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A Comparative Analysis between Environmental Protection (Waste Management) Regulation 2000 and Bidhan Nagar Municipal Solid Waste Management to Propose a Realistic Solutions

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***Abstract* - A comparative analysis of municipal solid waste management (MSWM) of environmental protection (waste management) regulation 2000 and Bidhan Nagar municipal corporation was carried out in order to identify its current status, and highlight the prevailing conditions of MSWM. An overview of the various aspects of MSWM in these two model is provided, with emphasis on comparing the legal, technical, and managerial aspects of MSW. Collection systems and recycling practiced to the involvement of the government sector, are also presented.**

Keywords – Solid Waste Management, Realistic Solutions

I. INTRODUCTION

Municipal solid waste management (MSWM) is an integral part of urban environmental planning [1, 2, 3, 5, 8, 11, 12]. The characteristics and quantity of MSW arising from domestic, commercial and industrial activities in a region is not only the result of growing population, rising standards of living and technology development, but also due to the abundance and type of the region's natural resources [4]. The collection, transport, treatment and disposal of solid wastes, particularly wastes generated in medium and large urban centres, have become a relatively difficult problem to solve [6,7]. To promote sustainable development, waste management has evolved into material flow management in many developed countries, and includes careful handling of raw materials and reduction of emissions as well as climate/environment protection [9, 10, 13, 14].

More than 90% of the MSW generated in India is directly disposed on land in an unsatisfactory manner .The problem is already acute in cities and towns as disposal facilities have not been able to keep pace with the quantum of wastes generated. It is common to find large heaps of garbage lying in a disorganized manner in every nook and corner in large cities. Salt lake is one of India's plane cities and like other large cities faces similar problems of poor solid waste management. The objective of this paper is to analyze some of the strengths and deficiencies in the current MSW management (MSWM) system in Salt Lake and propose feasible solutions.

II. OBJECTIVE AND SCOPE OF PRESENT WORK

In most countries MSW is collected as a mixed stream and disposed of, typically, by landfill or incineration. These disposal methods do not take advantage of the properties of the organic fraction and recycling nutrients and organic matter. Generally only a small part of the MSW is recycled (waste paper, bottles etc.) usually excluding the digestible fraction. In recent years both source separation and recycling have attracted increasing attention. Consequently, separate fractions of MSW are becoming available for more advanced treatment prior to disposal or recycling.

In the view of what has been stated so for the present work has been under taken with a view of study the following –

- Discuss the various components of waste collection system.
- Explain the characteristics of waste containers relative to their use.
- Evaluate how a collection system is planed and implemented.
- Estimation of municipal solid waste.
- Design the location of waste bins using GIS.
- Planning for segregation, recycling and treatment.

III. COMPARISON

In this section of this proposed work, comparative analysis is done between the Environmental Protection Regulation 2000 and Solid Waste Management of Bidhan Nagar Municipality.

1. Generating Waste

Environmental Protection (Waste Management) Regulation 2000

(1) If waste is, or may be, generated under the authority, program or approval, the administering authority—

(a) Must consider the following issues—

(i) Segregation of the waste;

(ii) Emission controls;

(iii) Storage of the waste;

(iv) Monitoring and reporting of matters concerning the waste; and

(b) Must have regard to any cleaner production program prepared to address the waste generation; and

(c) Must have regard to the application of the waste management hierarchy and principles to management of the waste; and

(d) Must have regard to any waste management strategic plan in force for the local government area in which the waste is, or may be, generated or dealt with.

In this section—

"Cleaner production program" means a program to identify and implement ways of improving a production process so that the process—

(a) Uses less energy, water or another input; or

(b) Generates less waste; or

(c) Generates waste that is less environmentally harmful.

Bidhan Nagar Municipal Corporation in context of Generating Waste

Solid waste management is a statutory function and Bidhan Nagar Municipal Corporation is responsible for the management of MSW generated in the city. The city is divided into 88 block and all operations of solid waste management (SWM) in this area are performed under four heads – sweeping , collection, transportation and disposal. Major sources of MSW in the Bidhan Nagar Municipal Corporation area are residential areas, commercial/market areas, offices and institutions. Salt lake city generates approximately 200.578 ton/ d of MSW daily. Bidhan Nagar Municipal Corporation has estimated the amount of MSW generated from various sources in the city, shown in table I.

Table I

Sources And Quantity Of Solid Waste.

Sources Of Waste	Weight(Kg)
House	110085
Market	34450
Play Ground	75
Park	1452
Institution	7342
Office	7824
Shopping Mall	2707
Hospital	2155
Bhavan/Complex	32879
Factory	1600
Total	200578

Sources: Bidhan Nagar Municipality Corporation (2011)

2. Collection of Municipal Solid Waste

Environmental Protection (Waste Management) Regulation 2000

(a) Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely :-

i) Organising house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels);

ii) Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas;

iii). Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes;

iv) Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose;

v) Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerised carts or other small vehicles;

vi). Horticultural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws;

vii). Waste (garbage, dry leaves) shall not be burnt;

viii) Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws.

(b) The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town.

Bidhan Nagar Municipal Corporation in context of Collection of Municipal Solid Waste

Waste collection is inadequate, in which a large percentage about 10% remains either in the places where it originates or staying longer in the collection points leading to a number of environmental and health hazards e.g. dust, smell, smokes from burning etc. Furthermore, the mounds of waste stored become breeding grounds for disease carrying flies, cockroaches, mosquitoes and rats and thus creating health risks.

Due to climatic factors like high temperature and humidity along with high organic matter content, MSW decomposes rapidly resulting in unhygienic conditions. Hence in most areas, collection has to be done on a daily basis. Currently, different collection methods are being used in Bidhan Nagar Municipal Corporation and include: house-to-house collection (primary collection), and collection from roadside storage areas (3-sided enclosures). The remaining waste is disposed on vacant land and in canals.

Salt Lake city is divided into 88 blocks. For better SWM 6-8 sweepers are provided in each block. A broom, a scraper and a small bin and a tri cycle bar is provided to each sweeper. 4 members for sweeping 2 member for market sweeping and 2 member for house to house collection is working for waste collection. After the collection the waste they just disposed into the community bins.

3. Segregation of Municipal Solid Wastes

Environmental Protection (Waste Management) Regulation 2000

In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials. The municipal authority shall undertake phased programme to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.

Bidhan Nagar Municipal Corporation in the context of segregation of Municipal Solid Waste

Wastes produced in the house are called household wastes. It is classified as dry waste, wet waste and hazardous wastes. Plastic, packing materials, and pieces of glass are not bio-degradable, that is, they do not decay or decompose. They are called dry waste. The left over vegetables, unconsumed food, fruits, flowers, meat, and bones are bio- degradable and are known as wet wastes. Used battery cells, paint boxes, chemicals, pesticides, used syringes, unused and outdated medicines and so on are called hazardous wastes.

But Bidhan Nagar Municipal Corporation is not taking any steps for segregation or classified as dry waste, wet waste and hazardous wastes. Also they are not organising awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials.

4. Storage of Municipal Solid Wastes

Environmental Protection (Waste Management) Regulation 2000

Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely -

(a) Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users;

(b) Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly;

(c) Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green; those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black;

(d) Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper

Bidhan Nagar Municipal Corporation in the context of storage of Municipal Solid Wastes

Bidhan Nagar Municipal Corporation has provided 45 storage places in the form of large masonry storage enclosures, and dumpers for temporary storage of MSW, which is collected from the city during secondary collection. Large masonry storage enclosures are open spaces enclosed on three sides with a masonry wall of about 1.2–1.8 m height, with capacities ranging from 30 to 60 m^3 and located in congested areas with narrow winding streets. Waste is brought to these depots in handcarts during primary collection while trucks can drive into these areas and pick-up waste from here for disposal to the landfill site. These large storage enclosures can also be thought of as transfer stations even though they are not formally designed for compaction, nor do they have equipment for separation or processing.

5. Transportation of Municipal Solid Wastes

Environmental Protection (Waste Management) Regulation 2000

Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:-

(a) The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing;

(b) Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.

Bidhan Nagar Municipal Corporation in the context of transportation of Municipal Solid Wastes

A part from absence or improper locations for transfer stations for solid waste collection, the routing system for trucks in Salt lake has a lot to be desired. Some areas of the city are extremely difficult to access by refuse collection trucks, waste is transported to a collection point. In those situations, the trucks make one trip or two instead of three times a week as per requirements. Thus, much waste remains uncollected.

Bidhan Nagar Municipal Corporation aims to provide daily collection, but overflowing bins are common features throughout the city, despite the excess storage capacity. A major factor responsible for this problem is the frequency of collection. In practice, the collection frequency is less than the design requirement (daily); in many cases collection is on a weekly basis. Another major factor is the location of the bins. These locations are decided without considering vehicle accessibility, population density or rate of waste generation in the local service area.

6. Processing of Municipal Solid Waste

Environmental Protection (Waste Management) Regulation 2000

Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:-

(a) The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes.

(b) Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without

energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorisation.

Bidhan Nagar Municipal Corporation in the context of processing of municipal solid waste

The waste dumped in Muller very area does not undergo any treatment; hence a threat to the environment and pose health risks to the inhabitants. For this reason, the biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of waste.

7. Municipal Solid Waste Recycling

"Recycling" means the process of transforming segregated solid wastes into raw materials for producing new products, which may or may not be similar to the original products. Recycling systems, even though unorganized, are often well Established in developing countries. The major characteristics of waste recycling systems existing in Bidhan Nagar municipal corporation area are:

(a) Newspapers, old bottles, and metals are sold from or reused in households.

(b) Waste pickers sort recyclable or saleable materials from the refuse heaps or vats.

(c) Waste collectors spend 25–30% of their time sorting saleable materials from refuse both at the collection points and the disposal site.

(d) Many residents of poor communities in the vicinity of the dumping site or disposal area scavenge for their livelihood.

Table II
Block Wise Quantity of Solid Waste

Sector	Block	House (In Kg)	Market (In Kg)	Play Ground (In Kg)	Park (In Kg)	Institution (In Kg)	Office (In Kg)	Shoping Mall (In Kg)	Hospital (In Kg)	Bhavan/Complex (In Kg)	Factory (In Kg)	Total (In Kg)
I	A Block	15,703	2000	1	1	235	213	0	0	2200		20,353
	B Block	16002	6200	2	5	30	172	400	0	0		22,811
	C Block	11268	2000	1	6	50	70	0	0	5832		19,227
	D Block	2708	2000	0	2	55	195	1600	750	1850		9160
	E Block	2260	4000	2	1	45	209	5	0	2600		9122
II	A Block	10584	2000	1	6	0	47	0	0	1500		14,138
	B Block	12700	2000	1	5	67	33	0	55	0		14,861
	C Block	9024	4000	1	2	23	67	0	150	0		13,267
	D Block	1908	0	0	1	0	20	0	0	80		2008
	E Block	1720	2000	1	1	0	17	0	200	75		4014
III	F Block	9044	2000	41	3	172	175	2	0	2885		14,322
	G Block	5880	2000	3	1	260	30	0	0	1400		9574
	H Block	5288	0	3	2	15	34	0	200	345		5887
	I Block	3932	2250	1	1	0	23	150	800	675		7832
	J Block					700						700
	K Block	208						350		3520		4078
	L Block					3900	350			750		5000
IV					1400							1400
V	A Block	500				220	385			1100		2205

Sector	Block	House (In Kg)	Market (In Kg)	Play Ground (In Kg)	Park (In Kg)	Institution (In Kg)	Office (In Kg)	Shoping Mall (In Kg)	Hospital (In Kg)	Bhavan/Complex (In Kg)	Factory (In Kg)	Total (In Kg)
	B Block					530	525			1360	200	2615
	D Block	388	2000	2			760			650	200	4000
	C Block					420	1450			650	450	2970
	E Block	960				445	1600			200		3205
	GM	88		5	10	70	1350			1400	200	3123
Total(Kg)		**110085**	**34450**	**75**	**1452**	**7342**	**7824**	**2707**	**2155**	**32879**	**1600**	**200578**

(e) Waste pickers and waste collectors sell the assorted materials to middleman buyers who often perform some simple sorting and cleaning.

(f) Middlemen buyers sell to wholesalers or large dealers, and some components of waste are cycled back to primary industries.

8. Disposal of Municipal Solid Wastes

Environmental Protection (Waste Management) Regulation 2000

Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing.

Bidhan Nagar Municipal Corporation in the context of Disposal of wastes

In Salt Lake, the disposal site of Muller very is located in sector- v at an average distance of 5 km from the collection points. Bulldozers at the disposal area are used to spread and level the garbage. There is no restriction for non-biodegradable, inert waste and other waste that are not suitable either environment and pose health risks to the inhabitants. For this reason, the selection of sites where to dispose the waste has to be done scientifically with a number of feasibility studies.

IV. Result And Discussion

From the above comparison it was found that for proper solid waste management, all block wise estimation of quantity of solid waste is necessary. If the quantity of solid waste in each block is known, it can be distributed the number of sweeper in each block for 100% collection and number of vehicle as per required. Then segregation is necessary for non hazardous wastes. The most important thing is the location of waste bins for proper utilise and easy to transfer of garbage. Another thing is that biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes.

A. Block Wise Estimation of Solid Waste

Major sources of MSW in the Bidhan Nagar Municipal Corporation area are residential areas, commercial/market areas, offices and institutions. So, for accurate estimation of quantity of municipal solid waste in each block, it is necessary to know the number of house in each block, number of market in each block, number of office and institution in each block. Form this figure it can be calculated the quantity of waste generation in each block. Table II indicating the block wise quantity of municipal solid waste generation.

B. Segregation of solid waste

In all parts of the Salt Lake, people by and large do salvage re-usable or saleable material from waste and sell it for a price, e.g. newspaper, glass bottles, empty tins, plastic bags, old clothes etc., and to that extent such reusable / recyclable waste material is not thrown out for disposal. However, a lot of recyclable dry waste such as waste paper, plastic, broken glass, metal, packaging material etc., is not segregated and is thrown on the streets along with domestic / trade / institutional waste. Such waste is picked up to some extent by poor rag picker for their livelihood. At times they empty the dustbins and spread the contents around for effective sorting and collection. By throwing such recyclable material on the streets or into a common dustbin, the quality of recyclable material deteriorates as it gets soiled by wet waste, which often contains contaminated and hazardous waste.

The Local Bodies may actively associate resident associations, trade and industry associations, Central Organization's and NGO's in creating awareness among the people to segregate recyclable material at source and hand it over to a designated identified waste collector. The local body may give priority to the source segregation of recyclable waste by shops and establishments and later concentrate on segregation at the household level.

The upgraded rag-pickers on becoming door-step waste-collectors may be given an identity card by the NGO's organizing them so that they may have acceptability in

society. The local body may notify such an arrangement made by the NGO's and advise the people to cooperate.

This arrangement could be made on "no payment on either side basis" or people may negotiate payment to such waste collectors for the doorstep service provided to sustain their efforts.

C. Design the Location of Waste Bins

The collection points were found to be arbitrarily located while the traditional method of selection them was not a scientific one. There is no background information collected to support the sitting of the collection points. In general, the collection points were on an inefficient route. If we use the GIS applications for design the location of waste bins is capable and help improve waste collection in residential areas of Salt Lake.

D. Treatment and Disposal

It is essential to save the recyclable waste material from going to the waste processing and disposal sites and using up landfill space. Profitable use of such material could be made by salvaging it at source for recycling. This will save national resource and also save the cost and efforts to dispose of such waste. This can be done by forming a habit of keeping recyclable waste material separate from food waste and other bio-degradable wastes, in a separate bag or bin at the source of waste generation, by having a two-bin system for storage of waste at homes, shops and establishments where the domestic food waste (cooked and uncooked) goes into the Municipal system and recyclable waste can be handed over to the waste collectors (rag-pickers) at the door step.

By and large, crude dumping of waste is done in the country without following the principles of sanitary land filling. As negligible segregation of waste at source takes place, all waste including hospital infectious waste generally finds its way to the disposal site. Quite often industrial hazardous waste is also deposited at dump sites meant for domestic waste.

The waste deposited at the dump site is generally neither spread nor compacted on a regular basis. It is also not covered with inert material. Thus, very unhygienic conditions prevail on the dump sites.

V. CONCLUSIONS

In this process we want to develop the social-scientific aspects and operationalize them as assessment tools. An empirical assessment of all the problems surrounding public acceptance, i.e. social compatibility, is the ultimate goal. The work describes the various components of waste collection system, explain the characteristics of waste containers relative to their use, estimation of municipal solid waste and design the location of waste bins using GIS for proper solid waste management and most important thing is planning for segregation, recycling and treatment. The tools presented in this paper have the prospective to find the feasible solution not only in Salt Lake but also in other transient economies where sustainable waste management practices are yet to meet a critical mass of success.

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