

SCIENTIFIC SOLID WASTE MANAGEMENT PLAN
FOR HAVELOCK ISLAND
ANDAMAN AND NICOBAR ISLANDS



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1. INTRODUCTION:

Havelock is one of the favorite tourist destinations of the Union Territory of Andaman and Nicobar Islands blessed with world famous sea beaches namely Radhanagar, Kalapathar and Elephanta beach. The blissful white sandy beaches, coral reefs with colourful array of aquatic life, tall kadi mavha trees along the shore line attracts Foreign and Indian tourists. Island is situated at 57 Km north east of Port Blair town with an area of slightly more than 100 Sq.Km. Habitation is mainly of Bengali settlers.

There are two Panchayats Govindnagar and Shyamnagar which covers five villages namely Govinda Nagar, Bejoy Nagar, Shyam Nagar, Krishna Nagar and Radha Nagar. The island comes under revenue jurisdiction of the South Andaman District.

The majority of the population are farmers cultivating paddy and vegetables. In last two decade, tourism industries developed and play major economical activities of the island. At present approximately 47 No. of hotels and resorts are catering to the demand of the tourists.

2. PRESENT SCENARIO OF SOLID WASTE AND ITS MANAGEMENT:

As per 2011 census, the population of the Havelock island is 6315 and approximately 1000 floating population working in restaurants, hotels & other establishments. On an average 4 to 4.5 tones of solid waste is generated every day. The major chunk of waste comes from the booming tourist industry of Hotel and Restaurants. These wastes contains plastic including PET bottles, glass bottles, cans & tins and kitchen waste including food waste, vegetable peels, cardboards etc.

Due to continuous efforts of administration, most of the hotels are segregating waste at source. The plastic and glass waste are being collected by dealers for further recycling at mainland by availing the Administration's scheme on Freight exemption of transportation to mainland.

A survey conducted by the Andaman and Nicobar Administration Pollution Control Committee in June 2014, following are observed:

1. One solid waste dump yard is established under Shyamnagar Panchyat which do not have any facility for handling the waste in a scientific manner as per the provisions of MSW Rule,2000.
2. Presently the wastes are segregated at source in most of the hotels into plastic, glass and kitchen waste. The plastic and glass waste are being collected by the recycler. The kitchen waste are mostly dumped in the garbage dump yard at Shyamnagar Panchyat.
3. Some of the farmers started piggery and they collect kitchen waste for feed from nearby hotels, which is one of the method for disposal of kitchen waste.
4. While analyzing the composition of wastes, beside plastic and glass, it has been observed that large quantity of can(tin), cardboard and plastic pouches are also generated. These waste are recyclable and as such in Port Blair, these are collected by vendors. However in Havelock, it is not done so far and these recyclable wastes are mixed with general solid waste.

The present solid waste management system could be improved by adopting the following measures :

1. Rapid and complete removal of environmentally dangerous waste.
2. Improved scientific method of collection, transportation and disposal.
3. Recycling of solid waste.
4. Involvement of the community and private entrepreneurs to be with the PRI's.
5. Segregation of garbage at source and collection of garbage from the segregated source.
6. Avoid human habitation within 1 km vicinity of the dumpsite area.
7. Sponsorship system for the dustbin and tricycle may be encouraged to ensure regular income for maintenance of solid waste management system.

3. MANAGEMENT PLAN

3.1 Implementation of MSW Rules

Management of solid wastes has become a critical issue for island like Havelock due to its isolated geographical locations and small land mass. There is no industrial activities which discharge pollutants in the environment but with rapid growth of tourism activities , no of hotels, restaurants and shops are increasing. These hotels and restaurants are the main source for generation of solid waste in large quantity. Although the responsibility of solid waste management remains primarily with the PRIs, several other stakeholder groups also play a significant role in the process of scientific management of solid.

The Municipal Solid Waste (Management & Handling) Rules, 2000 has specific directives to the Local Bodies, District Administrations and the Urban Development Departments of the State Governments for proper and scientific management of municipal solid waste. Under these rules, it is mandatory for all the urban local bodies to provide facilities for collection, transportation, treatment & disposal of municipal solid waste in a scientific and hygienic manner.

3.2 Composition of waste and present disposal methods

Types of waste	Composition	Disposal methods	Recommended method
Biodegradable waste	Vegetable peels, meat, fish, egg shell, tea leaves, old food, etc	Mixed with other solid waste and dumped at landfill site	Compositing either by Vermiculture or Aerobic biological method
Recyclable waste	Cardboards, tin, cans, PET bottles, plastic, glass.	1. Some quantity of plastic and glass waste are transported for recycling 2. The cardboard, tin, cans etc which at present mix with other waste.	All recyclable waste should be segregated at source and send for recycling.
Hazardous waste	Tube lights, CFL, Bulbs, batteries, medical waste etc	Mixed with other solid waste and dumped at landfill site	These waste should be kept in earmarked area and disposed in consultation with ANPCC

3.3 Indicative action plan for Management of Solid Waste:

S.No	Activities	Action
1	Authorization	Local body should apply for authorization in form – I (Annexure-I) and seek from ANPCC
2	Collection of waste	Comply with schedule-II of the rules(Annexure-II)
3	Segregation of waste	Launch mass awareness programme
4	Storage of waste	Set up waste storage facilities which would be combination of conventional and as well as mechanized system and maintaining them in hygienic manner
5	Transportation of waste	Economic type of vehicles including tricycle, considering hygienic aspects.
6	Processing of waste	1. Compositing either by Vermiculture or Aerobic biological method 2. Setting up of compact and shredding unit for plastic waste.
7	Disposal of waste	All recyclable waste should be segregated at source and send for recycling. The hazardous waste should not be mixed along with other waste and kept in designated landfill site. Debris can be used for filling in the construction of road and other residential sites.

3.4 Indicative guidelines for formulation of specific action plan:

Activity	Action point	Time frame	Agency
Collection of waste	Making arrangement for collection of waste to cover: <ul style="list-style-type: none"> • House to house collection • Commercial areas include hotel, resort etc • Construction and demolition waste • Office complexes • Slaughter house, vegetable markets 		PRI's
Segregation of waste	Mass awareness programmes for segregation of waste: <ul style="list-style-type: none"> • At markets/commercial area • At schools • At residents • With hoteliers 		<ul style="list-style-type: none"> • PRI's • Dept. of Tourism • Dept. of Environment and Forests

	<p>Through</p> <ul style="list-style-type: none"> • Pamphlet • Interaction • Hoarding/ Newspaper/ local cable network 		<ul style="list-style-type: none"> • ANPCC
Island activity	<ul style="list-style-type: none"> • Regulations of stray cattle movement • Prohibitions of burning of garbage, leaves, other waste • Regular street sweeping • Setting up of public complaints cell and attending them on urgent basis. 		<ul style="list-style-type: none"> • PRI's
Storage of waste	<ul style="list-style-type: none"> • Setting up of bins of appropriate sizes in different localities like harbor, beaches, residential areas, hotel, resorts, market, etc • Setting up of three bins as per Rules • Regular operation and maintenance of waste storage facilities. • Provision of bins for weekly markets, marriage halls and other functions. • Open site to be eliminated. 		<ul style="list-style-type: none"> • PRI's • Dept. of Tourism
Transportation of waste	<ul style="list-style-type: none"> • Devising transportation system for congested areas. • Setting up of workshop facilities for O & M of vehicles. 		<ul style="list-style-type: none"> • PRIs
Processing of waste	<p>Local body to initiate tendering procedures for setting up of plastic, glass, tin, rubber, cardboard and other non biodegradable waste collection unit at different location of the island so that the waste generator can deposit these waste at collection centre. This will reduce load on landfill site.</p> <p>At landfill site, a proper vermin composting or Aerobic biological composting of the biodegradable waste should be setup.</p> <p>There is no sewage treatment plant</p>		<ul style="list-style-type: none"> • PRIs

	operating in the island and the liquid waste are disposed most through septic tank. There is a need for sewage treatment plant in the islands which will handle the liquid waste in a scientific manner and reduce the chance of contamination of ground water and coastal sea water for this purpose local body can encourage private entrepreneur to set up such plants in the island.		
Disposal of waste	<ul style="list-style-type: none"> • Improvement in existing sites to includes; provisions of fencing gate, office cum records room, construction of approach road, installation of weigh bridge and making alternate arrangement and other provisions as specified under the rules. • Provision of monitoring of pollution (water quality monitoring, ambient air quality monitoring) • Plantation at landfill site 		<ul style="list-style-type: none"> • PRI's • ANPCC • PRI's & Forests

3.5 Road Map for Management of MSW

S. No	Action points	Actions to be taken by	Time-Target (before)
1	Prepare a Detailed Project Report (DPR) on management of MSW in accordance with MSW Rules to cover; <ul style="list-style-type: none"> • Waste segregation • Collection • Storage • Transportation • Proceeding; and • Disposal • DPR could be prepared based on the indicative guidelines brought out by MoEF/CPCB 	Rural Development Department (RD) and PRI's	Six months

2.	Each local body to undertake assessment of Quantity of MSW generation and its composition before identification of processing technology for MSW management	Rural Development Department (RD) and PRI's	One month
3	ANPCC to Grant Authorizations to local bodies after getting DPR as indicated under sl .no.(1)	ANPCC	Within 1 month
4 4.1	<p>Organising waste segregation, collection, storage and transportation facilities as per MSW Rules. This will need to detail out)</p> <ol style="list-style-type: none"> i. Designing of mass awareness programmers for promoting segregation; ii. Identification and engaging agency to collect segregated waste on house-to-house collection basis; iii. Making arrangements for placement of waste storage facilities `in city/towns as per need. iv. Arranging adequate transportation fleet for targeting 100%waste transportation per day v. Making proper arrangement to monitor activities indicated at (i) to (iv) on day-to- day basis vi. Policy framework for recovery of fees from household. Options being direct collection by agency from household or in from of MSW cess to be collected by municipal body or through other means such as cess in electricity bill 	<ul style="list-style-type: none"> • Local Bodies • Rural Development Department (RD) PRI's 	
5 5.1	Identification of state level Agency or by the local body at its level and execution of waste processing and Disposal facilities (Including common	The approximate waste generated at Havelock islands is tons/ day which	Within 10 months

	<p>facilities as per feasibility) as per Schedule-III and IV of MSW Rules(Annexure III & IV)) through such Agency. Assessments/ Work orders to be finalized to this effect</p>	<p>is a very low quantity for setting up of any waste processing and disposal facility. Therefore at this stage, it will be appropriate to segregate the recyclable waste like plastic, glass, tin, paper, rubber etc and send it to mainland for recycling and at the dump yard site composting plant can be setup for disposal of biodegradable waste.</p>	
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3.6 Requirements

Present status and actual requirements of the bins, machineries, manpower and funds.

S.No	Particulars	Existing No	Actual required/ Proposed	Approx cost (Rs.)	Use
1	Total No. of bins				
	Plastic Bins (140 ltrs ,240 ltrs, 360 ltrs)	16	50+50	8 lakhs	Can be placed at roads sides, bus stands, markets, beaches etc
	Containers (660 ltrs, 1100 ltrs)	-	50	20 lakhs	Can be placed in the beach and market area for waste collection
	RCC bins	-	-		
2	No. of vehicles				
	Trucks	trucks are hired for transportation of waste(02 nos)	1+1	9 lakhs/year	Used for collecting and transporting MSW from all the bins to dump yard
	Truck tipper	-	-		
	Dumper	-	-		
	Trolley	-	20+20	4 lakhs	Trolleys are used for collecting waste from the country side shops and markets area.
	Tricycle	-	10+10	2.4 lakhs	Used for collecting the waste in the villages and streets where roads are narrow
3	No. of manpower	8	20+20	43 lakhs/ annum	
Total:				86.4 Lakhs	

Note: Rs 86.4 lakhs for two Panchyat of Havelock island, out of which 34.4 lakhs is non recurring and 52 lakhs will be the recurring expenditure on truck hire charges and salary.

3.7: STRATEGIES TO IMPROVE THE EXISTING SYSTEM

It is necessary for the Panchyats to adopt strategies that meet MSW(M&H)Rule, 2000. Segregated collection should be introduced as part of the door to door collection system with wet waste being collected daily in the morning and dry waste being collected twice a week. The wet waste may be disposed by the vermi composting or aerobic biological methods.

The Panchyats may also open collection centre for collection of PET bottles and all other recyclable wastes. The collection centres should be established in approachable place to common people and tourist show that they can deposit the PET bottles etc at the centre. This will improve the scenario and also change the littering habits.

The hotel, bars, ANIIDCO wine shops are made responsible to collect and hand over all the IMFL bottles generated in their unit to Panchayat collection centre or at dump site.

PRI may encourage the private entrepreneur to setup shredding units to crush the plastic waste to reduce the volume and send all other waste to Port Blair for further transportation to mainland for proper disposal. Entrepreneurs can avail the ANPCC scheme “**Andaman and Nicobar islands scheme for exemption of freight charges for transportation of plastic and glass wastes**” for transportation. The scheme only allow of free transportation of plastic and glass waste. Therefore administrative approval is needed to allow all recyclable other waste for free transportation up to Port Blair from Havelock island. This will reduce the quantity of waste at Havelock islands as well as also after recycling therefore will be value addition for the same.

For management of liquid waste at present hotels are having septic tank facility, but there is no system to dispose the waste collected in the septic tank. This can cause contamination of ground water as well as coastal water. Since most of the waters are situated on coastal side, therefore it will be appropriate to have a **Sewage Treatment Plant(STP)** with digester which will also be able to handle the entire biodegradable waste generated in the hotels. This will reduce the load on the dump yard. To setup STP, time and investment is required, therefore 1 year time may be given to all the hotels specially falls under Red and Orange Category to installation of STP.

The existing land fill site may be fenced properly and in phase manner the dumping site should be lined with thick synthetic liner to avoid leaching which will prevent contamination of ground water. During dry season, collection of recyclable waste specially the tin and glass materials can be segregated and collected and sent for recycling.

4. FINANCIAL IMPLICATION

S. No	Item	Amount	Agencies can contribute:
1	Development of landfill site a) Fencing & gate. b) Office cum records room. c) Construction of approach road. d) Segregation shed e) Compost shed	Based on the estimated prepared by Zilla Parishad	Zilla Parishad
2	Machinery & Equipments a) Trucks b) Tricycles c) Shredder unit d) Installation of weigh bridge	a) Rs. 9 Lakhs/year b) 2.4 lakhs c) 2 lakhs d) -	1. PRI's 2. Zilla Parishad
3	Segregation of waste a) Dustbins b) Container	Rs. 28 lakhs	PRI's
4	Manpower	Rs. 43 lakhs/year Rs. 10.8 Lakhs/year	PRI's Zilla Parishad
5	Awareness programs a) Workshop & Seminars b) Poster, banners, hoardings	Rs. 2 Lakhs/ year	ANPCC & Forest

Note: 1) Rs. 43 lakhs per annum is salary component including the persons working at dump site. At present the income generated by the Panchayats are very less, however the income generated will be detected out of the total allocation or else for effective implementation of the plan we can adopt 80:20 ratio. That is 80 % will be given by the administration and 20% will be generated by Panchayat.

2) The basic principles namely “Precautionary” and Polluter pay” shall be strictly followed on anticipatory basis. It is the responsibility of the hoteliers to dispose the waste generated in their hotel in a scientific manner. Hence Panchayat can fix charges per bed for hotels and per seat for restaurants, bars and conference hall for collection, transportation and disposal of MSW.

5. VOCABULARY & ANNEXURE

- I. **“Anaerobic digestion”** means a controlled process involving microbial decomposition of organic matter in the absence of oxygen.
- II. **“Authorization”** means the consent given by the Board or Committee to the “operator of a facility”.
- III. **“Biodegradable substance”** means a substance that can be degraded by micro-organisms.
- IV. **“Collection”** means lifting and removal of solid wastes from collection points or any other location.
- V. **“Demolition and construction waste”** means waste from building materials debris and rubble resulting from construction, re-modelling, repair and demolition operation.
- VI. **“Disposal”** means final disposal of municipal solid waste in terms of the specified measures to prevent contamination of ground waste, surface waste and ambient air quality.
- VII. **“Landfilling”** means disposal of residual solid waste on land in a facility designed with protective measure against pollution of ground water, surface waste and air fugitive dust, blown bad odor , fire hazard, birds menace, pests or rodents, green house gas emissions, slope instability and erosion.
- VIII. **“Processing”** means the process by which solid waste are into new or recycled products.
- IX. **“Recycling”** means the process by the transforming segregated solid wastes into raw materials for producing new products, which may or may not be similar to the original products.
- X. **“Schedule”** means a schedule appended to these rules.
- XI. **“Storage”** means conveyance of municipal scold waste from place to place hygienically through specially designed transport system so as to prevent foul odor, littering, unsightly conditions and accessibility to vectors.
- XII. **“Vermicomposting”** “is a process of using earthworms for conversion of biodegradable waste into compost.

Form –I
[see rules 4(2) & 6(2)]
Application for obtaining authorization

To,

The Member Secretary
 Pollution Control Committee
 Andaman and Nicobar Administration
 Post: Dollygunj, Port Blair
 South Andaman

1.	Name of the municipal authority/Name of the agency appointed by the municipal authority	:	
2.	Correspondence address Telephone No. Fax No.	:	
3.	Nodal Officer & designation(Officer authorised by the municipal authority or agency responsible for operation of processing or disposal facility)	:	
4.	Authorization applied for (Please tick mark)	:	(a) Setting up & operation of waste processing facility (b)Setting up & operation of disposal facility
5.	Detailed proposal of waste processing/disposal facility (to be attached) to include	:	
5.1	Processing of Waste i. Location of site ii. Name of waste processing technology iii. Details of processing technology iv. Quantity of waste to be processed per day v. Site clearance (from local authority) vi. Details of agreement between municipal authority and operating agency vii. Utilization programme for waste processed (Product utilization) viii. Methodology for disposal of waste processing rejects (quantity and quality) ix. Measures to be taken for prevention and	:	

	<ul style="list-style-type: none"> control of environmental pollution x. Investment on Project and expected returns xi. Measures to be taken for safety of workers working in the plant 		
5.2	<p>Disposal of Waste</p> <ul style="list-style-type: none"> i. Number of sites indentified ii. Layout maps of site iii. Quantity of waste to be disposed per day iv. Nature and composition of waste v. Details of methodology or criteria followed for site selection vi. Details of existing site under operation vii. Methodology and operational details of landfilling viii. Measures taken to check environmental pollution 	:	
Date		Signature of Nodal Officer	

Schedule -II
[see rules 6(1) and (3), 7(1)]
Management of Municipal Solid Wastes

S.no	Parameters	Compliance criteria
1.	Collection of municipal solid wastes	<p>1. Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely :-</p> <ol style="list-style-type: none"> i. Organising house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels); ii. Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas; iii. Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes; iv. Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose; v. Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerised carts or other small vehicles; vi. Horticultural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws; vii. Waste (garbage, dry leaves) shall not be burnt; viii. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws. <p>2. The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town.</p> <p>3. It shall be the responsibility of generator of wastes to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority as per para 1(2) of this Schedule.</p>

2.	Segregation of municipal solid wastes	<p>In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials.</p> <p>The municipal authority shall undertake phased programme to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.</p>
3.	Storage of municipal solid wastes	<p>Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely :-</p> <ol style="list-style-type: none"> i. Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users; ii. Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly; iii. Storage facilities or ‘bins’ shall have ‘easy to operate’ design for handling, transfer and transportation of waste. 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; iv. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.
4.	Transportation of municipal solid wastes	<p>Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:-</p> <ol style="list-style-type: none"> i. The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing; ii. Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.

<p>5.</p>	<p>Processing of municipal solid wastes</p>	<p>Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:-</p> <p>(i) The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV;</p> <p>ii. Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorisation.</p>
<p>6.</p>	<p>Disposal of municipal solid wastes</p>	<p>Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms. Landfill sites shall meet the specifications as given in Schedule –III.</p>

Schedule III
[see rules 6(1) and (3), 7(2)]
Specifications for Landfill Sites

Site Selection

1. In areas falling under the jurisdiction of ‘Development Authorities’ it shall be the responsibility of such Development Authorities to identify the landfill sites and hand over the sites to the concerned municipal authority for development, operation and maintenance. Elsewhere, this responsibility shall lie with the concerned municipal authority.
2. Selection of landfill sites shall be based on examination of environmental issues. The Department of Urban Development of the State or the Union territory shall co-ordinate with the concerned organisations for obtaining the necessary approvals and clearances.
3. The landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.
4. The landfill sites shall be selected to make use of nearby wastes processing facility. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.
5. The existing landfill sites which continue to be used for more than five years, shall be improved in accordance of the specifications given in this Schedule.
6. Biomedical wastes shall be disposed off in accordance with the Bio-medical Wastes (Management and Handling) Rules, 1998 and hazardous wastes shall be managed in accordance with the Hazardous Wastes (Management and Handling) Rules, 1989, as amended from time to time.
7. The landfill site shall be large enough to last for 20-25 years.
8. The landfill site shall be away from habitation clusters, forest areas, water bodies monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.
9. A buffer zone of no-development shall be maintained around landfill site and shall be incorporated in the Town Planning Department’s land-use plans.
10. Landfill site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained in cases where the site is to be located within 20 km of an airport or airbase..

Facilities at the Site

11. Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.
12. The landfill site shall be well protected to prevent entry of unauthorised persons and stray animals.
13. Approach and other internal roads for free movement of vehicles and other machinery shall exist at the landfill site.
14. The landfill site shall have wastes inspection facility to monitor wastes brought in for landfill, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipments.
15. Provisions like weigh bridge to measure quantity of waste brought at landfill site, fire protection equipments and other facilities as may be required shall be provided.

16. Utilities such as drinking water (preferably bathing facilities for workers) and lighting arrangements for easy landfill operations when carried out in night hours shall be provided.
17. Safety provisions including health inspections of workers at landfill site shall be periodically made.

Specifications for land filling

18. Wastes subjected to land filling shall be compacted in thin layers using landfill compactors to achieve high density of the wastes. In high rainfall areas where heavy compactors cannot be used alternative measures shall be adopted.
19. Wastes shall be covered immediately or at the end of each working day with minimum 10 cm of soil, inert debris or construction material till such time waste processing facilities for composting or recycling or energy recovery are set up as per Schedule I.
20. 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 berms shall be constructed to divert run-off away from the active cell of the landfill.
21. After completion of landfill, a final cover shall be designed to minimize 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 cms of clay or amended soil with permeability coefficient less than 1×10^{-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 minimize erosion.

Pollution prevention

22. In order to prevent pollution problems from landfill operations, the following provisions shall be made, namely :-
 - a. Diversion of storm water drains to minimize leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions;
 - b. Construction of a 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) minimum liner specifications shall be a composite barrier having 1.5 mm high density polyethylene (HDPE) geomembrane, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1×10^{-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;
 - c. Provisions for management of leachates collection and treatment shall be made. The treated leachates shall meet the standards specified in Schedule- IV;
 - d. Prevention of run-off from landfill area entering any stream, river, lake or pond.

Water Quality Monitoring

23. 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 metres of the periphery of landfill site shall be periodically monitored to ensure that the ground water is not contaminated beyond acceptable limit as decided by the Ground Water Board or the State Board or the Committee. Such monitoring shall be carried out to cover different seasons in a year that is, summer, monsoon and post-monsoon period.
24. Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) is to be considered after ensuring its quality. The following specifications for drinking water quality shall apply for monitoring purpose, namely :-

S.No.	Parameters	IS 10500: 1991 Desirable limit (mg/l except for pH)
1.	Arsenic	0.05
2.	Cadmium	0.01
3.	Chromium	0.05
4.	Copper	0.05
5.	Cyanide	0.05
6.	Lead	0.05
7.	Mercury	0.001
8.	Nickel	-
9.	Nitrate as NO ₃	45.0
10.	PH	6.5-8.5
11.	Iron	0.3
12.	Total hardness (as CaCO ₃)	300.0
13.	Chlorides	250
14.	Dissolved solids	500
15.	Phenolic compounds (as C ₆ H ₅ OH)	0.001
16.	Zinc	5.0
17.	Sulphate (as SO ₄)	200

25. Ambient Air Quality Monitoring
26. Installation of landfill gas control system including gas collection system shall be made at landfill site to minimize odour generation, prevent off-site migration of gases and to protect vegetation planted on the rehabilitated landfill surface.
27. The concentration of methane gas generated at landfill site shall not exceed 25 per cent of the lower explosive limit (LEL).
28. 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 directly escape to the atmosphere or for illegal tapping. Passive venting shall be allowed if its utilization or flaring is not possible.
29. Ambient air quality at the landfill site and at the vicinity shall be monitored to meet the following specified standards, namely :-

S.No.	Parameters	Acceptable levels
(i)	Sulphur dioxide	120 $\mu\text{g}/\text{m}^3$ (24 hours)
(ii)	Suspended Particulate Matter	500 $\mu\text{g}/\text{m}^3$ (24 hours)
(iii)	Methane	Not to exceed 25 per cent of the lower explosive limit (equivalent to 650 mg/m^3)
(iv)	Ammonia daily average	
	(Sample duration 24 hrs)	0.4 mg/m^3 (400 $\mu\text{g}/\text{m}^3$)
(v)	Carbon monoxide	1 hour average : 2 mg/m^3 8 hour average : 1 mg/m^3

29. The ambient air quality monitoring shall be carried out by the concerned authority as per the following schedule, namely:-

- (a) Six times in a year for cities having population of more than fifty lakhs;
- (b) Four times in a year for cities having population between ten and fifty lakhs;
- (c) Two times in a year for town or cities having population between one and ten lakhs.

Plantation at Landfill Site

30. A vegetative cover shall be provided over the completed site in accordance with the and following specifications, namely :-

- (a) Selection of locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be allowed to grow;
- (b) The plants grown be such that their roots do not penetrate more than 30 cms. This condition shall apply till the landfill is stabilised;
- (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 minimize soil erosion.

Closure of Landfill Site and Post-care

31. 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 accordance with requirements and maintaining ground water quality;
- (d) Maintaining and operating the landfill gas collection system to meet the standards.

32. 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 and leachate analysis comply with the specified standards.

Schedule IV
[see rules 6(1) and (3), 7(2)]
Standards for Composting, Treated Leachates and Incineration

1. The waste processing or disposal facilities shall include composting, incineration, pelletisation, energy recovery or any other facility based on state-of-the-art technology duly approved by the Central Pollution Control Board
2. In case of engagement of private agency by the municipal authority, a specific agreement between the municipal authority and the private agency shall be made particularly, for supply of solid waste and other relevant terms and conditions.
3. In order to prevent pollution problems from compost plant and other processing facilities, the following shall be complied with, namely :-
 - i. The incoming wastes at site shall be maintained 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;
 - ii. Necessary precautions shall be taken to minimise nuisance of odour, flies, rodents, bird menace and fire hazard;
 - iii. In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of wastes to the landfill site;
 - iv. 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-recyclables shall be sent for well designed landfill site(s).
 - v. In case of compost plant, the windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay, 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;
 - vi. Ambient air quality monitoring shall be regularly carried out particularly for checking odour nuisance at down-wind direction on the boundary of processing plant.

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

Parameters	Concentration not to exceed * (mg/kg dry basis , except pH value and C/N ratio)
Arsenic	10.00
Cadmium	5.00
Chromium	50.00

Copper	300.00
Lead	100.00
Mercury	0.15
Nickel	50.00
Zinc	1000.00
C/N ratio	20-40
PH	5.5-8.5

* 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.

4. The disposal of treated leachates shall follow the following standards, namely:-

S.No	Parameter	Standards (Mode of Disposal)		
		Inland surface water	Public sewers	Land disposal
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 ₆ H ₅ OH) 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.

The incinerators shall meet the following operating and emission standards, namely:-

A. Operating Standards

- (1) The combustion efficiency (CE) shall be at least 99.00%.
- (2) The combustion efficiency is computed as follows :

$$C.E. = \frac{\%CO_2}{\%CO_2 + \%CO} \times 100$$

1. Emission Standards

<u>Parameters</u>	<u>Concentration mg/Nm³ at (12% CO₂ correction)</u>
(1) Particulate matter	150
(2) Nitrogen Oxides	450
(3) HCl	50
(4) Minimum stack height shall be 30 metres above ground.	
(5) Volatile organic compounds in ash shall not be more than	0.01%.

Note :

1. Suitably designed pollution control devices shall be installed or retrofitted with the incinerator to achieve the above emission limits, if necessary.
2. Wastes to be incinerated shall not be chemically treated with any chlorinated disinfectants
3. Chlorinated plastics shall not be incinerated.
4. Toxic metals in incineration ash shall be limited within the regulatory quantities as specified in the Hazardous Wastes (Management and Handling) Rules, 1989 as amended from time to time.
5. Only low sulphur fuel like LDO, LSHS, Diesel shall be used as fuel in the incinerator.