

# **CHAPTER 23**

## **MANAGEMENT INFORMATION SYSTEM**

### **23.1 INTRODUCTION**

#### **23.1.1 Objective**

Good Municipal Solid Waste management practices is the key to keep a city clean. This requires collection of critical information which is not just for keeping the records up-to-date but used effectively for taking corrective measures as well as proper planning for future. Some information is, therefore, required to be collected to have an overall idea of the prevalent situation, deficiency in the system and likely requirements of the further information which could highlight deficiencies in the system on day-to-day basis and could be used for taking corrective measures has to be collected at regular intervals to monitor the services. Computerisation of such information helps at all the levels of administration to work not harder but smarter, increases the level of job satisfaction, and also to establish strong and reliable information data base necessary to facilitate the decision making and monitoring process for management.

With the advancement of information technology, Geographic Information System (GIS) could be introduced in large cities and integrated with Management Information System. Similarly, there is a need for a citizen interface to seek comments, suggestions etc., in respect of utility services.

#### **23.1.2 Need**

Information that needs to be recorded and studied includes relevant information of the department for planning process as well as specific information to know whether every one involved in SWM services is performing his duty well, adequate vehicles are given to the SWM Dept. by the workshop, the vehicles give their optimum output, the repairing and maintenance of vehicles and equipment at the workshop is properly done, the vehicles carrying the waste to the disposal site are optimally utilised, the processing plants are performing well, landfill sites are well managed etc.

The first thing each morning the chief executive should see is whether anything unusual or unsatisfactory has happened needing immediate remedial measures. A list of items is given below on which the data should be collected and kept on record for planning purposes and a few proformae are designed for monitoring the activities done

by various sections of SWM department as under which may be utilised by the local bodies with suitable modifications.

## **23.2 GENERAL INFORMATION DATA**

These general information to be collected and updated from time to time

### **23.2.1 Salient Features of the City/Ward**

1. Area of the city
2. Population of the city
3. Decadal growth of population
4. Number of wards, their area and population
5. Ward-wise information in regard to :
  - Population density in different wards
  - No. of Households, shops and Establishments
  - Vegetable/fruit/meat/fish markets
  - No. of Slaughter Houses
  - No. of Educational Institutions
  - No. of Theatres / Meeting halls
  - No. of office complexes
  - No. of Temples - Religious centres
  - Number of Hotels & Restaurants, Marriage halls
  - Number of Hospitals & Nursing Homes
  - Number of Industries, Large / Medium / Small
  - Number of Slum pockets / their population
  - Road length/width
  - Percentage of area covered with Under-Ground Sewage system
  - Percentage of area having Surface Drains
  - Percentage of area having no Drainage Facility
  - Total Number of Public Toilets and Toilet seats
  - Number of Public Urinals
  - Number of Nuisance Spots type, size and age.

## **23.2.2 General Information on S.W.M.**

### **23.2.2.1 Waste Generation**

- Average quantity of waste generated per capita - per day in Kg.
- Average quantity of waste produced each day in metric tonnes(M.T.)
- Seasonal variations in daily waste generation
- Total quantity of waste produced annually during last 3 years(M.T.)
- Breakup of the quantity of wastes generated per day in Kg or M.T.
  - i. Household, shops and establishment waste
  - ii. Vegetable and food market waste
  - iii. Meat, fish and slaughter house waste
  - iv. Construction & demolition waste
  - v. Hospital waste - non infectious - general
  - vi Industrial waste - non hazardous
- Average number of carcass removed each day

### **23.2.2.2 Staff Position**

- Number of sanitation workers deployed in the city for the collection of waste
- Number of sanitation workers deployed for the transportation of waste (loading)
- Ward wise allocation of sanitation workers
- Sweeper/ population ratio in each ward
- Sweeper/ road length ratio in each ward
- Sweeper/ supervisor ratio in each ward

### **23.2.2.3 Waste storage depots**

- Number of sites designated / notified for temporary collection of waste (Dust bins) / dalaoh / open site / open site
- Type and size of dustbins / dalaoh / open site provided in each ward
- Ward-wise quantum of waste generated each day.

And for other information refer Chapter 12 of the Manual.

#### **23.2.2.4      *Transportation***

- Number of vehicles available with the local body for the transportation of waste, their type, size and age
- Number of trips made by each vehicle in one shift.
- Number of vehicles used in :
  - First shift
  - Second shift & Third shift
- Quantity of waste transported in each shift
- Quantity of waste transported by each vehicle
- Total quantity of waste transported each day
- Percentage of waste transported each day

And for other information refer Chapter 13 of the manual.

#### **23.2.2.5      *Composition of Waste:***

##### **(i)      Physical Characteristic ( % by weight ):**

Paper  
Plastic  
Metal  
Glass  
Dust (Inert)  
Organic (Decomposable)  
Leather  
Coconut Shells  
Dry Leaves  
Rubber etc.

##### **(ii)      Chemical Characteristics:**

Moisture percentage (by weight)  
Calorific value (K. cal/Kg)  
pH Value

Organic Content  
Carbon Content  
Nitrogen  
Phosphorus as (P<sub>2</sub>O<sub>5</sub>)  
Potassium as K<sub>2</sub> O  
Carbon/Nitrogen Ratio

**(iii) Toxic Material Content:**

Cadmium	Pesticides
Sulphur	Fertilizers
Lead	Chemicals
Mercury	Insecticides
Chromium	Paints
Copper	

And for other information refer Chapter 3 of the Manual

**23.2.2.6 Waste Processing and Disposal**

- Number of waste processing and disposal sites in the city
- Their distances from the centre of the city
- The area of the these sites
- The qty. of waste treated / disposed of at each site
- The expected life of each land filled site

**23.2.2.7 Computerisation**

Computer cell should be made available in all the Urban Local Bodies. Computerisation of all information helps all the levels to work not harder but smarter and increases the level of job satisfaction and also to establish strong in reliable information data base necessary to facilitate the decision making and monitoring process for management.

### **23.2.2.8 *Financial Aspects***

#### **Operating Cost**

- a. Cost of collection / tonne / day
- b. Cost of Transportation / tonne / day
- c. Cost of Disposal / tonne / day
- d. Allocation of revenue and capital budget for SWM vis a vis the City Corporation budget - Annual

### **23.3. TECHNICAL**

#### **23.3.1 Primary Collection**

Primary collection is the first and prime activity in Solid Waste Management. For Planning and designing effective, sustainable and cost effective and efficient primary collection system, the following information shall be established for each Ward / Town / City. (For other information refer Chapter 10 of the Manual)

##### **23.3.1.1 *Population and Composition of Waste***

- Present & future growth of population
- Waste generation per capita / day
- Quantity of waste generated per day
- Area
- Population density
- Physical Characteristic
- Chemical Characteristic & Toxic Characteristic

And for other information refer Chapter 3 of the Manual

##### **23.3.1.2 *Source of Generation***

- Residential
- Commercial
- Industrial
- Hospital

- Institutional
- Water Ways - Rain Water Drain - Silts
- Construction waste

#### **23.3.1.3      *Manpower and Implements***

- Man Power - Sanitation workers in local body
- Contract workers
- NGO / CBO - Voluntary agencies workers
- Implements Tools and Plants
- Primary collection vehicles
- Containerised Hand Carts
- Wheel barrow
- Storage Depots (Dust bins / Open Collection / Dalaoh)
- Welfare Measures for workers  
Uniforms, Housing , Healthcare, Loan for education , Literacy and Motivation.

#### **23.3.1.4      *Monitoring of Primary Collection Services***

The following data may be collected, compiled and analysed for daily, weekly and monthly monitoring of SWM activities as per the Proforma designed as under by the individual and Section of SWM department for effective management of SWM services. Also refer Annexures 23.1(a) & 23.1(b)

#### **I.      **REPORTS TO BE SENT DAILY****

##### **(a)      *Collection of Waste:***

- i.      Number of sweepers required to report for duty.
- ii.     Number of sweepers actually reporting for duty
- iii.    Number of sweepers absent
- iv.     Areas left unattended

- v. Arrangements made or proposed to be made for clearing the backlog.

**(b) *Inspection by Supervisors for Street Sweeping & Primary Collection:***

- i. Number of persons required to supervise
- ii. Number of persons supervised during the day
- iii. Number of cases where performance found satisfactory
- iv. Number of cases where performance was not upto the mark
- v. Action taken or proposed to be taken
- vi. Complaints received and attended

**(c) *Inspection of Cost Recovery Services:***

Such as Hotels, Hospitals, Commercial streets and Offices

- i. Number of cost recovery sites under his charge
- ii. Number of sites inspected
- iii. Deficiencies noticed
- iv. Complaints received and attended
- v. Action taken or proposed to be taken

**(d) *Inspection of Bulk Community Waste Storage Sites:***

Number of sites in the area under his charge

- i. Number of sites inspected
- ii. Number of sites found well maintained
- iii. Number of sites found ill maintained or needing repair or replacement
- iv. Action taken
- v. Number of unauthorized waste disposal sites or sites identified during field visits.
- vi. Action taken



**(e) Inspection of Silt Removal Sites & Building Waste Disposal Sites:**

- i. Number of silt removal sites inspected
- ii. Number of sites found satisfactory
- iii. Number of sites where silt was found lying outside the man hole or surface drain.
- iv. Number of construction sites / construction waste disposal sites visited
- v. No. of sites where construction waste was found disposed of unauthorisedly.
- vi. Action taken

**(f) Recovery of Additional Cleaning Charges:**

- i. Name of the ward
- ii. Areas visited
- iii. Additional cleaning charges recovered :   Number           Amount (Rs)  
From households  
From shops  
From offices  
From other establishments  
From road side vendors, eating points

**II. REPORT TO BE SENT MONTHLY**

**(a) Cost Recoveries / Penalties:**

Wardwise cost recoveries made every month for a variety of services rendered. Wardwise penalties or levy of administrative charges from offenders every month.

**(b) Legal Matters:**

Number of cases filed in the courts each month for violation of sanitation laws. For the effective monitoring of SWM services, the information collected in various proforma should be carefully analysed and corrective measures taken promptly.

There should be route maps and duty charts with each of the supervisory staff, who should check whether work on site is going as per schedule and whether vehicles and manpower are giving their optimum output. Wireless pagers or other communication networks essential for effective communication and monitoring of services.

### **23.3. 2 Secondary Collection**

#### **23.3.2.1 *Transfer Stations***

The second and vital activity in Solid Waste Management Services is the Transfer of Waste prior to Transportation. To design and decide establishing an ideal Transfer Station either a "DeLaou" or Transfer station or "sub depot" and to ensure synchronised Transporting system, the following information need to be established for every Town / City or ward.

- Location
- Area
- Capacity
- Type of Transfer System
- Mode of unloading
- Mode of loading
- Type of Vehicles - Through-In and Out
- Sources of collection - wards / streets
- Reception facility
- Quantum assessment-weigh bridge
- Period of operation
- Sanitation Impact aspect
- Operated by private / Department / Local Body / NGO
- Segregation facility - Wet / Dry
- Rain Water Drain Facility
- Compound wall & Security & Lighting & Washing
- Public Resistance

The Information Formats for all these parameters are enclosed in Annexure 23.2(a) & 23.2(b).

### **23.3.2.2.      *Transportation***

Secondary collection, otherwise termed as Transportation plays a vital role in solid Waste Management services. This is mostly a mechanised System of operation. To enable designing a cost effective and efficient Secondary collection system to synchronise with the operation of primary collection and Transfer systems, following information are to be essentially established for each Ward / Town / City.

#### **(a)      *Source / Storage:***

- Quantity of Garbage generated
- Source of generation
- Physical and Chemical Characteristic of garbage
- Length of road
- Width of road
- Collection points (Dust bins / open collection)
- Transfer Points (Delaou / Transfer Station / Sub Depots)
- Distance between the collection points
- Distance between the Transfer points
- Quantity at collection points / Transfer points
- Pay load capacity of the vehicle

#### **(b)      *Transportation of Waste:***

- Number and type of vehicles and equipment required to report for duty.
- Number and type of vehicles and equipment which actually reported for duty.
- Breakdowns reported during the day and action taken.
- Number of trips made to the disposal site by each vehicle.
- Number of bins cleared during the day.
- Number and locations of bins left uncleared and

- Arrangements made or proposed to be made for clearing the backlog

**(c) *Quantities of Waste Transported:***

- Number of vehicles deployed during the day
- Number of trips made
- Quantity of waste transported
- Number of vehicles which did not make adequate trips
- Number of vehicles which carried less garbage
- Action taken or proposed to be taken against defaulters

**(d) *Record of Trip Made by Transport Vehicle at the Processing and Disposal Sites:***

- Serial Number
- Date
- Vehicle Number
- Name of the Driver
- Arrival time of the vehicle
- Trips made including this trip
- Waste Source and Route Number
- Weight of Waste in M. tones
- Deficiencies noticed
- Action taken

**(e) *Vehicle & Machinery:***

**(i) *Vehicles :***

- Tipper
- Non - Tipper
- Make
- Ordinary body truck
- Stainless Steel lined body

- Heavy / Light Category
- Trip Assigned - FN / AN / Night
- Quantity assigned / Trip
- Ownership
- Private
- Department
- Distance to Dumping Ground / Disposal Site

**(ii) Route Schedule : (each ward / each shift):**

- Starting time
- Closing time
- Distance travelled
- Duration
- No. of collection / Transfer points
- Assigned quantity
- Fuel efficiency - HMV / LMV

**(iii) Machinery:**

- Bull Dozer
- Loaders
- Bulk Refuse Collector
- Compactor
- Roll-on-Roll off equipment

**(iv) Depots:**

- Zonal Depots / ward No.
- Centralized Depot
- Role of Repairing / maintenance
- Fuel Station
- Infrastructure

- Shift of operation
- Private Sector participation - maintenance - security

**(v) Manpower:**

- Drivers
- Mechanics
- Cleaners
- Security
- Technical Assistance (JE / AE)
- Norms
- Private Sector (Maintenance & Security)
- Welfare measures.

**(vi) Monitoring of Vehicles / Machinery:**

- Performance & Utility
- Fuel Efficiency
- Cost Analysis

The input format for all these parameters are enclosed in Annexures 23.3(a) to 23.3(f)

**(f) Workshop Performance : Monthly Statement:**

- Number and percentage of vehicles on road
- Number and type of vehicles under repairs at Corporation's or private workshop
- Nature of breakdown
- Duration of breakdown : under one week, 1-2 weeks, 2-4 weeks and over one month.
- Reasons for delay in repairs
- Expected date of vehicle to be back on road

- Number and type of vehicles and equipment required to be given to the SWM Dept. by the workshop or through contractor.
- No and type of vehicles and equipment actually given
- Shortfall if any
- Reasons
- Alternate arrangements made
- Action taken

Computerisation of inventory daily with in and out information, balance in stock and economic order quantity would be very useful to keep track of availability and replacement of spares.

**(g) Inspection of Workshop Stores:**

- Whether the list of fast moving items is maintained
- Whether the list of critical items is maintained
- Whether minimum level of stock is maintained
- Items found to be out to stock
- Items found to be over stocked
- Deficiencies / irregularities noticed
- Action taken.

**(h) Each Vehicle Should Maintain a Log Book Showing Information of its Daily Movement and Performance as Under :**

**VEHICLE LOG BOOK**

Department	Date
Vehicle Number	Shift
Driver's Name :	

1. Departure from workshop
2. Return to workshop
3. Fuel taken Ltrs.
4. Kilometer reading at start of work
5. Kilometer reading at the end of work

6. Total mileage / kilometer
7. Details of trips made and locations covered
8. Inspected at point Number \_\_\_\_\_ by \_\_\_\_\_ at \_\_\_\_\_ am/pm
9. Weight recorded at weighbridge Time in / Time out

Weighbridge Operator's signature

Driver's Signature

User Dept's Signature

### **23.3.3 Disposal**

Disposal is the last and most important activity in Solid Waste Management practices. To have an effective planned operation of Disposal and to design for developing an Engineered and Scientific Disposal system, the following information needs to be established.

#### **23.3.3.1 Options**

1. Recycling
2. Processing / Treatment
3. Landfilling

#### **(a) Re-cycling:**

Recycling is a waste processing technique. By recycling new useful material is produced for use, at the same time the quantity of waste for disposal is very much reduced in volume.

#### **(b) Processing / Treatment:**

To plan for effective waste processing technique following information needs to be established. (Also refer format in Annexure 23.4(h)).

1. Physical Conversion - Refuse Derived Fuel Pellets
2. Thermal Conversion for Energy Recovery-Incineration, Pyrolysis/ Gasification.
3. Bio-Conversion for Energy Recovery-Anaerobic Digestion/Bio-Methanation.



4. Bio- Conversion for Compost production - Aerobic Composting, Vermi Composting.
5. Quantity of waste
6. Characteristic of waste - Physical and chemical
7. Extent of Landfill
8. Marketing & Demand
9. Performance Analysis Report - Success story
10. Cost Analysis
11. Training
12. Government Policy
13. Response from Private Sector

(c) ***Landfilling:***

For Landfill identification, selection, designing and operating the following information are necessarily to be established. For landfilling refer Chapter 17.

1. Site Topography and Location and Land use
2. Ownership
3. Extent
4. Habitation
5. Public consultation
6. Access
7. Hydrology - Ground Water level
8. Flood Control
9. Environmental Assessment
10. Nature of disposal
  - (a) Open dump
  - (b) Controlled dump
  - (c) Engineered land fill
  - (d) Sanitary landfill
11. Life expectancy - Void space (cubic metre)
12. Leachate and Methane Protection

13. Infrastructure
14. Personal and Training
15. Machinery
16. Monitoring - Operation and maintenance
17. Economic - Cost Analysis
18. Public Resistance.

Refer formats in Annexures 23.4(a) to 23.4(g) and also refer Chapter 17.8.2.1 on “Record keeping” in Chapter 17 on “MSW Landfills”.

### **23.3.3.2. *Daily/Weekly Records***

#### **(a) *Inspection of Processing Sites:***

- i. Whether the plant was functional during the week
- ii. Whether it received the garbage as prescribed regularly
- iii. Whether the site is properly maintained and waste stacked properly.
- iv. Quantity of Bio organic fertilizer / desired material produced
- v. Quantity of production sold during the week
- vi. Quantity of end product in stock
- vii. Any irregularity noticed
- viii. Action taken

#### **(b) *Inspection of Waste Disposal Site:*** (also refer Chapter 17)

- i. Name of the site inspected
- ii. Whether all the staff were present on duty during the week
- iii. Whether the required machinery was available on site on all the days
- iv. Whether the approach road and internal roads are properly made
- v. Whether the weigh bridge is functional and properly used
- vi. Quantity of waste received at the site on the days during the week
- vii. Whether the entire waste was spread, compacted and covered on the same day.

- viii. Whether communication facilities such as telephone, wireless etc. remained functional during the week.
- ix. Whether shelter and drinking water facility is adequate
- x. Deficiencies noticed
- xi. Remedial action taken or proposed to be taken

## **23.4 PROJECT MONITORING**

For any Project of Solid Waste Management an effective information system is necessary to monitor the progress as well as the operation and maintenance of the project, time to time.

The information format is enclosed in the Annexures 23.5(a) and 23.5(b).

## **23.5 PUBLIC AWARENESS AND TRAINING**

### **23.5.1 Public Awareness**

Public awareness is an important activity in Solid Waste Management to keep the system sustainable. The Information related to public awareness are necessary for creating a sustainable system.

### **23.5.2. Training to Ward Councilors**

In the context of 74th amendment to the constitution with decentralized Local Body administration training for Ward Councilors in the area of Solid Waste Management is essential. Training for SWM staff at all levels is also essential.

### **23.5.3 Partnership Role for Public Awareness**

1. NGO
2. CBO

### **23.5.4 Mode of Implementing Public Awareness Programs**

1. Audio & Video program
2. IEC program
3. Child to child education
4. School education

### **23.5.5.Public Participation**

- Total number of sweepers allotted for door to door waste collection work in each ward.
- Number of sweepers getting good response from citizens in the matter of doorstep collection.
- Number of sweepers not getting response from the public
- Percentage of public participation
- Improvement in this area over the last month.

### **23.6 INSTITUTIONAL ORGANISATION**

The information on Institutional Organization is very much essential for Solid Waste Management for any Town / City / Local Body with responsibilities and roles, for setting up an effective administration set-up.

1. For population 1 lakh to 5 lakhs
2. For population 5 lakhs to 15 lakhs
3. For population 15 lakhs to 40 lakhs
4. For population above 40 lakhs

### **23.7 POLICY GUIDELINES**

Information and Policy guidelines for Solid Waste Management regarding administration, enforcement, Waste processing concession, Hospital waste, Handling of legal matters are found essential for day-to-day management. (also refer Chapter 25)

1. National Policy
2. State Policy
3. Solid waste Handling Rules notification
4. Central and State PCB guidelines
5. World Health Organization guidelines

## **23.8 FINANCIAL AND ECONOMIC ASPECT**

The information on Finance and Economical aspects are essential for Solid Waste Management for implementing various schemes of projects and also to get revenue from various cost recovery system for any Town / City / local body for its self sustenance. Also for seeking external financial assistance.

The information format is enclosed in the Annexures 23.6(a) to 23.6(c).

## **23.9 LEGAL ASPECTS**

Information on Legal aspects are essential to enforce and maintain Environment Sanitation. The following information are to be made available in each Ward / Town / City and also to the public.

- Municipal Act
- Public Health Act
- Penalties and enforcement
- Administrative charges
- Special service charges
- Mobile Courts
- Public Interest Litigation cases.

The information format is enclosed in the Annexures 23.7(a) and 23.7(b).

## **23.10 COMPLAINT REDRESSAL**

Information on complaint redressal on public grievance is essential to update and get a feed-back on the nature of complaint and time taken for redressing complaints and for taking positive steps to improve the services to the public.

Following are the steps for complaint redressal system to be followed :

1. Citizen Charter
2. Centralized complaint cell
3. Zonal level complaint cell

4. Ward level complaint cell
5. Norms for Redressal of complaints
6. Monitoring of complaint redressal

**FORMAT**

**DAY/WEEK/MONTH**

Sl. No.	Date	Name of the Complainant and Address	Nature of Complaint	Details of action taken	Remarks