-waste or electrical and electronic equipment listed in Schedule I, including their components, consumables, parts and spares which make the product operational but shall not apply to -

(a) used lead acid batteries as covered under the Batteries (Management and Handling) Rules, 2001 made under the Act;

(b) micro enterprises as defined in the Micro, Small and Medium Enterprises Development Act, 2006 (27 of 2006); and

(c) radio-active wastes as covered under the provisions of the Atomic Energy Act, 1962 (33 of 1962) and rules made there under.

3. Definitions. -

(1) In these rules, unless the context otherwise requires, -

(a) 'Act' means the Environment (Protection) Act, 1986 (29 of 1986);

(b) 'authorisation' means permission for generation, handling, collection, reception, storage, transportation, refurbishing, dismantling, recycling, treatment and disposal of e-waste, granted to manufacturer, dismantler, refurbisher and recycler;

(c) 'bulk consumer' means bulk users of electrical and electronic equipment such as Central Government or State Government Departments, public sector undertakings, banks, educational institutions, multinational organisations, international agencies, partnership and public or private companies that are registered under the Factories Act, 1948 (63 of 1948) and the Companies Act, 2013 (18 of 2013) and health care facilities which have turnover of more than one crore or have more than twenty employees;

(d 'Central Pollution Control Board' means the Central Pollution Control Board constituted under sub-section (1) of section 3 of the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974);

(e) 'collection centre' means a centre or a collection point or both established by producer individually or as association jointly to collect e-waste for channelising the e-waste to recycler and play such role as indicated in the authorisation for Extended Producer Responsibility granted to the producer and having facilities as per the guidelines of Central Pollution Control Board, including the collection centre established by the dismantler or refurbisher or recycler which should be a part of their authorisation issued by the State Pollution Control Board where the facility exists;

(f) 'component' means one of the parts of a sub-assembly or assembly of which a manufactured product is made up and into which it may be resolved and includes an accessory or attachment to another component;

(g) 'consumables' means an item, which participates in or is required for a manufacturing process or for functioning of the electrical and electronic equipment and may or may not form part of end-product. Items, which are substantially or totally consumed during a manufacturing process, shall be deemed to be consumables;

(h) 'consumer' means any person using electrical and electronic equipment excluding the bulk consumers;

(i) 'channelisation' means to direct the path for movement of e-wastes from collection onwards to authorised dismantler or recycler. In case of fluorescent and other mercury containing lamps, where recyclers are not available, this means path for movement from collection centre to Treatment, Storage and Disposal Facility;

(j) 'dealer' means any individual or firm that buys or receives electrical and electronic equipment as listed in Schedule I of these rules and their components or consumables or parts or spares from producers for sale;

(k) 'deposit refund scheme' means a scheme whereby the producer charges an additional amount as a deposit at the time of sale of the electrical and electronic equipment and returns it to the consumer along with interest when the end-of- life electrical and electronic equipment is returned;

(l) 'dismantler' means any person or organisation engaged in dismantling of used electrical and electronic equipment into their components and having facilities as per the guidelines of Central Pollution Control Board and having authorisation from concerned State Pollution Control Board;

(m) 'disposal' means any operation which does not lead to recycling, recovery or reuse and includes physico-chemical or biological treatment, incineration and deposition in secured landfill;

(n) 'end-of-life' of the product means the time when the product is intended to be discarded by the user;

(o) 'environmentally sound management of e-waste' means taking all steps required to ensure that e-waste is managed in a manner which shall protect health and environment against any adverse effects, which may result from such e-waste;

(p) 'electrical and electronic equipment' means equipment which are dependent on electric current or electro-magnetic field in order to become functional;

(q) 'e-retailer' means an individual or company or business entity that uses an electronic network such as internet, telephone, to sell its goods;

(r) 'e-waste' means electrical and electronic equipment, whole or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment and repair processes;

(s) 'e-waste exchange' means an independent market instrument offering assistance or independent electronic systems offering services for sale and purchase of e-waste generated from end-of-life electrical and electronic equipment between agencies or organisations authorised under these rules;

(t) 'Extended Producer Responsibility' means responsibility of any producer of electrical or electronic equipment, for channelisation of e-waste to ensure environmentally sound management of such waste. Extended Producer Responsibility may comprise of implementing take back system or setting up of collection centres or both and having agreed arrangements with authorised dismantler or recycler either individually or collectively through a Producer Responsibility Organisation recognised by producer or producers in their Extended Producer Responsibility - Authorisation;

(u) 'Extended Producer Responsibility - Authorisation' means a permission given by Central Pollution Control Board to a producer, for managing Extended Producer Responsibility with implementation plans and targets outlined in such authorisation including detail of Producer Responsibility Organisation and e-waste exchange, if applicable;

(v) 'Extended Producer Responsibility Plan' means a plan submitted by a producer to Central Pollution Control Board, at the time of applying for Extended Producer Responsibility - Authorisation in which a producer shall provide details of e-waste channelisation system for targeted collection including detail of Producer Responsibility Organisation and e-waste exchange, if applicable;

(w) 'facility' means any location wherein the process incidental to the collection, reception, storage, segregation, refurbishing, dismantling, recycling, treatment and disposal of e-waste are carried out;

(x) 'Form' means a form appended to these rules;

(y) 'historical e-waste' means e-waste generated from electrical and electronic equipment as specified in Schedule I, which was available on the date from which these rules come into force;

(z) 'manufacturer' means a person or an entity or a company as defined in the Companies Act, 2013 (18 of 2013) or a factory as defined in the Factories Act, 1948 (63 of 1948) or Small and Medium Enterprises as defined in Micro, Small and Medium Enterprises

Development Act, 2006 (27 of 2006), which has facilities for manufacture of electrical and electronic equipment;

(aa) 'orphaned products' means non-branded or assembled electrical and electronic equipment as specified in Schedule I or those produced by a company, which has closed its operations;

(bb) 'part' means an element of a sub-assembly or assembly not normally useful by itself, and not amenable to further disassembly for maintenance purposes. A part may be a component, spare or an accessory;

(cc) 'producer' means any person who, irrespective of the selling technique used such as dealer, retailer, e-retailer, etc.;

(i) manufactures and offers to sell electrical and electronic equipment and their components or consumables or parts or spares under its own brand; or

(ii) offers to sell under its own brand, assembled electrical and electronic equipment and their components or consumables or parts or spares produced by other manufacturers or suppliers; or

(iii) offers to sell imported electrical and electronic equipment and their components or consumables or parts or spares;

(dd) 'Producer Responsibility Organisation' means a professional organisation authorised or financed collectively or individually by producers, which can take the responsibility for collection and channelisation of e-waste generated from the 'end-of-life' of their products to ensure environmentally sound management of such e-waste;

(ee) 'recycler' - means any person who is engaged in recycling and reprocessing of waste electrical and electronic equipment or assemblies or their components and having facilities as elaborated in the guidelines of Central Pollution Control Board;

(ff) 'refurbishment' means repairing of used electrical and electronic equipment as listed in Schedule I for extending its working life for its originally intended use and selling the same in the market or returning to owner;

(gg) 'refurbisher' for the purpose of these rules, means any company or undertaking registered under the Factories Act, 1948 or the Companies Act, 1956 or both or district industries centre engaged in refurbishment of used electrical and electronic equipment;

(hh) 'Schedule' means the Schedule appended to these rules;

(ii) "spares" means a part or a sub-assembly or assembly for substitution which is ready to replace an identical or similar part or sub-assembly or assembly including a component or an accessory;

(jj) 'State Government in relation to an Union territory means, the Administrator thereof appointed under article 239 of the Constitution;

(kk) 'State Pollution Control Board' means the concerned State Pollution Control Board or the Pollution Control Committee of the Union Territories constituted under sub-section (1) of section 4 of the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974);

(ll) 'target' means the quantity of e-waste to be collected by the producer in fulfilment of Extended Producer Responsibility;

(mm) 'transporter' means a person or company or entity engaged in the off-site transportation of e-waste by air, rail, road or water carrying a manifest system issued by the person or company or entity who has handed over the e-waste to the transporter, giving the origin, destination and quantity of the e-waste being transported;

(2) Words and expressions used in these rules and not defined but defined in the Act shall have the meanings respectively assigned to them in the Act.

CHAPTER II
RESPONSIBILITIES

4. Responsibilities of the manufacturer. -

(1) collect e-waste generated during the manufacture of any electrical and electronic equipment and channelise it for recycling or disposal;

(2) apply for an authorisation in Form 1 (a) in accordance with the procedure prescribed under sub-rule (2) of rule 13 from the concerned State Pollution Control Board, which shall give the authorisation in accordance with Form 1 (bb);

(3) ensure that no damage is caused to the environment during storage and transportation of e-waste;

(4) maintain records of the e-waste generated, handled and disposed in Form-2 and make such records available for scrutiny by the concerned State Pollution Control Board;

(5) file annual returns in Form-3, to the concerned State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates.

5. Responsibilities of the producer. - The producer of electrical and electronic equipment listed in Schedule I shall be responsible for -

(1) implementing the Extended Producers Responsibility with the following frameworks, namely:-

(a) collection and channelisation of e-waste generated from the 'end-of-life' of their products or 'end-of-life' products with same electrical and electronic equipment code and historical waste available on the date from which these rules come into force as per Schedule I in line with the targets prescribed in Schedule III in Extended Producer Responsibility - Authorisation;

(b) the mechanism used for channelisation of e-waste from 'end-of-life' products including those from their service centres to authorised dismantler or recycler shall be in accordance with the Extended Producer Responsibility - Authorisation. In cases of fluorescent and other mercury containing lamps, where recyclers are not available, channelisation may be from collection centre to Treatment, Storage and Disposal Facility;

(c) for disposal in Treatment, Storage and Disposal Facility, a pre-treatment is necessary to immobilise the mercury and reduce the volume of waste to be disposed off;

(d) Extended Producer Responsibility - Authorisation should comprise of general scheme for collection of waste Electrical and Electronic Equipment from the Electrical and Electronic Equipment placed on the market earlier, such as through dealer, collection centres, Producer Responsibility Organisation, through buy-back arrangement, exchange scheme, Deposit Refund System, etc. whether directly or through any authorised agency and channelising the items so collected to authorised recyclers;

(e) providing contact details such as address, e-mail address, toll-free telephone numbers or helpline numbers to consumer(s) or bulk consumer(s) through their website and product user documentation so as to facilitate return of end-of-life electrical and electronic equipment;

(f) creating awareness through media, publications, advertisements, posters, or by any other means of communication and product user documentation accompanying the equipment, with regard to -

(i) information on address, e-mail address, toll-free telephone numbers or helpline numbers and web site;

(ii) information on hazardous constituents as specified in sub-rule 1 of rule 16 in electrical and electronic equipment;

(iii) information on hazards of improper handling, disposal, accidental breakage, damage or improper recycling of e-waste;

(iv) instructions for handling and disposal of the equipment after its use, along with the Do's and Don'ts;



(v) affixing a visible, legible and indelible symbol given below on the products or product user documentation to prevent e-waste from being dropped in garbage bins containing waste destined for disposal;

(vi) means and mechanism available for their consumers to return e-waste for recycling including the details of Deposit Refund Scheme, if applicable;

(g) the producer shall opt to implement Extended Producer Responsibility individually or collectively. In individual producer responsibility, producer may set up his own collection centre or implement take back system or both to meet Extended Producer Responsibility. In collective system, producers may tie-up as a member with a Producer Responsibility Organisation or with e-waste exchange or both. It shall be mandatory upon on the individual producer in every case to seek Extended Producer Responsibility - Authorisation from Central Pollution Control Board in accordance with the Form-1 and the procedure laid down in sub-rule (1) of rule 13;

(2) to provide information on the implementation of Deposit Refund Scheme to ensure collection of end-of-life products and their channelisation to authorised dismantlers or recyclers, if such scheme is included in the Extended Producer Responsibility Plan.

Provided that the producer shall refund the deposit amount that has been taken from the consumer or bulk consumer at the time of sale, along with interest at the prevalent rate for the period of the deposit at the time of take back of the end-of- life product;

(3) the import of electrical and electronic equipment shall be allowed only to producers having Extended Producer Responsibility authorisation;

(4) maintaining records in Form-2 of the e-waste handled and make such records available for scrutiny by the Central Pollution Control Board or the concerned State Pollution Control Board;

(5) filing annual returns in Form-3, to the Central Pollution Control Board on or before the 30th day of June following the financial year to which that return relates. In case of the Producer with multiple offices in a State, one annual return combining information from all the offices shall be filed;

(6) the Producer shall apply to the Central Pollution Control Board for authorisation in Form 1, which shall thereafter grant the Extended Producer Responsibility - Authorisation in Form 1(aa).

(7) Operation without Extended Producer Responsibility-Authorisation by any producer, as defined in this rule, shall be considered as causing damage to the environment.

6. Responsibilities of collection centres. -

(1) collect e-waste on behalf of producer or dismantler or recycler or refurbisher including those arising from orphaned products;

Provided the collection centres established by producer can also collect e-waste on behalf of dismantler, refurbisher and recycler including those arising from orphaned products

(2) ensure that the facilities are in accordance with the standards or guidelines issued by Central Pollution Control Board from time to time;

(3) ensure that the e-waste collected by them is stored in a secured manner till it is sent to authorised dismantler or recycler as the case may be;

(4) ensure that no damage is caused to the environment during storage and transportation of e-waste;

(5) maintain records in Form-2 of the e-waste handled as per the guidelines of Central Pollution Control Board and make such records available for scrutiny by the Central Pollution Control Board or the concerned State Pollution Control Board as and when asked for.

7. Responsibilities of dealers. –

(1) in the case the dealer has been given the responsibility of collection on behalf of the producer, the dealer shall collect the e- waste by providing the consumer a box, bin or a demarcated area to deposit e- waste, or through take back system and send the e-waste so collected to collection centre or dismantler or recycler as designated by producer;

(2) the dealer or retailer or e-retailer shall refund the amount as per take back system or Deposit Refund Scheme of the producer to the depositor of e-waste;

(3) every dealer shall ensure that the e-waste thus generated is safely transported to authorised dismantlers or recyclers;

(4) ensure that no damage is caused to the environment during storage and transportation of e-waste.

8. Responsibilities of the refurbisher. –

(1) collect e-waste generated during the process of refurbishing and channelise the waste to authorised dismantler or recycler through its collection centre;

(2) make an application in Form 1(a) in accordance with the procedure laid down in sub-rule (4) of rule 13 to the concerned State Pollution Control Board for grant of one time authorisation;

(a) the concerned State Pollution Control Board shall authorise the Refurbisher on one time basis as per Form 1 (bb) and authorisation would be deemed as considered if not objected to within a period of thirty days;

(b) the authorised Refurbisher shall be required to submit details of e-waste generated to the concerned State Pollution Control Board on yearly basis;

(3) ensure that no damage is caused to the environment during storage and transportation of e-waste;

(4) ensure that the refurbishing process do not have any adverse effect on the health and the environment;

(5) ensure that the e-waste thus generated is safely transported to authorised collection centres or dismantlers or recyclers;

(6) file annual returns in Form-3 to the concerned State Pollution Control Board, on or before the 30th day of June following the financial year to which that return relates;

(7) maintain records of the e-waste handled in Form-2 and such records should be available for scrutiny by the appropriate authority.

9. Responsibilities of consumer or bulk consumer. –

(1) consumers or bulk consumers of electrical and electronic equipment listed in Schedule I shall ensure that e-waste generated by them is channelised through collection centre or dealer of authorised producer or dismantler or recycler or through the designated take back service provider of the producer to authorised dismantler or recycler;

(2) bulk consumers of electrical and electronic equipment listed in Schedule I shall maintain records of e-waste generated by them in Form-2 and make such records available for scrutiny by the concerned State Pollution Control Board;

(3) consumers or bulk consumers of electrical and electronic equipment listed in Schedule I shall ensure that such end-of-life electrical and electronic equipment are not admixed with e-waste containing radioactive material as covered under the provisions of the Atomic Energy Act, 1962 (33 of 1962) and rules made there under;

(4) bulk consumers of electrical and electronic equipment listed in Schedule I shall file annual returns in Form-3, to the concerned State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates. In case of the bulk consumer with multiple offices in a State, one annual return combining information from all the offices shall be filed to the concerned State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates

10. Responsibilities of the dismantler. -

(1) ensure that the facility and dismantling processes are in accordance with the standards or guidelines prescribed by Central Pollution Control Board from time to time;

(2) obtain authorisation from the concerned State Pollution Control Board in accordance with the procedure under sub-rule (3) of rule 13;

(3) ensure that no damage is caused to the environment during storage and transportation of e-waste;

(4) ensure that the dismantling processes do not have any adverse effect on the health and the environment;

(5) ensure that dismantled e-waste are segregated and sent to the authorised recycling facilities for recovery of materials;

(6) ensure that non-recyclable or non-recoverable components are sent to authorised treatment storage and disposal facilities;

(7) maintain record of e-waste collected, dismantled and sent to authorised recycler in Form-2 and make such record available for scrutiny by the Central Pollution Control Board or the concerned State Pollution Control Board;

(8) file a return in Form-3, to the concerned State Pollution Control Board as the case may be, on or before 30th day of June following the financial year to which that return relates;

(9) not process any e-waste for recovery or refining of materials, unless he is authorised with concerned State Pollution Control Board as a recycler for refining and recovery of materials;

(10) operation without Authorisation by any dismantler, as defined in this rule, shall be considered as causing damage to the environment.

11. Responsibilities of the recycler. –

(1) shall ensure that the facility and recycling processes are in accordance with the standards or guidelines prescribed by the Central Pollution Control Board from time to time;

(2) obtain authorisation from concerned State Pollution Control Board in accordance with the procedure under the sub-rule (3) of rule 13;

(3) ensure that no damage is caused to the environment during storage and transportation of e-waste;

(4) ensure that the recycling processes do not have any adverse effect on the health and the environment;

(5) make available all records to the Central Pollution Control Board or the concerned State Pollution Control Board for inspection;

(6) ensure that the fractions or material not recycled in its facility is sent to the respective authorised recyclers;

(7) ensure that residue generated during recycling process is disposed of in an authorised treatment storage disposal facility;

(8) maintain record of e-waste collected, dismantled, recycled and sent to authorised recycler in Form-2 and make such record available for scrutiny by the Central Pollution Control Board or the concerned State Pollution Control Board;

(9) file annual returns in Form-3, to the concerned State Pollution Control Board as the case may be, on or before 30th day of June following the financial year to which that return relates;

(10) may accept waste electrical and electronic equipment or components not listed in Schedule I for recycling provided that they do not contain any radioactive material and same shall be indicated while taking the authorisation from concerned State Pollution Control Board;

(11) operation without Authorisation by any recycler, as defined in this rule, shall be considered as causing damage to the environment.

12. Responsibilities of State Government for environmentally sound management of E-waste. –

(1) Department of Industry in State or any other government agency authorised in this regard by the State Government, to ensure earmarking or allocation of industrial space or shed for e-waste dismantling and recycling in the existing and upcoming industrial park, estate and industrial clusters;

(2) Department of Labour in the State or any other government agency authorised in this regard by the State Government shall:

a. ensure recognition and registration of workers involved in dismantling and recycling;

b. assist formation of groups of such workers to facilitate setting up dismantling facilities;

c. undertake industrial skill development activities for the workers involved in dismantling and recycling;

d. undertake annual monitoring and to ensure safety & health of workers involved in dismantling and recycling;

(3) State Government to prepare integrated plan for effective implementation of these provisions, and to submit annual report to Ministry of Environment, Forest and Climate Change.

CHAPTER III
PROCEDURE FOR SEEKING AND GRANT OF AUTHORISATION FOR MANAGEMENT OF E-WASTE

13. Procedure for Seeking and Grant of Authorisation. -

(1) **Extended Producer Responsibility - Authorisation of Producers.** –

(i) every producer of electrical and electronic equipment listed in Schedule I, shall make an application for Extended Producer Responsibility - Authorisation within a period of ninety days starting from the date of these rules coming into force in Form-1 to Central Pollution Control Board;

(ii) on receipt of the application complete in all respects, the Central Pollution Control Board will carry out evaluation of the Extended Producer Responsibility Plan and on being satisfied that the producer has detailed out an effective system to manage Extended Producer Responsibility in the country, shall grant Extended Producer Responsibility - Authorisation, in Form 1(aa) within a period of one hundred and twenty days. The Extended Producer Responsibility - Authorisation shall be valid for a period of five years;

This authorisation shall include among others the targeted quantity of e-waste, product code wise, to be collected during the year. The actual target for collection of e-waste for dismantling or recycling will be fixed on the basis of quantity of electrical and electronic equipment, product code wise, placed in the market in the previous years and taking into consideration the average life of the equipment. The estimated quantity of e-waste generated during the current year will be indicated by the producer and the quantity expected to be collected with the collection scheme proposed to be implemented by the producer will be indicated in the Extended Producer Responsibility plan. The Central Pollution Control Board shall fix the targets in accordance with Schedule III.

(iii) the Central Pollution Control Board, after giving reasonable opportunity of being heard to the applicant shall refuse to grant Extended Producer Responsibility – Authorisation;

(iv) in the event of refusal of Extended Producer Responsibility - Authorisation by the Central Pollution Control Board, the producer will forfeit his right to put any Electrical and Electronic Equipment in the market till such time the Extended Producer Responsibility - Authorisation is granted;

(v) the Central Pollution Control Board after grant of Extended Producer Responsibility - Authorisation shall forward the Extended Producer Responsibility Plan to respective State Pollution Control Board for monitoring;

(vi) an application for the renewal of Extended Producer Responsibility-Authorisation shall be made in Form-1 before one hundred and twenty days of its expiry to Central Pollution Control Board. The Central Pollution Control Board may renew the authorisation for a period of five years after receipt of compliance report from the concerned State Pollution Control Board which shall submit the compliance report to Central Pollution Control Board within sixty days from the date of the receipt of the application. In case of non receipt of the compliance report from the State Pollution Control Board within stipulated time period of sixty days, Central Pollution Control Board may renew the Extended Producer Responsibility- Authorisation after examining such case on merit basis, subject to no report of violation of the provisions of the Act or the rules made there under or the conditions specified in the Extended Producer Responsibility - Authorisation;

(vii) every producer of Electrical and Electronic Equipment listed in Schedule I, shall take all steps, wherever required, to comply with the conditions specified in the Extended Producer Responsibility – Authorisation;

(viii) the concerned State Pollution Control Board shall monitor the compliance of Extended Producer Responsibility - Authorisation, take cognizance of any non- compliance and inform Central Pollution Control Board for taking action, as necessary;

(ix) Central Pollution Control Board shall conduct random check and if in its opinion, the holders of the Extended Producer Responsibility - Authorisation has failed to comply with any of the conditions of the authorisation or with any provisions of the Act or these rules and after giving a reasonable opportunity of being heard and after recording reasons thereof in writing cancel or suspend the Extended Producer Responsibility - Authorisation issued under these rules for such period as it considers necessary in the public interest and inform the concerned State Pollution Control Board within ten days of cancellation.

(x) the Central Pollution Control Board shall maintain an online register of Extended Producer Responsibility - Authorisation granted with conditions imposed under these rules for environmentally sound management of e-waste, and which shall be accessible to any citizen of the country.

(xi) The producer authorised under the provision of this rule shall maintain records in Form-2 and shall file annual returns of its activities of previous year in Form-3 to the Central Pollution Control Board on or before 30th day of June of every year;

(2) **Authorisation of Manufacturer. –**

(i) the manufacturer generating e-waste shall obtain an authorisation from the concerned State Pollution Control Board;

(ii) the manufacturer shall make an application for authorisation, within a period of ninety days from the date of these rules coming into force in Form 1(a) to the concerned State Pollution Control Board for grant of authorisation;

(iii) on receipt of the application complete in all respects for the authorisation, the concerned State Pollution Control Board may, after such enquiry as it considers necessary and on being satisfied that the applicant possesses appropriate facilities, technical capabilities and equipment to handle e-waste safely, grant within a period of one hundred and twenty days an authorisation in Form 1(bb) to the applicant to carry out safe operations in the authorised place only, which shall be valid for a period of five years;

(iv) the concerned State Pollution Control Board after giving reasonable opportunity of being heard to the applicant may refuse to grant any authorisation;

(v) every person authorised under these rules shall maintain the record of e-waste handled by them in Form-2 and prepare and submit to the concerned State Pollution Control Board, an annual return containing the details specified in Form-

(3) on or before the 30th day of June following the financial year to which that return relates;

(vi) an application for the renewal of an authorisation shall be made in Form-1(a) before one hundred and twenty days of its expiry and the concerned State Pollution Control Board may renew the authorisation for a period of five years after examining each case on merit and subject to the condition that there is no report of violation of the provisions of the Act or the rules made thereunder or the conditions specified in the authorisation;

(vii) manufacturer shall take all steps to comply with the conditions specified in the authorisation;

(viii) the concerned State Pollution Control Board shall maintain an online register of authorisations granted with conditions imposed under these rules for environmentally sound management of e-waste, and which shall be accessible to any citizen of the country.

(3) **Procedure for grant of authorisation to dismantler or recycler.** -

(i) every Dismantler or Recycler of e-waste shall make an application, within a period of one hundred and twenty days starting from the date of coming into force of these rules, in Form-4 in triplicate to the concerned State Pollution Control Board accompanied with a copy of the following documents for the grant or renewal of authorisation, namely:-

(a) consent to establish granted by the concerned State Pollution Control Board under the Water (Prevention and Control of Pollution) Act, 1974, (25 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981(21 of 1981);

(b) certificate of registration issued by the District Industries Centre or any other government agency authorised in this regard;

(c) proof of installed capacity of plant and machinery issued by the District Industries Centre or any other government agency authorised in this behalf;

(d) in case of renewal, a certificate of compliance of effluent and emission standards, treatment and disposal of hazardous wastes as applicable from the concerned State Pollution Control Board or any other agency designated for this purpose:

Provided that any person authorised or registered under the provisions of the Hazardous Wastes (Management, Handling and Transboundary Movements) Rules, 2008, and the E-waste (Management & Handling) Rules, 2011 prior to the date of coming into force of

these rules shall not be required to make an application for authorisation till the period of expiry of such authorisation or registration:

(ii) the concerned State Pollution Control Board, on being satisfied that the application is complete in all respects and that the applicant is utilising environmentally sound technologies and possess adequate technical capabilities, requisite facilities and equipment to dismantle or recycle and process e-waste in compliance to the guidelines specified by Central Pollution Control Board from time to time and through site inspection, may grant authorisation to such applicants stipulating therein necessary conditions as deemed necessary for carrying out safe operations in the authorised place only;

(iii) the concerned State Pollution Control Board shall dispose of the application for authorisation within a period of one hundred and twenty days from the date of the receipt of such application complete in all respects;

(iv) the authorisation granted under these rules shall be valid for a period of five years from the date of its issue and shall be accompanied with a copy of the field inspection report signed by that Board indicating the adequacy of facilities for dismantling or recycling of e-waste and compliance to the guidelines specified by Central Pollution Control Board from time to time;

(v) the concerned State Pollution Control Board may refuse, cancel or suspend an authorisation granted under these rules, if it has reasons to believe that the authorised dismantler or recycler has failed to comply with any of the conditions of authorisation, or with any provisions of the Act or rules made thereunder, after giving an opportunity to the dismantler or recycler to be heard and after recording the reasons thereof;

(vi) an application for the renewal of authorisation shall be made in Form - 4 before one hundred and twenty days of its expiry and the concerned State Pollution Control Board may renew the authorisation for a period of five years after examining each case on merit and subject to the condition that there is no report of violation of the provisions of the Act or the rules made there under or the conditions specified in the authorisation;

(vii) the Dismantler and Recycler shall maintain records of the e-waste purchased, processed in Form-2 and shall file annual returns of its activities of previous year in Form-3 to the concerned State Pollution Control Board on or before 30th day of June of every year;

(viii) the Central Government and the Central Pollution Control Board may issue guidelines for standards of performance for dismantling and recycling processes from time to time.

(4) **Procedure for grant of authorisation to refurbisher.** –

(i) every refurbisher of e-waste shall make an application, with in a period of one hundred and twenty days starting from the date of coming into force of these rules, in Form 1 (a) in triplicate to the concerned State Pollution Control Board accompanied with a copy of the following documents for the grant or renewal of authorisation, namely:-

(a) consent to establish granted by the concerned State Pollution Control Board under the Water (Prevention and Control of Pollution) Act, 1974, (25 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981 (21 of 1981);

(b) certificate of registration issued by the District Industries Centre or any other government agency authorised in this regard;

(c) proof of installed capacity of plant and machinery issued by the District Industries Centre or any other government agency authorised in this behalf.

(ii) the concerned State Pollution Control Board, on being satisfied that the application is complete in all respects and complies with the guidelines prescribed by Central Pollution Control Board from time to time, may grant one time authorisation in Form 1 (bb) to such applicants stipulating therein necessary conditions as deemed necessary for carrying out refurbishing activities in the authorised place only;

(iii) the concerned State Pollution Control Board shall dispose of the application for authorisation within a period of one hundred and twenty days from the date of the receipt of such application complete in all respects;

(iv) the concerned State Pollution Control Board may refuse, cancel or suspend a authorisation granted under these rules, if it has reasons to believe that the authorised refurbisher has failed to comply with any of the conditions of authorisation, or with any provisions of the Act or rules made thereunder, after giving an opportunity to the refurbisher to be heard and after recording the reasons thereof;

(v) the Refurbisher shall maintain records of the e-waste purchased and refurbished in Form-2 and shall file annual returns of its activities of previous year in Form-3 to the concerned State Pollution Control Board on or before 30th day of June of every year.

14. Power to suspend or cancel an authorisation.-

(1) The State Pollution Control Board may, if in its opinion, the holder of Manufacturer or Dismantler or Recycler or Refurbisher Authorisation has failed to comply with any of the conditions of the authorisation or with any provisions of the Act or these rules and after giving a reasonable opportunity of being heard and after recording reasons thereof in writing cancel or suspend the authorisation issued under these rules for such period as it considers necessary in the public interest and inform Central Pollution Control Board within ten days of cancellation;

(2) The Central Pollution Control Board, if in its opinion, the holders of the Extended Producer Responsibility- Authorisation has failed to comply with any of the conditions of the authorisation or with any provisions of the Act or these rules and after giving a reasonable opportunity of being heard and after recording reasons thereof in writing cancel or suspend the Extended Producer Responsibility- Authorisation issued under these rules for such period as it considers necessary in the public interest and inform State Pollution Control Boards or Pollution Control Committees within ten days of cancellation;

(3) Upon suspension or cancellation of the authorisation, the Central Pollution Control Board or State Pollution Control Board may give directions to the persons whose authorisation has been suspended or cancelled for the safe storage and management of the e-waste and such persons shall comply with such directions.

CHAPTER IV

15. Procedure for storage of e-waste. - Every manufacturer, producer, bulk consumer, collection centre, dealer, refurbisher, dismantler and recycler may store the e-waste for a period not exceeding one hundred and eighty days and shall maintain a record of collection, sale, transfer and storage of wastes and make these records available for inspection:

Provided that the concerned State Pollution Control Board may extend the said period up to three hundred and sixty five days in case the waste needs to be specifically stored for development of a process for its recycling or reuse.

CHAPTER V
REDUCTION IN THE USE OF HAZARDOUS SUBSTANCES IN THE MANUFACTURE OF ELECTRICAL AND ELECTRONIC EQUIPMENT AND THEIR COMPONENTS OR CONSUMABLES OR PARTS OR SPARES

16. Reduction in the use of hazardous substances in the manufacture of electrical and electronic equipment and their components or consumables or parts or spares. –

(1) Every producer of electrical and electronic equipment and their components or consumables or parts or spares listed in Schedule I shall ensure that, new Electrical and Electronic Equipment

and their components or consumables or parts or spares do not contain Lead, Mercury, Cadmium, Hexavalent Chromium, polybrominated biphenyls and polybrominated diphenyl ethers beyond a maximum concentration value of 0.1% by weight in homogenous materials for lead, mercury, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers and of 0.01% by weight in homogenous materials for cadmium.

(2) Components or consumables or parts or spares required for the electrical and electronic equipment placed in the market prior to 1st May, 2014 may be exempted from the provisions of sub-rule (1) of rule 16 provided Reduction of Hazardous Substances compliant parts and spares are not available.

(3) The applications listed in Schedule II shall be exempted from provisions of sub- rule (1) of rule 16.

(4) Every producer of applications listed in Schedule II shall ensure that the limits of hazardous substances as given in Schedule II are to be complied.

(5) Every producer shall provide the detailed information on the constituents of the equipment and their components or consumables or parts or spares alongwith a declaration of conformance to the Reduction of Hazardous Substances provisions in the product user documentation.

(6) Imports or placement in the market for new electrical and electronic equipment shall be permitted only for those which are compliant to provisions of sub-rule (1) and sub rule (4) of rule 16.

(7) Manufacture and supply of electrical and electronic equipment used for defence and other similar strategic applications shall be excluded from provisions of sub- rule (1) of rule 16.

(8) Every producer while seeking Extended Producer Responsibility - Authorisation will provide information on the compliance of the provisions of sub-rule (1) of rule 16. This information shall be in terms of self-declaration.

(9) Central Pollution Control Board shall conduct random sampling of electrical and electronic equipment placed on the market to monitor and verify the compliance of Reduction of Hazardous Substances provisions and the cost for sample and testing shall be borne by the Producer. The random sampling shall be as per the guidelines of Central Pollution Control Board.

(10) If the product does not comply with Reduction of Hazardous Substances provisions, the Producers shall take corrective measures to bring the product into compliance and withdraw or recall the product from the market, within a reasonable period as per the guidelines of the Central Pollution Control Board.

(11) Central Pollution Control Board shall publish the methods for sampling and analysis of Hazardous Substances as listed in sub-rule(1) of rule 16 with respect to the items listed in Schedule I and II and also enlist the labs for this purpose.

CHAPTER VI
MISCELLANEOUS

17. **Duties of authorities. -** Subject to other provisions of these rules, the authorities shall perform duties as specified in Schedule IV.

18. Annual Report. –

(1) The concerned State Pollution Control Board shall prepare and submit to the Central Pollution Control Board an annual report with regard to the implementation of these rules by the 30th day of September every year in Form-5.

(2) The Central Pollution Control Board shall prepare the consolidated annual review report on management of e-waste and forward it to the Central Government along with its recommendations before the 30th day of December every year.

19. **Transportation of e-waste.** –The transportation of e-waste shall be carried out as per the manifest system whereby the transporter shall be required to carry a document (three copies) prepared by the sender, giving the details as per Form-6:

Provided that the transportation of waste generated from manufacturing or recycling destined for final disposal to a treatment, storage and disposal facility shall follow the provisions under Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.

20. Accident reporting.- Where an accident occurs at the facility processing e-waste or during transportation of e-waste, the producer, refurbisher, transporter, dismantler, or recycler, as the case may be, shall report immediately to the concerned State Pollution Control Board about the accident through telephone and e-mail.

21. Liability of manufacturer, producer, importer, transporter, refurbisher, dismantler and recycler.-

(1) The manufacturer, producer, importer, transporter, refurbisher, dismantler and recycler shall be liable for all damages caused to the environment or third party due to improper handling and management of the e-waste;

(2) The manufacturer, producer, importer, transporter, refurbisher, dismantler and recycler shall be liable to pay financial penalties as levied for any violation of the provisions under these rules by the State Pollution Control Board with the prior approval of the Central Pollution Control Board.

22. Appeal.-

(1) Any person aggrieved by an order of suspension or cancellation or refusal of authorisation or its renewal passed by the Central Pollution Control Board or State Pollution Control Board may, within a period of thirty days from the date on which the order is communicated to him, prefer a appeal in Form 7 to the Appellate Authority comprising of the Environment Secretary of the State.

(2) The Appellate Authority may entertain the appeal after expiry of the said period of thirty days if it is satisfied that the appellant was prevented by sufficient cause from filing the appeal in time.

(3) Every appeal filed under this rule shall be disposed of within a period of sixty days from the date of its filing.

23. The collection, storage, transportation, segregation, refurbishment, dismantling, recycling and disposal of e-waste shall be in accordance with the procedures prescribed in the guidelines published by the Central Pollution Control Board from time to time. Implementation of e-waste (Management and Handling) Amendment Rules, 2011 shall be in accordance with the guidelines prescribed by the Central Pollution Control Board from time to time.

24. Urban Local Bodies (Municipal Committee or Council or Corporation) shall ensure that e-waste pertaining to orphan products is collected and channelised to authorised dismantler or recycler.

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SCHEDULE I

[See rules 2, 3(j), 3(y), 3(aa) and 3(ff); 5; 9; 11(10); 13 (1) (i), 13 (1) (vii) and 16(1), 16(11)]

Categories of electrical and electronic equipment including their components, consumables, parts and spares covered under the rules

Sr. No.	Categories of electrical and electronic equipment	Electrical and electronic equipment code
i.	**Information technology and telecommunication equipment :**	
	Centralised data processing: Mainframes, Minicomputers	ITEW1
	Personal Computing: Personal Computers (Central Processing Unit with input and output devices)	ITEW2
	Personal Computing: Laptop Computers (Central Processing Unit with input and output devices)	ITEW3
	Personal Computing: Notebook Computers	ITEW4
	Personal Computing: Notepad Computers	ITEW5
	Printers including cartridges	ITEW6
	Copying equipment	ITEW7
	Electrical and electronic typewriters	ITEW8
	User terminals and systems	ITEW9
	Facsimile	ITEW10
	Telex	ITEW11
	Telephones	ITEW12
	Pay telephones	ITEW13
	Cordless telephones	ITEW14
	Cellular telephones	ITEW15
	Answering systems	ITEW16
ii.	**Consumer electrical and electronics:**	
	Television sets (including sets based on (Liquid Crystal Display and Light Emitting Diode technology)	CEEW1
	Refrigerator	CEEW2
	Washing Machine	CEEW3
	Air-conditioners excluding centralised air conditioning plants	CEEW4
	Fluorescent and other Mercury containing lamps	CEEW5

SCHEDULE II

[See rules 16 (3), 16 (4) and 16 (11)]

Applications, which are exempted from the requirements of sub-rule (1) of rule 16	
	Substance
1	Mercury in single capped (compact) fluorescent lamps not exceeding (per burner):
1(a)	For general lighting purposes <30 W : 2.5 mg
1(b)	For general lighting purposes ≥ 30 W and <50 W : 3.5mg
1(c)	For general lighting purposes ≥ 50 W and <150 W : 5mg
1(d)	For general lighting purposes ≥150 W : 15 mg
1(e)	For general lighting purposes with circular or square structural shape and tube diameter ≤17 mm : 7mg
1(f)	For special purposes:5 mg
2(a)	Mercury in double-capped linear fluorescent lamps for general lighting purposes not exceeding (per lamp):
2(a)(1)	Tri-band phosphor with normal life time and a tube diameter < 9mm (e.g. T2): 4mg
2(a)(2)	Tri-band phosphor with normal life time and a tube diameter ≥ 9 mm and ≤ 17 mm (e.g. T5): 3 mg
2(a)(3)	Tri- band phosphor with normal life time and a tube diameter >17 mm and ≤ 28 mm(e.g. T8): 3.5 mg
2(a)(4)	Tri-band phosphor with normal life time and a tube diameter >28 mm (e.g. T 12):3.5 mg
2(a)(5)	Tri-band phosphor with long life time (≥25000 h):5mg
2(b)	Mercury in other fluorescent lamps not exceeding(per lamp):
2(b)(1)	Linear halophosphate lamps with tube >28 mm (e.g. T 10 and T12):10 mg
2(b)(2)	Non-linear halophosphate lamps(all diameters):15mg
2(b)(3)	Non-linear tri-band phosphor lamps with tube diameter >17 mm(e.g.T9): 15 mg
2(b)(4)	Lamps for other general lighting and special purposes (e.g. induction lamps):15mg
3	Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL)for special purposes not exceeding (per lamp):
3(a)	Short length(≤ 500 mm):3.5mg
3(b)	Medium length(>500 mm and≤1500 mm): 5mg
3(c)	Long length(>1500 mm): 13mg
4(a)	Mercury in other low pressure discharge lamps (per lamp): 15mg
4(b)	Mercury in High Pressure Sodium(vapour) lamps for general lighting purposes not exceeding (per burner)in lamps with improved colour rendering index Ra>60:
4(b)-I	P ≤155 W : 30 mg
4(b)-II	155 W < P ≤405 W : 40 mg
4(b)-III	P >405 W: 40 mg

4(c)	Mercury in other High Pressure Sodium(vapour)lamps for general lighting purposes not exceeding (per burner):
4(c)-I	P≤155 W:25mg
4(c)-II	155 W < P ≤ 405 W:30 mg
4(c)-III	P >405 W:40 mg
4(d)	Mercury in High Pressure Mercury (vapour) lamps (HPMV)
4(e)	Mercury in metal halide lamps (MH)
4(f)	Mercury in other discharge lamps for special purposes not specifcally mentioned in this Schedule
5(a)	Lead in glass of cathode ray tubes
5(b)	Lead in glass of fluorescent tubes not exceeding 0.2% by weight
6(a)	Lead as an alloying element in steel for machining purposes and in galvanized steel containing up to 0.35% lead by weight
6(b)	Lead as an alloying element in aluminium containing up to 0.4% lead by weight
6(c)	Copper alloy containing up to 4% lead by weight
7(a)	Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or more lead)
7(b)	Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission, and network management for telecommunications
7(c)-I	Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound.
7(c)-II	Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher
7(c)-III	Lead in dielectric ceramic in capacitors for a rated voltage of less than 125 V AC or 250 V DC
8(a)	Cadmium and its compounds in one shot pellet type thermal cut-offs
8(b)	Cadmium and its compounds in electrical contracts
9	Hexavalent chromium as an anticorrosion agent of the carbon steel cooling system in absorption refrigerators up to 0.75% by weight in the cooling solution
9(b)	Lead in bearing shells and bushes for refrigerant-containing compressors for heating, ventilation, air conditioning and refrigeration (HVACR) application.
11(a)	Lead used in C-press compliant pin connector systems
11(b)	Lead used in other than C-press compliant pin connector systems
12	Lead as a coating material for the thermal conduction module C- ring
13(a)	Lead in white glasses used for optical applications
13(b)	Cadmium and lead in filter glasses and glasses used for reflectance standards.

14	Lead in solders consisting of more than two elements for the connection between the pins and the package of microprocessors with a lead content of more than 80% and less than 85% by weight
15	Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages.
16	Lead in linear incandescent lamps with silicate coated tubes
17	Lead halide as radiant agent in high intensity discharge (HID) lamps used for professional reprography applications.
18(a)	Lead as activator in the fluorescent powder (1% lead by weight or less) of discharge lamps when used as specialty lamps for diazoprinting reprography, lithography, insect traps, photochemical and curing processes containing phosphors such as SMS ((Sr, Ba)2Mg Si2O7:Pb)
18(b)	Lead as activator in the fluorescent powder (1% lead by weight or less) of discharge lamps when used as sun tanning lamps containing phosphors such as BSP (Ba Si2O5:Pb)
19	Lead with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and with PbSn-Hg as auxiliary amalgam in very compact energy saving lamps (ESL)
20	Lead oxide in glass used for bonding front and rear substrates of flat fluorescent lamps used for Liquid Crystal Displays (LCDs)
21	Lead and cadmium in printing inks for the application of enamels on glasses, such as borosilicate and soda lime glasses
23	Lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm and less
24	Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors
25	Lead oxide in surface conduction electron emitter displays (SED) used in structural elements, notably in the seal frit and frit ring.
26	Lead oxide in the glass envelope of black light blue lamps
27	Lead alloys as solder for transducers used in high-powered (designated to operate for several hours at acoustic power levels of 125 dB SPL and above) loudspeakers
29	Lead bound in crystal glass
30	Cadmium alloys as electrical/mechanical solder joints to electrical conductors located directly on the voice coil in transducers used in high-powered loudspeakers with sound pressure levels of 100 dB(A) and more
31	Lead in soldering materials in mercury free flat fluorescent lamps (which e.g. are used for liquid crystal displays, design or industrial lighting)
32	Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes

33	Lead in solders for the soldering of thin copper wires of 100 µm diameter and less in power transformers
34	Lead in cermet-based trimmer potentiometer elements
36	Mercury used as a cathode sputtering inhibitor in DC plasma displays with a content up to 30 mg per display
37	Lead in the plating layer of high voltage diodes on the basis of a zinc borate glass body
38	Cadmium and cadmium oxide in thick film pastes used on aluminium bonded beryllium oxide
39	Cadmium in colour converting II-VI LEDs (<10 µg Cd per mm2of light- emitting area) for use in solid state illumination or display systems.

SCHEDULE III

[See rules 5 (1) (a) and 13 (1) (ii)]

Targets for Extended Producer Responsibility - Authorisation

No.	Year	E-Waste Collection Target (Number/Weight)
(i)	During first two year of implementation of rules	30% of the quantity of waste generation as indicated in Extended Producer Responsibility Plan.
(ii)	During third and fourth years of implementation of rules	40% of the quantity of waste generation as indicated in Extended Producer Responsibility Plan.
(iii)	During Fifth and Sixth years of implementation of rules	50% of the quantity of waste generation as indicated in Extended Producer Responsibility Plan.
(iv)	Seventh year onward of implementation of rules	70% of the quantity of waste generation as indicated in Extended Producer Responsibility Plan.

SCHEDULE IV

[See rule (17)]

LIST OF AUTHORITIES AND CORREPONDING DUTIES

Sr. No	AUTHORITY	CORRESPONDING DUTIES
1.	Central Pollution Control Board, Delhi	(i) Grant and Renewal of Extended Producer Responsibility - Authorisation and monitoring of its compliance. (ii) Maintain information on Extended Producer Responsibility - Authorisation on its web site. (iii) Set and revise targets for collection of e-waste from time to time. (iv) Coordination with State Pollution Control Boards (v) Preparation of Guidelines for Environmentally Sound Management of e-waste. (vi) Conduct random check for ascertaining compliance of the e-waste rules and identification of such importers or producers who have not applied for Extended Producer Responsibility authorisation or are not complying with RoHS provision. Wherever necessary, Central Pollution Control Board will seek the help of customs department or any other agency of the Government of India. (vii) Conduct random inspection of dismantler or recycler or refurbisher. (viii) Documentation, compilation of data on e-waste and uploading on websites of Central Pollution Control Board (ix) Actions against violation of these rules. (x) Conducting training programmes. (xi) Submit Annual Report to the Ministry. (xii) Enforcement of provisions regarding reduction in use of hazardous substances in manufacture of electrical and electronic equipment. (xiii) Interaction with IT industry for reducing hazardous substances. (xiv) Set and revise targets for compliance to the reduction in use of hazardous substance in manufacture of electrical and electronic equipment from time to time. (xv) Any other function delegated by the Ministry under these rules from time to time.

2.	State Pollution Control Boards or Committees of Union territories	(i) Inventorisation of e-waste. (ii) Grant and renewal of authorisation to manufacturers, dismantlers, recyclers and refurbishers. (iii) Monitoring and compliance of Extended Producer Responsibility - Authorisation as directed by Central Pollution Control Board and that of dismantlers, recyclers and refurbishers authorisation. (iv) Conduct random inspection of dismantler or recycler or refurbisher. (v) Maintain online information regarding authorisation granted to manufacturers, dismantlers, recyclers and refurbishers. (vi) Implementation of programmes to encourage environmentally sound recycling. (vii) Action against violations of these rules. (viii) Any other function delegated by the Ministry under these rules.
3.	Urban Local Bodies (Municipal Committee or Council or Corporation)	(i) To ensure that e-waste if found to be mixed with Municipal Solid Waste is properly segregated, collected and is channelised to authorised dismantler or recycler. (ii) To ensure that e-waste pertaining to orphan products is collected and channelised to authorised dismantler or recycler.
4.	Port authority under Indian Ports Act, 1908 (15 of 1908) and Customs Authority under the Customs Act, 1962 (52 of 1962)	(i) Verify the Extended Producer Responsibility - Authorisation. (ii) Inform Central Pollution Control Board of any illegal traffic for necessary action. (iii) Take action against importer for violations under the Indian Ports Act, 1908/Customs Act, 1962.

FORM-1

[See Rules 5(1) (g), 13(1) (i), 13(1) (vi)]

Applicable to producers seeking Extended Producer Responsibility - Authorisation

The application form should contain the following information:

1.	Name and full address along with telephone numbers, e-mail and other contact details of Producer (It should be the place from where sale in entire country is being managed)	:	
2.	Name of the Authorised Person and full address with e-mail, telephone and fax number	:	
3.	Name, address and contact details of Producer Responsibility Organisation, if any with full address, e-mail, telephone and fax number, if engaged for implementing the Extended Producer Responsibility	:	
4.	Details of electrical and electronic equipment placed on market year-wise during previous 10 years in the form of Table 1 as given below:	:	

Table 1:
Details of Electrical and Electronic Equipment placed on the market in previous years - Code wise

Sr. No.	Electrical and Electronic Equipment Item	Electrical and Electronic Equipment Code	Quantity, number and weight placed on market (year-wise)									
A	**Information technology and telecommunication equipment:**											
1	Centralised data processing: Mainframes, Minicomputers	ITEW1										
2	Personal Computing: Personal Computers (Central Processing Unit with input and output devices)	ITEW2										

3	Personal Computing: Laptop Computers(Central Processing Unit with input and output devices)	ITEW3										
4	Personal Computing: Notebook Computers	ITEW4										
5	Personal Computing: Notepad Computers	ITEW5										
6	Printers including cartridges	ITEW6										
7	Copying equipment	ITEW7										
8	Electrical and electronic typewriters	ITEW8										
9	User terminals and systems	ITEW9										
10	Facsimile	ITEW10										
11	Telex	ITEW11										
12	Telephones	ITEW12										
13	Pay telephones	ITEW13										
14	Cordless telephones	ITEW14										
15	Cellular telephones	ITEW15										
16	Answering systems	ITEW16										
B	**Consumer electrical and electronics:**											
17	Television sets (including sets based on (Liquid Crystal Display and Light Emitting Diode technology)	CEEW1										
18	Refrigerator	CEEW2										
19	Washing Machine	CEEW3										
20	Air-conditioners excluding centralised air conditioning plants	CEEW4										
21	Fluorescent and other Mercury containing lamps	CEEW5										

5. Estimated generation of Electrical and Electronic Equipment waste item-wise and estimated collection target for the forthcoming year in the form of Table 2 including those being generated from their service centres, as given below:

Table 2
Estimated generation of Electrical and Electronic Equipment waste item-wise and estimated collection target for the forthcoming year

Sr. No.	Item	Estimated waste electrical and electronic equipment generation Number and weight	Targeted collection Number and weight

6. Extended Producer Responsibility Plans:
   (a) Please provide details of your overall scheme to fulfil Extended Producer Responsibility obligations including targets. This should comprise of general scheme of collection of used/waste Electrical and Electronic Equipment from the Electrical and Electronic Equipment placed on the market earlier such as through dealers and collection centres, Producer Responsibility Organisation, through buy-back arrangement, exchange scheme, Deposit Refund Scheme, etc. whether directly or through any authorised agency and channelising the items so collected to authorised recyclers.
   (b) Provide the list with addresses along with agreement copies with dealers, collection centres, recyclers, Treatment, Storage and Disposal Facility, etc. under your scheme.
7. Estimated budget for Extended Producer Responsibility and allied initiatives to create consumer awareness.
8. Details of proposed awareness programmes.
9. Details for Reduction of Hazardous Substances compliance (to be filled if applicable):
   (a) Whether the Electrical and Electronic Equipment placed on market complies with the rule 16 (1) limits with respect to lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominateddiphenyl ethers;
   (b) Provide the technical documents (Supplier declarations, Materials declarations/Analytical reports) as evidence that the Reduction of Hazardous Substances (RoHS) provisions are complied by the product based on standard EN 50581 of EU;
   (c) Documents required:
      i. Extended Producer Responsibility plan;
      ii. Copy of the permission from the relevant Ministry/Department for selling their product;
      iii. Copies of agreement with dealers, collection centre, recyclers, Treatment, Storage and Disposal Facility, etc.;
      iv. Copy of Directorate General of Foreign Trade license/permission as applicable;
      v. Self-declaration regarding Reduction of Hazardous Substances provision;
      vi. Any other document as required.

Place: **(Authorised signature)**

Date:

FORM 1(a)

[See rules 4(2), 8 (2), 13(2) (ii), 13(2) (vi) and 13(4) (i)]

APPLICATION FOR OBTAINING AUTHORISATION FOR GENERATION OR STORAGE OR TREATMENT OR DISPOSAL OF E-WASTE BY MANUFACTURER OR REFURBISHER*

From: .....

.....

To

The Member Secretary,

..... Pollution Control Board or…… Pollution Control Committee

.....

.....

Sir,

I / We hereby apply for authorisation/renewal of authorisation under rule 13(2) (i) to 13(2) (viii) and/or 13 (4) (i) of the E-Waste (Management) Rules, 2016 for collection/storage/ transportation/ treatment/ refurbishing/disposal of e-wastes.

For Office Use Only

Code No. :

Whether the unit is situated in a critically polluted area as identified by Ministry of Environment and Forests (yes/no);

To be filled in by Applicant

1. Name and full address:
2. Contact Person with designation and contact details such as telephone Nos, Fax. No. and E-mail:
3. Authorisation required for (Please tick mark appropriate activity/ies*)
   - (i) Generation during manufacturing or refurbishing* ☐
   - (ii) Treatment, if any ☐
   - (iii) Collection, Transportation, Storage ☐
   - (iv) Refurbishing ☐
4. E-waste details:
   - (a) Total quantity e-waste generated in MT/A
   - (b) Quantity refurbished (applicable to refurbisher) (c) Quantity sent for recycling
   - (d) Quantity sent for disposal

5. Details of Facilities for storage/handling/treatment/refurbishing:

6. In case of renewal of authorisation previous authorisation no. and date and details of annual returns:

Place :_____ Signature: _____

Date : _____ (Name_____)

Designation: _____

Note:-

(1) *The authorisation for e-waste may be obtained along with authorisation for hazardous waste under the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, if applicable.

(2) Wherever necessary, use additional sheets to give requisite and necessary details.

FORM 1 (aa)

[See rules 5 (6) and 13(1)(ii)]

FORMAT OF EXTENDED PRODUCER RESPONSIBILITY - AUTHORISATION

[Extended Producer Responsibility Authorisation for Producer of the Electrical & Electronic Equipment]

Ref: Your application for Grant of Extended Producer Responsibility - Authorisation for following Electrical & Electronic Equipment under E-Waste (Management) Rules, 2016

1. Number of Authorisation:

Date:

2. **M/s.** _____ is hereby granted Extended Producer Responsibility - Authorisation based on:
   (a) overall Extended Producer Responsibility plan
   (b) proposed target for collection of e-waste
3. The Authorisation shall be valid for a period of _____ years from date of issue with following conditions:
   (i) you shall strictly follow the approved Extended Producer Responsibility plan, a copy of which is enclosed herewith;
   (ii) you shall ensure that collection mechanism or centre are set up or designated as per the details given in the Extended Producer Responsibility plan. Information on collection mechanism/centre including the state-wise setup should be provided;
   (iii) you shall ensure that all the collected e-waste is channelised to authorised dismantler or recycler designated as per the details. Information on authorised dismantler or recycler designated state-wise should be provided;
   (iv) you shall maintain records, in Form-2 of these Rules, of e-waste and make such records available for scrutiny by Central Pollution Control Board;
   (v) you shall file annual returns in Form-3 to the Central Pollution Control Board on or before 30th day of June following the financial year to which that returns relates;
   (vi) General Terms & Conditions of the Authorisation:
      a. The authorisation shall comply with provisions of the Environment (Protection) Act, 1986 and the Rules made there under;
      b. The authorisation or its renewal shall be produced for inspection at the request of an officer authorised by the Central Pollution Control Board;
      c. Any change in the approved Extended Producer Responsibility plan should be informed to Central Pollution Control Board on which decision shall be communicated

by Central Pollution Control Board within sixty days;

d. It is the duty of the authorised person to take prior permission of the concerned State Pollution Control Boards and Central Pollution Control Board to close down the facility;

e. An application for the renewal of authorisation shall be made as laid down in sub-rule (vi) of rule of 13(1) the E-Waste (Management) Rules, 2016;

f. The Board reserves right to cancel/amend/revoke the authorisation at any time as per the Policy of the Board or Government.

Authorized signatory
(with designation)

To,

Concerned Producer
Copy to:

1. Member Secretary, Concerned State.
2. In-charge, concerned Zonal Office, Central Pollution Control Board.

FORM 1(bb)

[See rules 4(2), 8(2)(a), 13(2) (iii) and 13(4)(ii)]

FORMAT FOR GRANTING AUTHORISATION FOR GENERATION OR STORAGE OR TREATMENT OR REFURBISHING OR DISPOSAL OF E-WASTE BY MANUFACTURER OR REFURBISHER

Ref: Your application for Grant of Authorisation

1. (a) Authorisation no. ..... and (b) date of issue …….
2. ……..……of……is hereby granted an authorisation for generation, storage, treatment, disposal of e-waste on the premises situated at…… for the following:
   a. quantity of e-waste;
   b. nature of e-waste.
3. The authorisation shall be valid for a period from …… to ……
4. The e-waste mentioned above shall be treated/ disposed off in a manner ..... at .....
5. The authorisation is subject to the conditions stated below and such conditions as may be specified in the rules for the time being in force under the Environment (Protection) Act, 1986.

Signature ----------

Designation ---------- Date: ----------

Terms and conditions of authorisation

1. The authorisation shall comply with the provisions of the Environment (Protection) Act, 1986, and the rules made thereunder.
2. The authorisation or its renewal shall be produced for inspection at the request of an officer authorized by the concerned State Pollution Control Board.
3. Any unauthorised change in personnel, equipment as working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorisation.
4. It is the duty of the authorised person to take prior permission of the concerned State Pollution Control Board to close down the operations.
5. An application for the renewal of an authorisation shall be made as laid down in sub-rule (vi) of rule 13(2).

FORM-2

[See rules 4(4), 5(4), 6(5), 8(7), 9(2), 10(7), 11(8), 13 (1) (xi), 13(2)(v), 13(3)(vii) and 13 (4)(v)]

FORM FOR MAINTAINING RECORDS OF E-WASTE HANDLED OR GENERATED Generated Quantity in Metric Tonnes (MT) per year

1.	Name & Address: Producer or Manufacturer or Refurbisher or Dismantler or Recycler or Bulk Consumer*		
2.	Date of Issue of Extended Producer Responsibility Authorisation*/ Authorisation*		
3.	Validity of Extended Producer Responsibility Authorisation*/ Authorisation*		
4.	Types & Quantity of e- waste handled or generated**	Category	Quantity
		Item Description	
5.	Types & Quantity of e-waste stored	Category	Quantity
		Item Description	
6.	Types & Quantity of e-waste sent to collection centre authorised by producer/ dismantler/recycler / refurbisher or authorised dismantler/ recycler or refurbisher**	Category	Quantity
		Item Description	
7.	Types & Quantity of e-waste transported*	Category	Quantity
		Item Description	
	Name, address and contact details of the destination		
8.	Types & Quantity of e-waste refurbished*	Category	Quantity
		Item Description	
	Name, address and contact details of the destination of refurbished materials		

9.	Types & Quantity of e-waste dismantled*	Category	Quantity
		Item Description	
	Name, address and contact details of the destination		
10.	Types & Quantity of e-waste recycled*	Category	Quantity
	Types & Quantity of materials recovered	Item Description	
		Quantity	
	Name, address and contact details of the destination		
11	Types & Quantity of e- waste sent to recyclers by dismantlers	Category	Quantity
		Item Description	
	Name, address and contact details of the destination		
12.	Types & Quantity of other waste sent to respective recyclers by dismantlers/ recyclers of e-waste	Category	Quantity
		Item Description	
	Name, address and contact details of the destination		
13.	Types & Quantity of e-waste treated & disposed	Category	Quantity
		Item Description	
	Name, address and contact details of the destination		

Note:-

(1) * Strike off whichever is not applicable

(2) Provide any other information as stipulated in the conditions to the authoriser

(3) ** For producers this information has to be provided state-wise

FORM-3

[See rules 4(5), 5(5), 8(6), 9(4), 10(8), 11(9), 13 (1) (xi), 13(2)(v), 13(3)(vii) and 13(4)(v)]

FORM FOR FILING ANNUAL RETURNS

[To be submitted by producer or manufacturer or refurbisher or dismantler or recycler by 30th day of June following the financial year to which that return relates].

Quantity in Metric Tonnes (MT) and numbers

1	Name and address of the producer or manufacturer or refurbisher or dismantler or recycler			
2	Name of the authorised person and complete address with telephone and fax numbers and e-mail address			
3	Total quantity of e-waste collected or channelised to recyclers or dismantlers for processing during the year for each category of electrical and electronic equipment listed in the Schedule I (Attach list) by PRODUCERS			
	Details of the above	TYPE	QUANTITY	No.
3(A)*	BULK CONSUMERS: Quantity of e- waste			
3(B)*	REFURBISHERS: Quantity of e-waste:			
3(C)*	DISMANTLERS: i. Quantity of e-waste processed (Code wise); ii. Details of materials or components recovered and sold; iii. Quantity of e-waste sent to recycler; iv. Residual quantity of e-waste sent to Treatment, Storage and Disposal Facility.			

3(D)*	RECYCLERS: i. Quantity of e-waste processed (Code wise); ii. Details of materials recovered and sold in the market; iii. Details of residue sent to Treatment, Storage and Disposal Facility.			
4	Name and full address of the destination with respect to 3(A)-3(D) above			
5	Type and quantity of materials segregated or recovered from e-waste of different codes as applicable to 3(A)-3(D)	Type	Quantity	

✓Enclose the list of recyclers to whom e-waste have been sent for recycling.

Place _____

Date _____

Signature of the authorised person

Note:-

(1) * Strike off whichever is not applicable

(2) Provide any other information as stipulated in the conditions to the authoriser

(3) In case filing on behalf of multiple regional offices, Bulk Consumers and Producers need to add extra rows to 1 & 3(A) with respect to each office.

FORM-4

[See rules 13(3)(i) and 13(3)(vi)]

APPLICATION FORM FOR AUTHORISATION OF FACILITIES POSSESSING ENVIRONMENTALLY SOUND MANAGEMENT PRACTICE FOR DISMANTLING OR RECYCLING OF E-WASTE

(To be submitted in triplicate)

1.	Name and Address of the unit			
2.	Contact person with designation, Tel./Fax			
3.	Date of Commissioning			
4.	No.of workers (including contract labour)			
5.	Consents Validity	a. Water (Prevention and Control of Pollution) Act, 1974; Valid up to_____ b. Air (Prevention and Control of Pollution) Act, 1981; Valid up to_____		
6.	Validity of current authorisation if any	e-waste (Management & Handling) Rules, 2011; Valid up to _____		
7.	Dismantling or Recycling Process	Please attach complete details		
8.	Installed capacity in MT/year	Products	Installed capacity (MTA)	
9.	E-waste processed during last three years	Year	Product	Quantity
10.	Waste Management:			
	a. Waste generation in processing e-waste	Please provide details material wise		
	b. Provide details of disposal of residue.	Please provide details		
	c. Name of Treatment Storage and Disposal Facility utilized for			

11.	Details of e-waste proposed to be procured from re-processing	Please provide details
12.	Occupational safety and health aspects	Please provide details
13.	Details of Facilities for dismantling both manual as well as mechanised:	
14.	Copy of agreement with Collection Centre	
15.	Copy agreement with Producer	
16.	Details of storage for dismantled e-waste	
17.	Copy of agreement with Recycler	
18.	Details of Facilities for Recycling	
19.	Copy of agreement with Collection Centre	
20.	Copy agreement with Producer	
21.	Details of storage for raw materials and recovered materials	

II. In case of renewal of **authorisation, previous registration or authorisation no. and date**

I hereby declare that the above statements or information are true and correct to the best of my knowledge and belief.

Signature

Place:_____ Name: _____

Date:_____ Designation: _____

Form-5

[See rule 18 (1)]

FORM FOR ANNUAL REPORT TO BE SUBMITTED BY THE STATE POLLUTION CONTROL BOARD TO THE CENTRAL POLLUTION CONTROL BOARD

To,

The Chairman,

Central Pollution Control Board,
(Ministry of Environment And Forests)
Government Of India, 'Parivesh Bhawan', East Arjun Nagar,
Delhi- 110 0032

1.	Number of authorised manufacturer, refurbisher, collection centre, dismantler and recycler for management of e-waste in the State or Union territory under these rules	:	
2.	Categories of waste collected along with their quantities on a monthly average basis:	:	Please attach as Annexure-I
3.	A Summary Statement code-wise of e-waste collected	:	Please attach as Annexure-II
4.	Details of material recovered from recycling of e-waste	:	
5.	Quantity of CFL received at Treatment, Storage and Disposal Facility	:	
6.	The above report is for the period from .....to		

Place: __

Date: __

Chairman or the Member Secretary
State Pollution Control Board

Form-6

[See rule 19]

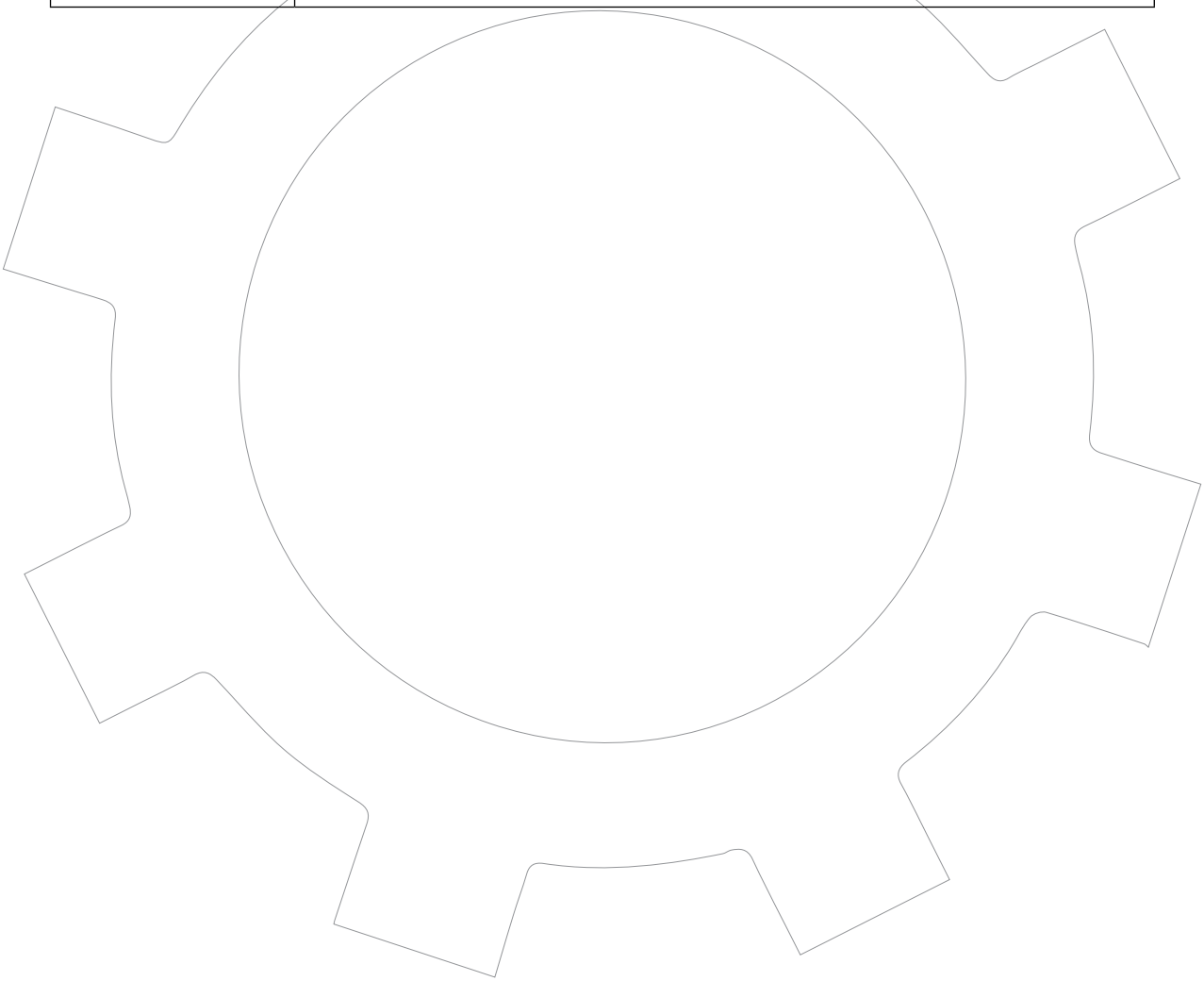
E-WASTE MANIFEST

1.	Sender's name and mailing address (including Phone No.) :	
2.	Sender's authorisation No, if applicable. :	
3.	Manifest Document No. :	
4.	Transporter's name and address : (including Phone No.)	
5.	Type of vehicle :	(Truck or Tanker or Special Vehicle)
6.	Transporter/s registration No. :	
7.	Vehicle registration No. :	
8.	Receiver's name & address :	
9.	Receiver's authorisation No, if applicable. :	
10.	Description of E-Waste (Item, Weight/ Numbers) :	
11.	Name and stamp of Sender* (Manufacturer or Producer or Bulk Consumer or Collection Centre or Refurbisher or Dismantler): Signature: Month Day Year	
12.	Transporter acknowledgement of receipt of E-Wastes	
	Name and stamp: Signature: Month Day Year	
13.	Receiver* (Collection Centre or Refurbisher or Dismantler or Recycler) certification of receipt of E-waste	
	Name and stamp: Signature: Month Day Year	

* As applicable

Note:-

Copy number with colour code (1)	Purpose (2)
Copy 1 (Yellow)	To be retained by the sender after taking signature on it from the transporter and other three copies will be carried by transporter.
Copy 2 (Pink)	To be retained by the receiver after signature of the transporter.
Copy 3 (Orange)	To be retained by the transporter after taking signature of the receiver.
Copy 4 (Green)	To be returned by the receiver with his/her signature to the sender



FORM 7

[See rule 22]

APPLICATION FOR FILING APPEAL
AGAINST THE ORDER PASSED BY CENTRAL POLLUTION CONTROL BOARD/STATE POLLUTION CONTROL BOARD

1.	Name and address of the person making the appeal	:	
2.	Number, date of order and address of the authority to which passed the order, against which appeal is	:	(certified copy of the order be attached)
3.	Ground on which the appeal is being made	:	
4.	Relief sought for	:	
5.	List of enclosures other than the order referred in point 2 against which the appeal is being filed	:	

Signature……...…….

Name and address…….

Place:

Date:

Bishwanath Sinha
Joint Secretary to Government of India
(F No. 12-6/2013-HSMD)

MODEL WASTE MANAGEMENT PROJECTS



Biogas Plant - Alappuzha Govt. Medical College



Material Recovery Facility (MRF) - Chittur Thathamangalam Municipality



Organic Waste Composting Machine - Trivandrum Club, Trivandrum







Plastic Recycling Centre -
Mokeri Grama Panchayat, Kannur





Plastic Processing Unit -
Pallikkara Grama Panchayat, Kasaragod





Mini Material Recovery Facility - Punalur Municipality, Kollam



Vermi Compost Plant - North Paravur Municipality, Ernakulam



Biopark - Legislative Assembly, Trivandrum



Household level Waste Management - Kitchen Bin & Tri-Mud Pot, Trivandrum Coorporation



Wat-San Park, Alappuzha Municipality



Bio Gas Plant



Slaughter House - Kattappana



Biodegradable Waste Management in LSGIs - Kumily Grama Panchayat



Biodegradable Aerobin - Eloor Municipality





Crematorium - Pachalam, Ernakulam District



Crematorium - Mulanthuruthy



Collection from houses and shops - Mokeri Grama Panchayat



Crematorium - Mattannur



Technopark - Thiruvananthapuram





Sewage Treatment Plant, Taliparamba, Kannur





Organic Waste Converter, Trivandrum Club



Biogas plant at Health Circle Office, Trivandrum Coorporation Office Manacaud



Material Recovery Facility at Sreekanteshwaram



Segregated waste collection by Kudumbasree, Manacaud, Thiruvananthapuram





Non Bio Degradable waste management, Eraviperoor Panchayat





Aerobic composting unit at Mezhuveli Grama Panchayat



Aeorobic cluster, Thumboormuzhy

Mini MRFC's in Alappuzha Municipality











Adatt Grama Panchayat , Thrissur



Composting unit

Non bio degradable

Adaatt





Second level segregation at RRC









Products



Kinanoor Karinthalam Grama Panchayat-
Non-Biodegradable Poultry processing and rendering unit, Kasaragode







