

Chapter IX

SOLID WASTE MANAGEMENT

Solid Waste Management is an obligatory function of municipal corporations, municipalities and other local bodies in India. Due to increase in population, urbanization, change in life style and consumption pattern the problem of solid waste management in urban areas is increasing. Chennai is not an exception to it.

9.02 Chennai Corporation is the responsible agency for solid waste management in the City Corporation area. Chennai Corporation area is divided into 10 zones and each zone is further sub-divided into about 15 Divisions totaling to 155 Divisions. Conservancy responsibility has been delegated to Zonal officials in City Corporation. According to Census 2001, the population of the City was 43.43 lakhs and the average per capita solid waste generated within the City is estimated to be about 585 grams. It has been estimated that 3000 tonnes of solid waste is generated in these 10 zones in the City area daily and in addition Chennai Corporation also handles about 500 tonnes of debris.

9.03 Recognising the importance of solid waste management and its increasing problems in this Metropolis, CMDA had in consultation with the agencies concerned in this matter conducted a study called " Municipal Solid Waste Management Study for Madras Metropolitan Area" with the World Bank assistance during the year 1996 through the consultants M/s Environmental Resources Management, U.K. It was a detailed study covering all aspects of solid waste management (existing situation and also the future requirements). The Study has shown that the solid wastes generated from households, commercial establishments, etc. are at the ratio given in the Table No 9.01.

Table No.9.01 Solid Waste Generated in Chennai City		
S.No	Waste generation	% to total
1	Residence	68
2	Commercial	14
3	Restaurants / Hotels/ Kalyanamandapams / Schools and others	11
5	Markets	4
6	Hospitals and Clinics (collected separately)	3
	Total	100

Source: M/S ERM, UK 1996

From the above, it may be seen that the largest generator of solid waste is the household.

9.04. As part of the Study, sample of waste was analysed for composition and characteristics and its results are given in Table No 9.02.

Table No. 9.02: Composition of Waste		
Sl. No	Composition	% to total by weight
1	Paper	8.38%
2	Rags	3.11%
3	Organic Matter	51.34%
4	Plastics	7.48%
5	Metals	0.19%
6	Rubber & leather	0.19%
7	Inert	26.01%
8	Glass	0.29%
9	Coconut	2.48%
10	Wood	0.50%
11	Bones	0.01%

Source: NEERI, 2006

9.05 Chemical analysis of Chennai City solid waste samples have shown that it contain as given in Table No. 9.03.

Table No.9.03: Chemical Analysis of Solid Waste		
Sl. No	Items	% Value
1	Moisture content	47.00%
2	Ph Value	6.20% to 8.10%
3	Volatile matter at 550°C	42.62%
4	Carbon	24.72%
5	Nitrogen content	0.88%
6	Phosphorous as P ₂ O ₃	0.44%
7	Potassium as K ₂ O	0.89%
8	C / N Ratio	29.25
9	Calorific Value in Kj/kg	2594

Source: NEERI, 2006

9.06 From the above it is seen that Chennai municipal solid waste contains higher moisture content, small percentage of recyclable materials and more of compostable (organic matter) and inert materials. These characteristics show the low potential for applying refuse derived fuel and waste to energy (i.e. incineration) processing option due to the low combustibles, high moisture and high inert contents of the wastes. However, they indicate high potential for composting of solid wastes.

9.07 NGO's in cooperation with Municipal Corporation are assisting communities to collect solid waste through community based arrangement in some areas of the City. Collection by NGO's from individual houses / establishments using tricycles are deposited in dustbins which are cleared by Chennai Corporation. Municipal Corporation provides street sweepings and scientific collections throughout the City. Municipal Corporation has handed over the solid waste collection and transfer to disposal sites in respect of the zones VI, VIII & X to a private organisation and it handles about 1000 tonnes per day.

9.08 Solid waste from the Chennai Corporation area is taken to the transfer stations and from there it is finally disposed off at two designated disposal sites viz. Kodungaiyur located at northern part of City and Perungudi an adjoining village in the south. Both the sites are located in low lying areas and are adjacent to the Metro Water Sewage Treatment Works. The extent of the Kodungaiyur landfill site is 182 hectares and the Perungudi land site is 142 hectares. About 45% of the total solid waste generated is disposed at Kodungaiyur site and the remaining at Perungudi site. Within the Chennai Corporation there is a well established repair and maintenance system for solid waste management for mechanical vehicles.

9.09 Central Pollution Control Board has estimated that the per capita solid waste generated in small, medium and large cities, towns in India to be 0.1 Kg to 0.2 to 0.4 Kg and 0.5 Kg per capita per day respectively. In the ERM Study conducted in 1996 it was estimated that the per capita waste requiring disposal in respect of Chennai City was 0.585 Kg per capita per day. It has also arrived at the figures of waste generation rate in respect of municipalities as 0.585 Kg, town pancahayts as 0.439 Kg and panchayat Unions as 0.293 Kg per capita per day within the CMA. Applying these arrived norms, the estimation of solid waste (excluding debris) generated in Chennai City, Municipality and other local bodies within CMA in 2026 would be as follows:

Chennai City	3400 Tonnes
Municipalities	2050 Tonnes
Town Panchayats	550 Tonnes
Panchayat Unions	540 Tonnes
Total for CMA	6590 Tonnes

9.10 In Chennai Metropolitan area small, medium and large enterprises (Secondary raw material) are involved in the recycling industry. They get the supplies from dealers who specialize in waste papers, glass, plastic, metals and other reusable material and are in turn supported by vast network of dealers and small traders. Rag pickers,

including those at the landfill site, transfer stations and street level, together with itinerant buyers who collect, separate materials from door to door, provide dealers with regular supply of waste. It has been estimated that they recover about 400 tonnes per day of these material.

Rest of Chennai Metropolitan Area

9.11 All solid waste management functions are the responsibility of the executive authorities of the local bodies namely municipalities, town panchayats, and village panchayats.

9.12 In respect of municipalities, most of them do not have any transfer stations and they directly dispose off the waste collected in the land filled sites available within the local bodies. In most of the village panchayat areas the system of solid waste collection and disposal is very limited.

9.13 The consultants after conducting a detailed study in 1996 had given the recommendations after considering what sort of waste management system would be appropriate in CMA in another 15 to 20 years, and the various steps that need to be taken to get out from the existing situation to the more ideal situation proposed, based on experience elsewhere and modifying the same as necessary taking into consideration the climatic, locational, cultural differences and situation appropriate to Chennai. Action programme for implementation given by the consultants is given in the Annexure VIII A.

9.14 The consultants observed that the greatest and the most cost-effective improvements in providing a waste management service to the people are likely to come from improvements in the current framework for providing these services rather than from the introduction of new or different technologies. Improvements to existing arrangements, more clearly defined responsibilities, better management and improved training are therefore seen as paramount to the success of the plan recommended by them.

9.15 The study had recommended a new CMA-wide disposal organization should be set up to develop and manage sanitary land fill and transfer/haulage facilities throughout the area and that organization referred to under the working term "Metro Waste" which need to be developed from the existing solid waste management expertise available with Chennai Municipal Corporation whose capabilities in waste disposal should be strengthened. 'Metro Waste' should be structured in a manner, which

distinguishes the 'client' function (raising finances and controlling operational performance) from the 'contractor' function (carrying out the services on a day-to-day basis). The benefit of structuring Metro Waste in such a manner will allow greater control over the environmental, operational and financial performance of services. It also recommended the phased introduction of private sector in provision of solid waste management services. Whilst public sector must always remain 'responsible' to the public for the performance of solid waste management services, the private sector can be used to efficiently carry out a large proportion of the day-to-day duties. The involvement of community organisations (CO's) in primary collection services is considered to be essential to the sustained success of the strategy.

9.16 Chennai Corporation has taken action to modernize 7 transfer stations and machinery and also to improve basic infrastructure facilities at the landfill sites. It has also taken action to execute the project of making manure from solid waste on Design-Build-Operate- and-Transfer basis. It has employed the consultants M/s National Productivity for preparation of detailed report on modernisation of the Perungudi and Kodungaiyur Solid Waste Disposal sites and they have submitted their report, which is under consideration of the Corporation of Chennai. As a small scale measure at ward level in 115 places, facilities have been created for making manure from community wastes and the Corporation uses the manure for the parks.

9.17 In respect of the municipalities within CMA availability of land for management presently and requirement of land as per the estimates of the local bodies by 2005 are given in the Table No. 9.04.

Table No.9.04: Land Requirement For Land Fill / Compost Sites				
Sl. No.	Name of the Municipality	Requirement of land (in acres)	Existing land (in acres)	Expenditure (Rs. in crores)
1	Alandur	20.46	15.00	37.47
2	Pallavapuram	20.16	-	37.47
3	Tambaram	19.27	4.25	117.46
4	Pammal	6.86	1.00	15.00
5	Anakaputhur	4.44	-	10.00
6	Ullagaram Puzhithivakkam	4.26	-	8.00
7	Ambattur	42.35	7.60	20.00

8	Avadi	22.00	7.20	12.50
9	Kathivakkam	4.56	-	-
10	Madhavaram	15.00	3.66	-
11	Thiruvottiyur	29.65	12.00	-
12	Thiruverkadu	4.30	-	-
13	Poonamalle	5.95	-	-
14	Maduravoil	6.18	-	-
15	Valasaravakkam	5.77	-	-
16	Manali	5.30	5.00	-

9.18 All the municipal areas have identified disposal sites for scientific disposal of solid waste. A common land of extent 50 Acres has been purchased for Alandur, Pallavaram and Tambaram Municipalities at a cost of Rs.113.28 crore at Venkatamangalam village for developing the same as a modernized compost yard bringing the segregated wastes for the purpose. In addition, Tambaram Municipality has identified an extent of about 55 Acres at Nallur village in Sriperumbudur Taluk and 25 Acres in Puchai-Pothivakkam village, Chengalpattu Taluk. In respect of Ambattur Municipality 30 acres of land at Vengal village has been identified. For Kathivakkam Municipality, a site of an extent 5.5 Acre has been identified at Manali Village. Thiruvottiyur and Kathivakkam Municipalities are presently using the common disposal site of an extent 12 Acres at Sathangadu and Thiruvottiyur Municipality has taken action to alienate about 10 Acres from the sewage treatment plant site. Madhavaram Municipality has identified a site of an extent 4.70 Acres at Vadaperumbakkam and 4.93 Acres at Manali and taken action to acquire the same. Pammal Municipality has obtained 2.00 Acres of land for this purpose. Thiruverkadu Municipality has taken action to get 10.20 Acres of poromboke land at Koladi Village for this purpose. Valasaravakkam Municipality has also taken action to acquire lands.

9.19 In respect of the panchayat areas are concerned, only in thickly built-up areas, collection is carried out and disposal made in compost yards that are located in close proximity. In these less dense areas the solid waste collection and disposal is very limited, meeting its present requirements.

Hazardous Waste:

9.20 Hazardous waste residue of production process may cause significant damage to environment and human health and / or environment unless handled, stored,

transported, treated and disposed of scientifically using environmentally sound technologies. The improper and careless handling of hazardous waste has all too often created problems for human health and environment. Effective management and handling of hazardous waste is of paramount importance for protection of human health and environment.

9.21 Prior to notification of the rules in 1989, most of the industries had stored the wastes in their premises or had disposed the same on land within the premises. These wastes were disposed especially by small-scale units in low-lying areas and on roadsides along with the municipal solid wastes as no infrastructure were available. However, after notification of the Hazardous Waste (Management & Handling) Rules 1989, the TNPCB took efforts to identify the generators and made them store wastes within their own premises in designated areas. Efforts were taken to provide individual secured landfill facilities within the industrial premises or the Chromium bearing sludge and Arsenic bearing sludge.

9.22 Sites for establishing the common treatment storage and disposal facility (TSDF) for the hazardous waste have been identified, detailed EIA have been carried out and the Government has notified the sites. However, there is public opposition for establishment of common hazardous waste TSDF facility due to the apprehension that the nearby land and groundwater will be polluted. Therefore, the Board could not establish TSDFs during the X plan period for scientifically disposing the hazardous wastes despite the best efforts. A TSDF has been notified in the Gummidipoondi Industrial Estate construction of which is in progress.

Bio-Medical Waste:

9.23 Bio-medical wastes are hazardous because of its potential for infection and also for its ingredients including antibiotics, cytotoxic drugs, corrosive chemicals and radioactive substances. The TNPCB has estimated that in-patient hospital services in Chennai generate about 1 to 2 kg of solid wastes per person per day, and Chennai city has 528 hospitals with a bed strength of about 22,180 and the bio-medical waste generate per day is about 12,000 k.g. TNPCB has authorized two sites for location of common treatment and disposal of bio-medical wastes, which are functioning at Thenmelpakkam village, Chengalpattu Taluk, Kancheepuram District and Chennakuppam, Sriperumbudur Taluk, Kancheepuram District to serve Chennai, Thiruvallur and Kancheepuram Districts and adjoining Villupuram and Cuddalore Districts.

E-Waste:

9.24 The rapid proliferation of computers and consumer electronics such as mobile phones, refrigerators, washing machines, radios, tape recorders, microwave oven, calculators, display devices, telecommunication devices and toys have resulted in a global mountain of hi-tech trash (E-Waste) due to its obsolescence in nature. E-waste consists of lead, mercury, arsenic, cadmium, PVC, Brominated Flame Retardants (NFRS) and dozens of other toxic and potentially hazardous compounds. The fruits of our hi-tech revolution are pure poison if not properly managed at the end of their productive life. A personal computer system weighing about 25 kg is estimated to contain about 1.5 kg of lead. The primary source of computer waste in Tamilnadu is from software companies, Government and public companies, PC retailers and manufacturers, secondary market of old PCs dumped from developed countries and domestic uses. There are about 89 large-scale software companies located in Chennai, Thiruvallur and Kancheepuram Districts. Approximately 38,000 computers and laptops are generated as E-waste every year. Other computer peripherals and printers, fax machines, air conditioner, UPS, network accessories to the quantum of 3000 are also generated every year.

9.25 Seven E-waste recycling industries have been authorized by TNPCB within the CMA. They conduct restricted operations of dismantling of computer hardware, manual segregation of scrap after breaking the scrap by using mechanical equipments like jaw crushers and cutters. The scraps are segregated into plastic components, glass, ferrous material and non-ferrous material. The printed circuit boards available in computer are segregated and exported to reprocessing facilities at Belgium, Singapore, Hong Kong, China & Taiwan for metal recovery. Metals recovered are usually copper and gold. Informal recyclers are located at Labbai Street, Periamet at Chennai. Scrap workers are working in the residential buildings. They are segregating the E-waste manually in a crude method by using small tools or with blower arrangement. IC wastes, Printed Wiring Board (PWB) are burnt in outskirts of Chennai to get Aluminium from the burn-out.

Construction Debris :

9.26 In Chennai City about 500 tonnes of construction debris are generated per day. Chennai Corporation has identified few sites within the City wherein the private developers dump this debris. The developers, who require these debris for landfill are collecting them and utilizing the same. Presently, this kind of solid waste does not pose much problem except unauthorized dumping along certain roads. A system of collection and recycling/ disposal of this construction debris should be worked out by the local bodies concerned and implemented.

Bio- Methanation Plant :

9.27 In Koyembedu Wholesale Market Complex (KWMC) perishable wastes of about 100 tonnes per day are generated. With the assistance of Government of India, Ministry of Non Conventional Energy Sources (67%) and from CMDA's share (33%) the project to generate electricity from vegetable waste (30 tonne] has been planned and implemented at KWMC at a total cost of Rs.5.07 Crores. Electricity generated in this project will be about 230 kW per day. The compost generated will be 10 tonnes per day.



Annexure IX A

Municipal Solid Waste Management Master Plan for Chennai - Technical Action Programme				
Description	Local Body	1996-2000	2001-2005	2005-20011
Collection				
Coverage	MC Area	90%	100%	100%
	Municipalities	50%	70%	100%
	Town Panchayats	10%	30%	70%
Waste Storage & Primary collection	Municipal Corporation Area	Public scheme for owner container-based collection system operated by MC & NGO's in Zone VI	Complete introduction of new collection system	
		Implement preferred collection system in all zones at the rate of 2 zones per year	Maintain communal containers in some areas as appropriate	
		Communal container for low income, apartment blocks, commercial and institutional premises.	Maintain public awareness campaign as new collection system is introduced	
		Implement bulk collection points where appropriate	Evaluate the potential for using "wheelie bins" in appropriate areas	
		Develop and implement an appropriate local public awareness campaign for the pilot scheme proposed for Zone VI		

		Expand the public awareness campaign to cover each zone where the proposed new collection system is being implemented		
	Municipalities	Pilot scheme for new collection system following and on similar basis to that in MC	Extend coverage of new collection system	
	Town Panchayats		Initiate new collection system	Extend coverage of collection system
Street Sweeping	MC Area	Carry out pilot project trials of new street sweeping system	Complete introduction of trolley system into all Zones	Evaluate potential for street sweeping using mechanical equipment
		Introduce trolley system with 60t containers (x2) into 2 Zones per year	Continue re-evaluation of street sweeping tasks and performance norms	
		Introduce simple task force in each Zone to clear debris and accumulations		
		Introduce central heavy duty task force under direction of Commissioner to work on programmed clearance and emergency response		
		Re-evaluate street sweeping tasks and performance norms waste collection scheme is introduced into each Zone		
	Municipalities		Introduce trolley system for manual street cleaning into 2 municipalities per year	

	Town Panchayats			Evaluate and if appropriate introduce trolley system into Town Panchayats
Secondary Collection	MC Area	Phase out bullock carts	Complete phasing in of standardised collection vehicles	Evaluation and pilot scheme to test the potential of "wheelie bin" type storage and enclosed compactor vehicles
		Phase out 9.5 tonne tippers for collection, use for transporting waste from Transfer Stations	Complete phasing out of non-standard vehicles	
		Phase in standardised collection vehicles: *3 tonne tippers (general) *1.5 tonne tippers (narrow streets) *0.75 tonne 3 wheeler (narrow streets)		
	Municipalities	Phase out bullock carts by year 5	Complete phasing in of standard collection vehicles	
		Phase in standardised collection vehicles as per MC	Evaluate the potential for contracting out the collection and transport of wastes from collection points to the treatment or disposal points	
		Phase out 9.5 tonne tippers for collection, use for transporting waste from Transfer Stations		

	Town Panchayats		Phase out bullock carts by year 10	Complete phasing in of standard collection vehicles
			Phase in standardised range of collection vehicles	Evaluate the potential for contracting out the collection and transport of wastes from collection points to the treatment or disposal points
Transfer System				
Transfer stations	MC Area	Rehabilitate / develop transfer stations one per Zone apart from Zone I, at a rate of 2 per year, all to be completed by year 5		Evaluate the potential for rationalising the number of transfer stations and developing some of them to enable waste to be containerised and conveyed by higher payload vehicle
				If specialised enclosed compactor collection vehicles are considered for introduction, some transfer stations should be closed and collection vehicles diverted either to other transfer stations or directly to disposal

	Municipalities	Develop Transfer Stations in the Alandur, Thiruvottiyur, Ambattur, Avadi, Pallavaram and Tambaram Municipalities		
		Develop transfer points for the transport of waste for disposal in Madhavaram and Kathivakkam Municipality		
	Town Panchayat		Develop transfer points in Town Panchayats to be completed by year 10	
Bulk Transport System	MC Area	Continue to use existing 9.5 tonne tippers for transport from transfer stations to treatment or landfill, replace as necessary		Evaluate potential for container type vehicles in parallel with evaluation of enclosed compaction vehicles and rationalising transfer stations
	Municipalities	9.5 tonne tippers for haulage of waste from transfer stations purchased by new waste body		
		Purchase Roll-on-off vehicles for the transport of containers from the new transfer points		
	Town Panchayats		Purchase Roll-on-off vehicles in line with development of transfer points	

Treatment and Disposal				
Existing landfills		Upgrade existing land fills at Perungudi and Kodungaiyur to controlled landfill status and to accept the co-disposal of Municipal Solid Waste with appropriate industrial and hospital wastes, to include, improved operational practices, improved site drainage and leachate control, improved access roads, relocation of weigh bridge at Kodungaiyur, development of screening bunds around sites, restoration and landscaping of completed areas	Continue with phased development and restoration of existing sites	Continue with phased development and restoration of existing sites, upgrading of Engineered Landfill status
		Purchase new landfill dozer for each site	Develop site extensions on basis of engineered landfill designs	
		Set up small site laboratories for testing and monitoring		
		Carry out detailed environmental assessment of site extension project		
New landfill		Purchase land necessary for access to the proposed landfill	Carry out competitive tendering exercise for selection of Design, Build and Operate Contractor	Continue with phased development and restoration of new site
		Carry out detailed investigation and environment assessment	Develop new landfill site at..... to start operating in year 7	Monitor BOO contractor performance

		Develop Design, Build and Operate contract specifications	Monitor BOO operator performance	
Composting		Evaluate the potential of composting selected high organics waste, including involvement of the private sector	Based on the results of the pilot composting scheme, develop full scale composting facility/ies	
		Develop pilot scheme for composting		
Vehicle Maintenance				
Front line maintenance	MC Area	Retained by Zonal operational depots under direction of new zonal Assistant Engineers (Mech)		Evaluate potential for contracting out front line maintenance to the private sector
	Municipalities	Retain private sector contracting out	Contracted out	Contracted out
	Town Panchayats	Retain limited private sector contracting out	Contracted out	Contracted out
Workshops	MC Area (B&D)	Extend workshops into disused cattle shed areas	Sustain maintenance equipment levels to meet requirements of the vehicle fleet	Evaluate equipment requirements for new collection vehicle types if these are adopted
		Rehabilitate and re-equip workshops to undertake major repairs		
	Municipalities/Town Panchayats	Contracted out	Contracted out	Contracted out