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Waste Management Plan and Public Awareness for SWM in Kota City

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Abstract:- *Kota city is major coaching hub of India. Kota city is swiftly moving towards being a "Smart City". But municipal waste disposal is very big problem in kota city.*

Municipal waste is a challenge to every developed or developing or under developed countries. Due to its harmful effects to humans and to the environment as well, it becomes important to manage these waste. An important method of waste management is the prevention of waste material being created, also known as waste reduction. Environmental sensitivity can only grow through a major public awareness campaign. This has several tools – the electronic media the press, school and college education adult education, which are all essentially complementary to each other. Public awareness is therefore essential to protect environment in time of rapid industrialization compromising on the environmental aspects. The Problem of Solid Waste management cannot be solved until and unless every citizen is aware of the solid waste disposal and its effects. This is the time to make aware and motivate each and every individual for environmental consciousness. Present study stress to know about alternative plan for solid waste disposal i.e. incineration process in Kota city and generating public awareness for proper waste handling and disposing.

Keywords: Combustible, Biodegradable, Waste Management, Sewage, Refuse, Garbage, Landfill, Waste Reduction

1. INTRODUCTION

Solid waste is defined as the waste arising from domestic, commercial, industrial, institutional and agricultural activities. Waste (or garbage) is any material, non-hazardous or hazardous, that has no further use, and which is managed at recycling, processing, or disposal sites. The disposal of solid waste is one of the major environmental problems of most of the Indian cities. Problem associated with solid waste began with the dawn of civilization when humans started coming together in communities. This problem continues to grow with the growth of population, rapid urbanization and development of industries. Municipal solid waste management (MSWM) encompasses activities in which materials are identified as either being of value and are either thrown away or gathered together for disposal. Solid waste management includes the entire process of dealing with solid waste, starting from the collection from the primary source to ultimately disposing off it hygienically, so that it may not be a nuisance or create any harmful effect on society. The solid waste management involves, management at waste generation level, storage at the source of generation, primary collection, street cleansing, temporary storage at locality level, regular and periodic transportation of this temporarily collected waste to disposal sites and treatment plants.

1.1 GENERATION OF MSW IN KMC (Kota Municipal Corporation)

The residential areas, slums and commercial areas are major source of generation of solid waste. The approximate quantity of MSW collected is 551.0 TPD from a population of more than 10 lakhs distributed in 65 divisions in 2016 (Design Year). Thus, the average per capita generation of waste is estimated to be 480 gms/capita/day (2016).

TABLE 1: Waste Generation and Per Capita Waste

Year	Waste Generation in TPD	Per Capita Waste Gen in Kgs
2014	510.0	0.471
2016	551.0	0.480

2019	618.9	0.500
2024	751.3	0.540
2029	911.9	0.570
2034	1106.5	0.610
2039	1342.1	0.650
2044	1627.8	0.690

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Figure 1 Nanta Dumping Yard

2. CURRENT STATUS OF MSW MANAGEMENT SYSTEM IN KOTA

Waste reaching the existing dumpsite/ trenching ground

- The existing trenching site is located at Dabi Road Nanta nearly 10-15 km from the city and having an area of 52.28 Hectare. Waste transportation vehicles dispose waste at this authorized site from all over the city collected at the points designated by Nagar Nigam. With the purpose of estimating the current efficiency of total waste transportation from the city, the site was physically observed by our surveying team.

- Each and every vehicle reaching the site were noted in a log book and weighed for tare and load weight and estimation of quantity is arrived thereafter. As reported by KMC approximately 551 MT/Day waste is collected by the transportation fleet.

Residential and Commercial Establishment

- The major portion of residents belonging to the residential establishments dump their household waste outside their homes and in some cases in dustbin (if available), or on the streets (open dumps) or in the drains running in front of the house. The karamcharis/Committee collect waste from the various lanes and drains dump it in the vacant plots or in the open dumps.

- An exhaustive survey of the 500 residential establishments was carried out for a week in order to assess the collection and transportation system at source and per capita waste quantity generated. The survey includes residents from Economically Weaker Section (EWS), Low Income Groups (LIG), Middle Income Groups (MIG) and High Income Groups (HIG). These groups have been characterized as per living standards, family size, main occupation, housing typology, solid waste disposal practice prevalent in Kota city.

- However, these establishments are scattered in all wards and also the waste generated differs on a daily basis. Further, the per capita value obtained for different groups does not include street sweeping, drain silt and construction debris. Single bin system, with/without segregation is prevalent and the use of polythene for waste disposal was also found to be in vogue. Household survey indicates a higher percentage of bio degradable waste, as most of the waste here is fresh kitchen waste. The awareness of the people to recover recyclables is high which is sold to the kabadiwallas.

MSW Collection System in City

- The MSW collection in Kota city is not well organized due to lack of awareness among the citizens as well as civic bodies responsible for collection of waste. However, Collection conducted in a two stages. In first stage, the waste collected from door to door is transported to dustbins and open dumps.

- In this stage, collection is not very efficient even though large numbers of private operators/ committees are engaged in waste collection from door to door at a nominal charge. Most residents drop the waste outside their residence, which in-turn is swept away by street sweeping and lifted by means of handcart, rickshaw trolley by Nagar Nigam workers to the nearby opens dumps.

- In second stage waste filled DP Container is replaced with empty DP container by Dumper placer vehicle. The waste is transported to the designated dumpsite. Waste from open dumps is collected in trucks/tipper trucks/tractor manually or by JCB's and Loaders and finally transported to the designated dumpsite. The mode of transportation of waste from secondary dumpsites is decided on the basis of waste quantity as well as access road.

Primary Collection System

- The primary collection of waste refers to house to house collection of waste in the community bins either by the resident themselves or by the sanitary workers. There is no organized arrangement for house to house collection of waste in almost whole city except for some part of the city.

- Community bins are also not available at convenient locations for depositing the waste. As already mentioned, that there is mixed pattern of primary waste collection from households.
- Private Sweepers/ committee collect waste from household in handcarts and transport it to nearby open dump/ Dustbins. Nagar Nigam workers (*SAFAI KARAMCHARIS*) collect waste that is thrown outside the residences while sweeping the streets. The waste collection timings generally range from 6:00 AM and 2:00 PM.
- Nagar Nigam has 1130 permanent sweepers, 2134 contract sweepers, 100 handcarts, 7 auto tippers engaged in primary collection. About 70% of the primary collection equipment are in usable condition.
- Besides this, The Project team observed that pilot project for door to door collection is implemented by 15 Private Contractor in their respective wards. The Garbage lifting Summary from 01/04/2010 to 31/03/2011 states that 196 MT of waste has been collected per day which is 35% of total waste generated in 2010-11.
- The chargeshas been fixed by Kota Nagar Nigam and is different for different waste generators. The details are summarized below in Exhibit no 5.

Table 3: Details of User Fee Charges

S.no.	Waste Generators	User Fees (INR per month)	
		Area under Nagar Palika	**Area under Nagar Nigam**
1.	Slums or HH of less than 100 sq ft	30	40
2.	HH of more than 100 sq ft	40	50
3.	Commercial establishments	50	80
4.	Hotels, restaurants, eating points	80	100

Secondary Collection System

- The MSW collected from each of the primary collection points mentioned above is transported to designated open dump areas and DP containers (mostly on the main roads), which are the secondary collection points identified in Kota.
- Most of the waste is transported in rickshaw trolley and handcarts to the secondary collection points. The waste from the secondary collection points situated at congested places is lifted manually using pans and favdas tipper trolleys.
- In other cases, JCB/ loaders are used to load the tipper truck/trolley, which in turn are used to transport this waste. In addition, the JCB loaders are used to lift the construction and demolition waste.
- Based on the field observations made by the survey team, Truck /tractors/ tippers are used for picking up MSW from open dumpsites. Dumper placer is used to lift waste from DP containers. All waste is finally dumped to Dabi Road. Waste is lifted in two to three trips per day by each vehicle.

Below are the details of existing infrastructure for Collection and Transportation:

Table 4: Infrastructure for Collection and Transportation

Vehicles	Nos	In Use	Trips	Capacity in MT
Dumper Placers	17	17	2	1.8
Compactors	0	0	2	6
Tractor-Trailers	68	68	2	3
Tipper Lorrys	0	0	2	4
Trucks	7	7	2	5
Auto/ Mini Trucks	7	7	2	4
Refuse Collector	2	2	2	0.66
Pushcarts	100	100	5	0.1
Bull Dozer	2	2		

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Waste Processing and Disposal

At present KMC (Kota municipal cooperation) does not possess any Waste Processing Facility. The unsegregated waste is disposed at Dabi Road Nanta dumpsite located at Industrial area having an area of 52.28 Hectare. Waste is also dumped at various low lying and private vacant plots. Certain recycling waste is segregated and sold by Rag picking community.

Details of Manpower Available

Manpower	Available
CHO	1
AEE	0
Sanitary Officer	10
Sanitary Inspector	1
Sanitary Supervisor	12
Corporate Sanitary Workers	1130
Out sourced Sanitary Workers	2134

ALTERNATIVE SOLUTION FOR DISPOSAL OF WASTE

- Incineration is an alternative solution in the waste disposal crisis when landfill space is limited. Incineration reduces the waste volume and generates heat and power for commercial use. For MSW, incineration will depend on two main factors, moisture and heating value. Both factors have seasonal variability, which must be considered while designing an incinerator.

- Air pollution is also a major concern because contaminated or hazardous household wastes create the air emission and ash from the facility. Explosive materials shall be sorted out to avoid harming the incinerator. Thus special attention is required for MSW burning operation, which will further increase the cost of the project.

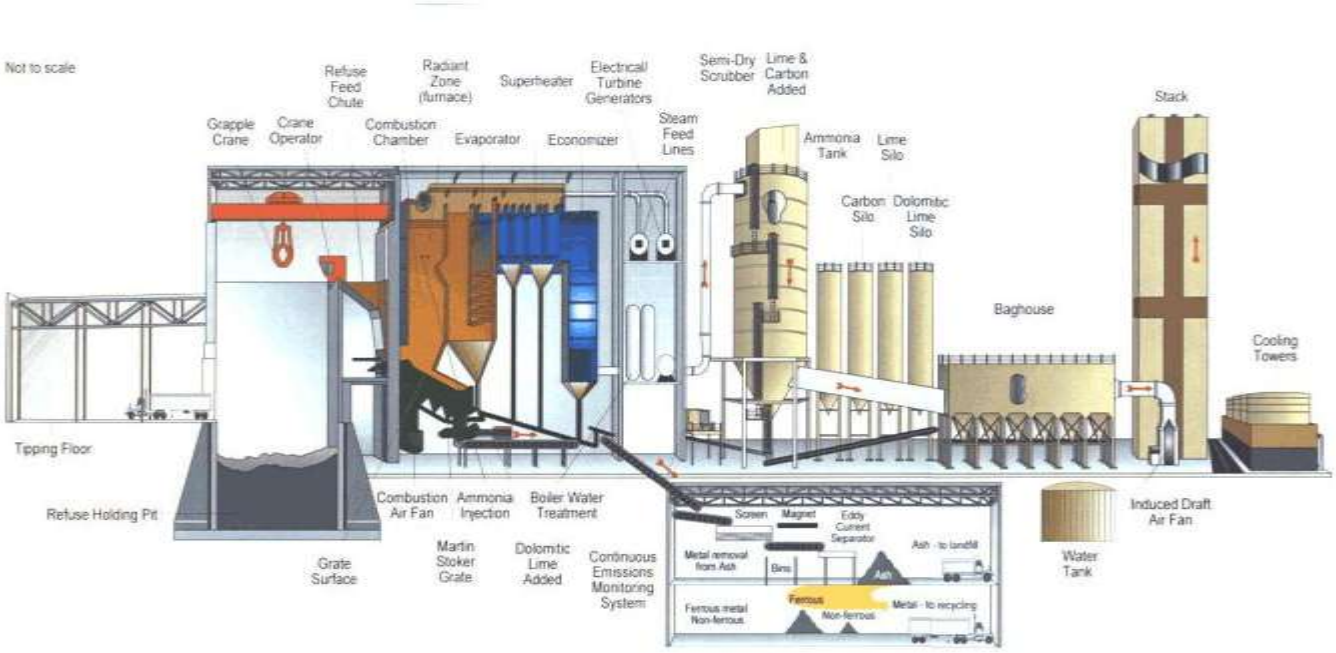
- Combustion technologies used for MSW are stoker-fired incinerator, fluidized bed incinerator, and rotary kiln incinerator. Each technology is suitable for converting waste to energy but with different advantages and disadvantages. Heat from the combustion process is used to turn water into steam that will be routed to a steam turbine-generator for power generation.

- The used steam is then condensed in condenser and routed back to the boiler. Residues produced include bottom ash (which falls to the bottom of the combustion chamber), fly ash (which exits the combustion chamber with the flue gas), and residue (including fly ash) from the flue gas cleaning system.

- It is the process of direct burning of wastes in the presence of excess air (oxygen) at temperatures of about 800 ^{0}C and above, liberating heat energy, inert gases and ash. Net energy yield depends upon the density and composition of the waste; relative percentage of moisture and inert materials, which add to the heat loss; ignition temperature; size and shape of the constituents; design of the combustion system (fixed bed/ fluidized bed) etc.

- In practice, about 65 to 80 % of the energy content of the organic matter can be recovered as heat energy, which can be utilized either for direct thermal applications, or for producing power via steam turbine-generators (with typical conversion efficiency of about 30%).

Schematic Diagram of Waste to Energy Plant



- Wastes burned solely for volume reduction may not need any auxiliary fuel except for start-up. When the objective is steam production, supplementary fuel may have to be used with the pulverized refuse, because of the variable energy content of the waste or in the event that the quantity of waste available is insufficient.

- While Incineration is extensively used as an important method of waste disposal, it is associated with some polluting discharges which are of environmental concern, although in varying degrees of severity. These can be effectively controlled by installing suitable pollution control devices and by suitable furnace construction and control of the combustion process.

- Common mass incineration plants comprise of the following functional units:

  - Waste reception, storage and pre-treatment
  - Feed-stock and combustor
  - Slag extraction / treatment of residuals / storage
  - Boiler / steam usage
  - Flue gas cleaning & Chimney

Processing Plant Capacities

- Kota city generates about 551.0 TPD of MSW and currently, no processing facilities is under operation. The waste supplied comprises of some amount of C&D and other inerts as well. The design consideration has involved an adjustment for the waste and the moisture loss during the pre-heating process to arrive at a waste to energy plant capacity of 400 TPD.

- However, the operator is advised to adopt required design modifications in accordance with the actual site requirements as well as on the future capacity requirements. The capacity expansion shall be at the operator's own expense. The operator shall further provide for proper segregation and disposal of the non-compatible components including C&D and rejects in an environmental friendly manner as per the applicable norms.

Recommended Waste to Energy Technology for KMC

The various waste to energy technologies were compared for selecting the technology to be adopted for processing the waste at KMC. Considering various parameters like material requirements, land requirement, net energy production, and Incineration technology for processing the MSW with a Sanitary Landfill Disposal facility for disposal of rejects is recommended as the proposed solution over sanitary landfill disposal.

3. CONCLUSIONS

- Solid waste management is one such activity, where public participation is a key to success. The local body can never be successful without active community participation, whatever may be the investments made from the municipal or Government funds.

- The local body should therefore, seriously consider involving community in all programmes through a consultative process and variety of other communication approaches.

- Public awareness, effective community participation, transparent and clean administration, introduction of citizen charters and accountability at all levels can only bridge this gap. People do desire a better quality of life and raise their voice quite often for improving solid waste management services, but when it comes to cost sharing, they shy away.

- Nor do they use the facilities already provided by the urban local bodies and keep on littering streets, regardless of income or education levels. It is a common experience that at places where the local body has made a provision of dustbins, people tend to throw the waste outside the bin instead of using the facility provided.

- Though households and establishments spend a lot of money on their well-being, they do not show concern by sharing the costs for improved SWM services, despite knowing fully well that traditional services are poor and can be updated only by mobilizing additional finances.

- However, of late some public responses are seen towards sharing of costs if people are assured a better quality of service. Studies at Panaji, Trivandrum, Cochin, Calicut, Delhi and Bangalore have shown that people are ready to share the costs if the level of service is improved.

- These examples should inspire the citizens of kota city to make kota one of the best clean city across the Rajasthan.

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