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SOLID WASTE MANAGEMENT

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ABSTRACT

The report is aimed to study the "Solid Waste Management" with emphasis on the following case study at "Rajahmundry". Municipal solid waste (MSW), also called urban solid waste, is a waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes collected by a municipality within a given area. They are in either solid or semisolid form and generally exclude industrial hazardous wastes. The term residual waste relates to waste left from household sources containing materials that have not been separated out or sent for reprocessing. There are five broad categories include Biodegradable waste, Recyclable material, Inert waste, Composite wastes and Domestic Hazardous Waste. The elements of municipal solid waste involve i) Waste generation, ii) Waste handling and separation, storage and processing at the source, iii) Collection, iv) Separation and processing and transformation of solid wastes v) Transfer and transport vi) Disposal. The study overviews the various waste to disposal methods and various objectives to protect environment.

Keywords: Biodegradable Substance, Collection, Composting, Demolition, Disposal, Generator, land filling, leachate, Municipal solid waste, Processing, Pellitisation, Recycling, Segregation, Storage, Transportation.

I. INTRODUCTION

Solid waste management is an obligatory function of urban local bodies in India. However the service is poorly rendered in majority of urban local bodies resulting in the problem of Health, sanitation and environment degradation. With over 3.6% of annual growth in urban population and rapid pace of urbanization the situation is becoming more and more critical with the passage of time. Infra structure development is not in a position to keep pace with population growth owing to poor financial health of most of the urban locals bodies. Solid waste management is one among essential serves which suffers which suffers of the most in such a situation. Lack of financial resources, improper choice of technology and public apathy towards solid waste management has made this service far from satisfactory.

II. NECESSITY FOR SWM

The lack of any plan for the management of solid wastes leads to the epidemic of a disease like plague and other vector borne diseases. Ecological impacts, such as water and air pollution, also have been attributed to improper, management of solid wastes. For instance, liquid from dumps and poorly engineered landfills has contaminated

surface waters and ground waters. Thus to avoid problems lie these it is necessary to adopt an environmentally compatible SWM.

III. IMPORTANCE OF SWM

Due to rapidly increasing population and rapid industrialization, the SWM has assumed significant importance. Recognizing that our world is finite and that the continued population of our environment will, if uncontrolled, be difficult to rectify in the future, the subject of solid waste management is both timely and important .the overall objective of solid waste management is to minimize the adverse environmental effects caused by the indiscriminate disposal of solid wastes, especially of hazardous wastes. To assess the management possibilities it is important to consider:

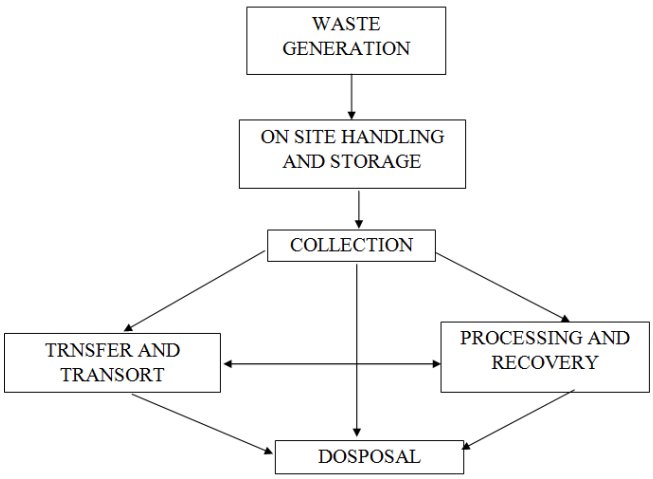
1. Material flow in society
2. The four's of the solid waste mantra:
    a. **REDUCE**- reduction in raw materials usage
    b. **REUSE**- reuse of material
    c. **RECYCLE-** recycle of material
    d. **RECOVER-** recovery of materials and energy
3. Day – to –day solid waste management.

IV. FUNCTIONAL ELEMENTS OF SOLID WASTE MANAGEMENT

The activities involved with the management of solid wastes from the point of generation to final disposal have been grouped into six functional elements:

1. Waste Generation
2. On site handling, storage and processing
3. Collection
4. Transfer and Transport
5. Processing and Recovery
6. Disposal

The inter relationship between the functional elements is shown in figure below:



V. SOURCES AND GENERATION

Knowledge of the sources and types of solid wastes, along with data on the composition and rates of generations, basic to the design and operation of the functional elements associated with the management of solid wastes.

Source of solid waste are , in general , related to land use and zoning although any number of source classifications can be developed the following categories have been found useful: *i) Residential, ii) Commercial, iii) Municipal, iv) Industrial, v) Open areas, vi) Treatment plants, vii) Agriculture, viii) Hazardous wastes*

VI. HAZARDOUS WASTES

Wastes that pose a substantial danger immediately or over a period of time to human, paint, or animal life are classified as hazardous wastes. A waste is classified as hazardous if it exhibits any of the following characteristic: *i) Ignitability, ii) Corrosivity, iii) Reactivity, iv) Toxicity*

In the past, hazardous wastes were often grouped into following categories*: i) Radioactive substances, ii) Chemicals, iii) Biological wastes, iv) Flammable wastes, v) Explosives*

The chemical category includes wastes that are corrosive, reactive, or toxic. The principal sources of hazardous biological wastes are hospitals and biological research facilities.

VII. CHARACTERISTICS OF SOLID WASTES

Information on the properties of solid wastes is important in evaluating alternative equipment needs, system and management programs and plans especially with respect to the implementation of disposal and resource and energy options.

7.1 Physical Composition

Information and data on the physical composition of the solid wastes includes: i) Identification of the individual, ii) Analysis of particle size, iii) Moisture content, iv) Density of solid wastes

7.2 Chemical Composition

Information on the chemical composition of solid wastes is important in evaluating alternative processing and energy recovery options.

1. Chemicals analysis of Indian wastes has shown that total nitrogen varies from 0.5% to 0.7% phosphorus from 0.52% to 0.8% potassium from 0.52% to 0.8% and carbon /nitrogen ratio is between 21 and 31.
2. Calorific values would range between 800 & 1010 kilo calories/kg

VIII. GENERATION RATES

The reason for measuring generation rates is obtain data can be used to determine the total amount of wastes to be managed. To assess the quantity of solid wastes generated, separated discussions in this regard are devoted to:

1. **Measures of quantities:** Both volume and weight are used for the measurement of solid wastes quantities. Unfortunately, the use of volume as a measure of quantity can be extremely misleading. So the solid waste quantities should be expressed in terms of weight**.**
2. **Statistical analysis of generation rates:** Developing solid wastes management systems, it is often necessary to determine the statistical characteristics of solid wastes generation. The statistical measures that must be considered include the mean, mode, median, standard, deviation and coefficient of variation.
3. **Expressions for unit determine rates:** In addition to knowing the source and composition of solid wastes that must be managed, it is equally important to be able to develop meaningful units of expression for the quantities generated. For example the units for residential wastes is expressed in kg per
4. **Methods used to determine generation rates:** Methods commonly used to assess the per capita generation f solid wastes are:*i) Load –count analysis, ii) Weight – volume analysis, iii) Materials – balance analysis*
5. **Typical generation rates**
6. **Factors that effects generation rates:** Factors that influence the quantity of municipal wastes generated include: *i) Geographic location, ii) Season of the year, iii) Collection frequency, iv) Use of kitchen wastes grinders, v) Characteristics of the population, vi) Public attitudes, vii) Legislation*

IX. ONSITE HANDLING AND STORAGE

The handling, storage, and processing of solid wastes at the source before they are collected is the second of the six functional elements in the solid wastes management system. Onsite handling refers to the activity associated with the handling of solid wasted until they are placed in the containers used for their storage before collection.

X. COLLECTION

Collection of solid waste is difficult and complex because the generation of residential, commercial and industrial solid wastes is diffused process that takes places in every home, every apartment buildings and every commercial and industrial facility as well as in streets, parks, and even in vacant areas of every community. They are : ***i)House – To – House Collection***, ***ii) Community Bin System, iii) Collection of Wastes From Streets, iv) Commercial – Industrial Collection Service, v) Special Collection Services:*** *Hauled container system, Stationary container system, Hoist – truck systems*

XI. TRANSFER AND TRANSPORT

In the field of solid wastes, the functional elements of transfer and transport refers to the means, facilities, and appurtenances used to effect the transfer to wastes from relatively small collection vehicles to large vehicles and to transport them over extended distance to either processing centres or disposal sites.

Transfer operation can be used successfully with almost any types of collection system. Factors that tend to make use of transfer operation attractive include: i) The presence of illegal dumps and large amounts of litres. ii) The location of disposal sites relatively far from collection routes. iii) The use small – capacity collection trucks, iv) The existence of low – density residential area, v) The widespread of medium – sized containers.

11.1 Types of Transfer Stations:

Depending on the methods used to load the transport vehicles, the transfer stations can be classified into three types

1. **Direct discharge:** In direct – discharge transfer station, wastes from the collection vehicles usually are emptied directly into vehicles to be used to transport them to a place of final disposition.
2. **Storage discharge:** In storage – discharge transfer station, wastes are empties either into a storage pit or into a platform from which they are loaded into transport vehicles by various types of auxiliary equipment.
3. **Combined direct and storage discharge:** These are multipurpose facilities designed to service a broader range of user than single – purpose facilities. It can also house a materials salvage operations

XII. PROCESSING TECHNIQUES AND EQUIPMENT

Processing techniques are used in solid wastes management systems to improve the efficiency of operations, to recover resources (usable materials,) and recovery conversion products and energy. The techniques used are: i) Mechanical volume reduction (compaction), ii) Chemical volume reduction (incineration), iii) Mechanical size reduction (shredding), iv) Components separation (manual and mechanical), v) Drying and dewatering (moisture content reduction)

Selection of specific processing techniques for SWN system depends on the purpose to be achieved. The three main purposes are: i) To improve the efficiency of SWM systems, ii) To recover usable materials**,** iii) To recover conversation products and energy

XIII. DISPOSAL OF SOLID WASTES AND RESIDUAL MATTER:

Ultimately, something must be done with solid wastes that are collected and of no further use and with the residual matter after solid wastes have been processed and the recovery of conversion products and or energy has been accomplished. There are only two residual matter disposal on or in the earth's mantle, and disposal at bottom of the ocean. Disposal on land is by far the most common method in use today. The disposal of refuse can be done be the following methods: *i) By sanitary land filling, ii) By composting, iii) By incineration, iv) By dumping into sea, v) By hog feeding, vi) By grinding and discharge to sewer, vii) By salvaging.*

CASE STUDY MUNICIPAL CORPORATION: RAJAMUNDRY

SANITATION

1.	Area in sp. Kms	: 44.50 Sq.Km
2.	Population at present	: 3.90 lakhs
3.	No. of households	: 85,582
4.	No. of slums households	: 17,395
5.	No. of slum population	: 75,981
6.	Linear length of roads	: 474.596 Kms
7.	Linear length of small drains	: 642.782 Kms
8.	Linear length of major drains	: around 20 Kms
9.	No. of PH workers engaged for sweeping	:491

10. No. of drains cleaners (small drain) engaged :458
11. No. of PH workers attending major drains : 68
12. No. of dumping yards : At R&B work shop near AP
    a. paper mills about acres 4.00
13. No. of vehicles engaged foe transportation Of garbage & Silt. : 14 contract + 2 SC
    a. Society + 8 Dwacua +1 MCR+
    b. 1 MCR Krishi
14. No. f Dumper placers : 10
15. No. of Trippers : 7
16. No of Dumpers : 200
17. No. of rickshaws : 226
18. No of Dust Bins : 550
19. Average tonnage of garbage lifted daily : around 350M.Tonne
20. Door to Door collection of garbage holds : 28 wards, 55 % 47070 House
21. No .of markets : 7

PRESENT SCENARIO OF SOLID WASTE MANAGEMENT: WASTE GENERATION RATES

- In Indian cites the waste is generally not weighted. it is measures by volume to determine the quantity of waste disposed of.
- The range of waste generation is between 200 gms per capita/day and 500 gm / capita / day

COMPOSTION OF WASTE:

PHYSICAL CHARCTERISTICS OF WASTE:

- In Indian waste there is a small percentage of recyclable materials and more of compost able and inert materials like ash and road dust.
- There is very large informal sector of rag pickers which collects recyclable waste from the streets, bins disposal sites.
- The recyclable waste constitutes, paper, plastic, metal, glass, rubber, rags, etc (7% all together)

CHEMICAL CHARCTERISTICS OF WASTE:

- **C**hemical analysis of Indian wastes has shown that total nitrogen varies from 0.5% to 0.7% phosphorus from 0.52% to 0.8% and the carbon / nitrogen ratio is between 21 and 31.
- Calorific values would range between 800 and 1010 kilo calories/ kg.

PRIMARY COLLECTION OF WASTES:

- This is most important component of solid waste management service and is grossly neglected.
- There is no arrangement of house to house collection of waste.
- The dust bin/ population ratio has large variation ranging between 1:130 and 1:2500.
- Distance between households and dustbins are also large verifying from 50 meters to 500 meters.
- In the absence of any system of primary collection of waste, street sweeping is the only method left for primary collection.

TIMING & METHODOLOGY OF STREET CLEARING:

- Generally streets sweeping is done in two sessions in a day (morning and afternoon).

- Official duty hours range from 6.00 to 8.00 hrs.
- In the morning work is generally done between 6.00 AM to 11.00 AM.
- In the afternoon between 2.00 PM to 6.00 PM.
- In the morning, sweeping is generally done.
- In the afternoon, group work is done.

TRANSPORT OF WASTE:

The container lifting devices such as dumper placers may be utilized for transportation of solid waste. In urban local bodies with financial ill health, tippers with mechanized unloading facility may be used. Or tractors with trailers may be used. In certain localities where neither a tractor trailer nor dumper placer could enter tricycles with attached carriage may be used. For bio medical waste transportation a separate van with enclosures from all sides to avoid pollution may be used.

DISPOSAL OF WASTES:

Open crude dumping of wastes in a most unscientific manner in low lying areas is the common most method used. Some urban local bodies dump their waste along the side of approach roads, creating heaps of waste on the road sides.

Land Fill Practices: As no segregation at sources takes place, all waste including hospital waste finds its way to disposal site. Quite often industrial waste is also deposited at the dump site meant for domestic waste. In this practice waste is merely deposited in low lying areas, quarry pits, roadsides without testing soil permeability and lining. It cause nuisance, foul smell, smoke and environmental pollution of ground waste, air and soil. Breeds files, rodents, pets and attract dogs. Dump site cause subsoil water pollution.

Composting: The composting is being done departmentally in few urban local bodies in a most unscientific manner. The local bodies just dump garbage into a pit and partly cover it for six months. Later they sell it out in "as is where is" condition at thrown away price.

INSTITUTIONAL DEFICIENICES:

Most of the city fathers and senior decision making bearcats do not consider this subject worth their personal attention. In spite of this service consuming the largest municipal budget, the subject is left in hand of junior level officer having no vision, foresight and training.

Division of Responsibility: There is no synchronization between various related sections in the urban local bodies. The maintenance of solid waste management vehicles gets low priority and generally old vehicles which require frequent repairs are given to this department.

Man Power Productivity: In the absence of scientific work norms and effective monitoring system, the productivity of labor and equipment very low. The main drawback is in work distribution and lack of supervision. Many lower supervision do not do not often report to duty in time and many sweeping staff tends to leave the place of work much earlier than the prescribed time. Large scale absenteeism is another factor.

MODERNISED SOLID WASTE MANAGEMENT PRACTICES:

STORAGE OF WASTE AT SOURCE:

It is essential to keep the streets and public places clean at all the time of day. This is possible only if waste producers cooperate. People have to form a habit of storing the waste at source in their personal dust bins. They should discharge the so stored waste into the municipal system only at specified times.

THE FOLLOWING MEASURE MAY BE TAKEN BY URBAN LOCAL BODIES TO MEET THE EXPECTATIONS:

- All the hotels may be directed that
- They shall not throw any solid waste in their neighbor hood, on the street, open space, vacant sites or in the drains.
- They shall keep food waste / bio-degradable waste as and when generated in any domestic waste container.
- They should keep recyclable waste in separation container.
- They should keep domestic hazardous waste separately for disposal as arranged for urban local body.
- The association of flats/ multistoried building shall be provided a community bin facility for member of their society for storage of wet domestic waste to be discharged in municipal solid waste management system.
- Similarly they shall provide another bin for recyclable waste collection for onwards transmission in the municipal system.

Financial Scenario: Most local bodies experience an acute shortage of funds even to maintain existing service and are not in position to undertake development activities and pay salaries in time.

Lack of Community Involvement: Though households and establishment spend lot of money on their well being, they do not show concern by sharing the costs for improved sanitation service.

PROCESSING AND DISPOSAL OF WASTE:

Human habitation generates large quanta of waste which has significant component of pursuable waste. In urban areas this waste is disposed of unscientifically by dumping through in low lying areas. This result in air, water and lend contamination. Nowadays several technologies are being advocated by private entrepreneurs for processing, treatment and disposal of municipal solid waste. Some practice microbial composting and vermin composting. Some are based on application in foreign countries which are being tried such as incineration power generation and fuel pellitisation. “Pellitisation” means the process by which solid wastes are transformed into or recycled products.

VERMI COMPOSTING:

It is process in which earthworms consume decayed plant animal waste with the help of bacteria in their gut to excrete fine grains soil like vermin casting rich in minerals and microbes. This is beneficial to plants. It is suitable on small scale.

ANEROBIC COMPOSTING:

This process is very slow takes about 180 days. Produce compost in airless pits in ground. It produces methane a poisonous gas which is environmentally harmful. This methane gas is fuel which is useful. The slurry produced is good organic manure.

SANITARY LAND FILLING:

Mistakenly used by municipal staff to refers to open dumping. True sanitary landfills for untreated mixed wastes require impervious soil strata or liners at bottom plus bottom piping for collecting & pumping out leachate for treatment & recirculation along with piping arrangement to collect, extract and use of the methane gas generated in such anaerobic conditions. The process is very expensive. So only rejects should be land filled.

INCENERATION:

This is a thermal process for burning the waste at a very high temperature. It requires high calorific value waste. Indian waste contains only 3 to 7 % of combustibles.

The calorific value of Indian waste at dump site is found to range from 800 to 1000 k.cal which very low. This system therefore is not suitable under Indian conditions. Moreover its establishment is also very costly. This system requires high technical skills.

CHOICE OF TECHNOLOGY:

Given the technological options available for processing and disposal of waste at the present juncture only composting of organic / food and bio degradable waste and disposal of reject at the land fill sites is recommended.

XIV. CONCLUSION

IN RAJAHMUNDRY:

- Out of 50 wards are door – to – door collection of garbage is going (garbage produced – 340 metric tons)
- Sweeping on roads, public places, etc., are done perfectly.
- Compliance criteria for different parameters under management of MSW are on process perfectly.
- They are collection, segregation, storage, transportation, processing perfectly.

Suggestions:

Sanitary land fill should be done. Incinerators should be provided without causing any air pollution by taking control measures. Power plant has to be provided to produce the electricity with zero solid waste. Segregation is to be done. The waste like paper, mica, plastic, etc., are to be separated and if necessary they are recycled. Solid waste should not be thrown on the streets, open places, and footpaths etc. Collection system should be improved. It is advisable to maintain organic manure plant so that bio – degradable organic waste can be converted into manure. Ban on throwing of waste on the streets, doorstep collection of waste. Both the streams of waste, organic / biodegradable waste as well recyclable waste, shall be collection from the doorstep. containerized handcarts or containerized tricycles or small – motorized vehicles shall be used for daily collection of food / biodegradable waste from the doorstep through public participation using a bell, whistle or horn as a mean of announcing the arrival collection staff. Sweeping of streets on all days of the year, work norms for sweeping of streets, provision of litterbins at public places, transportation of waste to Synchronize with Waste Storage Facility Dispense with Manual Loading of Waste.

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