

Appendices

Appendix-1.1
(Reference: Paragraph-1.2, page 02)
Processing Technologies

- **Material Recovery Facility**

A material recovery facility (MRF) is a place where non-biodegradable or recyclable solid waste collected from the doorstep is segregated, sorted and various components of recyclable waste recovered from it for resale. The MRF accepts mixtures of waste fractions (non-biodegradable or recyclable) and its configuration depends on the several factors like the type, quantity and quality of incoming waste materials. Here the material is basically segregated into different streams of waste fractions (paper, plastic, packaging paper, bottles etc.) which is further sold to intermediaries who supply bulk material to the recycling industries. MRFs also require large storage spaces to temporarily store sorted recyclables which can be made available to recyclers in bulk for improved resale value. Depending on the scale of operations and the level of mechanization in the facility, MRFs may be classified as manual or mechanized. Small scale units employ manual MRFs wherein manual sorting process is being carried and it's typically owned, operated and managed by the informal sector. Large scale units have mechanized MRFs with sophisticated systems and equipment that enable efficient separation of large quantity of material into different fractions.

Material Recovery Facility



Grinder Machine



Bailer Machine,

- **Composting**

After waste minimisation and recycling systems, the ISWM hierarchy indicates adoption of resource recovery strategies and composting as the third preferred waste management practise, ensuring that waste is processed appropriately to facilitate further



use of the material. Composting is a controlled aerobic process of biologically “digesting” the MSW, so it may be recycled for other purposes—plant nutrient, stabilization of soil in remediation process, or soil amendment for recovery of poor soils. Compost production can be carried out at the decentralised level (home composting, bin composting, box composting, vermicomposting, in vessel composting) or at a centralised level (windrow composting, in vessel composting, aerated static pile), depending on the feasibility of implementation. Both processes require significant pre-processing, and only segregated organic matter can be composted. Compost produced should meet with quality criteria specified by the Fertilizer Control Order (FCO), 2009 and 2013. A market for the compost should be ascertained before sizing the compost plants.

- **Waste to Energy**

Where material recovery and composting from MSW is not possible or desirable due to local conditions or because of the nature of waste, recovery of energy from MSW is suggested as a feasible alternative. When high calorific value fractions of MSW are either incinerated (thermal process) or biodegradable fraction of MSW is processed anaerobically (biomethanation), the resultant energy, either as heat (incineration) or biogas (methane) can be reused either directly or converted to electricity using appropriate generators. Sale of this energy should result in the financial viability of waste to energy systems. Where the tariff of power is not high enough to ensure financial sustainability of the plant, a tipping fee may be considered by the ULB. Appropriate care should be taken to ensure continued and stable supply of the waste for achieving requisite economies of scale. Proper environmental checks should also be in place to meet with stringent norms for incineration.

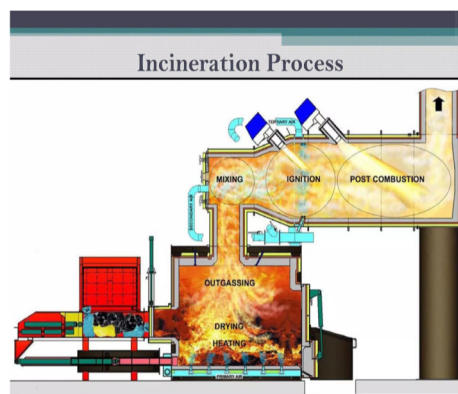


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- **Incineration**

Incineration is a waste treatment process that involves combustion of waste at very high temperatures in the presence of oxygen, resulting in the production of ash, flue gas, and heat. It is feasible for unprocessed or minimally processed refuse besides the segregated fraction of the high calorific waste. The potential for energy generation depends on the composition, density, moisture content, and presence of inert in the waste. About 65-80 per cent of the energy



content of the organic matter can be recovered as heat energy, which can be utilized for thermal applications. Incineration is an option to be considered only after implementing suitable material recycling and recovery systems, or where other better options for

processing are not feasible and land availability is a problem. Typically, only cities which are able to supply at least 1,000 tonnes per day (TPD) of waste should venture to install waste-to-energy plants. However, incinerator plants have the potential to cause significant environmental impacts through emissions and fly ash if plants are not operated efficiently and if appropriate emission control measures are not adopted. Therefore, due care should be taken to comply with operating and emission standards as prescribed under revised SWM Rules, 2016 along with adoption of emission abatement technologies.

- **Biomethanation**

Biomethanation is the anaerobic (in the absence of air or, more specifically, free oxygen) digestion of biodegradable organic waste in an enclosed space under controlled conditions of temperature, moisture, pH, etc. It is considered one of the most technically viable option for the Indian MSW due to MSW's high organic and moisture content. Biomethanation plant requires a consistent source of degradable organic matter free from inert material as well as a sustainable demand for the generated biogas at appropriate economic conditions. Biomethanation plant can be operated at decentralised level (up to 5 TPD) or centralised level depending on the feasibility of the implementation and waste inflow. The overall performance of the biomethanation plant is greatly influenced by the input feed specification, and the plant requires segregated biodegradable MSW (e.g., hotel and restaurant waste, market waste) for optimal plant performance. The homogeneity of the feed material is an important parameter from the efficiency viewpoint.

- **Refuse Derived Fuel**

Refuse-derived fuel (RDF) refers to the high calorific non-recyclable combustible fraction of processed MSW, which is used either as a fuel for steam and electricity



generation or as alternate fuel in industrial furnaces and boilers. The composition of RDF is a mixture that has higher concentrations of combustible materials than those present in the parent mixed MSW. RDF should preferably be co-processed in cement plants. Co-processing of RDF in steel industry and for power generation is also indicated, but yet to be proven in India. Internationally, the co-processing of RDF for power generation is technically proven and widely practised as a part of their waste management strategy; however, not much information is available for co-processing of RDF in steel sector.

Appendix-1.2

(Reference: Paragraph-1.5.2, page 07)

Details of allotment and expenditure in test checked ULBs

(₹ in crore)

Year	OB	Fund received from					Total available fund	Exp.	Closing Balance
		Central	State	Own	Others ¹	Total			
2017-18	52.54	56.19	247.81	78.12	0.25	382.37	434.91	298.15	136.76
2018-19	136.76	53.54	258.80	79.51	10.03	401.88	538.64	329.25	209.39
2019-20	209.39	89.32	247.28	95.16	9.32	441.08	650.47	334.59	315.88
2020-21	315.88	106.73	259.55	80.12	21.18	467.58	783.46	471.20	312.26
2021-22	312.26	48.92	267.61	85.29	30.50	432.32	744.58	528.04	216.54
Total		354.70	1,281.05	418.20	71.28	2,125.23		1,961.23	

Source: Information provided by the test checked ULBs.

¹ Chardham Yatra, Covid-19, Kavadi Mela, Daiviye Aapda, Kumbh Mela, Swachh Bharat Mission, Special Assistance to States for Capital Investment etc.

Appendix-2.1
(Reference: Paragraph-2.1.2, page 13)

Contingency Plan not prepared

Location	Size of the Land (in sq. meter)	Landowner	Mixed Waste dumped during 2017-18 to 2021-22 (MT)	Audit view
Ward no-03, Chandangrah, Dineshpur	300.00 sq. meter	Nagar Panchayat, Dineshpur	2,190 Ton-Approx	<i>The lenient view of the Panchayat not only resulted in dumping of the Municipal Solid Waste in open localities of the Panchayat jurisdiction but also causing threat to the environment. Panchayat which was responsible for maintaining environment standards in the area was itself damaging the environment by dumping the MSW in different open area of the Panchayat.</i>
Ramkot no-06, Barirai, Dineshpur	2,023.43 sq. meter or 0.5 acre	Raj Singh s/o shri Amar Singh	1. 352 Ton-Approx. (Hired for period December 2019 to March 2020) 2. 1,825 Ton-Approx. for the year 2020-21 (Hired for period March 2020 to February 2023)	
Gram- Ramkot No-06, Tehsil-Gadarpur	1,393.54 sq. meter or 15,000 sq. foot	Ritik s/o shri Ravindra	1,825 Ton- Approx. for the year 2021-22 (Hired for period February 2021 to February 2022)	
Gram- Anandkheda, Tehsil-Gadarpur	2,023.43 sq. meter or 0.5 acre	Ajit Singh s/o Chandan Singh	300 Ton- Approx Operated only for 02-months (Hired for period May 2022 to May 2023)	
Bura Nagar, Tehsil-Gadarpur, (Mahtosh Moad)	3,000 sq. meter or 0.30 hectare	Vijay Kumar Munjal	900 Ton- Approx. (Hired for period July 2022 to July 2023)	

Appendix-2.2
(Reference: Paragraph 2.5.5, page 18)

Status of project work in test checked ULBs

Name of the ULB	DPR prepared under scheme	Name of the Project to be established	Land owned or not	Status of the work
NPP Mussoorie	National Mission on Himalayan Studies	Biomethanation plant and Pyrolysis plant	Yes	Yet to be established, process is underway.
NPP Nainital	National Mission on Himalayan Studies	For collection, segregation and upcycling of solid waste (Processing plant)	Yes	Yet to be established, process is underway.
NN Haldwani	Jawaharlal Nehru National Urban Renewal Mission (JnNURM) (Cluster Based)	Establishment of processing plant, scientific landfill site.	Yes	The processing plant & scientific landfill site was not established yet. Tender yet to be finalised.
NPP Khatima	Swachh Bharat Mission	Compost plant & desegregation hall to be established	Not yet	Land yet to be occupied
NN Dehradun	Jawaharlal Nehru National Urban Renewal Mission	Processing plant & sanitary land fill site	Yes	Processing of waste done; RDF dumped at the site
NP Dineshpur	Swachh Bharat Mission	Centralised processing facility (establishment of desegregation hall)	Yes	No action initiated after demise of contractor's engaged for the work.
NN Rudrapur	Included in Haldwani cluster			
NN Haridwar	Jawaharlal Nehru National Urban Renewal Mission	Processing plant & sanitary land fill site	Yes	Processing plant running, RDF dumped at the SLF site.
NPP Swargshram Jonk	Swachh Bharat Mission (Cluster based)	Included in Rishikesh cluster		
NPP Barkot	Swachh Bharat Mission	MRF centre, compost pits, sanitary landfill	Yes	MRF centre, compost pits set up. Sanitary landfill yet to be set up.
NP Agustmuni	Swachh Bharat Mission	Processing plant, sanitary landfill site.	Not yet	Land yet to be occupied
NPP Tehri	Swachh Bharat Mission	Processing Plant, Sanitary Landfill site.	Yes	Project yet to start due to residents' agitation.
NP Naugaon	Swachh Bharat Mission	Processing plant, sanitary landfill site.	Yes	Agreement made for disposal facility including sanitary landfill

Source: Information provided by the ULBs.

