Chalsi Gautam, 2021, 9:3
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

Review Paper of Assessment of Municipal Waste: An initiative to sustain our Biodiversity

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Abstract- Municipal solid waste (MSW) management is one of the most serious concerns in India. In most of the Indian cities management of MSW is very poor and unscientific. This study illustrates the present scenario of MSW management in Agra city (India). It was observed that MSW management in Agra in improper and unsustainable. Population of city is more than 15 lakh and per capita waste generation is approximately 490 gm per capita per day. Door to door waste collection is being done by Agra municipal corporation. All collected waste is being dump on an open ground without segregation. There are many inadequacies in the current practices followed for the management of solid waste. Study recommends the use of modern technology, skilled manpower, design of sanitary landfill for proper management of MSW.

Keywords:- MSW management, Study recommends etc.

I. INTRODUCTION

Solid waste management (SWM) is a challenging issue for most of the developing countries of the world (Seik, 1997; Suochenget al., 2001; Damghani et al., 2008; AbdManaf et al., 2009). Rapid increase in population, industrialization, and urbanization are continuously increasing the problem of waste management (Pokhrel & Viraraghavan 2005; Talyanet al., 2008; Chattopadhyay et al., 2009).

In most of the Indian cities urban local bodies (ULBs)/ municipal authorities are responsible for management of solid waste(Pattnaik & Reddy 2010). ULBs face many problems like insufficient fund, lack of manpower and technology (Pattnaik & Reddy 2010). Therefore, it is very difficult for them to properly manage the solid waste. In the present study, SWM practice in Agra city has been assessed and recommendation for the improvement have been provided..

The Municipal Corporation area covers the entire Agra city except for the area controlled by Cantonment Board. Agra city is of historic importance, due to the numerous historical monuments in and around the city. Thus it is a major tourist destination as well as regional urban commercial centre of India.

Fig 1. Map of Agra.

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Agra houses one of the '7 wonders of the World' i.e. Taj Mahal. Agra lies on the parts of the Great Indo-Gangetic Plain region. The water table is 6 m to 8 m below ground level.

II. MSW GENERATION

Major sources of solid waste in Agra city are household waste, shops and commercial establishments. Waste from industries, hospitals, slaughter houses, street sweeping. also contributes to MSW in some parts due to lack of public participation and improperly managed separate handling facilities. Construction and demolition wastes are mixes with the MSW in some area. petha sweet making produces substantial quantity of organic waste in the city.

Dairy waste also contributes to city waste generation. Apart from this there is a huge generation of leather and rubber trimming from small footwear units spread in the city which contibutes major portion to MSW. Agra is estimated to generate MSW of about 750 TPD (Tonnes per day).

The per capita waste generation rate is about 492 grams/person/day. Whereas, according to NEERI survey on SWM in India, (February 1996) the per capita waste generation in the city with population range of 10-20 lacs should be 270 grams per capita per day.In last five decades the city experienced maximum growth rate of 32.15 per cent during 1971-81, when the municipal corporation limits were largely extended.

1. Solid waste collection and transportation:
At the present, the door to door collection is being done by the Agra municipal corporation (AMC). Collection of MSW happens in three types of container. Green receive organic and bio degradable waste, Blue containers receive dry and recyclables where as the Red containers collect Domestic Hazardous Waste (DHW).

Primary and secondary collections are done by using handcarts and small motorized vehicles. The various equipmentis being given to the workers for the collection of the solid waste. The various vehicles used for collection are shown in figure 2. Dry waste are transported to Material Recovery Facility (MRF) located at Rambagh. Construction & Demolition Waste (C&D Waste) is both collected and transported by private company.

Fig 2. Vehicles used by Municipal Corporation Agra to collect the waste.

2. Disposal of Solid waste:
Before 2009 the solid waste of Agra city was dumped to a site called KlindeeVihar, after 2009 the site was modified into a park after it was completely filled with the solid waste. In year 2009 itself the tender for the SWM was given to the company named Ultra Urban on the PPP (public private partnership) basis, which worked for almost 22 months. The company set up a solid waste compost plant at Kuberpur site to make fertilizer (Fig. 3).

Fig 3. Present scenario of the segregation and compost plant at Kuberpur.

Due to some dispute between the municipal corporation Agra and the company and also the company was not benefited with this project so it cancelled the contract. After 2011 the solid waste of Agra city was directly dumped at the landfill site at Kuberpur.

The heaps of solid waste can be seen there. There was no well segregation of biodegradable and non-biodegradable waste and also the bio medical waste is not separated.

In 2016 the new tenders were allotted for the waste to energy on PPP basis to a private company which will set up a waste to energy plant at Kuberpur site. Disposal and management of Bio-Medical waste (BMW), were outsourced by AMC to private organization, They lifts the waste dumped outside the medical establishments in dual bins and transports the same to incineration facility operated by them on the outskirts of the city.

However, all the clinics or smaller nursing homes etc. are not registered with the company and often dump the BMW at open dumpsites/ dhalaos along with the MSW. Recently AMC improves processing of wet waste by installing three decentralized Waste to Compost (WTC) Plants and one flower to Compost Plant. There is also a centralized Waste to Compost facility at Kuberpur Agra operated by private company named India Organics.

AMC has taken a good initiative by preparing compost at parks. there are 75 parks in the city which use the organic waste that is generated in the park such as leaves and twigs.These were collected in small pits at park itself. The semi compost produced at the park were taken to Kuberpur organic waste to compost plant and makes finished compost product.

III. PROPOSED MSW MANAGEMENT PLAN

Presently, in Agra there is limited system of primary collection of waste. It is proposed that AMC shall identify more NGOs/private operators for this purpose and authorize them for undertaking this activity. The NGOs/private operators shall be assigned responsibility area wise.

The private operator authorized for a particular area shall ensure that there is proper waste collection of biodegradable and recyclable waste as per the plan from all sources in his area. The waste will be stored by the generators in two separate bins, one each for biodegradable and recyclables. NGOs/private operators will ensure day-to-day collection of waste. Door-to-door collection of garbage will be through rickshaw trolleys. Initially AMC workers will do street sweeping on a daily basis. Overtime number of workers will reuse (due to retirement and introduction of VRS scheme) and this service will also be given to private operator. The street sweeping waste will be collected in wheelbarrows. The waste collectors will transfer bio-degradable and non-biodegradable waste to the secondary collection location and will sell the recyclable waste.

The existing infrastructure for secondary collection of waste will be upgraded to comply with MSW Rules 2016 and additional secondary collection locations will be developed to ensure that no primary collection staff has to travel more than 250m for dumping of waste. Construction and demolition wastes will be used for making bricks or filling-up the man- made low-lying areas. The local residents shall hand-over the construction waste to AMC workers for proper use.

Table 1. Source & Types Of Municipal Solid Waste.

Source	Typical Waste Generators	Components of solid waste
Residential	Single & multi family dwellings	Food waste, paper, cardboard, plastics, textiles, glass, metals, ashes, special wastes (bulky items, consumer electronics, batteries, tires & household hazardous wastes
Commercial	Stores, Hotels, Restaurants, Markets, Office buildings	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, govt. centres, hospitals	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Municipal waste	Street cleaning, landscaping parks,beaches,recreational areas	Street sweeping, landscape & tree trimmings, general wastes from parks, beaches and other recreational areas

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Most of the waste generated from slaughter houses such as bones, skin and horns is recyclable and shall be sold to the recyclers. The only solid waste generated from the slaughter houses is flesh cuttings, which shall be buried in a designated area. The private workforces and AMC workers shall be properly equipped to avoid direct contact with waste.

Improper and unorganized disposal of Municipal Solid Waste (MSW) in open area sand landfills have a negative impact on the living conditions of human beings as well as the overall environment.

It results in spread of communicable and non-communicable diseases among human beings and animals, thus affecting the welfare, livelihood and economic productivity.

In addition, it causes contaminations of soil, surface water, ground water and generation of toxic and green-house gases.

1. Population of Agra:

As per as census 2001, the population of Agra is estimated 12.75 lakhs (excluding population of cantonment of Agra) with a decadal growth rate of 30.37%.

During the post-independence period commerce showed a phenomenal increase with the associated industrial development and establishment of industrial estate, which resulted in the increase of city population.

In the last four decades growth rate was maximum of 32.15%. In the year 2011, population of Agra crossed 15 lakhs and solid waste also increased with the population increase.

2. Nagar Nigam:

The main organization which is responsible for urban governance and civic management is the Agra Nagar Nigam.

The Nagar Nigam is divided into 90 election wards which are further divided into 19 Sanitary wards being headed by sanitary inspectors. The sanitary inspector is responsible for managing the fleet routes, collection procedure, allocating diesel to vehicles, street sweeping and de-lineation of responsibility of the supervisors and safai karamcharis.

3. Administrative Structure of Nagar Nigam:

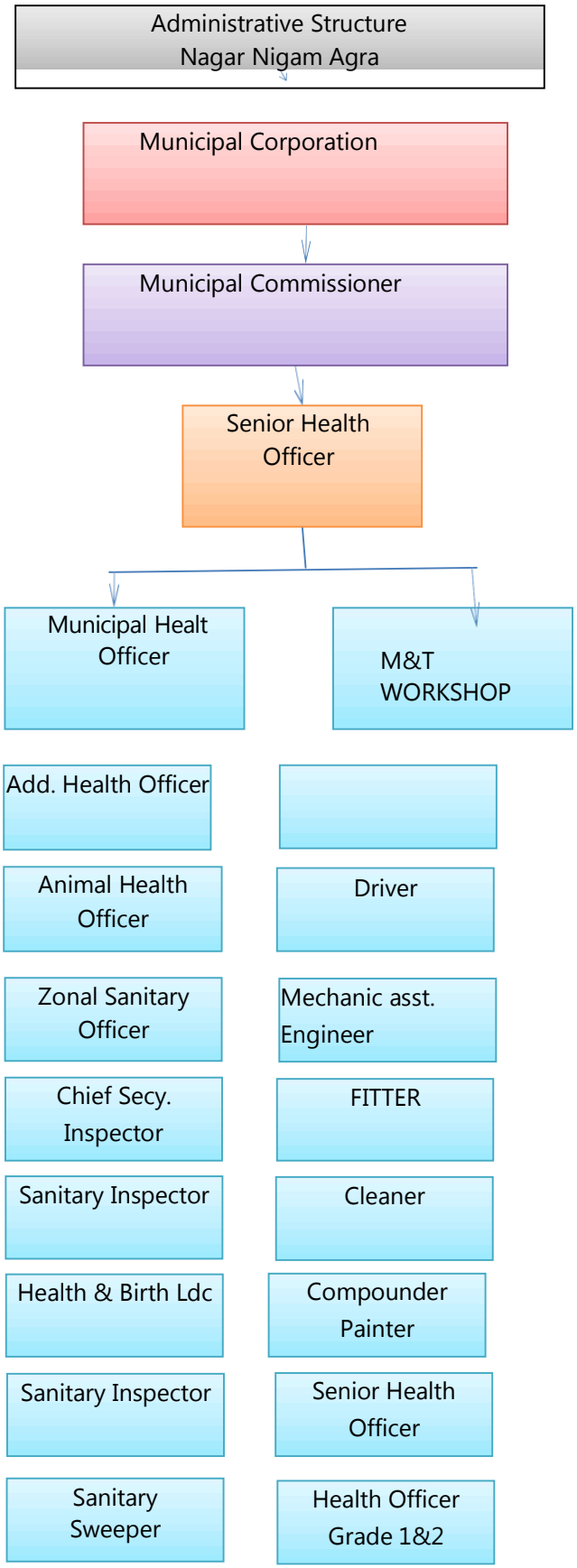

Fig 4. Administrative Structure of Nagar Nigam.

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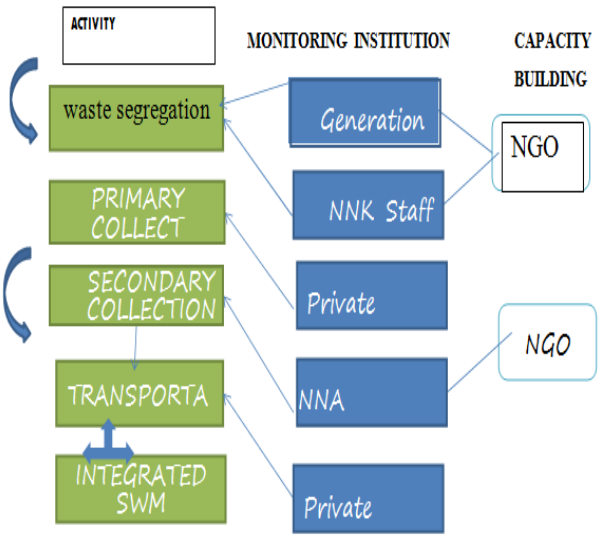

Fig 5. Proposed Structure and Framework of SWM.

IV. SOURCES OF WASTE GENERATION IN AGRA

The primary source of waste generation in Agra city are the local households, markets and commercial establishments such as hotels, restaurants, shops etc. Due to mismanagement and unavailability of separate handling facilities, Waste from industrial establishment, Hospitals and nursing homes, slaughter houses, streets weeping and sanitary drains etc. also contribute to MSW.

As lot of demolition of old structures and reconstruction works are taking place, construction and demolition waste is significant. Agra is famous for Petha sweets and petha making produces substantial quantity of organic waste. Dairy waste also contributes to city waste generation. Apart from this, there is a huge generation of leather and rubber trimming from small footwear units spread in the city which adds up major part into Municipal solid waste.The waste generated in the various parts of the city reaches the open dumps and dustbins that are located in each part of the city

Waste from Commercial establishment:

The commercial areas identified in Agra city are situated throughout the city and include Sanjay Palace, Bhagwan Talkies chaurah, Bijligha chaurah, Nai ki Mandi, Rakabganj, DayalBagh Road, Bhagirath Marg etc. These areas are mixed zones comprising of commercial (shops and markets) and residential areas as well as hotels and restaurants. MSW generated from Commercial establishment is more recyclable and inert waste compared to organic waste. However a bulk waste like cartoon etc. is recycled at source and does not add on to total MSW generation.

1. Waste generation from Hospitals & Nursing Homes:

Apart from Biomedical Waste generation, Hospital and nursing home generates non infectious waste which contributes to total MSW generation. According to the CPHEEO guidelines the waste generation by medical institution will be around 1.5kg/bed/ day of which 75% wil be noninfectious i.e., Municipal solid waste and25% will be biomedical waste. As reported in City Development Plan and by NNA,Agra has 127private hospitals and about 101 government hospitals and medical offices in the city. The total bed strength reported is about 8000.

2. Waste generation from Hotels/ Restaurants/ Banquet Hall:

A summary of number of eating joints/ hotels identified in Agra city is provided in Table 4 .The waste from these establishments mostly includes left-over food, crockery. Workers of these establishments dump the wastes at near by container/ open dump from where the same is transported to designated dump site by Nagar Nigam workers. An estimate of the total waste generated in metric tonsper day (MT/day) from hotels, restaurants, guest houses, marriage halls.

3. Waste generation from Industries:

There are various small scale and cottage industries in Agra city. Based on observations made by the survey team about these industries, the MSW is primarily generated from Petha and Footwear unit. Petha units are mostly located at Noori Darwaza and Raja Mandi .The petha waste is biodegradable and about 50% is eaten up by grazing animals. However, significant amount of waste is thrown in nallah and nearby secondary collection points.

The leather and rubber trimming from foot wear industry is accounted larger, Khattipara, Azamganj, Gobarchowki, pankisarai, Naikimandi, shakuntla Nagar, Raj Nagar, khaitana road . Waste from Large leather and Rubber industry is not prominent but job works done by individuals for larger establishment which are mainly done at cottage level does not practice recycling rather throw waste in open areas or nallahs. It was also observed that accumulated

waste at open dump or dustbins was burnt in order to reduce the volume when it remains unattended for several days.

4. Construction and Demolition Sites:
This waste varies from time to time depending up on the construction or demolition activities in Agra city. A major portion of this waste is generally used in reconstruction activities or for filling up of the low lying areas or kacha road. The individual generating construction waste generally engages private vehicle to collect the construction waste and dump it any elsewhere in the city for a nominal cost.

V. MUNICIPAL SOLID WASTE MANAGEMENT STRATEGY IN AGRA

MSW COLLECTION IN AGRA CITY

MSW Collection conducted in 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 sweepers 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 streets weeping 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 sand 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.

1. Primary Collection Systems:
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. Private Sweepers collect waste from households inhand carts and transport it to nearby open dump/ Dustbins.

Nagar Nigam workers (safaikaramcharis) collect waste that is thrown outside the residences while sweeping the streets.

2. Secondary Waste Collection System:
The MSW collected from each of the primary collection points is transported to designated open dump areas and DP containers (mostly on the main roads), which are the secondary collection points identified in Agra. Most of the waste is transported in rickshaw trolley and handcarts to 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.

3. Recyclable Wastes:
The recyclable wastes are segregated manually by kabadiwalas and rag-pickers. The kabadiwalas purchase recyclable waste from residential and commercial establishments while rag-pickers collect recyclables from marketplaces, dustbins, and dumping sites, and sort them before selling off. Majority of such groups are located at Ravidas Nagar, North Idgah, Police line, Idgah (also on the back of Idgah Nallah), Kathghar, Mohanpura, Chipitola behind puranimandi, Rakab ganj near police station etc.

4. Bio-degradable Wastes
The bio-degradable waste is not segregated either at the primary collection points,secondary collection points, or dumping sites. Most of the bio-degradable waste was found to be eaten by animals at the grazing on the open dumping sites.

5. Non-biodegradable Wastes:
Street sweepings and drain silt is a major constituent of the non-biodegradable wastes. This type of waste is disposed off at the dumping sites along with other wastes without any prior processing.

6. Status of Present Disposal & Proposed Landfill Site:
The existing SWM system for Agra does not have an engineering landfill site for disposal of waste. The waste collected from secondary collection points is dumped inan unorganized manner at the dumpsite. The authorized dumpsite is located at Shadhara on Agra-Tundla Bypass Road.

Behind this site KalindiVihar area is situated and on the other side Jharna Nallah.It is at a distance of 4-5 kms. From Workshop at Transport Nagar.

The present situation of the landfill site is over dumped to a height of approx. 8 ft.from Road level. The total area of the Dumping site is 4.475 acres. The way to the dumping site is badly damaged, due to which the vehicle of Nagar Nigam for waste disposal transport waste less than there capacity. During the discussion with NNA,it was also brought out that situation become worst in rainy season as the way becomes too much slippery due to which there exists risk of frequent accident.

The Agra Nagar Nigam has 22 acres of land at kuberpurteshil, Etmadpur, which has been proposed for the development of Integrated Sanitary Landfill Facility. However, additional adjoining land is under process of acquisition by Agra Development Authority to take care of the requirement of an integrated solid waste complex for the next 25 years.

VI. DRAWBACKS IN MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM IN AGRA

The MSW collection in Agra city is not well organized due to lack of awareness among the citizens as well as civic bodies responsible for collection of waste.The solid waste management system in the city is grossly inadequate.

1. Primary collection of solid waste is not appropriate:
NNA does not provide door-to-door MSW collection service to its residents. The major portion of residents of Agra city pays private operators to collect their daily waste in handcarts and disposed off to near by secondary collection point.

However, others throw the household waste outside their residences from where sweepers of NNA collect waste by means of rickshaw trolley and dump the same into the dustbins or onto streets (open dump). In most of the cases, generators themselves dispose off waste in nearby waste collection points/containers, onto the streets, or in the nearby drains.

The safaikaramcharis employed by the NNA do street sweeping, collect drain silt and waste heaps from roadsides and dispose them off at a nearby open dumps. These unorganized disposal methods have resulted in accumulation of solid waste on roadsides and vacant plots and in low lying areas and storm water drains.

2. Secondary storage of solid waste is unorganized:
The team observed that at places wherever dustbins are available, either they are rusted or damaged. At other places, waste is dumped on open dumps which have evolved over time. In the absence of secondary storage facility for MSW, it is dumped at any location in the vicinity – drains, vacant plots, street corners, low lying areas, and other open areas.

Heaps and stretches of un-segregated waste in open areas is an eyesore, thereby causing environmentally hazardous & unhygienic conditions across the city, thus, creating conditions for breeding of mosquitoes, grazing by cattle.

3. Solid waste is transported in open vehicles:
Most of the times, solid waste is transported in open trucks and trolleys. The Project team observed that these vehicles are overloaded with waste, resulting in road littering during transportation.

The loading and unloading of waste is done manually and safaikaramcharis involved in this activity do not use any Personal Protection Equipment (PPE) for their protection.

4. Biomedical waste is not managed properly in all health care facilities:
Most of the private hospitals/nursing homes inAgra are segregating their waste and the bio- medical waste.

They have contracted with a UPPCB approved contractor M/s Dutta Enterprises of Agra for collection and disposal of BMW. However, few organizations does not strictly follow segregation of BMW and needs to be penalized by the competent authority.

5. Collection and disposal of construction waste is not appropriate:
The construction/ demolition waste generated by local residents is transported in tractor trolleys and disposed off in open/ low-lying areas in the vicinity, privately.

6. Disposal of solid waste is not appropriate:
The solid waste collected from various sources is disposed off in open dump sites indiscriminately without segregation or preprocessing. There is no engineered sanitary landfill site for safe disposal of solid waste.

7. Lack of awareness among city residents and civic authorities:
The NNA staff is responsible for managing MSW in Agra city in accordance with the MSW Rules 2000. However, they are completely ignorant of these rules and the implementation practices recommended in the document.

Therefore, a planned and concerted effort is required to bring about awareness among the public and make them realize their responsibilities as individuals and as a community. In summary, public awareness, community participation, transparent administration, accountability at all levels is the need of hour so as to ensure success of any MSW management plan.

8. Environment, Health and Safety Aspects:
Improper Solid Waste Management gives rise to problems of health, sanitation and environmental degradation. Several diseases are spread due to waste mismanagement. Rodents and vector insects transmit various diseases like dysentery, cholera, plague, typhoid, infective hepatitis and others.

The workers engaged in SWM services are exposed to high health risks and frequently suffer from respiratory track infections and also gastro-intestinal problems. The rag pickers who move from street to street, bin to bin and go to dump yards to retrieve recyclable waste are most vulnerable to diseases on account of their direct contact with contaminated waste. They too are found to suffer from intestinal and respiratory infections, skin disorders and eye infection. They also suffer from injuries at open dumps, which can cause tetanus and serum hepatitis.

9. Others:
- Community bins not available at convenient locations
- Street sweeping operations are inefficient
- Several temporary storage points are not cleared on a day-to-day basis
- No disposal site in the city, the waste is also dumped along the river bank Yamuna.
- Burning of garbage leads to air pollution.

VII. STRATEGY FOR SUSTAINABLE MUNICIPAL SOLID WASTE MANAGEMENT FOR AGRA

In the present scenario waste management and handling process is unplanned due to lack of proper infrastructure, awareness among the public and its involvement. No target oriented awareness programmes conducted in the past for solid waste management improvement or for waste segregation.

Thus for making proper, reduced,segregated waste collection, there is a great need of public awareness and their involvement. Along with this, the Municipal Solid waste collection, handling and processing staff should be trained.

For this purpose need of Information, Education & Communication (IEC) Plan and Training & Capacity Building of staff have been noticed.

1. Objective
- The major objectives of the IEC and Capacity Building are as follows:
- Bringing of attitudinal and behavioral changes among the residence about the segregation of waste and sanitation improvement.
- Public awareness through informing and educating the masses on various aspects of solid waste management and achieve the target of receiving segregated waste from each household.
- Creating Public Participation in Planning and Management of MSW Activities.
- Capacity Building of the personnel's involved in implementing MSW i.e.Institutional Capacity of Health Department of FNPP for Improved MSW Management.
- Integration and involvement of private sweepers and Rag Pickers in improving MSW management.

2. Public Participation and Awareness through IEC programmes:
The basic approach of IEC plan is to create effectiveness of the Solid Waste Management System. The success of any solid waste management scheme can be measured through the extent of cooperation and participation of people, effectiveness of the proposed system and operational efficiency.

3. Approach of IEC Plan:

Attitudinal and behavioral changes of the residents are important for the success of the segregated waste collection and its sustainability. For this purpose, communication with the residents is required through various techniques and modes. There needs to be a two-way approach for IEC Implementation:

3.1 Program communication (to bring about behavioral changes): Behavioral changes are must to achieve the objective of receiving segregated waste from each household. For this purpose, the strategy should be to build and community awareness and education through adopting awareness initiatives among the citizens.

3.2 Social Mobilization (for alliance building): It is universal that presence of local stakeholder or group in an issue can provide a very effective mechanism for community outreach and associated information and education activity. Hence support of NGOs, Local Leaders, RWAs, and Educational Institutions etc. are indispensable for social mobilization.

4. Strategy for Creating Awareness:

Selection of key target audience plays a key role in generating effective awareness and cities like Agra need more careful planning for this purpose. Some of the target audience can be from sectors of particular interest including the female head of the family, children and youth, who require some form of role model to influence their behaviour. Broadly, the target audience can be categorized as waste generators, waste collectors and waste managers. Once the target groups have been identified, the responsibility lies in developing the approach for educating these groups.

For successful implementation of any program involving public at large, it is essential to spell out clearly and make them know the manner in which the problem is proposed to be tackled to keep area clean and improve the quality of life. The communication material should be developed and must be utilized in public awareness program through the tools of publicity.

The use of various publicity tools will be made as under:

- Focus Group Discussions
- Inter personal communications
- Creating watchdog committees comprising of local influential people, RWA members and important stakeholders, societies
- Printed materials and Audio-visual aids
- Other locally popular media

5. Training and Capacity Building:

The basic approach of training & Capacity Building of managing staff is to create effectiveness of the Solid Waste Management System and its operational efficiency of sanitary staff.

5.1 Objectives: The Capacity Building/training programs must aim at:

- To sensitize the key stakeholders with working knowledge of the benefits of waste reduction, segregation and management.
- To Impart skills about the respective roles from generator to waste managers For achieving these objectives, a core group of trainers needs to be organized for continuous in-house training of the manpower to be deployed and other sanitation staff. For the success of this program it is essential that training and orientation be planned for all the people involved in various activities of solid waste management at different levels viz. Administrative and Officials, Technical and non-technical staff etc. Along with these, private sanitary staff and rag-pickers should also be motivated for their active role in waste collection process. The skill up-gradation programmes may be conceptualized and implemented will result to the followings.
- Develop effective O&M of facilities such as Tri-cycles, Dustbins and Waste containers with the help of public.
- Develop an effective monitoring mechanism with the proper involvement of officials Responsible.

5.2 Specific activities in regard to training/ Capacity Building Programmes:

- Training Need Assessment
- Training made for specific Target Groups
- Conducting orientation program and need based site visits
- Training made for specific Target Groups
- Evaluation of Training and orientation programmes
- Gap Analysis
- Reinforcement programmes to fulfill the gap
- Setting of appropriate Institutional framework for sustainability.

VIII. PUBLIC PRIVATE PARTNERSHIP (PPP) MODEL

At present, the role of the private sector in municipal service delivery is negligible. A small stretch of street light maintenance on the MG Road has been contracted out and has not been running successfully. Similarly, a limited area around the Taj Mahal has been given out for private sweepers for cleaning. However, even this has not been properly managed and is not a successful experience.

SWM as per the MSW (M&H) Rules 2000 is essentially a public responsibility. Therefore, the services rendered by NNA have to be efficient, economic and reliable to comply with Honorable Supreme Court directives in this regard.

The need for improvement in waste management by NNA in terms of efficiency and its effectiveness. The deficiency in the existing system is due to lack of infrastructure, appropriate technology, restrictive bureaucracy, lack of accountability, higher administrative and salary expenses. These are not commensurate with desired level of productivity.

Public awareness and community participation needs to be encouraged. The present unsatisfactory state of sanitation and cleanliness in Agra reflects the above mentioned anomalies. Private sector involvement through private public participation more often than not results in the win-win situations for all stakeholders both in the short and long term.

Private sector investors being accountable for the services rendered will help make the operations more reliable and efficient – Short term advantage Sustained efficient operations will bring investment/ finances for such projects which will further improve operational efficiency

IX. CONCLUSION

There are numerous inadequacies in the present practices followed for MSW management by AMC in Agra city. Major problems are inadequate manpower, lack of fund and equipment required to efficiently carry out several activities of MSW management.Following are the suggestions for the better management of MSW in Agra: Preparation of an efficient integrated MSW management system having capacity to collect, separate,transport and safely disposed solid waste.

Preparation of an effective action plan incorporating strategies and guidelines that is easy to implement and customized to the areas.

100 % collection of MSW from houses, street, shops and offices as well as proper identification and separation of waste pertaining to industry, hospital and agricultural souses.

Landfills are part of an integrated and important system for the disposal of MSW. Suitable designed Scientific landfill site with adequate space is needed within the context of the local infrastructure and available resources The waste quantity should be measured properly. Recycling and resource recovery from the waste before final disposal. All the above mentioned activities will help in controlling environmental pollution and better MSW management..

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