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Government of TamilNadu ENVIS CENTRE, DEPARTMENT OF ENVIRONMENT



DATA BASE ON SOLID WASTE MANAGEMENT IN TAMIL NADU



PREPARED IN COLLABORATION WITH

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1. INTRODUCTION

Waste refers to lack of use or 'useless remains'. Waste is a by-product of human activity. Physically, it contains the same materials as are found in useful products, it only differs from useful production by use of value. Wastes are broadly classified based on their source (**Table 1.1**). Urban solid waste includes household garbage and rubbish, street sweeping, construction and demolition debris, sanitation residues, trade and industrial refuse and bio-medical solid waste (CPCB, 2000). Further Bio-medical wastes are generated form health care establishments. Solid waste management (SWM) has three basic components namely collection, transportation and disposal. The objective of SWM is to reduce the quantity of solid waste disposed off on land by recovery of materials and energy from solid waste in a cost effective and environment friendly manner. The increasing pace of urbanization along with an increase in per capita waste generation driven by changing urban consumption patterns has created significant additional pressures on already stretched Municipal Solid Waste Management (MSWM) systems across the state. This challenge is further increased by the lack of adequate capacity, financial capabilities and skilled manpower in collection, transportation, processing and final disposal.

	Household waste- kitchen, house cleaning, old				
Domestic waste	papers, packing bottles, crockery wares, furnishing				
	materials, garden trimmings etc.				
	Waste generated at business premises , shops ,				
Commercial Waste	office ,markets, department stores, organic,				
	inorganic ,chemically reactive and hazardous waste				
	Schools, colleges, hospitals , large hotels and				
Institutional wastes	restaurants, markets selling vegetables, fruits, fish				
	,etc				
Industrial /Trade waste	Waste generated through manufacturing and				
Industrial / ITade waste	material processing				
Electronic Wastes	Waste from used electronics				
Debris or construction	Comprises of earth , bricks , stones , wooden logs				
rejects					
	Animal waste such as animal tissue, organs, body				
Bio medical wastes	parts ,carcasses ,fluid , blood , discharge from				
	hospitals ,animal houses				
	Hazar dous in nature for human health and the				
Hazardous wastes	environment, as in the Hazardous waste				
	management rues 1989				

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Source: CPHEEO, 2000- Manual on Municipal Solid Waste Management", Ministry of Urban Development,

Tamil Nadu has population of 7.21 Crores, an increase from figure of 6.24 Crore in 2001 census. Total population of Tamil Nadu as per 2011 census is 72,147,030 of which male and female are 36,137,975 and 36,009,055 respectively. In 2001, total population was 62,405,679 in which males were 31,400,909 while females were 31,004,770. Out of total population of Tamil Nadu, 48.40% people live in urban regions. The total figure of population living in urban areas is 34,917,440 of which 17,458,910 are males and while remaining 17,458,530 are females. The urban population in the last 10 years has increased by 48.40 percent. The State is therefore, faces a challenge of providing essential infrastructure in urban centres to keep pace with population growth.

On an average, 91% of MSW are dumped in landfills (CPCB 2000). However, a very small portion of these is scientifically dumped in sanitary landfills according to standards prescribed by concerned agencies. Average 5% to 6% wastes are disposed using various composting methods. Landfill sites have not yet been identified by many municipalities and in several municipalities, the landfill sites have been exhausted and the respective local bodies do not have resources to acquire new land.

SWM is part of public health and sanitation, and according to the Indian Constitution, it falls under the state list. Since the activity is non-exclusive, non-rivalled, and essential, the

responsibility for providing the service lies within the public domain. As this activity is of local nature, it is entrusted to the Urban Local Bodies .The ULB undertakes the task of solid waste service delivery with its own staff, equipment and funds. In a few cases part of the said work is contracted out to private enterprise (PPP).

The 74th Constitutional amendment gives constitutional recognition for local self Government institutions specifying the powers and responsibilities. Very few ULBs in the country have prepared long-term action plans for effective SWM in their respective cities. For obtaining a long-term economic solution, planning of the system on longterm sustainable basis is very essential. The Ministry of Environment and Forest (MOEF), GOI, has notified Municipal Solid Waste (Management and Handling) Rules, 2000 to tackle this problem. The increase in quantity of Municipal solid Waste generation with increase in urban population is quite obvious.

It is estimated that the per capita waste generation in Chennai is around 0.7 Kg/day. A total of 4500 MT of solid waste and 700 MT of building debris are generated every day in Chennai. Composition of the waste generated in Chennai is given in **Table 1.2**.

Physical Composition	%
Food waste	8.00
Green-waste	32.25
Timber (wood)	6.99
Consumable plastic	5.86
Industrial Plastic	1.18
Steel & Materials	0.03
Rags & Textiles	3.14
Paper	6.45
Rubber & Leather	1.45
Inert	34.65
Chemical Analysis	
Moisture content	27.60
pH value	7.86
Organic Content	39.06
Carbon content	21.53
Nitrogen content	0.73
Phosphorous P ₂ O ₅	0.63
Potassium K ₂ O	0.63
Waste Generation by	
category	
Residential	68
Commercial	16
Halls, schools, institutions	14
Industrial	2
	Separately
Hospitals & Clinics	disposed by
	hospitals

Table 1.2 Composition of the waste generated in Chennai

Source: Corporation of Chennai -2015

Improper disposal of solid wastes can create unsanitary conditions, and in turn can lead to pollution of the environment and to outbreaks of diseases. There are potential risks to environment and health from improper handling of solid wastes. Direct health risks concern mainly to the workers in this field, from contact with wastes. The main risks to health are indirect and arise from the breeding of disease vectors. Hazardous wastes from industries mixing up with municipal wastes create potential risks to human health. Some of the major health impacts are as follows:

- Poisoning through chemical inhalation
- Cancer

- Neurological disease
- Nausea and vomiting
- Plastic found in oceans ingested by birds
- Resulted in high algal population in rivers and sea.
- Degrades water and soil quality

Solid-waste management presents complex technical challenges to the governing authorities. There is a strong need for sustainable practice of solid waste management in Tamil Nadu. This report will provide a database of waste generation in the state, along with different management practices for the same. It also highlights key initiatives by the state government towards environmentally friendly management and disposal of the wastes.

2. MUNICIPAL SOLID WASTE

2.1 General

Municipal solid waste (MSW) includes wastes resulting from domestic wastes, institutional wastes and commercial wastes. Population growth and Urbanization are the key causes of increase in MSW. Domestic wastes include Household Waste-Kitchen, house cleaning, old papers, packing, bottles, crockery wares, furnishing materials, garden trimmings etc. Institutional wastes are those arising from schools, universities, research institutes etc. Commercial wastes included in this category are solid wastes that originate in offices, wholesale and retail stores, restaurants, hotels, markets, warehouses and other commercial establishments. Waste generated at business premises, shops, offices, markets, departmental stores (paper, packing material, spoiled, discarded goods). With the growth of Urban centres in the city the quantity of MSW is predicted to increase proportionally. All the MSW generated can be further classified into Bio-degradable, Non-biodegradable and Inert wastes. The main methods of treatment and disposal include Land filling, vermi-composting, biomethanation, Incineration composting, Anaerobic Digestion and and Pyrolysis/Gasification etc. Majority of the MSW in Tamil Nadu will end up in the Landfill. This chapter highlights data on the total generation, collection, treatment and disposal methods for MSW in Tamil Nadu.

2.2 Legislative Framework

In exercise of the powers conferred by section 3,6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the Municipal Solid Wastes, (Management and Handling) Rules, 2000. These rules shall apply to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes. "Municipal authority" means Municipal Corporation, Municipality, Nagar Palika, Nagar Nigam, Nagam Panchayat, Municipal Council including notified area committee (NAC) or any other local body constituted under the relevant statues and, where the management and handling of municipal solid waste is entrusted to such agency.

2.2.1 Responsibility of municipal authority

Every municipal authority shall, within the territorial area of the municipality, be responsibility for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipality solid wastes.

The municipal authority or an operator of a facility shall make an application in Form-I for grant of authorisation for setting up waste processing and disposal facility, including landfills from the State Board or the Committee in order to comply with the implementation programme laid down in Schedule -I.

The municipal authority shall comply with these rules as per the implementation schedule laid down in schedule -I. The municipal authority shall furnish its annual report in Form –II to the Secretary-in-charge of the Department of Urban Development of the concerned State or as the case may be of the Union territory, in case of a metropolitan city, or to the District Magistrate or the Deputy Commissioner concerned in case of all other towns and cities, with a copy to the Board or the Committee on before the 30th day of June every year.

2.2.2 Responsibility of the Central Pollution Control Bard and the State Board or the Committees

The State Board or the Committee shall monitor the compliance of the standards regarding ground water, ambient air, leachate quality and the compost quality including incineration standards as specified under Schedule II, III and IV.

The State Board or the Committee, after the receipt of application from the municipal authority or the operator of a facility in Form 1, for grant of authorisation for setting up waste processing and disposal facility including landfills, shall examine the proposal taking into consideration the views of other agencies like the State Urban Development, the Town and Country Planning Department, Airport or Air Base Authority, the Ground Water Board or any such other agency prior to issuing the authorisation.

The State Board or the Committee shall issue the authorisation in Form -III to the municipal authority or an operator of a facility within forty-five days stipulating compliance criteria and standards as specified in Schedule II, III and IV including such other conditions, as may be necessary.

The authorisation shall be valid for a given period and after the validity is over, a fresh authorisation shall be required.

The Central Pollution Control Board shall co-ordinate with the State Boards and the Committees with particular reference to implementation and review of standards and guidelines and compilation of monitoring data.

2.3 Generation of MSW

As indicated in the Manual on Municipal Solid waste Management published by CPHEEO, Ministry of Urban Development and Report of the Technology Advisory Group on Solid Waste Management constituted by Ministry of Urban Development, New Delhi, the per capita waste generation varies from 0.2 to 0.7 kg per day in cities with a population ranging from 0.1 million and above. Tamil Nadu state Government administers 12 Corporations, 124 Municipalities and 528 Town Panchayats. The total generation of municipal solid waste generation from Corporations is 9000 TPD, Municipalities is 3700 TPD and town panchayats is 1900TPD. (FY-2014-2015)

Generation of MSW for the year 2013-2014 and 2014-2015 are given in Table 2.3a,2.3b. Due to increase in per capita waste generation of about 1.3% per year, and growth of urban population between 3% to 3.5% per annum, yearly increase in the overall quantity of solid waste generation averages about 5%.

District	Corporation (C)	Municipality (M)	Town Panchayat (TP)	Total (TPD)
Chennai	4800			4800
Coimbatore	850	91	160	1101
Cuddalore		196	15	210
Dindigul		211	61	272
Erode	296	76	159	531
Dharmapuri & Krishnagiri		155	40	196
Karur		139	14	153
Madurai	658	50	29	737
Kanchipuram		442	363	805
Nagapatinam		87	8	95
Namakkal		149	39	188
Thiruvarur		52	4	56
Kanyakumari		27	42	70
Ooty		68	7	75
Pudukkottai		48	11	59
Salem	350	73	120	543
Ramnadapuram		61	15	76
Thanjavur		179	22	201
Theni		0	82	82
Thoothukudi	170	43	30	243
Tirunelveli	150	55	37	242
Tiruppur	500	106	1108	1714
Tiruvallur		241	26	267
Tiruvannamalai		132	199	331
Trichy, Ariyalur & Perambalur	405	108	40	553
Vellore	180	265	41	487
Virudhunagar		191	10	201
Villupuram		113	45	159
Total	8359	3433	2741	14532

 Table 2.3a Generation of Municipal solid wastes District wise (2013-2014)

Source: Corporation of Chennai-2013

From the above table we see that the generation of MSW is maximum from Chennai district at 4800 TPD. This is followed by Tiruppur District at 1714 TPD and further, Coimbatore district at 1101 TPD. Chennai and Coimbatore are emerging urban centres of Tamil Nadu, generation of MSW is bound to increase in the coming years with more people migrating to these districts.

	Corporation		Municipalities		Town Panchayats		Total	
Districts	Nos.	MSW generated (TPD)	Nos.	MSW generated (TPD)	Nos.	MSW generated (TPD)	No. of ULB	MSW generated (TPD)
Chennai	1	5000					1	5000
Coimbatore	1	890	3	107	37	210	41	1207
Cuddalore			5	228	16	15	21	275
Dindigul	1	110	3	74	23	68	27	252
Erode	1	275	4	76	42	159	47	510
Dharmapuri & Krishnagiri			3	158	17	40	20	198
Karur			2	139	11	31	13	170
Madurai	1	680	3	55	9	33	13	764
Kanchipuram			9	442	15	363	24	805
Nagapatinam			4	97	8	22	11	119
Namakkal			5	146	19	65	24	211
Thiruvarur			4	52	7	6.8	11	74
Kanyakumari			4	134	56	59	60	193
Ooty			4	68	11	15	15	75
Pudukkottai			2	55	8	23	10	78
Salem	1	350	4	73	33	120	38	543
Ramnad			4	100	7	35	11	135
Sivagangai			3	69	12	36	15	105
Thanjavur	1	120	2	55	22	75	25	250
Theni			6	77	22	72	28	226
Thoothukudi	1	205	2	44	19	30	22	279
Tirunelveli	1	180	7	121	36	38	44	339
Tiruppur	1	508	5	117	16	53	22	678
Tiruvallur			5	241	10	26	15	267
Tiruvannamalai			4	131	10	32	14	330
Tiruchirapalli	1	436	3	45	16	71	20	552
Ariyalur			3	49	6	11	4	60
Perambalur			1	24	4	10	5	34
Vellore	1	230	11	291	16	41	28	562
Virudhunagar			7	234	9	27	16	261
Villupuram			3	123	15	68	18	159
Total	12	8984	124	3703	528	1901	664	14588

Table 2.3a Generation of Municipal solid wastes District wise (2014-2015)

Source: Tamil Nadu Pollution Control Board – Annual Statement 2014-2015

S. No.	Name of Corporation	Population in lakhs	MSW generated TPD	MSW collected TPD	MSW treated	MSW disposed TPD
1.	Chennai	62.5	5000	5000		5000
2.	Coimbatore	12.621	890	890	590	180
3.	Dindigul	2.07	110	110	10	100
4.	Erode	4.98	275	275	120	155
5.	Madurai	14.62	680	640	350	180
6.	Salem	8.31	350	320	320	2
7.	Thanjavur	7.43	120	114		114
8.	Thoothukudi	4.10	205	205		205
9.	Tirunelveli	4.99	180	170		150
10.	Tiruppur	8.77	508	508		508
11.	Trichy	7.966	436	416	100	316
12.	Vellore	4.234	230	210		207

Generation of Municipal Solid Waste for the Corporations with respect to MSW Rules in the state of Tamilnadu

Source: TNPCB-Annual Statement 2014-2015

2.4 Collection & Storage

The management of solid waste is carried out as a five level operation in most corporations.

- Collection from the bins and road sides by the sanitary workers, this level also includes street sweeping operation.
- > The waste from the dust bins and road sides is cleared by the light vehicles.
- The collected waste from the vehicles is transported to the transfer stations or processing plants
- > From the transfer stations or processing plants to the landfill site
- > Processing plants ie, compost plants; the rejects shall be disposed off into the landfill.

The urban local bodies have partly started the source segregation of municipal solid waste generated in their limits and are partly composting the biodegradable waste. Transport facilities such as dumper placer, Tipper lorry ,tipper tractor, trucks etc. have been used by corporations for transportation of wastes and in some cases thee vehicles are closed or pneumatic compactors are used in a few corporations areas. Similarly, Municipalities and town panchayats utilize thee transport facilities such as tractor trailer, dumper placer , tipper , tricycle ,push carts etc. In most urban local bodies the

biodegradable wastes are partly composted, segregated plastic wastes is used for road laying and the remaining waste is dumped in the land fill.

2.4.1 Waste Transfer Points

Details of some of the modern waste transfer points as found in Coimbatore are given in Figure 2.1.



Figure 2.1 Waste Transfer points Coimbatore – Peelamedu.

2.5 Treatment & Disposal of Municipal Solid Wastes

Based on their type and for effective treatment all MSW can be further classified into 3 categories:

- 1. Biodegradable Wastes
- 2. Non-biodegradable wastes
- 3. Inert wastes

The different types of treatment of wastes are given in Figure 2.1.



Figure 2.1 Different types of treatment of MSW wastes

2.6 Treatment of Biodegradable MSW

2.6.1 Composting Using micro-organisms

With the proper mixture of water, oxygen, carbon, and nitrogen, micro-organisms are allowed to break down organic matter to produce compost. The composting process is dependent on micro-organisms to break down organic matter into compost. There are many types of microorganisms found in active compost of which the most common are

Bacteria- The most numerous of all the microorganisms found in compost. Depending on the phase of composting, mesophilic or thermophilic bacteria may predominate.

Table 2.4	Composition	of Compost
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Specifications	Unit	Norms (%)	Composition as per analysis (%)
Particulate Size (-4mm IS Seive)	min	90.0	100
Colour			Dark brown to black
Odour	No fou	l odour	Non objectionable
Bulk Density (gm/cm ³)	0.7	0.9	0.77
Moisture	15	25	18.48
Total Nitrogen as N	Min	0.5	1.19
Total Phosphorus as (P2O5)	Min	0.5	1.14
Total Potassium (K2O)	Min	1.0	1.26
Total Organic Carbon	Min	16	18.0
C:N (1:5)	Max	< 20.1	15.12
рН	6.5	7.5	6.95
Electrical Conductivity (dsm- 1)	Max	4	2.2
Heavy Metal (mg/kg)			
Arsenic as(As)	Max	10	BDL
Cadmium (asCd)	Max	5	0.19
Chromium (as Cr)	Max	50	0.15
Copper (asCu)	Max	300	98
Mercury (as Hg)	Max	0.15	BDL
Nickel (as Ni)	Max	50	BDL
Lead(Pb)	Max	100	BDL
Zinc(Zn)	Max	1000	132
Pathogens		Nil	NIL

2.6.2 Vermicomposting

Vermicompost is the product or process of composting using various worms, usually red wigglers, white worms, and other earthworms to create a heterogeneous mixture of

decomposing vegetable or food waste, bedding materials, and vermicast. These castings have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than do organic materials before vermicomposting. Containing water-soluble nutrients, vermicompost is an excellent, nutrient-rich organic fertilizer and soil conditioner. The most common worms used in composting systems, red-worms (*Eisenia foetida, Eisenia andrei*, and *Lumbricus rubellus*).

Benefits of vermin-composting

- Improves soil aeration
- Enriches soil with micro-organisms
- > Attracts deep-burrowing earthworms already present in the soil.
- Improves water holding capacity.
- > Enhances germination, plant growth, and crop yield
- Improves root growth and structure
- Bio-wastes conversion reduces waste flow to landfills
- Low capital investment and relatively simple technologies make vermicomposting practical for less-developed agricultural regions
- Production reduces greenhouse gas emissions such as methane and nitric oxide (produced in landfills or incinerators when not composted or through methane harvest).



Figure 2.2 Vermicompost

2.6.3 Bio-gas generation

Methanogenesis or biomethanation is the formation of methane by microbes known as methanogens. Organisms capable of producing methane have been identified only from the domain Archaea. The production of methane is an important and widespread form of microbial metabolism. In most environments, it is the final step in the decomposition of biomass. Further the methane produced can be used for power generation.

2.7 Treatment of Non-biodegradable wastes

2.7.3 Recycling

Separate glass, plastic and metal from other non-biodegradable waste for recycling. Recycling saves space in landfills and reduces the amount of virgin materials that must be mined or manufactured to make new products and thus saving energy.

2.7.4 Landfills

Landfills provide long-term storage for non-biodegradable waste. Ideally, landfills are carefully situated to prevent contamination from entering surrounding soil and water, and managed to reduce odour and pests as much as possible.

2.7.5 Design of Land fill

A landfill design life will comprise of an 'active' period and an 'closure and postclosure' period. The 'active' period shall be comprise of the period for which waste filling is in progress at the landfill and typically range from 10 to 25 years depending on the availability of land area. The 'closure and post-closure' period for which a landfill will be monitored and maintained shall be 30 years after the 'active period' is completed.



Figure 2.3 Design of Landfill



Figure 2.4 Impervious layer for Land fill site at Vellakal

2.7.5 Eco Bricks

Inert material can be utilised to manufacture eco bricks. The eco bricks are useful for construction of compound wall, footpath and pathways in parks.



Figure 2.3 Eco-Brick Manufacturing in the state

2.7.6 Specification for Landfill Sites

Site Section

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. 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 organisation for obtaining the necessary approvals and clearance. The landfill site shall be large enough to last for 20-25 years.

Specification for land filling

Wastes subjected to land filling shall be compacted in thin layers using landfill compactors to achieve high density of the wastes.

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.

Pollution Prevention

In order to prevent pollution problems from landfill operations, the following provisions shall be made, namely:-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. Construction of a non-permeable lining system at the base and walls of waste disposal area.

2.8 Municipal Solid Waste Collection Treatment And Disposal in the State

Name of Corporation	MSW Collection details	MSW Segregation details	MSW Storage details	Transportation details	portation details Details on Processing of Municipal Solid Waste	
Chennai	The sanitary workers in general are collecting and segregating all recyclable wastes at household level.		No storage facility	Primary collection is carried out by conservancy workers between 6.30 am to 10.30 a.m. & 2.30 p.m to 5.00 p.m. Besides wastes are also collected using compactors and tricycles from 6.30 a.m to 1.30 p.m.	Nil	Dumped in Kodungaiyur and Perungudi Dump yard
Coimbatore	By lorries using dust bins	No segregation at source is carried out	Open Storage	By lorries	Bio Composting	Composting and Land Filling
Dindigul	Collection using Truck- Tipper, Dumper- Placers and Tricycles	No Segregation	Stored in the Dump Yard	Transported using Truck-Tipper and Dumper- Placers	Partially composted	Dumping Yard
Erode	Door to door collection	Manual	518 No. of dumper bins are available for storing Municipal Solid Waste	250MT/day is collected by 43 numbers of vehicles.	120MT/day is processed by composting at Vendipalayam composting yard.	Open dumping – 130MT/day
Madurai	Collection bins & Door-Door Collection system	No source segregation followed	'Dumper bins' have been placed in Residential, Commercial, Market area.	Dumper placer, Mobile compactor, Tipper lorry, Tipper Tractor.	Windrow - Aerobic method is adopted for bio-composting.	Demolition and construction waste is dumped on notified low laying area.
Salem	Bins, Push Cart	Segregated at the MSW processing facility	Collected solid waste is transported through trucks to the MSW Treatment facility	Trucks	Bio degradable waste is composted Non Recyclable wastes disposed into landfill facility.	Bio compost is sold as manure. Non Biodegradable waste such as plastics and metals are sold to recycler.

Status of implementation of Schedule II [rules 6(1) and (3), 7(1)] by Corporations of Tamil Nadu

						Recyclable materials are sold to recyclers.
Thanjavur	Door to door colleciton	Segregation at source	Segregated washes, vegetable market, flower market, utilized for manufacture of manure	Throgh tipper onto tipper lorry tractors, dumper placer	Compostable wastes are utilized to manufacture of manure	
Thoothukudi	Manual	Manual	Storage yard	Truck, Tiller	-	-
Tirunelveli		1 M.T. of plastic waste are segregated daily and drive to shredding for Road laying	4.5 cu.m. containers of 220, and 1.1 cum bins of 410 are used.	Transporatation done through 6 Dumper Placer Lorry, 4 compactor Lorry and 8 Tipper Lorries	Waste to Energy under progress	Waste to Energy under progress
Tiruppur	Door to door collection is being implemented.	No segregation of solid wastes are carried out.	No storage facility.	The MSW are transported in a closed vehicle to the dump site.	No MSW processing facility is provided.	The MSW are disposed to the dump site without segregation and processing.
Trichy	Daily collected by sanitary workers	20 wards	open dumping	Truck TIPPER - 42TruckTrailer- 5Refuse collector-9Dumper placer 22	compost only 100T remaining as open dumping	manure/open dumping
Vellore	House to house collection by sanitary worker& self help group	No segregation	HDPE Bins-312	Push cart-167, Try Cycle-250, Mini Auto-4, Auto Tipper-6 Tipper Lorry-7 Refuse Collector-6 Tractors-9 Mini Lorry-1	No processing of Municipal Solid Waste	Open dumping

Name of District	Name of Municipality	MSW Collection	MSW Segregation	MSW Storage	Transportation details	Details on Processing of	Disposal of Municipal Solid
District	wincipanty	details	ls			Municipal Solid Waste	Waste
Coimbatore	Pollachi	By lorries using dust bins	No segregation at source is carried out	Open Storage	By lorries	Segregation using draw mill- windro composting- Pelletiztion is being carried out.	Composting and storage
	Valparai	By lorries using dust bins	No segregation at source is carried out	Open Storage	By lorries	Bio composting alone is carried out	Composting and storage
	Mettupalayam	Collection is done by house to house			Tipper lorries, truck lorries, dumper placers & pushcarts	Bio composting & Verni composting	Bio manure
Cuddalore	Cuddalore	Collection is one by house to house	Partial segregation at source	Dumped in the site	Tricycle, Push Cart and Tractor Trailor	Dumping	Dumping as it is at one site
	Chidambaram	Collection is done by house to house	Partial segregation at source	Dumped in the site	Tricycle and Tractor Trailor	Composting	2 No of landfill sites used
	Nellikuppam	Collection is done by house to house	Partial segregation at source	Dumped in the site	Dumper –Placer, Push cart, Mini auto, TATA ACE	Dumping	Dumping as it is at one site
	Panruti	Collection is done by house to house	Partial segregation at source	Dumped in the site	Tricycle, Tractor Trailorand Dumper –Placer	Dumping	Dumping as it is at one site
	Virudhachalam	Collection is done by house to house	Partial segregation at source	Dumped in the site	Tricycle, Tractor Trailorand Dumper –Placer	Composting	1 No of landfill sites used
Dindigul	Oddanchatram	Collection using Compactor bins	No Segregation	Stored in the Dump Yard	Transported using Truck- Tipper and	Dumping	Dumping Yard

Status of implementation of Schedule II [rules 6(1) and (3), 7(1)] by Municipalities of Tamil Nadu

					Dumper- Placers		
	Palani	Collection using Compactor bins	No Segregation	Stored in the Dump Yard	Transported using Truck- Tipper and Dumper- Placers	Dumping	Dumping Yard
	Koddaikanal	Collection using Dumper placer	No Segregation	Stored in the Compost Yard	Transported using Truck- Tipper and Dumper- Placers	Certain quantity of waste is compost in composted yard.	Compost Yard
Erode	Sathyamangalam	27 wards door to door collection	7 wards segregation	Dumper Bins: 55	Dumper Placer	Composting by Windrows method	3 mt of Segreated waste compost by Windrows method
	P.Puliampatty	Door to door collection by municipality workers	Primary segregation	open dumping by compost yard	Transportation by tipper lorry 1 No & dumper placer lorry 1 No	-	Open dumping
	Bhavani	Door to door collection by municipality workers	-	open dumping by compost yard	Tipper lorry 2 Nos & dumper placer 3 Nos	Composting	Open dumping
	Gobichettipalayam	Door to door collection by municipality workers	-	Dumping	Tipper lorry 2 Nos & dumper placer 2 Nos	-	Dumping
Dharmapuri and Krishnagiri	Krishnagiri	Door to Door by Municipality & SHG	Partial segregation at source	No Storage	Trucks & Tippers	Steps taken for composting	At present dumping
	Hosur	Door to Door by Municipality & SHG	Partial segregation at source	No intermediate storage	Thro" Tractor & Lorry	Market waste alone composting	Dumping as it is
	Dharmapuri	Door to Door by Municipality Staff & SHG	Partial segregation at source	No intermediate storage	Thro" Tractor & Lorry	No Process	Dumping as it is
Karur	Kulithalai	Tricycles, dumper placers & Push Carts	Seggregated	No storage	Trucks & Tippers	Composting & Landfill	Kulithalai

Madurai	Thirumangalam	House to House Collection by push carts. Dumper bins placed at appropriate places	No segregation	Dumper Bins have been placed in appropriate places	Transported through dumper placer vehicle and Tipper lorries	Nil	Demolised and construction waste is dumped on notified low laying area.
	Usilampatti	House to House Collection by push carts. Dumper bins placed at appropriate places	No segregation	Dumper Bins have been placed in appropriate places	Transported through dumper placer vehicle and Tipper lorries	Nil	Demolised and construction waste is dumped on notified low laying area.
	Melur	House to House Collection by push carts. Dumper bins placed at appropriate places	No segregation	Dumper Bins have been placed in appropriate places	Transported through dumper placer vehicle and Tipper lorries	Nil	Demolised and construction waste is dumped on notified low laying area.
Kanchipuram	Chengalpet	33 numbers	-	-	Auto-6 Tractor-4 Dumper-1 Tipper-2 Refuse collector- 1	-	Dumping yard
	Maraimalai Nagar	42MT	-	-	-	-	Dumping
	Tambaram	39420	21 wards that are privatized are imparted to do segregation.	-	103.68T/day of MSW are carried in 39 vehicles(26- private 13-Municipality)	1T/day of biodegradable waste is utilized to do vermicomposting in ward no.32	103.68 T/day
	Pallavapuram	Door to door collection	Segregated waste are collected from the	Organic waste are dumped,	Closed covered vehicles like	Presently dumped, new project has	Dumping (presently)

		source-60% achieved	recyclable waste are disposed.	compacters and dumper placers are used.	been commenced on waste to energy technology	
Pammal	35T collected daily through municipality and NGO firm	0.7MT plastic collected like PET bottles,carry bags,milk cover at door to door system	Dumping yards	Tipper lorry-2 Tractor-2 Compacter-1 JCB-1	Waste collected and segregated at door step and processed for Vermi composting in composting yard	After segregated the balance garbage and canal waste are dumped in compost yard.
Anakaputur	21MT daily generated out of this 20MT are collected daily through Municipal workers and contract workers	0.305 MT plastic bags and materials.ie.Re- useable were collected at door to door/primary collection	Dumping at yard	2-Tipper lorry Mini lorry-2	-	Dumping
Kancheepuram	Municipal solid waste are collected directly by municipal administration in 26 wards and through private party in 25 wards	Plastic waste are processed through SHG's	Waste collected are stored with help of compactor bins, dumper placer bins & hook loader bins	Having 3 tipper lorry, 1 tractor, 2 dumper placer, 3 compactor, 1 hook loader & 4 tipper auto.	-	Presently dumped in open yard
Madhurandhagam	Initially collected door to door for 7 wards (1to 7) through push carts and also 3 Autos being engaged for door to door collection for 6	Recently started segregation activity at compost yard separately engaged for 10 Daily wages labour for this activity	Land purchased under IUDM scheme 37 Compactor Bins with capacity of 1100 liters for storage of municipal solid waste at the community level.	Having three Dipper lorries for transportation of MSW to compost yard Daily two to three trips.	Planning to recycle MSW into manure through windrow composting and vermin composting.	

		wards (11 to 15 & 8)					
Nagapattinam	Nagapattinam	through dumper placer placed in streets	all the 36 wards	stored in compost yard	Truck – tipper – 4 nos dumper placers – 4 nos tricycle – 7 nos Auto tipper – 4 nos	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard
	Mayiladuthurai	through dumper placer placed in streets	all the 36 wards	stored in compost yard	Tractor trailer – 2 nos dumper placers – 3 nos tricycle – 39 nos tipper lorry – 3 nos	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard
	Sirkali	through dumper placer placed in streets	7 wards out of 24 wards	stored in compost yard	Truck tipper – 2 nos dumper placer – 1 nos Tricycle – 17 nos push cart – 18 nos	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard
	Vedaranyam	through dumper placer placed in streets	8 wards out of 20 wards	stored in compost yard	Tractor trailer – 1 no dumper placers – 1nos tipper lorry – 3 nos	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard
Namakkal	Rasipuram	Collection is done by house to house	Partial segregation at source	Dumped in the site	By lorries	Composting 10 Tons of organic waste by Windrow processing and also vermi	Segregated plastic waste is used for road laying and remaining dumped in the compost yard.

						composting	
	Pallipalayam	Collection is done by house to house	Partial segregation at source	Dumped in the site	By lorries	Manure are prepared from Biodegradable waste by SHG workers through sever machine daily in good manner	Segregated plastic waste is used for road laying and remaining dumped in the compost yard.
	Komarapalayam	Collection is done by house to house	Partial segregation at source	Dumped in the site	By lorries	Partial	Segregated plastic waste is used for road laying and remaining dumped in the compost yard.
	Namakkal	Collection is done by house to house	Partial segregation at source	Dumped in the site	By lorries	Partial Bio Mining	Segregated plastic waste is used for road laying and remaining dumped in the dump site.
	Thiruchengode	Collection is done by house to house	Partial segregation at source	Dumped in the site	By lorries	Partial	Segregated plastic waste is used for road laying and remaining dumped in the dump site.
Thiruvarur	Thiruvaur	through compactor bins placed in streets	10 wards out of 30 wards	stored in compost yard	Mini lorry – 1 no tipper mini lorry – 1no tractor trailer – 1 no tricycle – 10 Refuse- collector – 2 nos	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard

	Mannargudi	through dumper placer and compactor bins placed in streets	4 wards out of 33 wards	stored in compost yard	tipper lorry – 2nos truck tipper – 1 no tractor trailer – 1 no refuse – collector – 1 dumper placer – 2 nos tricycle – 20 nos	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard
	Thiruthuraipoondi	through bins placed in streets	10 wards out of 24 wards	stored in compost yard	truck tipper – 2nos tractor trailer – 1no tricycle – 4 nos	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard
	Koothanallur	through dumper placer placed in streets	-	stored in compost yard	mini lorry – 2 nos dumper placer – 1 mini van – 1	plastic waste are partially segregated	segregated plastic waste is used for road laying and remaining dumped in the compost yard
Kanyakumari	Kuzhithurai	Door to door collection	Partially done	Storage yard	Through Trucks	No processing	Stored in dumping yard
	Nagercoil	Door to door collection	Partially done	Storage yard	Through Trucks	No processing	Stored in dumping yard
	Padmanabhapuram	Door to door collection	Partially done	Storage yard	Through Trucks	No processing	Stored in dumping yard
	Colachel	Door to door collection	Partially done	Storage yard	Through Trucks	No processing	Stored in dumping yard
Nilgiris	Coonoor	Street collection and partially door to door collection	Segregated into Bio- degradable & Non- Bio-degradable	Bins	By Lorry	Nil	Dumped in open yard
	Udhagamandalam	Street collection and partially door to door	Segregated into Bio- degradable & Non- Bio-degradable	Bins	By Lorry	Nil	Dumped in open yard

		collection					
	Gudalur	Door to door collection	Partially done	Storage yard	Through Trucks	No processing	Stored in dumping yard
	Nelliyalam	Street collection and partially door to door collection	Segregated into Bio- degradable & Non- Bio-degradable	Bins	By Lorry	Windrow Composting yard	 Bio degradable convert into manure Non Bio degradable is dumped in open yard
Pudukkottai	Pudukkottai	Manual Collection & dumper placer bins-60 Nos	Door to door segregation in 15 wards out of 42	Stored in Dumping yard	Tipper Lorry, Dumper placer lorry	Composting is being carried out partially and the remaining is dumped	Partly disposed as manure and the remaining is dumped in the yard
	Aranthangi	Manual Collection & dumper placer bins-48 Nos	Door to door segregation in all 27 wards.	Stored in Dumping yard	Tipper Lorry, Dumper placer lorry, Tipper Tractor etc.,	Composting is being carried out partially and the remaining is dumped	Partly disposed as manure and the remaining is dumped in the yard
Salem	Attur	Bins, Push Cart	Plastic and other recyclable waste is segregated from MSW.	Collected solid waste is transported through trucks to the compost yard	Trucks	Segregated waste is composted in the compost yard and recyclable waste is sold	Bio compost is sold out. Recyclable materials are sold to recyclers.
	Narashingapuram	Bins, Push Cart	Plastic and other recyclable waste is segregated from MSW.	Collected solid waste is transported through trucks to the compost yard	Trucks	Segregated waste is composted in the compost yard and recyclable waste is sold	Bio compost is sold out. Recyclable materials are sold to recyclers.
	Edappadi	Bins, Push Cart	Plastic and other recyclable waste is segregated from MSW.	Collected solid waste is transported through trucks to the compost yard	Trucks	Segregated waste is composted in the compost yard and recyclable waste is sold	Bio compost is sold out. Recyclable materials are sold to recyclers.
	Mettur	Bins, Push Cart	Plastic and other recyclable waste is	Collected solid waste is	Trucks	Segregated waste is composted in the	Bio compost is sold out.

			segregated from MSW.	transported through trucks to the compost yard		compost yard and recyclable waste is sold	Recyclable materials are sold to recyclers.
Ramnad	Ramanathapuram	Door to door	Manual Segregation at composite Yard		Through municipal vehicals with net covered	Composting	Open dump
	Rameswaram	Door to door	Manual Segregation at composite Yard		Through municipal vehicals with net covered	Composting	Open dump
	Paramakudi	Door to door	Manual Segregation at composite Yard		Through municipal vehicals with net covered	Composting	Open dump
	Keelakarai	Door to door	Manual Segregation at composite Yard		Through municipal vehicals with net covered	Composting	Open dump
Sivagangai	Devakkottai						
	Sivagangai	Door to door	Manual Segregation at compost yard		Through municipal vehicles net covered	Composting	Open dump
	Karaikkudi	Door to door	Manual Segregation at compost yard		Through municipal vehicles net covered	Composting	Open dump
Thanjavur	Kumbakonam	MSW collected through push cart, tricycle and the collected garbage stored in	Segregated waste are disposed at STP site Thepperaumanallur	MSW stored in dumper placer bins	Dumper placer lorries		Dumping at STP site Thepperaumanallur. 5TPD Biomethanation power generation

		plastic containers					plant under erection at kumbakonam
	Pattukkottai	Door to door collection through cycle rickshaw	Only 11 wards segregation	Dumper placer bins – 57 nos.	Dumper placer – 2 Tractor - 3		Dumping at municipal compost yard
Theni	Theni-Allinagaram	Door to Door Collection Method	Segregation at source	No intermittent storage system adopted	Transported by Dumper Placer vehicle	Source segregation collection	Dumping at compost yard
	Periyakulam	Door to Door Collection Method	Segregation at source	No intermittent storage system adopted	Transported by Dumper Placer vehicle	Source segregation collection	Dumping at compost yard
	Bodinaickanur	Door to Door Collection Method	Segregation at source	No intermittent storage system adopted	Transported by Dumper Placer vehicle	Source segregation collection	Dumping at compost yard
	Cumbum	Door to Door Collection Method	Segregation at source	No intermittent storage system adopted	Transported by Dumper Placer vehicle	Source segregation collection	Dumping at compost yard
	Chinnamanur	Door to Door Collection Method	Segregation at source	No intermittent storage system adopted	Transported by Dumper Placer vehicle	Source segregation collection	Dumping at compost yard
	Gudalur	Door to Door Collection Method	Segregation at source	No intermittent storage system adopted	Transported by Dumper Placer vehicle	Source segregation collection	Dumping at compost yard
Thoothukudi	Kayalpattinam	Manual	Manual	Dumper bin	Lorry Tipper	Composting	
	Kovilpatti	Manual	Manual	Storage Yard	Lorry, Tipper	Composting	
Tirunelveli	Ambasamudram	Bio-Degradable - 53.5% Plastic - 3.00%	Segregation at Source Level for 7 Wards	Compost yard at 5.00 Acres	Mini Lorry Dumper Places Auto.		Dumping

	Paper - 4 %			Tractor		
	Metal, Glass &					
	Rubber -					
	1.5%					
	Inert - 38 %					
Kadayanallur	Bio-Degradable					
	- 46.59%%					
	Plastic -					
	9%			Mini Lorry		
	Paper -	Segregation at Source	Compost yard at	Dumper Places	Windrows	Windrows &
	3.15%	Level for 8 Wards	10.25 Acres	Auto.	windlows	Dumping
	Metal, Glass &			Tractor		
	Rubber -					
	1.40%					
	Inert					
Puliyangudi	Bio-Degradable					
	- 54%			Mini Lonny		
	Plastic - 2.5%	Correction of Course	Compost word at	Dumper Diseas		Windrows
	Paper - 2 %	Level for 11 Words	5 06 A area	Dumper Places	Windrows	Willdrows &
	Metal, Glass &	Level for 11 wards	5.00 Acres	Auto.		Dumping
	Rubber - 2.5%			•		
	Inert - 39 %					
Sankarankovil						
Shenkottai	Bio-Degradable					
	- 42.29%					
	Plastic - 4%			Mini Lorry		
	Paper - 2.10%		Compost yard at	Dumper Places	Windrows	Dumning
	Metal, Glass &		5.10 Acres	Auto.	willdrows	Dumping
	Rubber -					
	1.10%					
	Inert					
Tenkasi	Bio-Degradable		Compost yard at	Dumper		
	- 54%	Segregation at Source	Mathalamparai-	Dumper - Diacars 1		
	Plastic - 2%	Level for 12 Words	3.03acres	Push carts	Dumping	Dumping
	Paper - 2.5 %	Level 101 12 walus	Boganallur-8.25	Mini Lorry		
	Metal, Glass &		acres	WIIIII LOITY		

		Rubber - 2.5% Inert - 39%					
	V.K. Puram	Bio-Degradable - 48.83% Plastic - 3% Paper - 2.91 % Metal, Glass & Rubber- 1.67% Inert - 43.59 %		Compost yard at 6.84 Acres	Mini Lorry – 2 Nos. Dumper PlaceR – 1 Nos. 4 Wheeler Auto – 2 Nos. 3 Wheeler auto – 4 Nos	Open dumping	Open dumping
Tiruppur	Palladam Municipality	Door to door collection is being implemented.	No segregation of solid wastes are carried out.	No storage facility.	The MSW are transported in a closed vehicle to the dump site.	No MSW processing facility is provided.	The MSW are disposed to the dump site without segregation and processing.
	Udumalpet Municipality	Door to door collection is being implemented.	The MSW are segregated mechanically and manually in the MSW processing facility at SF.No.130/4, 130/5, Ganapathipalayam Village, Udumalpet Taluk, Tiruppur District. But, the segregation is not properly carried out.	Storage facility is provided at the MSW processing facility.	The MSW are transported in a closed vehicle to the MSW processing facility.	The MSW processing (bio composting) facility is provided at SF.No.130/4, 130/5, Ganapa thipalayam Village, Udumalpet Taluk, Tiruppur District.	The uncomposted MSW are stored in the processing facility
	Dharapuram Municipality	Door to door collection is being implemented.	No segregation of solid wastes are carried out.	No storage facility.	The MSW are transported in a closed vehicle to the dump site.	No MSW processing facility is provided.	The MSW are disposed to the dump site without segregation and processing.
	Kangayam Municipality	Door to door collection is being implemented.	No segregation of solid wastes are carried out.	No storage facility.	The MSW are transported in a closed vehicle to the dump site.	No MSW processing facility is provided.	The MSW are disposed to the dump site without segregation and

							processing.
	Vellakoil	Door to door	No segregation of solid	No storage	The MSW are	No MSW	The MSW are
	Municipality	collection is	wastes are carried out.	facility.	transported in a	processing facility	disposed to the dump
		being			closed vehicle to	is provided.	site without
		implemented.			the dump site.	1	segregation and
		1			1		processing.
Tiruvallur	Avadi	Bins	Nil	Nil	Tipper	Nil	MSW are being
							dumped in existing
							dumping yards
	Poonamallee	Bins	Nil	Nil	Tipper	Nil	MSW are being
							dumped in existing
							dumping yards
	Tiruvallur	Bins	Nil	Nil	Tipper	Nil	MSW are being
							dumped in existing
							dumping yards
	Tiruverkadu	Bins	Nil	Nil	Tipper	Nil	MSW are being
							dumped in existing
							dumping yards
	Tiruttani	Bins	Nil	Nil	Tipper	Nil	MSW are being
							dumped in existing
							dumping yards
Tiruvannamalai	Arani						
		Door to door	Partial Segregation at	No intermediate	Through lorry,	Nil	Dumped
		collection	source	storage	tractors		
	Tiruvannamalai						
		Door to door	Partial Segregation at	No intermediate	Through lorry,	Nil	Dumped
		collection	source	storage	tractors		_
	Thiruvathipuram						
		Door to door	Partial Segregation at	No intermediate	Through lorry,	Nil	Dumped
		collection	source	storage	tractors		
	Vandavasi						
		Door to door	Partial Segregation at	No intermediate	Through lorry,	Nil	Dumped
		collection	source	storage	tractors		
Trichy,	Manapparai						
Ariyalur &		Daily collected	No segregation	open dumping	Truck TIPPER -	NIL	open dumping
Perambalur		by sanitary			2 tri cycle 22		

		workers			Dumper placer 1		
	Thuraivur				Truck TIPPER -		
	, and y a	Daily collected			2 Push cart		
		by sanitary			32 Dumper		manure/open
		workers	18 wards	open dumping	placer 1	Vermi compost	dumping
	Thuvakudi				Truck TIPPER	1	10
					-1 Truck		
		Daily collected			Trailer- 1		
		by sanitary			mini auto - 2		manure/open
		workers	6 wards	open dumping	Dumper placer 1	NIL	dumping
	Perambalur				Truck TIPPER -		
					2 tri cycle 34		
		Daily collected			tata ace-9		
		by sanitary			compactor 2		
		workers			Dumper placer 1		
			No segregation	open dumping		NIL	open dumping
	Ariyalur				Truck TIPPER -		
					1 Truck		
		Daily collected			Trailer- 1		
		by sanitary			mini auto - 2		
		workers	No segregation	open dumping	Dumper placer 1	NIL	open dumping
	Jeyankondam				Truck TIPPER		
		Daily collected			-1 Truck		
		by sanitary			Trailer- 1		
		workers	No segregation	open dumping	Dumper placer 1	NIL	open dumping
Vellore	Vaniyambadi	The solid waste	The local body has	No transfer	The solid waste	No waste	The solid waste
		collected in the	carried out source	stations provided/	collected in street	processing facility	collected are dumped
		street bins are	segregation of solid	The solid waste	bins are	provided.	in the open dumping
		transferred to the	waste by door to door	collected in street	transported to the		yard
		open dumping	collection in 24 wards	bins are directly	open dumping		
		yard through		disposed through	yard through 4		
		trucks.		trucks and	No. of trucks		
				dumped in open			
				dumping yard.			
	Gudiyatham	The solid waste	The local body has	No transfer	The solid waste	No waste	The solid waste
		collected in the	carried out source	stations provided/	collected in street	processing facility	collected are dumped

	street bins are transferred to the open dumping yard through trucks.	segregation of solid waste by door to door collection in 18 wards	The solid waste collected in street bins are directly disposed through trucks and dumped in open dumping yard.	bins are transported to the open dumping yard through 3 No. of trucks	provided.	in the open dumping yard
Pernambut	The solid waste collected in the street bins are transferred to the open dumping yard through trucks.	The local body has carried out source segregation of solid waste by door to door collection in 8 wards	No transfer stations provided/ The solid waste collected in street bins are directly disposed through trucks and dumped in open dumping yard.	The solid waste collected in street bins are transported to the open dumping yard through 5 No. of trucks	No waste processing facility provided.	The solid waste collected are dumped in the open dumping yard
Tirupathur	The solid waste collected in the street bins are transferred to the open dumping yard through trucks.	The local body has carried out source segregation of solid waste by door to door collection in 13 wards	No transfer stations provided/ The solid waste collected in street bins are directly disposed through trucks and dumped in open dumping yard.	The solid waste collected in street bins are transported to the open dumping yard through 6 No. of trucks	No waste processing facility provided.	The solid waste collected are dumped in the open dumping yard
Ambur	The solid waste collected in the street bins are transferred to the open dumping yard through trucks.	The local body has carried out source segregation of solid waste by door to door collection in16 wards	No transfer stations provided/ The solid waste collected in street bins are directly disposed through trucks and dumped in open dumping yard.	The solid waste collected in street bins are transported to the open dumping yard through 5 No. of trucks	No waste processing facility provided.	The solid waste collected are dumped in the open dumping yard
Jolarpet	The solid waste collected in the	The local body has carried out source	No transfer stations provided/	The solid waste collected in street	No waste processing facility	The solid waste collected are dumped
	street bins are transferred to the open dumping yard through trucks.	segregation of solid waste by door to door collection in 4 wards	The solid waste collected in street bins are directly disposed through trucks and dumped in open dumping yard.	bins are transported to the open dumping yard through 2 No. of trucks	provided.	in the open dumping yard
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Ranipet Municipality	10 Wards-11282 house to house collection by sanitary worker& self help group	No segregation	Dumper-10	Tractor Trailer-2, Dumper placers - 2,Tricycle- 17,Push Cart- 30,Tipper Autos- 6 and Mini Lorry-1	No processing of Municipal Solid Waste	Open dumping
<u>Walajapet</u> Municipality	8 Wards-7860 house to house collection by sanitary worker& self help group	Plastic waste segregated from the Municipal Solid Waste	Dumper-45	Tractor Trailer-2, Dumper placers - 2,Tricycle- 24,Push Cart-32,	No processing of Municipal Solid Waste	Open dumping
Arcot Municipality	13071 house to house collection by sanitary worker	No segregation	Dumper placers- 68	Tipper lorry-1, Tipper Auto-3, Tractor Trailer-1, Dumpper placer lorry-1,Mini Lorry-4,	No processing of Municipal Solid Waste	Open dumping
Melvisharam Municipality	21 Ward-8893 house to house collection by sanitary worker& Self help group	No segregation	Dumper placers- 26	Tractor Trailer-2, Dumper placer lorry-1,Power Tilter-3,Mini Auto-2,	No processing of Municipal Solid Waste	Open dumping
Arrakkonam Municipality	36 Ward-21398 house to house collection by sanitary	No segregation	Dumper bins-78	Truck Tipper-3, Dumper placer lorry-2,Push cart- 72	No processing of Municipal Solid Waste	Open dumping

		worker& Self help group					
Villupuram	Villupuram	Yes	Yes	Open dumping		Composting	Used as Manure
	Tindivanam	Yes	Yes	Open dumping		Composting	Used as Manure
	Kallakurichi	Yes	Yes	Open dumping		Composting	Used as Manure
Virudhunagar	Rajapalayam	In all 42 wards covering 44460 House Holds Municipal Solid Waste Collections is done regularly	Only 10 Wards segregation of Solid Waste is done regularly	In 55 Dumber Placer Bins	3 Dumber placer lorry and 2 tipper lorry enhanced for transporation		
	Sattur	In all 24 wards covering 8136 House Holds Municipal Solid Waste Collections is done regularly	In 8 Wards segregation of Solid Waste is done regularly	In 24 Dumber Placer Bins and in 20 (200lit) bins solid waste is stored	Daily through Dumber Placer and Tipper Lorries Municipal Solid Waste is being transported.		
	Thiruthangal Municipality	House Holds Municipal Solid Waste Collections is done regularly	Metal 0.4 Plastic –waste 0.7mt Paper waste 1.2mt	Plastic –waste	Mini lorry -3 Tractor -1 Dumper placer -1	Dumping	Dumping
	Sivakasi Municipality	House Holds Municipal Solid Waste Collections is done regularly	Metal 1.4 Plastic –waste 2mt Paper waste 3.6mt	Plastic –waste	Mini lorry -2 Tractor -4 Dumper placer -3	Dumping	Dumping
	Srivilliputhur	House Holds Municipal Solid Waste Collections is	In 3 Wards segregation of Solid Waste is done regularly	In 32 Dumber Placer Bins	Daily through Dumber Placer and Tipper Lorries Municipal		

	done regularly			Solid Waste is being transported.		
Virudhunagar	House Holds Municipal Solid Waste Collections is done regularly	In 10 Wards segregation of Solid Waste is done regularly	In 40 Dumber Placer Bins	Tractor -2 Dumper placers - 2 Tricycle – 30 Pushcart – 45 Compactor-1	-	-
Aruppukottai Municipality	House Holds Municipal Solid Waste Collections is done regularly	Plastic –waste	Plastic –waste	Dumper Placer- 5 Tipper Lorry-3	Dumping	Dumping

Name of	No of Town	MSW Collection	MSW Segregation	MSW Storage	Transportation	Details on	Disposal of Municipal
District	Panchayats	details	details	details	details	Processing of Municipal Solid	Solid Waste
						Waste	
Coimbatore	37	By lorries using dust bins	No segregation at source is carried out	Open Storage	By lorries	Bio composting alone is carried out	Composting and storage
Cuddalore	16	Door to Door Collection with TP staff , SHG Groups in all wards	Partial segregation at source	Dumped in the site	Push cart, Mini Tipper and lorry, Tricycle and Tractor Trailor	Composting, Vermiculture and Pellets	13 Nos. of Land filling site & 3 nos. dumping at site
Dindigul	23	Manual Collection	Segregation not proper	No Storage	Using Trucks,	Partially Composted	Partially composted and partially dumped in Dumping Yard
	42	Door to door	Manual	No storage	Tractor	No processing	open dumping
Erode		collection through bins			trailer,power tiller&push carts		
Dharmapuri / Krishnagiri	17	Door to Door by SHG & T.P. Staff	Partial segregation at source	Collected in bins and no storage	Thro Tractor, tilter etc.	Partial composting, Degradable waste are composted	Dumping as it is
Karur	11	Through bins	Segregation done	No Storage	trucks & Tractors		Landfill
Madurai	9	House to House Collection by push carts and street sweeping.	No Segregation	Dust bins placed at appropriate places	Transported through tractor and Tipper without cover	Nil	Demolished construction waste is dumped separately.
Kanchipuram	15	Door to door collection	The collected wastes are segregated and dumped in area	No permanent dumping yard	Tractor , Tata Ace, Power Tiller, Tri Cycle, Mini Lorry, Mini auto	Bio-Compost Vermi Compost at Kundrathur TP. Compost yard at Walajabad TP.	Landfill at Walajabad TP only
1	8	through container	Partial segregation	stored in	truck tipper, tractor	plastic waste are	segregated plastic waste
Nagapatinam		and dumper		compost yard	trailer, dumper	partially segregated	is used for road laying,

Status of implementation of Schedule II [rules 6(1) and (3), 7(1)] by Town Panchayats of Tamil Nadu

		placer			placer, try cycle, push cart	partially composting and partially dumped in compost yard	and to produce recycled products compost disposed as manure and remaining dumped in the compost yard
Namakkal	19	Partial	Nil	Nil	Transported to dumpyard	Nil	Open dumping
Thiruvarur	7	through bins placed in the streets	Partial segregation	stored in compost yard	Tractor trailer, mini van, mini auto, try cycle, push cart	plastic waste are partially segregated partially composting and partially dumped in compost yard	segregated plastic waste is used for road laying , compost disposed as manure and remaining dumped in the compost yard
Kanyakumari	56	Manually	No segregation	Stored in dumping yard	By Carts/Trucks	Composting / Vermi Composting	Composting / Vermi Composting
Ooty	11	Street collection and partially door to door collection	Segregated into Bio- degradable & Non- Bio-degradable	Bins	By Lorry	Windrow composting yard for Kothagiri, Ketti, Devarshola TP	Bio degradable convert into manure & Non Bio degradable is dumped in open yard for Kothagiri, Ketti, Devarshola TP Dumped in open yard for other TP
Pudukkottoi	8	Door to door Collection	Partial Segregation	Stored in Dumping yard	Truck, Tractor & Tipper Lorry	Composting is being carried out partially and the remaining is	Partly disposed as manure and the remaining is dumped in the yard
Salem	33	Bins and Push cart	Not Segregated	Collected MSW is transported to the dump yard in tractor	Tractor	Dumped in the dump yard	Composted
Ramnad	7	Door to door	Source Segregation / Manual Segregation at composite Yard		Through tractor with net covered	Composting	Open dump

	12	Door to door	Source Segregation /		Through tractor	Composting	Open dump
			Manual Segregation at		with net covered		
Sivagangai			composite Yard				
	22	solid waste	Segregation at source	Segregated solid	Power triller,	solid wastes are	Compost converted into
		collected by		wastes are	tractors, TATA	split for compost	fertilizer and going to
		tractors		converted into	ACE, mini auto,	and plastic waste	sale for agricultural
Thanjavur				compost	push cart		purpose
		Door to Door	Segregation at source	No intermittent	Transported by	Source segregation	Landfill
		Collection		storage system	Mechanical system	collection	
Theni	22	Method		adopted			
Thoothukudi	19	Manual	Manual	Storage yard	Truck	-	-
			Collected wastes are			Segregated bio	Composting / Dumping
		Door by Door	segregated at compost		Tractor - 1 No,	degradable solid	
		Door by Door	yard only Four		Power Tiller - 1 No,	waste are used to	
		Collection for all	workers are		Mini auto-1	preparing manure	
		wards	segregating the		Push Card-5	with E.M. Solution	
Tirunelveli	36		workers				
		Door to door	No segregation of	No storage	The MSW are	No MSW	The MSW are disposed
		collection is	solid wastes are	facility.	transported in a	processing facility	to the dump site without
		being	carried out.		closed vehicle to the	is provided.	segregation and
Tiruppur	16	implemented.			dump site.		processing.
	10	Bins	Nil	Nil	Lorry	Nil	MSW are being dumped
							in existing dumping
Tiruvallur							yards
		Door to door	Partial segregation at	No intermediate	Through tractors	Partial Composting	Dumped
Tiruvannamalai	10	collection	source	storage			
					TRACTOR With		
		Daily collected			Trailer, One Mini		
		by sanitary	Daily segregated by	stored in	Auto,		Manure sold out / open
Ariyalur	2	workers	sanitary workers	compost yard	Push cart	Manure compost	dumping
					TRACTOR With		
		Daily collected			Trailer, One Mini		
		by sanitary	Daily segregated by	stored in	Auto,		Manure sold out / open
Perambalur	4	workers	sanitary workers	compost yard	Push cart	Manure compost	dumping

	16	House to house	Waste segregated at	RCC bin &	Tractor Trailer,	composting the part	Open dumping
		collection	composite site only	plastic bin	Power Tiller,	of the organic waste	
					Tricycle, push carts		
Vellore					and Tipper autos		
		Door to Door	Door to Door	S.Kodikulam	Through Vehicle	Partial composting	Stored in compost yard.
		collection	collection is not	Land site is	Tractor		
			effection due to lack	under dispute	Tricycle		
			of cooperation from		Pushcart		
			public. However				
			segregation is done at				
Virudhunagar	9		dumping yard.				
	15	Yes	Yes	Open dumping		Composting	Used as Manure
Villupuram						_	

Name of the Corporatio n	Site Selectio n	Facilities at the site	Specification s for land filling	Pollution Prevention	Water Quality Monitorin	Ambient Air Quality Monitorin	Plantatio n at Landfill Site	Closure of Landfill Site and Post-care
					g	g	Site	1 051-0410
Coimbatore	Site Selected	Corporation is generating 850 T/d of MSW. It is carrying out the following. Windrow Composting -757 TPD Vermi Composting -50 TPD.	Land fill provided as per the specification.	Scientific closure of existing dump is made.	Being done	To be done	Green belt is being developed	Yet to be closed
Erode	Dumping a	at three location	s of 28.87acres.					
	 Vendipalayam Vairapalayam Kasipalayam Landfill site yet to be identified. 							
Madurai	Site Selected	Approach Road and Weigh bridge provided	Vegetative layer provided	Storm Waste drains provided. Non- Permieable lining system provided.	Ground Water quality Monitored.	AAQ survey conducted	Vegetative Cover provided.	Maintaining the effectivenes s of final cover, and preventing run of from eroding.
Salem	Landfill facility in operatio n	Facility construction is in operation		1)Diversion of storm water drains 2)Provision for Managemen t of leach ate collection & treatment 3) Prevention of run-off from landfill area.	Piezometric wells are provided	Ambient Air Quality survey is being conducted	Green belt being developed at the facility	Closure of Landfill site and post care has been included in the solid waste management design details
Tirunelveli Corporation		Road and lighting facility available		Green belt				

Landfill details provided by the Corporations

District	Municipalities	Town Panchayats
Cuddalore	Chidambaram	Mangalampettai
	Virudhachalam	Pennadam
		Tittakudi
		Srimushnam
		Melpattampakkam
		Thorappadi
		Vadalur
		Kurinchipadi
		Lalpettai
		Kattumannarkoil
		Killai
		Paranginettai
		Bhuyanagiri
Kanahinuram	Changelnat	Thirupporur
Kanchipurani	Maraimalai Nagar	Edoiloghingdu
	Marannarar Nagar	Madamhaldzam
		Chitlanalalam
		Спиараккаш Тьільна алиста
		1 mruneermalai
		Uthiramerur
		Acharapakkam
T 1	G .1 1	Karunkuzni
Erode	Sathyamangalam	Ariyappampalayam
	P.Puliampatty	Bhavanısagar
		Chennimalai
		Jambai
		Kanjikoil
		Kasipalayam (G)
		Kolappalur
		Kuhalur
		Lakkampatti
		Nambiyur
		Olagadam
		P.Mettupalayam
		Pallapalayam
		Periyakodiveri
		Perundurai
		Pethampalayam
		Salangapalayam
		Vaniputhur
Pudukkottai	Pudukkottai	Illuppur
	Aranthangi	Arimalam
	-	Ponnamaravathy
		Karambakudi
		Keeranur
Thaniayur		Orathanadu
1 minju v ut		Darasuram
		Thiruvaivaru
		Cholapuram
		Ammanettai
		Perumagalur
		i crumagarui

List of Landfill sites identified for Municipalities & Town Panchayats

Theni	Theni-Allinagaram	Andipatti
	Perivakulam	Vadugapatti
	Bodinaickanur	Thamaraikulam
	Cumbum	Thenkarai
	Chinnamanur	Palanichetty Patti
	Gudalur	Veerapandi
	Outuniti	Uthamanalayam
		Ka Puthu patti
		Combai
		Theyaram
		Komaya Goundan Batti
		Kainaya Gounden Fatti
		Devethere retti
		Ven energy Detti
		Kenguvar Patti
		Odai Patti
		Kuchanur
		Hanumanthan Patti
		Pannai puram
		Mela Chokkanatha Puram
		Markkaiyan Kottai
		Bo.Meenatchi Puram
		Boothipuram
Tirunelveli		Achampudur
		Alangulam
		Alwarkurichi
		Eruvadi
		Gopalasamudram
		Kalakad
		Kallidaikurichi
		Keezhapavoor
		Manimuthar
		Melacheval
		Melagaram
		Mukkudal
		Nanguneri
		Panagudi
		Panholi
		Thirukurangudi
		Thiruyengadam
		Thicovervilei
		Voorovonollur
	TT1 1.	veelavallallui
Tiruppur	Udumalaıpet	
Vellore	Vaniyambadi	
	Gudiyatham	
	Pernambut	
	Tirupathur	
	Ambur	
	Jolarpet	
	r r	

S.	District	Composting		Vermi-Composting		
No	District	Municipalities	Town Panchayat	Municipalities	Town Panchayat	
1.	Coimbatore	Pollachi		Valparai		
2.	Cuddalore	Cuddalore Chidambaram Virudhachalam Panruti Nellikuppam	Killai Parangipettai Lalpettai Kurinchipadi Vadalur Thorappadi Melpattampakkam Pennadam Mangalampettai Tittakudi Srimushnam Sethiyathope Kattumannarkoil Annamalai Nagar Bhuvanagiri		Killai Parangipettai Lalpettai Kurinchipadi Vadalur Thorappadi Melpattampakkam Pennadam	
3.	Hosur	Hosur	Kadathur Pappireddipatti Harur Palacode Pennagaram Karimangalam Bargur Papparapatti Uthangarai Nagojanahalli Denkanikotta Marandahalli Kambainallur B. Mallapuram			
4.	Karur	Karur Kulithalai	F			
5.	Nagapatinam	Velankanni Thalainayar Tharangambadi		Tharangambadi		
6.	Namakkal (Partial)	Namakkal Tiruchengode Rasipuram Pallipalayam Komarapalayam	Alampalayam Mallasamudram Mohanur Namagiripe Padaveedu Paramathi Pandamangalam Pothanur Sendamangalam Velur Athanur Erumapatti Kallapanaickenpatti Pattanam			

List of Municipalities and Town Panchayats provided with treatment facilities

			Pillanalur Seerapalli Venandur Venkari R. Pudupatti	
7.	Thiruvarur	Needamangalam Peralam Koradacherry		
8.	Kanyakumari		AnjugramamArumanaiAsaripallamAzhagiapandipuramBoothapandyEdaicodeEranielEzhuthesamGanapathipuramKaliyakkavilaiKallukootamKappiaraiKeezhkulamKilliyurKollancodeKothanallurKumarapuramManavalakurichiNeyyoorPacodePalapallamPazhugalPuthukkadaiReethapuramSuchidrumThengampudurThiruvithamcoduUnnamalaikadaiValvatchagostamVellimalaiVerkilambiVilukuriThingalnagar	Aloor Aralvoimozhy Attoor Azhagappapuram Kadayal Kanniyakumari Karungal Kottaram Marungur Puthalam Thazhakudy Thenthamaraikulam Villavoor Ponmanai
9.	Ooty	Coonoor	Kothagiri, Ketti Devarshola	
10.	Perundurai	Sathyamangalam	Anthiyur Appakudal Athani Jambai	

			Karumandi Chellipalayam	
			P.Mettupalayam	
			Perundurai	
			Muthukulatur	
			R S Mangalam	
		Ramanathapuram	Kamuthi	
11	Siyagangai	Rameswaram	Abiramam	
	Sivugungun	Paramakudi	Thondi	
		Keelakarai	Savalgudi	
			Mandanam	
12	Tirunelveli		Veeravanallur	
12.	Thunciven		Chengam	
			Chetnet	
			Desur	
			Kalambur	
			Kannamangalam	
13.	Tiruvannamalai		Kilponnothur	
			Demomollur	
			Permananui	
			Polui	
			Pudupalayam	
			Vettavalam	
			Ammoor	
			Thiruvalam	
			Kaveripakkam	
			Thimiri	
			Villapakkam	
14.	Vellore		Kalavai	
			Panapakkam	
			Nemili	
			Thokkolam	
			Pennathur	
			Sholinghur	
			W. Puthupatti,	
15	Virudhunagar	Raianalayam	Sundarapandiam,	
15.	• In utilitinagai	кајаратауат	mamsapuram, Seithur and	
			Watrap	

3. BIOMEDICAL WASTE

3.1 Introduction

Biomedical waste is waste that is potentially infectious. Biomedical waste includes waste generated from medical or laboratory origin and research laboratory waste containing organisms. Discarded sharps are considered biomedical waste, due to the possibility of being contaminated with blood and as they can cause injury when not properly disposed.

Examples of infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable body parts, other human tissue, used bandages and dressings, discarded gloves, laboratory waste that exhibits the characteristics described above. Waste sharps include potentially contaminated used needles, scalpels, lancets etc.



Figure 3.1 Composition of Biomedical Waste

3.2 Legislative Framework

The Bio-Medical Waste (Management And Handling) Rules, 1998 (Moef Notification S.O. 630 (E) Dated 20.7.1998. have been prescribed for efficient management of the wastes. Salient Features of the rules are highlighted in the paragraphs below:

Salient Features

Rule 2	Application
	These rules apply to all persons who generate, collect, receive, store,
	transport, treat, dispose, or handle bio medical waste in any form.
Rule 3	Definitions
	(5) "Bio-medical waste" means any waste, which is generated during the
	diagnosis, treatment or immunization of human beings or animals or
	in research activities pertaining thereto or in the production or
	testing of biologicals, and including categories mentioned in Schedule
	I;
	(7) "Bio-medical waste treatment facility" means any facility wherein
	treatment. disposal of bio-medical waste or processes incidental to
	such treatment or disposal is carried out and includes common
	treatment facilities;
	(7) (a) : Form means Form appended in these rules
	(8) "Occupier" in relation to any institution generating bio-medical
	waste, which includes a hospital, nursing home, clinic dispensary,
	veterinary institution, animal house, pathological laboratory, blood
	bank by whatever name called, means a person who has control over
	that institution and/or its premises;
	(9) "Operator of a bio-medical waste facility" means a person who owns
	or controls or operates a facility for the collection, reception, storage,
	transport, treatment, disposal or any other form of handling of bio-
	medical waste;
Rule 4	Duty of Occupier
	It shall be the duty of every occupier of an institution generating bio-
	medical waste which includes a hospital, nursing home, clinic,
	dispensary, veterinary institution, animal house, pathological laboratory,
	blood bank by whatever name called to take all steps to ensure that such
	waste is handled without any adverse effect to human health and the
	environment.
Rule 5	Treatment and Disposal
	(1) Bio-medical waste shall be treated and disposed of in accordance with
	Schedule I, and in compliance with the standards prescribed in Schedule
	V.
	(2) Every occupier, where required, shall set up in accordance with the
	time-schedule in Schedule VI, requisite bio-medical waste treatment
	facilities like incinerator, autoclave, microwave system for the treatment
	of waste, or, ensure requisite treatment of waste at a common waste
	treatment facility or any other waste treatment facility.
Rule 6	Segregation, Packaging, Transportation and Storage
	(1) Bio-medical waste shall not be mixed with other wastes.

	(2) Bio-medical waste shall be segregated into containers/bags at the
	point of generation in accordance with Schedule II prior to its
	storage, transportation, treatment and disposal. The containers shall
	be labeled according to Schedule III.
	(3) If a container is transported from the premises where bio-medical
	waste is generated to any waste treatment facility outside the
	premises, the container shall, apart from the label prescribed in
	Schedule III, also carry information prescribed in Schedule IV.
	(4) Notwithstanding anything contained in the Motor Vehicles Act, 1988,
	or rules thereunder, untreated biomedical waste shall be transported
	only in such vehicle as may be authorized for the purpose by the
	competent authority as specified by the government.
	(5) No untreated bio-medical waste shall be kept stored beyond a period
	of 48 hours: Provided that if for any reason it becomes necessary to
	store the waste beyond such period, the authorized person must take
	permission of the prescribed authority and take measures to ensure
	that the waste does not adversely affect human health and the
	environment.
	(b) The Municipal body of the area shall continue to pick up and
	transport segregated non bio-medical solid waste generated in
	nospitals and nursing nomes, as well as duly treated bio-medical
	wastes for disposar at indificipal during site.
Rule 7	Prescribed Authority
Rule 7	Prescribed Authority
Rule 7 Rule 8	Prescribed Authority Authorization. - (1) Every occupier of an institution generating collecting receiving
Rule 7 Rule 8	Prescribed Authority Authorization (1) Every occupier of an institution generating, collecting, receiving, storing transporting treating disposing and/or handling bio-
Rule 7 Rule 8	 Prescribed Authority Authorization Every occupier of an institution generating, collecting, receiving, storing, transporting, treating, disposing and/or handling biomedical waste in any other manner, except such occupier of clinics.
Rule 7 Rule 8	 Prescribed Authority Authorization (1) Every occupier of an institution generating, collecting, receiving, storing, transporting, treating, disposing and/or handling biomedical waste in any other manner, except such occupier of clinics, dispensaries, pathological laboratories, blood banks providing
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Rule 7 Rule 8 Rule 9 Rule 9A Rule 10 Rule 11 Rule 12 Rule 13	Prescribed Authority Authorization (1) Every occupier of an institution generating, collecting, receiving, storing, transporting, treating, disposing and/or handling biomedical waste in any other manner, except such occupier of clinics, dispensaries, pathological laboratories, blood banks providing treatment/service to less than 1000 (one thousand) patients per month, shall make an application in Form 1 to the prescribed authority for grant of authorization. (2) Every operator of a bio-medical waste facility shall make an application in Form 1 to the prescribed authorization. (3) Every application in Form 1 for grant of authorization shall be accompanied by a fee as may be prescribed by the Government of the State or Union Territory. Advisory Committee Monitoring of Implementation of the Rules in Armed Forces Health Care Establishments Annual Report Maintenance of Records Accident Reporting

SCHEDULE I

(See Rule 5)

Categories of Bio-Medical Waste

Waste	Waste Category [Type]	Treatment and Disposal
Category No.		[option ⁺]
Category	Human Anatomical Waste:	Incineration@/deep
No.1	(human tissues, organs, body parts)	burial*
Category	Animal Waste	Incineration@/deep
No.2	(animal tissues, organs, body parts	burial*
	carcasses, bleeding parts, fluid, blood	
	and experimental animals used in	
	research, waste generated by	
	veterinary hospitals, colleges,	
	discharge from hospitals, animal	
	houses)	
Category	Microbiology & Biotechnology	Local autoclaving / micro-
No.3	Wastes:	waving /incineration@
	(wastes from laboratory cultures,	
	stocks or specimens of micro-	
	organisms live or attenuated vaccines,	
	human and animal cell culture used in	
	research and infectious agents from	
	research and industrial laboratories,	
	wastes from production of biologicals,	
	toxins, dishes and devices used for	
	transfer of cultures).	
Category	Waste sharps:	Disinfection (chemical
No.4	(needles, syringes, scalpels, blades,	treatment@@/auto claving
	glass etc. that may cause puncture	/ microwaving and
	and cuts. This includes both used and	multilation / shredding ##
	unused sharps).	
Category	Discarded medicines and Cytotoxic	incineration@/destruction
No.5	drugs:	and drugs disposal in
	(wastes comprising of outdated,	secured landfills
	contaminated and discarded	
	medicines)	
Category	Soiled waste:	incineration@ autoclaving
No.6	(Items contaminated with blood, and	/ microwaving.
	body fluids including cotton, dressings,	
	soiled plaster casts., lines beddings,	
	other material contaminated with	
	blood)	
Category	Solid Waste:	disinfection by chemical
No.7	(wastes generated from disposable	treatment@@ autoclaving /
	items other than the waste sharps	microwaving and

	such as tubings, catheters, intravenous sets etc.)	mutilation/ shredding ##
Category No.8	Liquid Waste: (waste generated from laboratory and washing, cleaning, house-keeping and disinfecting activities).	disinfection by chemical treatment@@ and discharge into drains.
Category No.9	Incineration Ash: (ash from incineration of any bio- medical waste)	disposal in municipal landfill
Category No.10	Chemical Waste: (chemicals used in production of biologicals, chemicals used in disinfection as insecticides etc).	Chemical treatment ^{@@} and discharge into drains for liquids and secured landfill for solids.

- @@ Chemical treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfection.
- ## Mutilation/shredding must be such so as to prevent unauthorized reuse.
- @ There will be no chemical pretreatment before incineration. Chlorinated plastics shall not be incinerated.
- * Deep burial shall be an option available only in towns with population less than five lakhs and in rural areas.
- + Options given above are based on available technologies. Occupier/operator wishing to use other State-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down to enable the prescribed authority to consider grant of authorization.

SCHEDULE II

(See Rule 6)

Colour coding and type of container for disposal of bio-medical wastes

Colour Coding	Type of Container	Waste Category	Treatment options as per Schedule I
Yellow	Plastic bag	Cat.1, Cat.2,	Incineration/deep burial
		Cat.3, Cat.6	
Red	Disinfected	Cat.3, Cat.6,	Autoclaving/Microwaving/
	container/plastic	Cat.7	Chemical Treatment
	bag		
Blue / White	Plastic	Cat.4, Cat.7	Autoclaving/Microwaving/
translucent	bag/puncture		Chemical Treatment and
	proof container		destruction/Shredding.
Black	Plastic bag	Cat.5 and	Disposed in secured landfill
		Cat.9 and	
		Cat.10 (Solid)	

3.3 Generation of Biomedical wastes in the State

The Tamil Nadu Pollution Control Board has inventoried 317 Government Hospitals and 1835 private hospitals. There are about 92,000 hospital beds all over the State.

S.No.	Name of the Corporation	No. of beds
1.	Chennai	19600
2	Coimbatore	6500
3	Salem	2600
4	Madurai	3875
5	Trichy	2800
6	Tirunelveli	2000

Table 3.1 Number of Corporations and No. of beds

There are 10 categories of Bio-medical waste as per schedule-I of Biomedical Waste (Management and Handling) Rules, 1998. Health care facilities are required to treat the Biomedical wastes as per the methods prescribed in Schedule-I in compliance with the standards prescribed in Schedule-V. In this regard health care facilities are required to provide requisite treatment and disposal facilities either individually or collectively within the time frame prescribed in the Schedule-VI.

Based of the quantum of waste received from the different biomedical treatment facilities the generation is shown in **Table 3.1**.

			Table 3 1	Biormed	ical Waste C	eneration and T	reatment In Ta	mil Nac	1			
Nam	Name of the State Pollution Control Board (or) Pollution Control Committee							Taminadu Pollution Control Roard				
Nam	Name of the Nadal Officen with contact talenhave no. & makile no.							iiutioii	Control Doard			
S.	Name & Address of the	Name of the cities/	Total	Total	Total	Cost of	Treatment	eauipn	nent/facilities	Air Pollution	Method of	Compliance Status
No	CBWTF with contact	areas covered by	no.of	no.of	Quantity	treatment of	instal	lled at C	CBWTF	Control	Disposal of	
	person name and telephone	CBWTF	HCFs	beds	of BMW	BMW	Equipments	Nos	Total installed	Systems	treated wastes	
	no.		being	covere	collected,	changed by		1	capacity in	attached	(incineration	
			covered	d	treated	the CBWTF			kg/day	with the	Ash/Shapes/Plasti	
					disposed	ner kø or Rs				(s)	(8)	
					of (in	per bed per						
					kg/day)	day)						
1.	M/s. G.J. Multiclave(India)	Part of Chennai,	564	24450	7335	Pvt- Rs.4 per	Incinerator	2	200 kg/hr &	Dust	Incineration Ash:	No.of Showcause notices/
	Pvt Ltd,	Kanceepuram and				bed per day			200 kg/hr	Collector and	Secured land fill	Direction issued: NIL
	I nenmelpakkam, Chengalpatt	I iruvallur Dt				GOVI-KS.	Autoclave		600 lts/cycle	wet scrubber		
	District					20/Kg	Hydrocla			-	Sharp concrete Pits	No. Of Court cases: NIL
							ve				Sharp concrete rits	
							Microwave					
							Shredder	1	50 kg/hr	-	Plastics:	Others: NIL
								1	75 kg/hr	-	authorized	
							EIP Doop Burial	1			recyclers	
							Deep Builai			-		
2	M/a Taminada Westa	Champai (Narth)	502	21520	7125	$D_{a} = 4.00/b = d/d$	Incinentan	1	200 1. ~/hm	Oversher	In sine section Ash.	No of Show course
2	Management I td Kinnar	Tiruvallur Dt	302	21520	/125	RS.4.00/bed/d		1	200 kg/nr 810 Lts/cycle	Venturi wet	secured land fill	notices/Direction issued:1
	Village, Maduranthagam T.K	Cuddalore Dt.				Hospitals &	Hydroclave	1		scrubber. Mist	Sharps: Sharp pit	No of Court cases
	Kanceepuram District.	Villupuram Dt.				Rs.26/kg for	Microwave			eliminator	~F ~F F	
		Kanceepuram Dt.(Part)				Govt Hospital	Shredder	1	150 kg/hr		Plastics:	Others:
							ETP	1		-	authorized	
						~ ~ ~ ~	Deep Burial				recyclers	
3	M/s. Medicare Enviro	Thanjavur Dt, Trichy	593	17320	3225	Govt- Rs.28-	Incinerator		$\frac{150 \text{ kg/hr}}{500 \text{ kg/hr}}$	Hood with	Incineration Ash:	No.of Show-cause
	r Taluk Thanjavur District	Dt, I Iruvarur Dt Naganattinam Dt				Rs 3 50/bed	Hydroclave		500 Lts/ Batch	arrangements	Sharpes:stored in	No of court cases: NII
	1 Taluk, Thanjavar District.	Karaikal, Pudukottai				per day to Rs	Microwave			Venturi	sharp pits	NO.01 COULT CASES. INIL
		Dt, Perambalur Dt,				4/bed per day	Shredder			Scrubber with	Plastics: Solid out	Others :NIL-
		Sivagangai Dt, Ariyalur					ETP			Stack of 30 m	to authorized	
							Deep Burial				recycler	
4	M/s Ken Bio Links Private	Vellor Dt,	305	7162	2900	Rs. 29/kg for	Incinerator	1	150kg/hr	Wet scrubber	Incineration Ash:	No. of Show –cause notices/
	Ltd., Kandipedu, Katpadi	Tirvannamalai Dt,				govt Hospital	Autoclave				secured landfill	Direction issued:1
	Taluk, Vellor District	vaniyambadi Dt.				/day for Put	Hydroclave			-	Snarps: Sharp pit	No.of Court Cases:
						Hospitals	Shredder	+		1	Plastics: Sold to	Others [.]
						r	ETP	1		1	authorized recycler	
							Deep Burial]		

		1	1	-		1	1	1		1		
5	M/s. Society for Ilia	Nilgris Dt	161	961	2450	Rs.20000 per	Incinerator		NIL	No	Incineration Ash:	
	Medical Waste					hospital per year	Autoclave	1	150 kgs / day	incinerator	Does not arise	
	Management,Udha					Rs.3500 for	Hydroclave				Sharps: disposed into secured	No. of Coon cases:
	gamandalam,					clinic/year, Rs.	Microwave				landfill	NIL
	The Nilgiris District.					4000 for lab/year	Shredder	1	25 kgs/hr		Planks:	Others: NIL
	Dr. Muralıdharan						ETP	1			storedinside	
	9443475946						Deep Burial	1			the premises	
6	M/s. Neat and	Ramanathapura	108	810	1894	Rs. 5 per	Incinerator		NIL	No	Incineration Ash:	N. of Show-ca use
	Clean Service	in Dt.				kg	Autoclave		100 kgs/hr	incinerator	Does not arise	notices/
	Squad,					C						Direction
	Muthuvayal,											issued:
	Rarnanathapurana											Ι
	District						Hydroclave		NIL	-	Sharps: recyclers	No. of Court cases:
	Mr.N.Ganesan						Microwave		NIL	-		NIL
	9965589523						Shredder		25 kgs/hr	-	Plastic. Sold	Others: NIL
							ETP			-	our to	
							Deep Burial		1.5*1.5.2.0 m		authorized =cycler	
7	M/s. Ramky	Salem,	810	17250	3560	Pvt- Rs.	Incinerator	1	150 kg/hr	Wet	Incineratio n Ash: secured	No. of Show-cause
	Energy and	Namakkal, Kam;				6.5/Bed/ day	Autoclave	1	650 Lt/cycle	Scrubber,	Land Fill	notices/ Direction issued:
	Environment Ltd,	Erode,				Govt - Rs. 40.50/			, j	Venturi		1
	Thangayur, Salem	Dhannapuri,				kg	Hydroclave		NA		Sharps: secured Land Fill	No. of Court
	District.	Krishnagin					Microwave		NA			Cases:NIL
	K.M. Nizat						Shredder	2	50 kg/hr &		Plastics : Authorized recycles	Others:
	Ahamed								100 kg/hr			NIL
	Phone No. 0427 -						ETP			_		
	4041139						Deep Burial					
	Mobile No. 967/1 -											
0	22708	0:14	217	10440	2400	D (5.50	T		0.50 1 / 1	0 1		
8	M/s. l echno	Coimbatore,	31/	10440	2400	Pvt - 5.50 per	Incinerator		250 kg/day	Quench	Incineration Ash:	No. of Showcause
	I herm Industries,	Pollachi,				bed/ per day	Autoclave		800 h -	Column,	Land Fill	notices/ Direction
	Orattukuppai,Coim	Udumalpet,				GOVT - KS. 29			16000	Scrubber		issued: I
	0.422 - 2207400	Tirupur				per kg	TT 1 1		hrs/day	Dropiet Separator ID		
	0422 - 2307400	Sathyamangalam					Hydroclave		NA	Pap 30 mts	Sharps: Sharp pit	No. of Court cases:
		Sauryamangaram					Microwave		NA 1001 /I	exhaust		
							Shredder		100 kg/ln -	Chimney	Plastics : after disinfectio n,	Others: NIL
									2000 Kg/day	Cimiley.	snredding and	
							EIP Deer D 1		25 m3/day	-	despatch to authorized recycler	
							Deep Burial		20 IT 10 9*6 9			
									donth			
									angingered			
									cligilieeleu			
									land fill			
					1				land III			

0		T' 1 1' D	1120	20210	265	D 2 00 /	T · /	1	2501 /1	XV 4 11	T · · · · A 1	
9	M/s. Aseptic System Bio	Tirunelveli Dt.	1126	20210	365	Rs3.00 to	Incinerator	1	250 kg/hr	Wet scrubber	Incineratio n Ash:	No. of
	Medical Waste Management	Tuticorin Dt.			9	4.50/	Autoclave	1	150 kg/cycle		Land Fill	Show-
		Kanyakumari				bed/day						cause notices/ Direction
	Pappankulam, I irunelveli	Pt.				for Pvt	TT 1 1			_		Issued: NII
	District.					Hospitals	Hydroclave			_	Sharps: Sharps pit	
	Mr. J.Elango						Microwave			_	N 1 1 1	No. of court cases: NIL
	0462 - 2553268					KS.26/Kg	Shredder	1	150 kg/cycle		Plastics : authorized	Other:NIL
						for Govt	ETP				recycler	
						Hospital	Deep Burial					
10	M/s. Ramky Energy and	Madurai Dt.	1670	23020	4165	Rs3.50/	Incinerator	1	150 kg/hr	Venturi	Incineratio n Ash:	No. of
	Environment Ltd.,	Virudhunagar				bed/day	Autoclave	1	60 kg/cycle	Scrubber	Land Fill	Show-
	Undurmilcidakulam	Dt.				for Pvt						cause notices/ Direction
	Virudhunagar District.	Dindigul Dt.				Hospital &						issued: Nil
		Theni Dt. &				Rs.27/kg	Hydroclave				Sharps: Sharp pit	No. of Court
	Mr.T.K.Sridhar	Govt Hospitals				for Govt	Microwave					Cases:
	9677105568	in Ramnad				Hospital						NIL
							Shredder				Plastics : authorized	Others:
							ETP	1	120 kg/hr		recycler	NIL
							Deep Burial					
11	M/s. Kovai Bio Waste	Coimbatore,	90	735	220	Pvt - 5.50	Incinerator		200 kg/day	Quench	Incineratio n Ash:	No. of
	Management Pvt Ltd.,	Nilgris				per bed/	Autoclave		300 Lt -16000	Column,	Land Fill	Show-
	Orattukuppai, Coimbatore					per day			hrs/day	Scrubber.ID		cause notices/ Direction
	District.					Govt -				Pan,		NIL
	8870356543					Rs. 29 per	Hydroclave		NA	Chimney	Sharps: Sharp pit	No. of Court
						kg	Microwave		NA			cases: NIL
						issued:	Shredder		100kg/ht -		Plastics : authorized	Others:
									2000 kg/day		recycler	NIL
							ETP		NA			
							Deep Burial		10 fr*20 fr*6			
									ft depth			
									engineered			
									secured land			
									fill			
12	M/s. Environ Bio Waste		-	-	-		Incinerator					
	Systems (India) Pvt Ltd,						Autoclave					
	Uthokottai Taluk, Tiruvallur	Vet to be					Hydroclave					
	District.	1 et 10 be					Microwave					
		commissioned					Shredder					
							ETP					
							Deep Burial			7		
	Total		6246	14387	38933							
			1	<u>' 0</u>	1		1	-	1	1	1	1

Sourcece : Tamil Nadu Pollution Control Board 2012-2013⁸

3.4 Transport & Storage

No untreated bio-medical waste shall be kept stored beyond a period of 48 hours. If kept the authorised person must take permission of the prescribed authority and take measures to ensure that the waste does not adversely affect human health and the environment.

3.5 Bio Medical Waste Treatment And Disposal

The common bio medical waste treatment and disposal facility consists of [as prescribed in the Biomedical wastes (Management & Handling) Rules, 1998 & 2000] the following:



Figure 3.2 Break-up of Hospital wastes

3.5.1 Autoclaving

An autoclave with temperature & pressure maintained at 1350C, 31 psi & 30 minutes cycle. In the initial 15 minutes, the temperature & pressure to be maximum to create a vacuum for full autoclaving with residence time of not less than 30 minutes to ensure full destruction of pathogens. Medical waste shall be subjected to a minimum of one pre vacuum pulse to purge the autoclave of all air. The autoclave should completely and consistently kill the approved biological indicator at the maximum design capacity of each autoclave unit.

3.5.2 Incinerator

Incinerator for destruction of body parts/anatomical waste and pathological waste. Incinerator shall have two-chamber facility to attain a temperature of $1100 \ ^{0}$ C in the secondary chamber with proper scrubber facility and automatic stack monitoring facilities. The temperature of primary chamber shall be $800 + 50 \ ^{0}$ C. The secondary chamber gas residence time shall be atleast 1 second at 1050 + 500C.

Compactor for compaction of the autoclaved waste to ensure atleast 50% volume reduction. Sanitary landfill for safe disposal of autoclaved and compacted waste with compatible liners and leachate collection facility. Shredder to shred the autoclaved materials. The facility also consists of vans with compartments for keeping the segregated waste and transporting it in a safe manner.

3.5.3 Microwaving

Microwave treatment shall not be used for cytotoxic, hazardous or radioactive wastes, contaminated animal carcasses, body parts and large metal items. The microwave system shall comply with the efficacy tests/routine tests. The microwave should completely and consistently kill bacteria and other pathogenic organism that is ensured by the approved biological indicator at the maximum design capacity of each microwave unit.

3.5.4 Deep Burial

A pit or trench should be dug about 2 m deep. It should be half filled with waste, and then covered with lime within 50 cm of the surface, before filling the rest of the pit with soil. It must be ensured that animals do not have access to burial sites. Covers of galvanised iron/wire meshes may be used. On each occasion, when wastes are added to the pit, a layer of 10cm of soil be added to cover the wastes. Burial must be performed under close and dedicated supervision. The site should be relatively impermeable and no shallow well should be close to the site. The pits should be distant from habitation, and sited so as to ensure that no contamination occurs of any surface water or ground water. The area should not be prone to flooding or erosion. The location of the site will be authorized by the prescribed authority. The institution shall maintain a record of all pits for deep burial.

3.6 SITING OF THE BIO-MEDICLA TREATMENT FACILITY :

Since biomedical waste incinerators cause emission and there are frequent public complaints from similar installations, the siting of biomedical waste facility becomes crucial. Individual treatment facilities within hospitals in corporations and towns are not advisable as the health care facilities are often located in densely populated areas and the population in the vicinity is at the risk of exposure to emissions, complaints and keeping environmental concerns in view, such facilities should be located atleast 500 m away from any habitations and water bodies.

So far 11 common facilities have been identified for the private sector health care units in the State at

- 1. Thenmelpakkam Kancheepuram District
- 2. Chennakuppam Kancheepuram District
- 3. Orattukuppai 1 Coimbatore District
- 4. Sengipatti Thanjavur District
- 5. Kandipedu Vellore District
- 6. Thangavur Salem District
- 7. Coonoor Nilgiris District
- 8. Muthuvayal Ramanathapuram District
- 9. Orattukuppai 2 Coimbatore District
- 10.Ettankulam Tirunelveli District
- 11. Undurumikkidakulam Virudhunagar District

4. Electronic Wastes

4.1 Introduction

Electronic waste or e-waste describes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered e-waste. Informal processing of electronic waste in developing countries may cause serious health and pollution problems, as these countries have limited regulatory oversight of e-waste processing. Electronic scrap components, such as CRTs, may contain contaminants such as lead, cadmium, beryllium, or brominated flame retardants. Even in developed countries recycling and disposal of e-waste may involve significant risk to workers and communities and great care must be taken to avoid unsafe exposure in recycling operations and leaking of materials such as heavy metals from landfills and incinerator ashes.

Central Pollution Control Board (CPCB) estimated India's e-waste at 1.47 lakh tonnes or 0.573 MT per day.11 A study released by the Electronics Industry Association of India (ELCINA) at the electronics industry expo – "Componex Nepcon 2009" had estimated the total e-waste generation in India at a whopping 4.34 lakh tonnes by end 2009.12 The CPCB has estimated that it will exceed the 8 lakh tonnes or 0.8 MT mark by 2012.13 There are 10 States that contribute to 70 per cent of the total e-waste generated in the country, while 65 cities generate more than 60 per cent of the total e-waste in India. Among the 10 largest ewaste generating States, Maharashtra ranks first followed by Tamil Nadu. In the state, Chennai is one of the key E-waste generating cities followed by Coimbatore.

4.2 Legislative Framework

E-waste Management & Handling Rules 2010, are prescribed by the Government of India for effective management and handling of E-wastes.

Sr. No.	Categories of electrical and electronic equipr	nent	
L	Information technology and telecommunical Centralised data processing: Mainframes, Minicomputers Personal computers Personal Computers (Central Processing Unit with Laptop Computers(Central Processing Unit with Notebook Computers Notebook Computers Printers including cartridges Copying equipment	tion equipment : th input and output input and output de	devices) vices)
	Electrical and electronic typewriters User terminals and systems Facsimile		
	Telex Telephones	1.1	
	Pay telephones Cordless telephones Cellular telephones	12	
	Answering systems		
ii.	Consumer electrical and electronics: Television sets (including sets based on (Liquid Diode technology), Refrigerator, Washing Ma contralised air conditioning electe	Crystal Display and achine, Air-conditio	I Light Emittin ners excludir

Categories of electrical and electronic equipment covered under the rules

List of Authorities and their Duties

SI	AUTHORITY	CORRESPONDING DUTIES
	Central Pollution Control Board, Deihi	 (i) Coordination with State Pollution Control Boards/ Committees of Union territories (ii) Preparation of Guidelines for Environmentally Sound Management of e-waste (iii) Conduct assessment of e-waste generation and processing (iv) Recommend standards and specifications for processing and recycling e-waste (v) Documentation, compilation of date on e-waste and uploading on websites of Central Pollution Control Board (vi) Conducting training & awareness programmes (vii) Submit Annual Report to the Ministry (viii) Any other function delegated by the Ministry under these rules (ix) Enforcement of provisions regarding reduction in use of hazardous substances in manufacture of electrical and electronic equipment (x) Initiatives for IT industry for reducing hazardous substances. (xi) Set targets for compliance to the reduction in use of hazardous substance in manufacture of electrical and electronic equipment (xi) Set targets for compliance to the reduction in use of hazardous substance in manufacture of electrical and electronic equipment (xi) Set targets for compliance to the reduction in use of hazardous substances in manufacture of electrical and electronic equipment (xii) Set targets for compliance to the reduction in use of hazardous devices and certification for oreas described by the
2	State Pollution Control Boards/ Committees of Union territories	 (i) Inventorization of e-waste. (ii) Grant & renewal of Authorization (iii) Registration of recyclers of e-waste (iv) Monitoring compliance of authorization and registration conditions (v) Maintain information on the conditions imposed for authorization etc. (v) 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. L ((Jrban Local Bodies (Municipal Committee/Council/ Corporation) (To ensure that e-waste if found to be mixed with Municipal Solid Waste is properly segregated, collected and is channelized to either authorized collection centre or dismantler or recycler. To ensure that e-waste pertaining to orphan products is collected and channelized to either authorized collection centre or dismantler or recycler.

4.3 Generation of Electronic wastes

The main sources of electronic waste in India are the government, public and private (industrial) sectors, which account for almost 70 per cent of total waste generation. The contribution of individual households is relatively small at about 15 per cent; the rest being contributed by manufacturers. Though individual households are not large contributors to waste generated by computers, they consume large quantities of consumer durables and are, therefore, potential creators of waste. An Indian market Research Bureau (IMRB) survey of 'E-waste generation at Source' in 2009 found that out of the total e-waste volume in India, televisions and desktops including servers comprised 68 per cent and 27 per cent respectively. Imports and mobile phones comprised of 2 per cent and 1 per cent respectively. The Ministry of Environment and Forests (MoEF) has notified the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 for effective management of hazardous wastes, including e-waste in the country.

The e-waste inventory in India for the year 2005 showed approximately 1,46,180 tonnes and is expected to exceed 8,00,000 tonnes by 2012 as projected in the "Guideline for Environmentally Sound Management of E-waste" published by the Government of India, MoEF and the Central Pollution Control Board (CPCB) in March 2008. An assessment made in Chennai city in 2004- 05, on the e-waste generated from personal computers, televisions and mobile phones revealed that about 26,183 tons e-waste was generated in the year which was estimated to increase to 1,32,778 tones by 2013-14. Considering the rapid growth in the IT industry and the use of IT, especially in the major cities and towns in Tamil Nadu, it is obvious that a large part of the e-waste is generated in Tamil Nadu.

E-waste arises from Manufacturing Units, Software Companies, Business Process Outsourcing Organizations (BPOs), Government and Private offices/Institutions, households etc. Increased consumption and rapid obsolescence of electronic goods contributes to the ever increasing e-waste problem in India. The magnitude of this problem has grown to such an extent that it requires Governmental intervention.

Table 4.1 Quantity of WEEE (Waste Electrical and ElectronicEquipment) generated in Tamil Nadu

Tamil Nadu	13,486.2 Tonnes

4.4 Treatment & Disposal of E-wastes

Audiovisual components, televisions, VCRs, stereo equipment, mobile phones, other handheld devices, and computer components contain valuable elements and substances suitable for reclamation, including lead, copper, and gold.

Land fills

The most common one has been storing e-wastes in landfills, but it is replete with all the dangers of leaching described earlier.

Incineration

Another commonly used has been to incinerate or burn the goods concerned, but this process releases heavy metals such as lead, cadmium and mercury into the atmosphere.

Recycling

Reusing and recycling are the other ways of dealing with e-wastes. They have been preferable because they increase the lifespan of the products and therefore imply less waste over time.

Re-use constitutes direct second hand use, or use after slight modifications are made to the original functioning equipment like memory upgrades, etc.

The reuse of second-hand electronic goods in the developing world including India falls in this category, where the waste ends up locally and where there is no adequate facility and competence to deal with them appropriately. While recycling appears to be a safe method to utilize or dispose e-wastes, it can be a misleading characterization of disparate practices-including dismantling, shredding, burning, exporting, etc. which are mostly unregulated and often create additional hazards itself. "Recycling" of hazardous wastes, even under the best of circumstances, has little environment benefit as it simply moves the hazards into secondary products that eventually have to be disposed of.

No.	Name Of The Firm	Address	Capacity
1	M/S. Sez Recyclers.,	Tp-7th, Ivth Avenue, Mahindra World City	
		Developers Ltd., Industrial Estate, Sez	30-40 T/Month
		Area, Thenmelapakkam Village, Kancheepuram Dt.	1500t Per Year
2	M/S. Tes-Amm India Pvt. Ltd.,	Plot No.A-18,Sipcot Industrial Growth Centre, Panruti A1 Village,Sriperampudur Taluk, Kancheepuram Dt.	5000 T/Year –From All States
3	M/S. Ultrust Solution India Pvt. Ltd.,	Pappanakuppam Village,Gummidipoondi Taluk,Thiruvallur Dt,	15000t/Year -100t/Month From All States
4	M/S. Victory Recovery & Recycle Technologies India Pvt. Ltd.,	Kottiyur Village, Tiruvallur Taluk & Dt	

Table 4.2 Details of E-Waste Recycling Units

Source: TNPCB - 2015

Table 4 3 Details Of F-Wa	ste Collection Centres In The State
I ADIC 4.5 DELAIIS OF L-WAS	Ste Conection Centres In The State

S.	NAME & ADDRESS OF INDUSTRY
No	
1	M/s. Apple India Private Ltd., C/o. M/s. Kuehne Nagel India Private Ltd., 41&42, Koduvalli karanai Village, Redhills to
	Thiruvallur High Road, Chennai - 55.
2	M/s. Canon India Private Ltd.,
	2 nd Floor, Wood Head Center, No 23, Sivaganga Road,
	Nungampakkam, Chennai-34.
3	M/s. Daikin Airconditioning India Pvt Ltd.,
	Flat No 1, D Block, Ground Floor, Gemini Parsn Apartments, Door
	No 599(Old No 121), Anna Salai, Chennai-600 006.
4	M/s. E Parisaraa Pvt Ltd.,
	Plot No 150(Part), Perunkudi Industrial Estate, Perunkudi, Chennai-
	600 091.
5	M/s. Kalyani Enterprises.,
	73, Konnur High Road, Annai Indra Nagar, Ayanavaram, Chennai-
	600 023.
6	M/s. Param Enterprises.,
	Plot No 3, Periyar Salai, Kovilampakkam, Chennai-600 117.
7	M/s. Schenker India Private Ltd., C/o. M/s. Lenova India Pvt Ltd.,
	No 426/3A-3D, Killi Road, Manjampakkam, Near Agarsen College,
	Madhavaram (Po), Chennai-600 060.

Source: TNPCB - 2015

5. HAZARDOUS - WASTE

5.1 Introduction

Hazardous waste is waste that poses substantial or potential threats to public health or the environment. Characteristic hazardous wastes are materials that are known or tested to exhibit one or more of the following four hazardous traits:

> Ignitability

Waste with flash point <60°C

> Reactivity

Unstable and undergoes violent change without detonation

-Violent reaction with water

-Potential explosive mixture with water

-Toxic gases, vapors or fumes generation of CN or Swastes

-Explosive

Corrosivity

A waste exhibits the characteristics of corrosivity if a representative sample of the waste has either of the following properties :

- (a) Any liquid which has a pH less or equal to 4 or greater than or equal to 12.5 as determined by the standard test procedure ; or
- (b) A waste, which can corrode steel at a rate greater than 6.35 mm per year at a temperature of 55 C as determined by the standard test procedure

> Toxicity

A solid waste exhibit the characteristics of toxicity if the leachate from the representative sample by TCLP test method (as followed by USEPA vide no. SW-846)

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

5.2 Legislative Framework

Following are the salient features of the The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.

SCHEDULE I

[*See* rule 3(1)]

List	of	Process	Generating	Hazardous	Wastes
------	----	---------	------------	-----------	--------

No. Image: No. 1. Petrochemical processes and pyrolytic operations 1.1 Furnace/reactor residues 1.2 Tarry residues 1.2 Oilu chudra amulais	aidua and dahria
1. Petrochemical processes and pyrolytic operations 1.1 Furnace/reactor residues 1.2 Tarry residues 1.2 Oily shydre amplaine	aidura and dahmia
pyrolytic operations 1.2 Tarry residues	sique and debris
1.3 Ony studge entuisio	on
1.4 Organic residues	
1.5 Residues from alka	li wash of fuels
1.6 Still bottoms from c	distillation process
1.7 Spent catalyst and	molecular sieves
1.8 Slop oil from waster	water
2. Drilling operation for oil and gas 2.1 Drill cutting contain	ning oil
production 2.2 Sludge containing c	bil
2.3 Drilling mud and ot	ther drilling wastes
3. Cleaning, emptying and 3.1 Oil-containing carge	o residue, washing
maintenance of petroleum oil water and sludge	
storage tanks including ships 3.2 Chemical-containin	ig cargo residue and
sludge	
3.3 Sludge and filters c	ontaminated with oil
3.4 Ballast water conta	ining oil from ships.
4. Petroleum refining/reprocessing 4.1 Oily sludge/emulsio	on
of used oil/recycling of waste oil 4.2 Spent catalyst	
4.3 Slop oil	
4.4 Organic residues fro	om process
4.5 Spent clay containin	ng oil
5. Industrial operations using 5.1 Used/spent oil	,
mineral/synthetic oil as 5.2 Wastes/residues o	containing oil
lubricant in hydraulic systems	
or other applications	
6. Secondary production and/or 6.1 Sludge and filter p	bress cake arising out
use of zinc of production of zinc su	liphate and Zinc
compounds	1. / . 1. '
6.2 Zinc lines/dust/as	sn/skimmings
(dispersible form)	· c ·
6.3 Other residues from	m processing of zinc
asn/skimmings	
0.4 Flue gas dust and 0 7 Drimony 7 Drimony	reacting
<i>i</i> . Fillinary production of <i>i</i> . File gas dust from <i>i i</i> . File gas dust from <i>i</i> .	roasung
zinc/reau/copper and other 7.2 Process residues	dao
aluminium 7 4 Non formula metal	hearing shudge and
aiummum 7.4 Non lerrous metal	bearing studge allo
7 5 Shidae from comph)erg
aluminium 7.4 Non ferrous metal residue 7.5 Studge from compth	bearing sludge and

8.	Secondary production of copper	8.1 Spent electrolytic solutions8.2 Sludges and filter cakes
		8.3 Flue gas dust and other particulates
9.	Secondary production of lead	9.1 Lead bearing residues
		9.2 Lead ash/particulate from flue gas
10.	Production and/or industrial	10.1 Residues containing cadmium and
	use of cadmium and arsenic	arsenic
	and their compounds	
11.	Production of primary and	11.1 Sludges from off-gas treatment
	secondary aluminium	11.2Cathode residues including pot lining
		wastes
		11.3Tar containing wastes
		11.4Flue gas dust and other particulates
		11.5Wastes from treatment of salt slags and
		black drosses
12.	Metal surface treatment, such	12.1 Acid residues
	as etching, staining, polishing,	12.2 Alkali residues
	galvanising, cleaning,	12.3 Spent bath /sludge containing
	degreasing, plating, etc.	sulphide, cyanide and toxic metals
		12.4 Sludge from bath containing organic
		solvents
		12.5 Phosphate sludge
		12.6 Sludge from staining bath
		12.7 Copper etching residues
12	Draduation of iron and staal	12.0 Flating metal studge
15.	including other ferrous allows	13.2 Benzel acid sludge
	(electric furnaces: steel rolling	13.3 Decenter tank tar sludge
	and finishing mills: Coke oven	13.4 Tar storage tank residue
	and by product plant)	15.1 Tai storage tank residue
14.	Hardening of steel	14.1 Cvanide-, nitrate-, or nitrite-
		containing sludge
		14.2 Spent hardening salt
15.	Production of asbestos or	15.1 Asbestos-containing residues
	asbestos-containing materials	15.2 Discarded asbestos
		15.3 Dust/particulates from exhaust gas
		treatment
16.	Production of caustic soda and	16.1 Mercury bearing sludge
	chlorine	16.2 Residue/sludges and filter cakes
		16.3 Brine sludge containing mercury
17.	Production of mineral acids	17.1 Residues, dusts or filter cakes
		17.2 Spent catalyst
18.	Production of nitrogenous and	18.1 Spent catalyst
	complex fertilizers	18.2 Spent carbon
		18.3 Sludge/residue containing arsenic
		18.4 Chromium sludge from water cooling

		tower
19.	Production of phenol	19.1 Residue/sludge containing phenol
20.	Production and/or industrial	20.1 Contaminated aromatic, aliphatic or
	use of solvents	napthenic solvents may or may not be fit for
		reuse
		20.2 Spent solvents
		20.3 Distillation residues
21.	Production and/or industrial	21.1 Process wastes, residues & sludges
	use of paints, pigments,	21.2 Fillers residues
	acquers, varnisnes, plastics	
22	Production of plastic raw	22.1 Residues of additives used in plastics
44.	materials	manufacture like dyestuffs stabilizers
		flame retardants, etc.
		22.2 Residues and waste plasticizers
		22.3 Residues from vinylchloride monomer
		production
		22.4 Residues from acrylonitrile production
		22.5 Non-polymerised residues
23.	Production and/or industrial	23.1 Wastes/residues (not made with
	use of glues, cements, adhesive	vegetable or animal materials)
1	and resins	
24.	Production of canvas and	24.1 Chemical residues
25	Industrial production and	25.1 Chemical residues
20.	formulation of wood	25.2 Residues from wood alkali bath
	preservatives	
26.	Production or industrial use of	26.1 Process waste sludge/residues
	synthetic dyes, dye-	containing acid or other toxic metals or
	intermediates and pigments	organic complexes
		26.2 Dust from air filtration system
27.	Production organo-silicone	27.1 Process residues
	compounds	
28.	Production/formulation of	28.1 Process Residues and wastes
	health care product	28.2 Spent catalyst / spent carbon
	ficaltif care product	28.4 Date-expired discarded and off-
		specification drugs/ medicines
		28.5 Spent organic solvents
29.	Production and formulation of	29.1 Process wastes/residues
	pesticides including stock-piles	29.2 Chemical sludge containing residues
		pesticides
		29.3 Date-expired and off-specification
		pesticides
30.	Leather tanneries	30.1 Chromium bearing residue and sludge
1		

31.	Electronic Industry	31.1 Process residues and wastes
		31.2 Spent etching chemicals and solvents
32.	Pulp & Paper Industry	32.1 Spent chemicals
		32.2 Corrosive wastes arising from use of
		strong acid and bases
		32.3 Process sludge containing adsorbable
		organic halides (AO _x)
33.	Disposal of barrels / containers	33.1 Chemical-containing residue arising
	used for handling of hazardous	from decontamination
	wastes / chemicals	33.2 Sludge from treatment of waste water
		arising out of cleaning / disposal of barrels
		/ containers
		33.3 Discarded containers / barrels / liners
		contaminated with hazardous
		wastes/chemicals
34.	Purification and treatment of	34.1 Flue gas cleaning residue
	exhaust, air, water & waste	34.2 Spent ion exchange resin containing
	water from the processes in this	toxic metals
	schedule and common	34.3 Chemical sludge from waste water
	ndustrial enjuent treatment	treatment
	plants (CETPS)	34.4 On and grease skinning residues
		treatment
35	Purification process for organic	35.1 Filters and filter material which have
55.	compounds/solvents	organic liquids in them e.g. mineral oil
	compounds/ solvents	synthetic oil and organic chlorine
		compounds
		35.2 Spent catalyst
		35.3 Spent carbon
36.	Hazardous waste treatment	36.1 Sludge from wet scrubbers
000	processes, e.g. incineration.	36.2 Ash from incineration of hazardous
	distillation, separation and	waste, flue gas cleaning residues
	concentration techniques	36.3 Spent acid from batteries
	`	36.4 Distillation residues from
		contaminated organic solvents

* The inclusion of wastes contained in this Schedule does not preclude the use of Schedule 2 to demonstrate that the waste is not hazardous. In case of dispute, the matter would be referred to the Technical Review Committee constituted by MoEF.
Schedule - II

[See rule 3(l)]

List of Wastes Constituents with Concentration Limits* $\underline{Class \ A}$

Concentration limit: 50 mg/kg

A1	Antimony and antimony compounds					
A2	Arsenic and arsenic compounds					
A3	Beryllium and beryllium compounds					
A4	Cadmium and cadmium compounds					
A5	Chromium (VI) compounds					
A6	Mercury and mercury compounds					
A7	Selenium and selenium compounds					
A8	Tellurium and tellurium compounds					
A9	Thallium and thallium compounds					
A10	Inorganic cyanide compounds					
A11	Metal carbonyls					
A12	Napthalene					
A13	Anthracene					
A14	Phenanthrene					
A15	Chrysene, benzo (a) anthracene, fluoranthene, benzo (a) pyrene, benzo					
	(K) fluoranthene, indeno (1, 2, 3-cd) pyrene and benzo (ghi) perylene					
A16	Halogenated compounds of aromatic rings, e.g. polychlorinated					
	biphenyls, polychloroterphenyls and their derivatives					
A17	Halogenated aromatic compounds					
A18	Benzene					
A19	Organo-chlorine pesticides					
A20	Organo-tin Compounds					
<u>Class B</u>						
Concent	ration limit: 5,000 mg/kg					
B1	Chromium (III) compounds					
B2	Cobalt compounds					
B3	Copper compounds					
B4	Lead and lead compounds					
B5	Molybdenum compounds					
B6	Nickel compounds					
B7	Inorganic Tin compounds					
B8	Vanadium compounds					
B9	Tungsten compounds					
B10	Silver compounds					
B11	Halogenated aliphatic compounds					
B12	Organo phosphorus compounds					
B13	Organic peroxides					
B14	Organic nitro-and nitroso-compounds					
B15	Organic azo-and azooxy compounds					

B16	Nitriles
B17	Amines
B18	(Iso-and thio-) cyanates
B19	Phenol and phenolic compounds
B20	Mercaptans
B21	Asbestos
B22	Halogen-silanes
B23	Hydrazine (s)
B24	Flourine
B25	Chlorine
B26	Bromine
B27	White and red phosphorus
B28	Ferro-silicate and alloys
B29	Manganese-silicate
B30	Halogen-containing compounds which produce acidic vapours on contact
	with humid air or water, e.g. silicon tetrachloride, aluminium chloride,
	titanium tetrachloride
Class C	
Concent	ration limit: 20,000 mg/kg
C1	Ammonia and ammonium compounds
C2	Inorganic peroxides
C3	Barium compounds except barium sulphate
C4	Fluorine compounds
C5	Phosphate compounds except phosphates of aluminium, calcium and
	iron
C6	Bromates, (hypo-bromites)
C7	Chlorates, (hypo-chlorites)
C8	Aromatic compounds other than those listed under A12 to A18
C9	Organic silicone compounds
C10	Organic sulphur compounds
C11	Iodates
C12	Nitrates, nitrites
C13	Sulphides
C14	Zinc compounds
C15	Salts of per-acids
C16	Acid amides
C17	Acid anhydrides
<u>Class D</u>	
Concent	ration limit: 50,000 mg/kg
D1	Total Sulphur
D2	Inorganic acids
D3	Metal hydrogen sulphates
D4	Oxides and hydroxides except those of hydrogen, carbon, silicon, iron,
	aluminum, titanium, manganese, magnesium, calcium
D5	Total hydrocarbons other than those listed under A12 to A18

D6	Organic oxygen compounds					
D7	Organic nitrogen compounds expressed as nitrogen					
D8	Nitrides					
D9	Hydrides					
Class E						
Regardles	ss of concentration limit, Classified as hazardous wastes if the waste					
exhibits a	any of the following Characteristics					
E1	Flammable : Flammable wastes with flash point 65.6°C or below					
E2	Explosive: Waste which may explode under the effect of flame, heat or					
	photochemical conditions. Any other wastes of explosive materials					
	included in the Indian Explosive Act					
E3	Corrosive: Wastes which may be corrosive, by chemical action, will					
	cause severe damage when in contact with living tissue.					
E4	Toxic: Wastes containing or contaminated with established toxic and or					
	eco-toxic constituents					
E5	Carcinogenicity, Mutagenecity and Endocrine disruptively					
	Wastes contaminated or containing established carcinogens, mutagens					
	and endocrine disruptors					

* Waste constituents and their concentration limits given in this list are based on erstwhile BAGA (the Netherlands Environment Protection Agency) List of Hazardous Substances. In order to decide whether specific wastes listed above is hazardous or not, following points be taken into consideration:

- (i) If a component of the waste appears in one of the five risk classes listed above (A,B,C,D or E) and the concentration of the component is equal to or more than the limit for the relevant risks class, the material is then classified as hazardous waste.
- (ii) If a chemical compound containing a hazardous constituent is present in the waste, the concentration limit does not apply to the compound, but only to the hazardous constituent itself.
- (iii) If multiple hazardous constituents from the same class are present in the waste, the concentrations are added together.
- (iv) If multiple hazardous constituents from different classes are present in the waste, the lowest concentration limit corresponding to the constituent(s) applies.
- (v) For determining the concentration of hazardous constituents in the waste "Toxicity Characteristics Leaching Procedure (TCLP) as per ASTM-D5233-92 should be adopted.

Schedule III	Part A	List of Hazardous Wastes Applicable for Import with Prior				
		Informed Consent				
	Part B	List of Hazardous Wastes applicable for Import and				
		Export Not Requiring Prior Informed Consent				
	Part C	List of Hazardous Characteristics				
	Part D	List of Metal Scrap, Paper Waste and other wastes				
		applicable for Import/Export				

Seclude IV	List of Hazardous Wastes requiring Registration for Recycling / Reprocessing							
Schedule V	Part A Specifications of used oil suitable for reprocessir recycling							
	Part B	Specifications of fuel derived from Waste Oil						
Schedule VI	Hazardous	Wastes Prohibited for Import and Export						
Schedule VII	List of Aut	horities and Corresponding Duties						
Form 1	Application treatment	Application for obtaining authorization for collection / reception / treatment / transport / storage / disposal of Hazardous Waste						
Form 2	Form for occupiers, collection, hazardous	grant / renewal of authorization by SPCB / PCC for reprocessors, rousers and operators of facilities for reception, treatment, storage, transport, and disposal of waste						
Form 3	Format for or operato:	maintaining records of hazardous wastes by the occupier r of a facility						
Form 4	Form for fi	ling annual returns by the occupier or operator of facility						
Form 5	Form of application for Grant / Renewal of registration of industrial							
units possessing environmentally sound management faci								
	reprocessing / recycling							
Form 6	Form for filing annual returns and records on recycling, hazardous wastes by the recyclers							
Form 7	Application	n for import or export of hazardous waste for reprocessing						
	/ recycling / reuse							
Form 8	Application	n for Transboundary movement of hazardous waste						
Form 9	Transbour	idary movement - Movement Document						
Form 10	Format for Maintaining records of hazardous waste imported and exported							
Form 11	Transport Emergency (TREM) Card							
Form 12	Marking of Hazardous waste container							
Form 13	Hazardous Waste Manifest							
Form 14	Format of Accident Report							
Form 15	Application	n filing Appeal against the order passed by CPCB / SPCB						
	/ PCC of the	ne Union Territory						
Form 16	Form for R	egistration of Traders for Schedule III, Part (D)						

5.3 Generation of Hazardous wastes

Table 5.1 Details of Hazardous waste generation in Tamil Nadu						
Number of UnitsQuantity in TPA						
Tamil Nadu	2,422	1,90,924				

Details of Total hazardous wastes generated in Tamil Nadu are given in Table 5.1

Source: CPCB

District wise break up of hazardous wastes are given in the table below:

Hazardous Waste Generation in Tamil Nadu-2007								
			HW generation in MTA as per					
		No. of			Total	Land	ty of H w in M	
Sl.No.	District	Industries	Schedule 1	Schedule 1	Quantity	files	Recyclable	Incinerable
1	Chennai	94	1140.886	1070.996	1705.085			1705.085
2	Coimbatore	110	6857.112	6469.4	9202			9202
3	Cuddalore	43	9202.538	6571.67	8774.85			8774.85
4	Dindigul	45	6141.955	9589.58	13047.16			13047.16
5	Erode	364	17781.27	2749.56	3806.83			3806.83
6	Osur	83	12555.156	11219.06	18084.93			18084.93
7	Kancheepuram	249	22025.356	10281.72	13804.95			13804.95
8	Kanniyakumari	16	537.414	538.25	538.294			538.294
9	Karur	61	6396.677	219.02	11246.34			11246.34
10	Madurai	108	5832.195	3916	4927.63			4927.63
11	Nagapattinam	18	531.254	522.796	522.796			522.796
12	Namakkal	127	4094.75	2283.01	4083.65			4083.65
13	Oty	12	682.034	99.98	910.106			910.106
14	Pudukottai	35	614.634	3134.47	3238.3			3238.3
15	Salam	129	16262.851	6901.32	17576.08			17576.08
16	Sivagangai	19	334.451	1037.92	1037.92			1037.92
17	Thanjavur	27	111.996	299.617	301.996			301.996
18	Theni	12	1039.252					
19	Thirunelveli	43	1479.855	24652.21	45357.17			45357.17
20	Thiruvallur	219	19384.962	453.384	453.384			453.384
21	Thiruvarur	11	459.08	6749.66	38655.96			38655.96
22	Thoothukudi	41	37696.883	3569	36766			36766
23	Tiruppur	267	42947.53	875.5	35980.32			35980.32
24	Trichy	77	5131.679	4959.058	5991.171			5991.171
25	Vaniyambadi	74	14872.6	0.96	16680.76			16680.76
26	Vellore	106	8965.99	5839.299	13552.27			13552.27
27	Villupuram	18	2464.31	2878.79	3132.31			3132.31
28	Virudhunagar	72	3487.179	16441.44	19147.99			19147.99
	Total	2480	249031.76	6249.8	255282			10714.3

Source : TNPCB,

5.4 Treatment & Disposal of Hazardous wastes

Currently, hazardous wastes undergo different treatments in order to stabilize and dispose of them. Most flammable materials can be recycled. Hazardous constituents can be recycled, lead acid batteries

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.

Co-Processing of wastes

Another commonly used treatment is cement based solidification and stabilization. Cement is used because it can treat a range of hazardous wastes by improving physical characteristics and decreasing the toxicity and transmission of contaminants.

Incineration

Incinerating wastes at a high temperature, flammable wastes can sometimes be burned as energy sources. 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 by-product or other materials, and this can affect the environment.

Current technology has developed more efficient incinerator units that control these emissions to a point where this treatment is considered a more beneficial option.

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.

Hazardous waste landfill

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.

Pyrolysis

Some hazardous waste types may be eliminated using pyrolysis in an ultra high temperature electrical arc, in inert conditions to avoid combustion.

This treatment method may be preferable to high temperature incineration in some circumstances such as in the destruction of concentrated organic waste types, including PCBs, pesticides.

6. PLASTIC WASTES

6.1 Introduction

A plastic material consists of a range of synthetic or semi-synthetic organic solids that are moldable. They are derived from petrochemicals. The use of plastic is wide (from toys, bags, plates etc) they are used in many industries as both for different products and for packaging material. The accumulation of Plastic wastes leads to plastic pollution.

The prominence of plastic pollution is correlated with plastics being both inexpensive and durable has led to high levels of plastics used by humans. Rapid urbanization in the cities of Tamil Nadu has increased the quantity of plastic wastes generated.

Plastic pollution occurs in many forms, including littering, marine debris and plastic netting. The main reasons for so much plastic to be dumped is because a large percentage of plastic produced each year is used for making single-use, disposable packaging products or items which will get permanently thrown after the use is met.

6.2 Legislative Frame work

Salient features of the plastic waste Management and Handling rules 2011 are given below:

5.15 THE PLASTIC WASTE (MANAGEMENT AND HANDLING) RULES, 2011 AS AMENDED MOEF Notification S.O.249(E) Dated 4.2.2011 & S.O. 1527(E) Dated 2.7.2011

Salient Features

Rule 3	Definitions
	(b) "Carry bags" mean bags made from any plastic material, used for the purpose of carrying or dispensing commodities but do not include bags that constitute or form an integral part of the packaging in which goods are sealed prior to use;
	(d) "Compostable plastics" means that undergoes degradation by biological processes during composting to yield CO_2 , water, inorganic compounds and biomass at a rate consistent with other known compostable materials and does not leave visible, distinguishable or toxic residue;
	(f) "Disintegration" means the physical breakdown of a material into very small fragments;
	(g) "Extended producer's responsibility (EPR)" means the responsibility of a manufacturer of plastic carry bags, and multilayered plastic pouches and sachets and the brand owners using such carry bags and multilayered plastic pouches and sachets for the environmentally sound management of the product until the end of its life.
	(h) "Food-stuff" means ready to eat food products, fast food, processed or cooked food in liquid, powder, solid or semi solid form;
	(i) "Manufacturer" means any person who manufactures plastic carry bags or multilayered plastic pouches or scathes or like;
	(j) "Municipal authority" means Municipal Corporation, Municipality, Nagar Palika. Nagar Nigam, Nagar Panchayat, Municipal Council including notified are committee (NAC) or any other local body constituted under the relevant statutes and, where management and handling of municipal solid waste is entrusted to such agency;
	(l) "Plastic" means material which contains as an essential ingredient a high polymer and which at some stage in its processing into finished products can be shaped by flow;
	(m) "Plastic waste" means any plastic product such as carry bags, pouches or multilayered plastic pouch or sachet etc, which have been discarded after use or after their intended life is over;
	(n) "Registration" means registration with the SPCB or PCC concerned, as the case may be, of units manufacturing plastic carry bags, multilayered plastic pouch or sachet or recycling of plastic waste;
	(o) "Virgin plastic" means plastic material which has not been subjected to use earlier and has also not been blended with scrap or waste;

Rule 4	Prescribed Authority
	(a) for enforcement of the provisions of these rules related to registration, manufacture and recycling shall be SPCB.
	(b) for enforcement of the provisions of these rules relating to the use, collection, segregation, transportation and disposal of plastic waste, the prescribed authority shall be the municipal authority concerned.
Rule 5	Conditions During the course of manufacture, stocking, distribution, sale and use of carry bags and sachets, the following conditions shall be fulfilled, namely
	(a) carry bags shall either be in natural shade (colourless) which is without any added pigments or made using only those pigments and colourants which are in conformity with IS 9833 : 1981.
	(b) no person shall use carry bags made of recycled plastics or compostable plastics for storing, carrying, dispensing or packaging food stuffs;
	(c) no person shall manufacture, stock, distribute or sell any carry bag made of virgin or recycled or compostable plastic, which is less than 40 microns in thickness;
	(d) sachets using plastic material shall not be used for storing, packing or selling gutkha, tobacco and pan masala;
	(e) recycled carry bags shall confirm to IS : 14534 : 1998;
	(f) carry bags made from compostable plastics shall conform to the IS/ISO 17088:2008.
	(g) plastic material, in any form, shall not be used in any package for packing gutkha, pan masala and tobacco in all forms.
Rule 6	Plastic Waste Management
	(a) recycling, recovery or disposal of plastic waste shall be carried out as per the rules, regulations and standards, stipulated by the Central Government from time to time;
	(b) recycling of plastics shall be carried out in accordance with the IS 14534:1998;
	(c) the municipal authority shall be responsible for setting up, operationalisation and co-ordination of the waste management system and for performing the associated functions, namely:- (i) to ensure safe collection, storage, segregation, transportation, processing and disposal of plastic waste; (ii) to ensure that no damage is caused to the environment during this process; (iii) to ensure setting up of collection centres for plastic waste involving manufactures; (iv) to ensure its channelisation to recyclers; (v) to create awareness among all stakeholders about their responsibilities; (vi) to engage agencies or groups working in waste management including waste pickers, and (vii) to ensure that open burning of plastic waste is not permitted;

	(d) (i) the responsibility for setting up collection systems for plastic waste shall be of the municipal authority concerned and the said municipal authority may, for this purpose, seek the assistance of manufacturers of plastic carry bags, multilayered plastic pouches or sachets or of brand owners using such products.					
	(d) (ii) the municipal authority may work out the modalities of a mechanism based on Extended Producer's Responsibility involving such manufacturers, registered within its jurisdiction and brand owners with registered offices within its jurisdiction either individually or collectively, as feasible or set up such collection systems through its own agencies.					
	(e) recyclers shall ensure that recycling facilities are in accordance with IS 14534: 1998.					
	(f) the concerned municipal authority shall ensure that the residues generated from recycling processes are disposed of in compliance with Schedule II (Management of Municipal Solid Waste) and Schedule III (Specifications for Landfill Sites) of the MSW Rules, 2000.					
	(g) the municipal authority shall incorporate the said rules in the Municipal bye laws of all the Urban Local Bodies;					
	(h) the municipal authority shall encourage the use of plastic waste by adopting suitable technology such as in road construction, co- incineration etc. The municipal authority or the operator intending to use such technology shall ensure the compliance with the prescribed including pollution control norms prescribed by the competent authority in this regard.					
Rule 8	Marking or Labeling					
	(a) each plastic carry bag and multilayered packaging shall have the following information printed in English or in local language, namely:-					
	(i) name, registration number of the manufacturer and thickness in case of carry bag;					
	(ii) name and registration of the manufacturer in case of multilayered packaging;					
	(b) each recycled carry bag shall bear a label or a mark "recycled" as shown in the rule and shall conform to the IS : 14534 : 1998.					
	(c) each carry bag made from compostable plastics shall bear a label "compostable" and shall conform to the IS / ISO 17099 : 2008;					
	(d) retailers shall ensure that plastic carry bags and multilayered packaging sold by them are properly labeled, as per stipulations under these rules.					
Rule 9	Registration of Manufacturers and Recyclers					
	(a) any person manufacturing or proposing to manufacture plastic carry bags, multilayered plastics pouch or sachet shall apply to the SPCB concerned to for the grant of registration or for the newneal of					

	registration for the manufacturing unit using Form I;
	(b) any person recycling or proposing to recycle carry bags or multilayered plastics pouch or sachet or any plastic waste shall apply to the SPCB for grant of registration or renewal of registration for the recycling unit using Form 2;
	(c) no person shall manufacture plastic carry bags, multilayered plastic pouch or sachet or recycle plastic carry bags or multilayered plastic pouch or sachet or any plastic waste without obtaining registration certificate from the SPCB or PCC as the case may be, prior to the commencement of production;
	(d) the SPCB and PCC shall not issue or renew a registration for manufacturing or recycling units unless the unit possesses a valid consent under the Water (P&CP) Act and the Air (P&CP) Act, 1981 and certificate of registration issued by the DIC or any other Govt. agency authorized in this regard;
	(f) the registration granted under this rule shall be valid for a period of three years, unless revoked, suspended or cancelled; and registration shall not be revoked, suspended or cancelled without providing the manufacturer an opportunity for a hearing;
	(g) every application for renewal of registration shall be made at least ninety days before the expiry of the validity of the registration certificate.
Rule 10	Explicit pricing of carry bags
	No carry bags shall be made available free of cost by retailers to consumers. The concerned municipal authority may by notification determine the minimum price for carry bags depending upon their quality and size which covers their material and waste management costs in order to encourage their re-use so as to minimize plastic waste generation.
Rule 11	State Level Advisory Body
Rule 12	Annual Reports
	(1) each SPCB or PCC shall prepare and submit the annual report to the CPCB on the implementation of these rules by the 30th day of September of each year;
	(2) 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 30th day of December each
	year.
Form 1	year. Application for registration of a unit for the manufacture of plastic carry bags and multilayered plastics

6.3 Generation of Plastic wastes

The total plastic wastes generated in the state district wise is given in the table below:

S.	District	Estimated	Qty Road	Open	Surprise	Collection	Awareness
Ν		plastic waste	Construct	Dump	checks(local	centers	programs
0.		generation TPA			Body)- 40		
1.	Chennai	116212	1100	104112	23	15	
2.	Coimbatore	2275.5	1.53		205		87
3.	Cuddalore	3317.85	1098.9	915.75	1097	29	70
4.	Dindigul	201.56	120	81.56		22	2
5.	Erode	6326.6	270.716	6059.8	234	6	31
	Dharmapuri &						
6.	Krishnagiri	1100	476.7	609.39	76		
7.	Karur						
8.	Madurai	4403.29	2593.48	1809.8	195	13	
9.	Kanchipuram	1581	251.08	1794.5	66	4	
10.	Nagapatinam	847.437	46.95	800.49	279	10	19
11.	Namakkal	7.28		7.28	312		Conducted
12.	Thiruvarur	502.434	78.434	424	381	7	15
13.	Kanyakumari	457.65	157.54	299.11	5052	153	
14.	Ooty	502.172	3.345	498.83		50	
15.	Pudukkottai	412.14	334.1	17.5	139	32	
16.	Salem	2463	1514.94			38	
17.	Ramnad	1926.3	87.95		341	1	15
18.	Sivagangai	908.55	121.125		399	5	25
19.	Thanjavur	2972.143	17.07	2312.5	614	19	
20.	Theni	2076.935	797.32		Regularly	28	
21.	Thoothukudi	1512.55	28	62	168	3	
22.	Tirunelveli	791	63	650	611	10	
23.	Tiruppur	819	109	710	302	13	
24.	Tiruvallur	22,062		22,062			4
25.	Tiruvannamalai	4315	10	4305	570	32	
26.	Trichy	12595.33	111.46	12484	523	46	547
27.	Vellore	6701.38	13.482	6687.4	54	13	38
28.	Virudhunagar	1571.31	40.096	1487.5	626		324
29.	Villupuram	3975		3975			
	Total	223111	6616.372	63223	10709	480	1001

Table District wise list of plastic waste generated and its disposal and action taken to createawareness on plastic waste management for Tamil Nadu 2013

Source: Tamil Nadu Pollution Control Board 2013

7. Environmental Impacts of Wastes

E-Wastes

The e-waste contains a number of toxic components that can cause serious damage to environment and human and animal health if not properly discarded in an environmentally sound manner. Effects of some of the chemicals found in e-waste on human health are given below:

Brominated flame retardants: Brominated flame retardants (BFRs) have routinely been added to consumer products for several decades in a successful effort to reduce fire-related injury and property damage. Recently, concern for this emerging class of chemicals has risen because of the occurrence of several classes of BFRs in the environment and in human biota. The widespread production and use of BFRs; strong evidence of increasing contamination of the environment, wildlife, and people; and limited knowledge of potential effects heighten the importance of identifying emerging issues associated with the use of BFRs. These do not decompose easily in the environment, and long term exposure can cause impaired memory function and learning. Pregnant women exposed to brominated flame retardants have been shown to give birth to babies with behavioral problems as it interferes with estrogen and thyroid functioning.

Lead: Lead is a naturally-occurring element that can be harmful to humans when ingested or inhaled, particularly to children under the age of six. Found in most computer monitors and televisions, lead exposure leads to intellectual impairment in children and serious damages to human reproductive systems, the nervous system and blood. Lead poisoning can cause a number of adverse human health effects, but is particularly detrimental to the neurological development of children.

Cadmium: The kidney is the critical target organ for the general population as well as for occupationally exposed populations. Cadmium is known to accumulate in the human kidney for a relatively long time, from 20 to 30 years, and, at high doses, is also known to produce health effects on the respiratory system and has been associated with bone disease. Found in rechargeable batteries for laptop computer and other electronic devices, can cause damage to kidneys and bones. Cadmium can be bio-accumulate in the environment and is extremely toxic to human, in particular adversely affecting kidneys and bones.

Mercury: Elemental and methyl mercury are toxic to the central and peripheral nervous systems. The inhalation of mercury vapor can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested. Neurological and behavioral disorders may be observed after inhalation, ingestion or dermal exposure of different mercury compounds. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headaches and cognitive and motor dysfunction. Kidney effects have been reported, ranging from increased protein in the urine to kidney failure. Mercury (Hg), which is used in lightening devices in flat screen monitors and televisions can cause damage to the breast milk.

Hexavalent Chromium Compounds: Hexavalent chromium is a toxic form of the element chromium. Hexavalent chromium compounds are man-made and widely used in many different industries. A known carcinogen, these are used in the creation of metal housing which are typical of many electronic products. It can cause lung cancer, irritation or damage to the nose, throat, and lung (respiratory tract), irritation or damage to the eyes and skin etc.

Plastic compounds: Poly vinyl chloride (PVC) cabling is used for printed circuit boards, connectors, plastic covers and cables. When burnt or land-filled, these PVCs release dioxins that have harmful effects on human reproductive and immune systems.

Municipal Solid Wastes

Municipal Solid wastes from urban centres mixing up with ground water courses create potential risks to human health. There is specific danger of concentration of heavy metals in the food chain, a problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/sewerage system and /or open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle including these some other types of effects are as follows

- Chemical poisoning through chemical inhalation
- Uncollected waste can obstruct the storm
- Water runoff resulting in flood
- Low birth weight

- Cancer
- Congenital malformations
- Neurological disease
- Nausea and vomiting
- Mercury toxicity from eating fish with high levels of mercury
- Plastic found in oceans ingested by birds
- Resulted in high algal population in rivers and sea
- Degrades water and soil quality

A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition.

Liquid leachate management varies throughout the landfills. Leachate poses a threat to local surface and ground water systems.

8. Government initiative taken for solid waste management in Tamil Nadu

E-waste Initiatives – Tamil Nadu

This Policy sets forth position of Tamil Nadu government on e-waste management by identifying the roles and responsibilities of all stakeholders to manage the e-waste in an environmentally sound manner, through reduction in the generation of e-waste and providing a system for collection, segregation and recycling of e-waste.

The alarming increase in e-waste generation and the consequent threat of environmental degradation arising from unauthorized recycling establishes the urgent need for an effective regulatory framework. In the absence of effective legislation or regulations to deal with this emergent situation and also to protect public interest, the Government of Tamil Nadu is now introducing a Policy on e-waste. This Policy sets forth the position of the Government of Tamil Nadu on e-waste management by identifying the roles and responsibilities of all stakeholders including the public to manage the e-waste in an environmentally sound manner in Tamil Nadu, through reduction in the generation of e-waste and providing a system for collection, segregation and recycling of e-waste.

Role of Public private partnership in Municipal Solid Waste Management in Tamil Nadu

Public private partnership arrangements pave the way to both the public and private sectors to share the responsibilities in providing the services. Public private arrangements can have many forms, but the common distinguishing characteristic is a shared governance structure and decision-making process. Such a partnership, combines the private sector's dynamism with the public sector's responsibility of public interest which makes it work better.

Chennai: is the pioneer in PPPs in solid waste on a large scale. The municipal corporation has withdrawn its staff from three out of the ten zones of the city. A seven year contract has been awarded to the private operator Onyx through a transparent bidding process for primary collection, street sweeping, secondary storage at transfer station and transportation of waste to disposal site. Onyx has engaged its own manpower, tools and equipment and fleet of vehicles.

The cost per ton of waste in this arrangement is 50% of the departmental cost for the same service provided by the city administration in other zones. (P.U.Asnani)

The Tamil Nadu Urban Development Fund (TNUDF) suggested that TMC should develop a composting plant on a PPP basis to treat the biodegradable waste. In 1999, IVR Infrastructures and Projects Ltd. was selected through a competitive bidding process to finance, construct and operate the plant on a Build-Own-Operate-Transfer (BOOT) mode for a period of 20 years. A specially designed 'windrow compost' yard having a 50 day life cycle piles was set up on a seven acre land. This land was taken on lease by the private concessionaire from the TMC atRs.1.75 lakh per annum. The concessionaire has set up equipments and machineries worth Rs.55 crore. The entire project cost was borne by the concessionaire. As per the concession agreement, TMC was supposed to provide 100 MT of mixed waste per day to the private concessionaire, of which at least 40 MTD would be biodegradable waste. The concessionaire would pay Rs.3.5 per ton of waste sold to it. If the municipality defaults in providing the concessionaire the waste, it would compensate the concessionaire by paying it Rs.5.20 per ton of waste not supplied. This meant that the demand risk was completely borne by the TMC. It was responsible for getting the required quantity of a given type of waste, thereby ensuring the sustainability of the project. The waste supplied after composting it into fertilizer would be sold to the farmers. This was the source of revenue for the concessionaire. At present there are about 3 MSWM projects have been implemented directly under PPP mode and 1 project is implemented under BOOT basis. The details are provided in the following tables.

SI.No	Urban Local Bodies (ULB)	Est. Cost (Rs in Cr.)
1	Coimbatore Corporation	96.51
2	Madurai Corporation	74.23
3	Namakkal Municipality	3.58
4	Venkatamangalam Project (Common facility for Alandur*,Pallavapuram and Tambaram)	44.21
4	Salem City Municipal Corporation**	

Cost estimates PPP – MSWM project

*Alandur now excluded from the project as it was merged with Chennai Corporation

** BOOT basis – Establishment of Material Recovery Facility, Compost plant and developing Scientific Sanitary land fill.

Various PPP Milestones in ISWM across ULBs, Tamil Nadu

Item	Namakkal Munici- pality	Madurai Corpora- tion	Venkataman- galam Project	Coim- batore Cor- poration
Concession Agreement Signed on	10.3.2008	14.07.2008	30.01.2009	19.11.2007
SPV formed on	27.3.2008	06.03.2008	23.04.2009	16.1.2008
Land Lease Agreement executed on	04.04.2008	20.9.2008	11.6.2009	09.05.2008
Construc- tion Period	12 months	12 months	12 months	12 months
Concession Period	20 years	20 years	20 years	20 years

In Coimbatore Corporation the Tipping fee is very high and this may be due to 4 transfer stations and 3 scientific closure of existing dumpsites are in the project scope and for Madurai Corporation is concerned the Quantity of waste to be handled is about 450 MT, it doesn't have a transfer station, and this project involves closure of only one site.

Namakkal has an added advantage that the 100 % source segregation is already achieved, extent and quantity of waste handled by this ULB is very less as compared to the others. In addition the project also got 90 % of the project cost as grant from GOI and GoTN and ULBs contribution was only 10%. The set of PPP projects on Integrated Municipal Solid Waste Management Projects in Coimbatore and Madurai is very successful.

Some of the images in the following pages highlight the key initiatives by the Government of Tamil Nadu in Solid waste Management.



Ariyappampalayam Town Panchayat in Erode District



Thorapadi Town Panchayat in Cuddalore District



Solavandan Town Panchayat in Madurai District



A campign mode approach taken up once in four months in all 561 Town Panchayats

Preparing vermin compost

All five localities perform secondary composting using earthworms. This process, called vermin composting, adds commercial value and increases the availability of nutrients in the final product. When designing vermin compost tanks, precautions must be taken to protect worms from predators, such as ants, rodents and crows.



Key Initiatives for Bio medical -waste management in Tamil Nadu

- > There are 1405 Private hospitals and 243 Government hospitals in Tamil Nadu.
- > There are about 96,000 hospital beds all over the States.
- The Chairman, Tamil Nadu Pollution Control Board has been designated as prescribed authority for granting authorization and implementation of the bio medical wastes (management and handling) rules, 1998.
- Tamil Nadu Pollution Control Board is taking necessary steps for the safe environmental management of hospital wastes and is monitoring the prevailing practices and evaluating various treatment and disposal options for the safe destruction of hospital wastes, considering the aspects of both environmental impact and cost.
- Common incinerator facilities have been provided in Salem for 58 hospitals and in Madurai for 78 hospitals with a capacity of 50Kg/hr each.
- Presently 50-55% of bio medical wastes was collected, segregated and treated as per bio medical waste management rules.

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