Introduction

The management of Solid Waste is changing fast around the world and Solid Waste Management (SWM) department of Kolkata Municipal Corporation (KMC) is also modernizing themselves to keep up with those changes in all three primary segments of SWM viz. primary collection, primary and secondary transportation and treatment and disposal. KMC area comprises about 206.08 Sq. Km having population of 44, 86,679 as per Census 2011. Waste generation rate is 500-550 gpcd (average). Quantity of Municipal Solid Waste generation in the city is about 4500 MT/Day. The collection, transportation and disposal of the Municipal Solid Waste (MSW) is primarily executed and managed by KMC with total workforce of around 15000 employees, most of which about 10,000 are engaged in the street sweeping and door to door collection. Before 2010, conservancy services were restricted up to 12.00 Noon but to improve the collection efficiency and to make the city presentable about 7000 number of employees under West Bengal Urban Employment Scheme are working in the afternoon and in some areas in the evening also.

A pilot project with the mission of vat free city has been introduced in ward no-85 by using Battery operated vehicle with hydraulic tipping system. In line with KMC has procured another 220 numbers of Battery operated Hydraulic Dumper in addition to conventional Hand Cart and Try-Cycle for door to door collection which helps to increase coverage of SWM services in households and bulk generators and strengthen the present SWM system of KMC at level of primary collection. SWM department has also procured considerable number 240 litre trash bins which have been set up on the road side for the use of pedestrians, shop owners and commercial purposes. SWM department is also continuing the source segregation of waste at source in 07 Wards in view of recycling or reuse of segregated materials and to reduce the overburden on landfill.

The portable compactor and compactor station, a modern scientific eco-friendly system being introduced for garbage handling and disposal is a revolutionary step for Kolkata. It also functions as mini transfer station. It also restricts communicability of disease and avoids foul smell, littering, informal collection etc. About 85 numbers of such compactor stations and 180 compactor containers have been installed in the stations replaces 300 numbers of open vats throughout the city of Kolkata.

For effective utilization of transportation of MSW, SWM department of KMC has procured 54 numbers of Hook Loaders, 80 numbers of Movable compactors in different areas of KMC which helps odorless transportation from compactor station to disposal site, avoids spillage of garbage and seepage of water during transportation, and reduces fuel consumption. The SWM department has also achieved to replace about 90% very old KMC owned and hired vehicle (more than 15 years) by the combination of Stationary and Movable compactors.

In case of waste disposal system KMC has removed 7459050 MT of waste generated in the city during the last 5 years. Introduction of online central server with CCTV networking system helps to provide security in the system, to facilitate huge data storage and helps to provide spatial and visual validation for provision of services at waste disposal site. SWM department has also provided car washing facilities to maintain the modern vehicles. Existing landfill site Dhapa is almost exhausted and portion of 12.14 hectare land has been taken up for bio-remediation project which is near in completion. KMC has also identified two lands one at Patharghata, Rajarhat and another at Raspunja, South 24 Parganas. KEIIP of KMC has been entrusted to prepare the master plan and integrated Solid Waste Management facilities for the city of Kolkata. Annual budged estimate for the year 2018-2019 of SWM department is Rs. 58,071.00 Lakhs.

Physical & Chemical Analysis of City Refuse

The analysis of refuse (Table 1) is carried out normally to know it's physical as well as chemical characteristics (Table 2) which enable us to decide the desired frequently of collection, precautions to be taken during its transportation and method of processing and disposal.

Table 1: Average physical composition of municipal solid waste

Total Compostables	Recyclables				Other including Inerts						Total
	Paper	Plastic	Glass	Metal	Inert	Rubber And Leather	Rags	Wooden Matter	Coconut	Bones	
50.56	6.07	4.88	0.34	0.19	29.60	0.68	1.87	1.15	4.50	0.16	100.00
50.56	11.48				37.96						100.00

(All values are expressed in percentage on wet weight basis)

Table 2: Average chemical composition of municipal solid waste

Sl. No	Parameters	Year 2005
01	Moisture	46
02	pH	0.3-8.07
03	Loss of Ignition	38.53
04	Carbon	22.35
05	Nitrogen as N	0.76
06	Phosphorus as P205	0.77
07	Potassium as K2O	0.52
08	C/N Ratio	31.81
09	LCV Kcal/Kg	1201

(All values are in percent by dry weight basis except pH & LCV)

All values of physical parameters are in percent by net weight and all values are of chemical parameters are in percent by dry weight basis except pH & LCV; * Bio-resistant and synthetic material.

CITY REFUSE



Segregation at Source:

- Source segregation in 7 wards: Ward no 33, 47, 64, 103, 110, 115 and 130.
- This system is in operation since March 2010.
- House hold and population covered (Table 3).
- After collecting the segregated Municipal Solid Waste (MSW), bio-degradable wastes are transported to disposal site for composting and recyclable MSW are sent to recycling unit.
- Apart from that source segregation in another 20 wards will shortly be introduced for more effective management of solid waste.

Table 3

Ward No.	Number of Household.	Total Population as per Census 2011
33	11095	45919
47	3271	14684
64	6342	31280
103	7105	25428
110	7628	27470
115	8461	31919
130	6150	23227

Some photos in source segregation activities are shown below:

SEGREGATION AT SOURCE









4.0 Primary Collection





a) Primary Collection

- Door to Door collection: 100% in 144 wards.
- Manpower engaged: 10,000
- Equipment used for primary collection:
  - » Hand Cart
  - » Tricycle van
  - » Battery Operated Hydraulic Dumper
  - » Auto tipper (2 cum capacity)
- Equipment used for street sweeping: Mainly in major roads, lanes. By-lanes manpower is used for sweeping and in high speed roads mechanical sweepers are used.
- To improve the air quality in traffic congested areas some street watering and washing vehicles are also used.

b) Storage - Mini Transfer Station:

- Before 2010, MSW were stored in open storage points, container points, pay- loader operated vat points.
- Afterwards open storage points are gradually replaced by Modern Scientific Waste Compactor stations (Mini Transfer Stations) and Movable Compactors to comply the rule of SWM Rule 2000 & 2016.
- At present 85 numbers of Modern Scientific Waste Compactor station are in use and another 50 nos. of Mini Transfer Stations are in pipeline.
- 11,500 nos. 240 litre trash bins are placed on streets, footpaths etc. for the use of pedestrians, shop owners to avoid littering.

COLLECTION











Transportation

- On an average 380 nos. of vehicles are used for transportation of MSW throughout the city of Kolkata.
- 54 nos. of Hook Loaders are used for lifting of compactor containers (10.5 cum) from different compactors stations.
- 80 nos. of Movable compactors are in use for transportation of MSW throughout the city of Kolkata and it also helps for odourless spillage free transportation.
- On an average 250 nos. of hired vehicles (covered) are engaged for transportation of waste including silt/rubbish/
  tree branches etc.
- There are 10 numbers Garages under SWM department used for maintenance of conservancy vehicles like Dumper Placers, Tipper Trucks, Movable Compactors, Hook Loaders for transporting Portable Compactors, Street Washing Vehicles, Mechanical Sweepers, Pay loaders, Bull Dozers, Bio-Shredding Machines, Tractor trailers, cess pool emptier. These are deployed regularly for different activities including sprinkling of water to reduce air pollution around the city to keep it clean and safe.

TRANSPORTATION







Treatment & Disposal

a) Treatment

i. Compost Plant

- Capacity of Compost plant: 500 MT per day
- Area used: 23 acre.
- Location: Dhapa Disposal Site (ward-57, Br-VII)
- Mode of Operation: PPP Model
- Operating agency: M/s Eastern Organic Fertilizer Pvt. Ltd.
- Method used for processing of compost: Windrow method.

ii. Organic Composter

As pilot project, installation of 3 nos. Organic Composter of 1 ton capacity is in pipeline.

iii. Bio-CNG

A pilot project has been taken up for the conversion of organic market waste into Bio-CNG, Bio-CO_2 and compost by processing 5 M.T. market waste daily at Dhapa.



TREATMENT





b) Disposal System

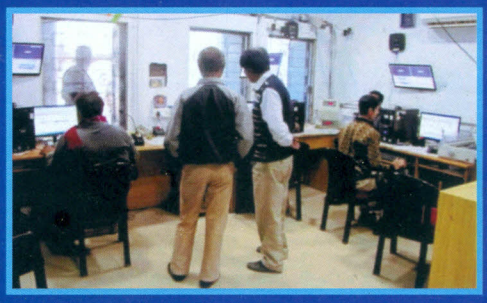
Location of disposal site:

Dhapa

- Dhapa is situated in the Eastern side of Kolkata, (ward-57 under Br-VII)
- Active area: 35 hectare (almost saturated).
- Dhapa disposal site is fenced with proper gate to monitor incoming vehicles or other modes of transportation.
- Approach and other important roads for free flow of vehicles and other machineries exist at the landfill site.
- Landfill site has waste inspection facilities to monitor waste brought in for landfill, office facilities for record keeping and shelter for keeping equipment and machineries.
- Weigh Bridge: 5 nos. weigh Bridges are in operation to measure quantity of waste brought at landfill site.
- Utilities such as drinking water and lighting arrangements exist for easy landfill operations when carried out in night hours.
- Periodical health inspections of workers are done by the Health department of KMC.
- The Dhapa Check Post is under 24 hrs surveillance with CCTV system.
- There is a Central server system, which stores all the data regarding the gross and empty weight of all the different vehicles entering the Dhapa disposal site for unloading the MSW.





DISPOSAL SITE

- Washing Bay: 2 nos. of Washing Bay have been installed at Dhapa Check Post area. The different vehicles entering the Dhapa disposal site for unloading the MSW gets dirty by the mud mainly during the monsoons which are are being washed in the Washing Bays.
- Street watering : To avoid air pollution street watering is done at the road around the disposal site.
- Infrastructure development: For rendering smooth disposal of MSW the roads are developed and maintained regularly by the inert and C&D waste coming to the disposal site.
- Bull dozers: 3 nos. of bull dozers are used for dressing and levelling of MSW coming to the disposal site.







Remediation project at Dhapa

Remediation project at Dhapa: Post closure care of existing landfill site (12.14 hectare) is nearing completion which includes:

- Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover.
- Monitoring leachate collection system in accordance with the requirement.
- Monitoring of ground water in accordance with requirements and maintaining ground water quality.

Implementing agency: West Bengal Pollution Control Board under financial assistance of World Bank.

REMEDIATION PROJECT AT DHAPA





Name of the project : Remediation/Closure & Containment of Dhapa Municipal, Dumpsite in Kolkata,West Bengal.

Agency: Saurastra Enviro Projects Pvt. Ltd.

Work Order value: Rs. 47,91,76,132.95

Leachate Treatment Plant (LTP)

Name of the Work : Construction,Erection,Testing & Commissioning and O&M during defect liability period for 300 KLD Leachate Treatment Plant for treatment of leachate generated from closed dump site in Kolkata, West Bengal on BOT

Work order Value: Rs. 2,99,00,000.00

Agency: Trans Organics (I) Pvt. Ltd.











Ongoing Project:

- Strengthening Primary and Secondary Solid Waste Management System in Kolkata City

  Project cost: 153 crores (approx).

  Description: Construction of Compactor station, Purchase of Movable Compactor, Purchase of 4.5 cum, Capacity container, Purchase of 1100 litre capacity Bin, Purchase of Portable Compactor, Purchase of Hook Loaders, Purchase of Auto Ti-ppers etc.

- Modernization of Solid Waste Management in Ward 77 under KMC

  Project cost: 4.11 crores.

  Description: Construction of Compactor Station, Battery operated Hydraulic Dumper, Procurement of 10 litre capacity bins, Procurement of 240 litre capacity bins, Street Washing Vehicle, Bio shredding machine etc.

- Conversion of Organic Market Waste in Bio-CNG, Bio-CO2, and Compost

  Project cost: 4.06 crores

  Description: Development of Civil Infrastructures like construction of Boundary wall, shed, concrete platform, concrete road, pathways, drains-culverts, etc. for Installation of Bio - CNG Plant with machinery, equipment and electrical arrangement.

Future Plan

KEIIP of KMC has been entrusted to prepare the master plan and integrated Solid Waste Management facilities for the city of Kolkata under financial assistance of ADB.

Ward-wise Map of Kolkata City:

