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Solid Waste Management, an Environmental Challenge in Millennium Cyber City in India, Gurgaon

Sanhita Bandyopadhyay

(Sanhita Bandyopadhyay, Environmental Planner, Phd Scholar, D-79, 1st Floor South City II , Gurgaon, bsanhita2@yahoo.co.in)

1 ABSTRACT

The cities only encompass two percent of the world's land surface, yet they are responsible for consuming over 75 percentage of the planet's resources and produce 75 percentage of the world's waste. The most pressing problem faced by any urban centre in India today is Municipal Solid Waste Management (SWM). Rapid urbanisation and changing lifestyles have led to the generation of huge amounts of garbage and waste in the urban areas. Over the past few years, the handling this SWM has become a major organizational, financial and environmental challenge.

As one of the signatories of the resolutions regarding Agenda 21, India is committed to the implementation of Agenda 21. Accordingly, India is considering applying the Green City concept to Gurgaon City as "Model for Sustainable Urban Management" by incorporating environmentally sustainable solutions with major urban issues in India. Gurgaon is "satellite" town in National Capital Region, Delhi, today turned over a new leaf, joining important position on the industrial map of India challenged by a very fast growth rate and is home to major icons in information technology recognized as 24 x7 hrs city. Its close proximity 25 km to Delhi, the capital of India is become an ideal showcase for the whole of India. A land locked city Gurgaon, with a standard urban area at about 167 square km. and a resident population of about 228,820 in year 2001 become 1,514,085 populations by year 2011. It generates 600 metric tons of solid waste every single day. The collected waste on 15th August 2012 was 521.27 metric tons for ultimate recycle plant whose capacity is only 400 metric ton solid waste everyday. Low lying area near the iconic DLF City (costliest residential colony in Gurgaon as well as in India) is being used for dumping. Close proximity of Aravalli Ridge, an ecological fragile area is another favorable place for illegal disposal site.

The SWM is a low priority. The existing SWM is constrained by institutional weakness, lack of proper funding, management and operational systems, public apathy, lack of municipal will. Waste dumping is the only favorable method to urban local body without any further action. Day by day increasing trend practice of dump to dump yard won't sustain the function. Developing countries, such as India, are undergoing a massive migration of their population from rural to urban centres. New consumption patterns and social linkages are emerging. India, will have more than 40 per cent, i.e. over 400 million people clustered in cities over the next thirty years (UN, 1995). Modern urban living brings on the problem of waste, which increases in quantity, and changes in composition with each passing day. There is, however, an inadequate understanding of the problem, both of infrastructure requirements as well as its social dimensions. Urban planners, municipal agencies, environmental regulators, labour groups, citizens' groups and non-governmental organisations need to develop a variety of responses which are rooted in local dynamics, rather than borrow non-contextual solutions from elsewhere. This paper aims to highlight the major challenges in Municipal SWM in Indian arena with the case study of millennium cyber city Gurgaon.

2 INTRODUCTION

Gurgaon, with a standard urban area at about 167.5 square km. and a resident population of about 1,514,085 (2011 census), the floating population is 1,00,000 per day. Average annual population growth is 18-20 %. The district headquarter is situated in Gurgaon city. Now Gurgaon has become one of the most important corporate and industrial hubs of state Haryana in India. Gurgaon also known as 'Guru Gram' or 'Guru Gaon' (village of the spiritual teacher) was named after Dronacharya, a character in the Epic Mahabharata. It is said that Guru Dronacharya of the Pandavas and the Kauravas gave spiritual instructions to them at this place. The office and manufacturing plant of India's largest car maker Maruti Udyog Limited is situated here as a large number other industries. Another area in which Gurgaon is excelling is the IT industry and software development. Real estate is booming here with new buildings coming up at an astronomical pace. Now this city is chosen for a showcase for sustainable urban development as a model for other Indian cities.

As one of the signatories of the resolutions regarding Agenda 21, India is committed to the implementation of Agenda 21. Accordingly, India is considering applying the Green City concept to Gurgaon City as "Model for Sustainable Urban Management" by incorporating environmentally sustainable solutions with respect to:

- water supply and waste water treatment;
- energy supply, energy savings and renewable energy development;
- waste management, soil pollution and air pollution;
- cleaner industrial technologies and environmental management;
- agriculture and food industries;
- building construction and urban ecology management;
- urban traffic and transportation.

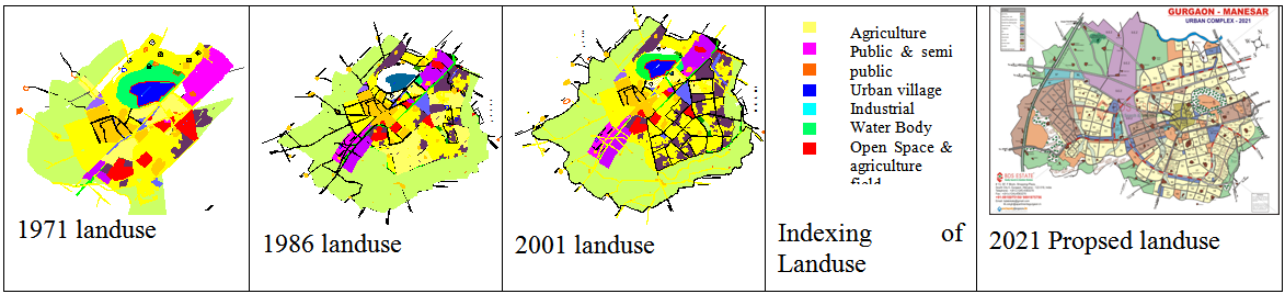
The aim is to achieve lasting harmony between man and nature and to protect the interests of future generations. An integrated medium to long-term planning and implementation strategy, close public-private participation, public awareness and responsibility constitute a basic approach to a holistic solution to urban environmental concerns.

3 GROWTH & EXPANSION OF CITY

Gurgaon city is located at 28°53' N latitude and 75° 35' E longitude and is situated at a distance of 25 kms south-west of Delhi, the National Capital and 285 km from Haryana state headquarter of Chandigarh. It lies at 229 meters above mean sea level and forms a part of the National Capital Region. Gurgaon district is an area of confluence of aravalli hills, Indo-Gangetic plains and Indian desert, Gurgaon urban area can be broadly classified under two district sections namly the HUDA (Haryana Urban development Authority) area and the old town (municipal area limit). The area under HUDA can be further subdivided into (i) private coloniser area, (ii) Huda sector (iii) Institutional area and (iv) the urban villages. The population of Gurgaon including the urban area, the existing town, and the 18 village surrounded by urban development was in 2001 400,000 (HUDA 2001). The projected total population of the urban area for the year 2011 is 1.5 million.

The Gurgaon city has been the head quarters of Gurgaon district, the southern most district of Haryana since 1816, and has exhibited steady growth after the independence of country. Spread over an area of 15.33 sq km the Gurgaon town had a population of 1,73,542 in 1991 and the Gurgaon urban area had a population of 2, 29,243 spreading over an area of 30.2 sq km according to 2001 census. The population density shows that Gurgaon city and urban area are densely populated as compared to the Gurgaon ditrict. The most important factor for this is its close proximity to Delhi. National Highway No. 8 passes throgh its main core of city. This Gurgaon originated as a village called Guru gram. Since that time it has been undercontrol of various rulers who come to rule from Delhi like Maurya, Tomar, Chauhan and Mughals. The Gurgaon district passed into British hands in 1803 and revealed in 1851. In 1966 Haryana took birth and it was designated as district and has been Tehsil and district headquater. The first development pro was started in 1971, 77 and further 82 and NCR in 1989 asigned as important hub for development. In 1981 haryana model has been eveolved as public-private partnership and it was boost up as Electronic City. But it was boost up where Maruti udyog has been set up in 1984 and in 1997 been develop Corporate park.It becomes recognise as Class I town in 1991.The city has developed into 5 phases:

1968-71 1st Phase, 1975-78 2nd phase, 1985-95 3rd Phase, 1995-2001 4th Phase, 001-2021 5th Phase



The existing demographic profile of the city plays an important role in understanding the growth pattern and changes witnessed by the city during the last decade. As per the 2001 Census, the population of Gurgaon urban area (Gurgaon UA andUrban villages) was approximately 3,42,000 (Gurgaon MCG -2,01,322; Towns-47,645; and urban colonizers was about 1,20,000 in 2001). Therefore the total population of Gurgaon urban

area was estimated to be 4,60, 000 persons in the year 2001. Gurgaon has also developed on similar trends as the NCT of Delhi and NCR.

Table 1.1 shows that during the past two decades, the urban population in Gurgaonhas registered a higher growth rate.

Area	Population in Year (No)			Growth Rate in %	
	1981	1991	2001	1981-1991	1991-2001
Urban NCR excluding Delhi	33,51,972	52,73,159	80,12,939	57 %	52 %
Delhi	62,20,406	94,20,644	137,82,976	51 %	46 %
Haryana State Sub Region	49,38,541	66,43,046	86,89,268	34 %	30 %
Gurgaon	1,00,877	1,35,884	2,29,243	34.7 %	69 %

Table 1.1: Growth of Urban Population, Gurgaon Municipal Area. Source: Census of India, 2001

The development plan for Gurgaon published in 1971 estimated the Citys population at 0.125 million. Later in 1977 and 1982, it was revised for a perspective population of 0.225 and 1 million respectively for 2001. The NCR Regional Plan 2021 has proposed the population of Gurgaon could grow to 1.65 million by 2021. However, the Department of Town and Country Planning, Government of Haryana expects the population to grow to 3.2 million. As per Census 2011 the population of Gurgaon is become 1.5 million.

The settlement pattern of Gurgaon city can be categorized as; Gurgaon developed area (HUDA sectors and private housing colonies), urban villages and informal housing or slums. Gurgaon developed area comprise of the residential colonies within the Guraon Municipal Council, and sectors within HUDA area. Approximately 60 % of the total population resides in these. This also includes areas, which have been developed by the private developers.

As per the census 2001, approximately 21 % of the total population of the city urban area lives in the 18 villages within the city. These urban villages have become incorporated in the urban extension.

The city started witnessing the squattering settlement from the early 90s,with setting up of new industries, townships and business parks due to huge influx of migrants. There are currently 14 slums in Gurgaon, accounting to 18 % of the total population of the town.

According to the new guidelines,the population density has been calculated at 48 people per hac, compared tothe earlier population density of 44 people per hac.

4 SOLID WASTE MANAGEMENT SYSTEM IN GURGAON

Rapid urbanization along with increases in population has led to the deterioration of physical environment in Gurgaon. Effective Solid Waste Management is one of the major challenges faced by the local authorities. High volumes of waste generation, inefficient collection and transportation system and limited disposal options are continuously impacting the health, environment and quality of life in the area. Field study indicates that availability of land for disposal is major area of concern in Gurgaon. Real estate boom coupled with NIMBY (Not in My Back Yard) issues have left very less land available for disposal of waste in the urbanized area.

Field observation indicates that large volume of waste is being generated per day within the urban area of which only a very-small portion is being collected and disposed in accordance with the Waste Management Rules of India. It generates 600 metric tons of solid waste every single day. The collected waste on 15th August 2012 was 521.27 metric tons for ultimate recycle plant whose capacity is only 400 metric ton solid waste everyday.

The provision of infrastructure for solid waste management by HUDA is sub optimal. The infrastructure for solid waste include 1.5 cum capacity bins, placed indifferent sectors for collection and three refuse collector trucks owned by HUDA and tractor-trailer deployed by private contractor. A site alone the Faridabad-Gureaon road is being used as a waste disposal site.

Public cooperation or participation in the solid waste management is non-existent at present and careless disposal of waste on vacant plots and streets is prevalent, this has the potential to cause health problems. Absence of a ground and surface water monitoring can not confirm the environmental sustainability of the disposal site.

5 CHARACTERISTICS

The majority of waste is generated by residential, commercial and institutional sources and municipal activities such as street sweeping and drain cleaning. The municipalities do not maintain records of waste generation by source itself. Contractors have kept record for total quantum of collection.

Municipal waste generation in Gurgaon is not formally tracked by MUNICIPAL CORPORATION GURGAON or HUDA. There are no controls or weighbridges at Municipal dumping gounds and no records were available to assist in establishing waste quantities. As a result, no quantitative municipal data is available for estimating waste generation in Gurgaon. The approach in establishing waste quantities used information obtained from other studies conducted in India or on line record of collection of waste by contractors and total potential generation quantum of city.

5.1 Generation

Per capita waste generation had assumed for Gurgaon is 320 gm/day which includes residential, commercial, institutional waste by govt. It is attributed to a number of factors which includes food habits, standard of living and degree of commercial and industrial activities in the area. Currently, about 400 MT of municipal waste is collected per day within the controlled area as per Govt record, of which about 75-80 MT is generated within MUNICIPAL CORPORATION GURGAON (MCG) area and balance is contributed by HUDA sectors, private developers' area, and urban villages. Municipal solid waste in Gurgaon, as per Indian scenario, is expected comprises of 50-52 % biodegradable, 12-15 % dry recycles and 30-35 % inert component. But actually the total quntum is 600 Metric tonns. The Municipal Solid Waste (MSW) generation of Gurgaon city in different areas are as under:

Sl No.	Area	Total Quantity of MSW Generated (MT) per day
1.	Gurgaon Old Municipal Area (MCG)	110
2.	DLF (Private Developers)	35
3.	Ansal (Private Developers)	7
4.	HSIIDC area (Industrial area of HUDA)	70
5.	HUDA area	120
6.	Other Private Developers & Commercial	58
Total		**400**

Table 1.2: MSW Generation (based on study conducted by MCG, 2006). Source: MCG, 2006

Population increases, economic activities and personal income levels will influence future waste generation in Gurgaon. Future waste generation for Gurgaon is calculated based on the estimated population carrying capacity of Gurgaon and the per capita increment in waste generation as 1.33 % per annum based on available national data (MCG, 2013). Waste projection for year 2011 and 2021 has been highlighted in the Table 1.3.

Year	Population	Per Capita Waste Generation (gm/capita)	Total Waste (MT/Day)
2006	1,250,000	320	400
2011	1,514,085	350	525
2021	2,600,000	400	1040

Table 1.3: Waste Projection. Source: MCG, 2013

5.2 Collection & Transportation

Municipal solid waste in Gurgaon is being managed by a number of organizations and there is no single authority responsible for waste management of entire urban area. MCG is responsible for collection, transportation and disposal of waste generated within the municipal limit; HUDA manages the waste generated in HUDA sectors; individual private developers in their respective colonies; and village Panchayat in the urban villages. Municipal Council and the private developer area have some level of waste management system, whereas waste management in HUDA sector is highly dismal and need immediate attention.

HUDA sectors: Waste management in HUDA sectors is undertaken by private contractors, RWAs as well as by permanent employees of HUDA. RWAs with financial assistance from HUDA manages the waste generated in sectors 4,7,9 and13; waste generated in sector 10 and 34 is being managed by HUDA itself and for rest of the HUDA sectors private contractors are deployed for street sweeping, collection and transportation of waste.

There is no planning for waste management system to meet the current or future needs. The provision of infrastructure is sub-optimal. The infrastructure for solid waste includes 1.5 cum bins, placed in different sectors for collection and 3 refuse collectors owned by HUDA and tractor-trailer deployed by private contractor.

Staff deployment pattern indicates that road length to be covered per sweeper is relatively high. About 30 sanitary staffs are in the regular role of HUDA and the balance is provided by RWAs and Private contractor. HUDAs SWM contract with the private operator neither specified the number of work force or road length nor the equipment and vehicles required for collection and transportation. This has resulted in adequate sweeping of the main roads, while interior roads and by-lanes are often left unattended. There is no need-based allocation of waste, which has lead to accumulation of waste in respective pockets.

Public cooperation or participation in the solid waste management is non-existent and careless disposal of waste on vacant plots and streets is prevalent resulting in littering of waste. In addition, absence of a proper monitoring mechanism has resulted in poor supervision of waste management activity.

MUNICIPAL CORPORATION GURGAON manages the waste generated only in the municipal area i.e. Gurgaon Town, with an operational staff of 387 sanitary workers, under the overall supervision of chief sanitary inspector. Storage of waste at source and segregation into organics and inorganics fraction, MSW rules is not practiced and street sweeping continues to be the principal system of primary collection of waste. Although some primary collection system has been initiated in the recent years, it is still in its infancy with no synchronization with secondary collection and transportation. While door to door primary collection has resulted in a dramatically improved level of cleanliness within neighbourhoods; it has resulted in a much dirtier appearance at the secondary storage or community bins abutting such neighbourhoods, as the city service at these collection points is not complementary and adequate.

Three different types of waste storage points exist in MCG area viz. Dhalao (community bin), refuse container and the dumper placer containers. The capacity of the waste storage receptacles is sufficient to store the waste generated within the municipal limits. The system of waste collection is predominantly manual, with only 25-30 % of the waste being collected mechanically using dumper placer container, loader and trucks. Waste transportation is done collectively by municipal and private operator. Although the number of vehicles deployed for collection and transportation is sufficient, designed transprtation network are not followed and waste is not cleared at regular intervals. The garbage clearance efficiency for MCG area is 60-70 %.

PRIVATE DEVELOPER: Private developers have engaged private contractors for door todoor collection, street sweeping, and transportation and disposal of waste. Door-to-Door collection is done by cycle rickshaws and tractors trolley or dump trucks are used for transportation of waste. In the absence of any designated site, collected waste is disposed in the vacant land or amenities in the develop area is also done on contract basis.

URBAN VILLAGES: There is no system of waste management in the urban villages (villages within urban pockets) within the controlled area boundary. Waste is normally thrown in the vacant landwithin or outside the village limit. In some villages, village Panchayat have employed sweeper for sweeping of villages roads

and collection of waste from the doorsteps, whereas in other villages, no proper measures has been adopted for waste management. Households throw waste directly on the streets, and there are no sweeper to collect them. As a result, waste is accumulated on the roads, adversely affecting health of the people and environment of the area.

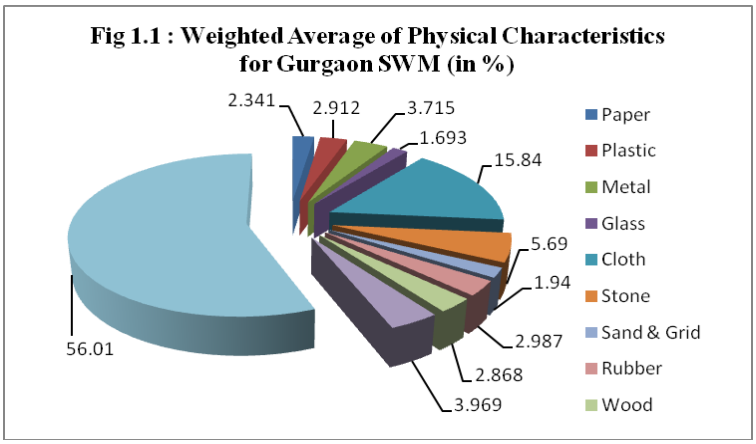
Apart from different Contractor there is some sanitation contractor also transporting the Garbage to Landfill from some villages/colonies, Approx 50 to 75 ton/day with rate of per ton/per Km basis.

5.3 Physio-Chemical Composition of Waste

Test Results on Physical Parameters of MSW Samples of Gurgaon isprovided at Table 1.4

Sl No.	Physical Parameters	Civil Line Area (MCG)	Station Area (MCG)	Vyapar Sadan, M. G. Road (HUDA)	HSIDC Area (HUDA)	DLF Area (Private developer)	Present Dumping Site	Weighted Average
1.	Paper	1.8	2.0	1.42	1.87	3.3	4.5	2.341
2.	Plastic	3.63	3.33	3.57	3.75	2.5	2.7	2.912
3.	Metal	-	1.33	3.57	6.25	8.3	4.5	3.715
4.	Glass	-	3.33	-	9.37	-	0.9	1.693
5.	Cloth	27.2	6.63	7.14	25	16.6	18.2	15.84
6.	Stone	2.0	20	-	6.29	2	2.7	5.69
7.	Sand & Grid	2.72	2.6	-	2.5	2.4	1.46	1.94
8.	Rubber	1.8	3.4	5.71	1.25	2.5	1.8	2.987
9.	Wood	1.8	0.66	4.28	2.5	3.3	2.7	2.868
10.	Leather	4.54	3.33	2.85	3.75	5.0	4.5	3.969
11.	Wax	-	-	-	-	-	-	-
12.	Organic Matter	54.5	53.3	71.4	37.5	54.1	56	56.01

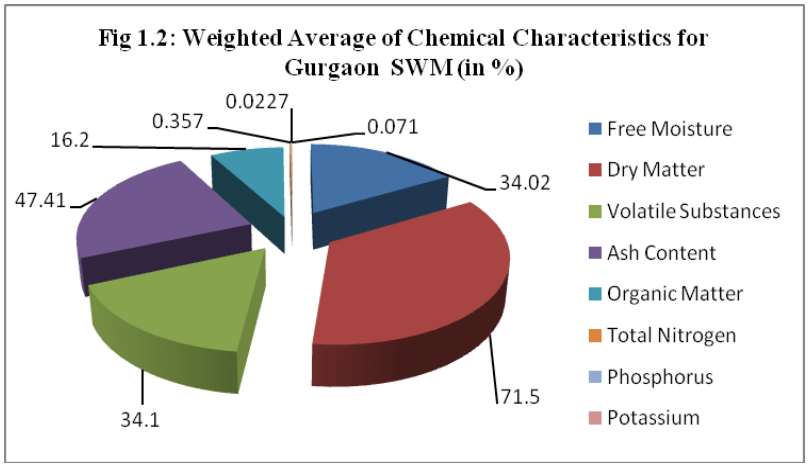
Table 1.4: Test Results on Physical Paramaters of SW Samples of Gurgaon (On Moisture Free Basis in Percentage). Source: MCG, 2013



The overall weighted average of Gurgaon waste physical characteristics is varied. The maxium value is under organic matter. Next is Cloth material and after that leather material which can be reused. The trace of metal in waste is also remarkable notice which shows the unhygienic disposal procedure of waste management practice. The debris quantum is also showing the characteristics of the real estate town. The organic content of the waste was found to vary considerably at various sites due to the variations in origin of waste and it is ranging very high. The average share of this biodegradable component was found to be 56.01 % against 35 % for the national average of Class-I cities in India. Compared to this, the average organic waste content of USA is 11.2 % (EPA, 2004). Around 15-20 % of the generated waste does not reach the disposal sites since part of it gets recycled even before reaching the dumps, part is dumped locally in rural areas, and part of it remains uncollected at several sites. Test Results on Chemical Parameters of MSW Samples of Gurgaon is provided at Table 1.5

Sl No.	Chemical Parameters	Civil Line Area (MCG)	Station Area (MCG)	Vyapar Sadan, M. G. Road (HUDA)	HSIDC Area (HUDA)	DLF Area (Private Developer)	Present Dumping Site	Weighted Average
1.	Free Moisture	36	30	42.39	32.8	34.7	21.4	34.02
2.	Dry Matter	82	61	72	86	62	75	71.5
3.	Volatile Substances	18	49	28	30	48	25	34.1
4.	Ash Content	62	37	46	56.3	42	43.8	47.41
5.	Organic Matter	18	11	24	12	7	30	16.2
6.	Total Nitrogen	0.49	0.36	0.08	0.43	0.43	0.42	0.357
7.	Phosphorus	0.012	0.021	0.032	0.029	0.022	0.024	0.0227
8.	Potassium	0.029	0.029	0.046	0.38	0.040	0.042	0.071
9.	pH(10%)	6.84	7.11	6.29	7.03	6.80	6.0	6.711
10.	Calorific value (Gross cal/gm)	2033	1303	2703	1504	981	3707	1925.1

Table 1.5: Test Results on Chemical Parameters of SW Samples of Gurgaon (On Moisture Free Basis in Percentage). Source: MCG, 2013



The overall weighted average of Gurgaon waste chemical characteristics is more compostable in nature. The maxium value is under dry matter constituting. Next is ash content which is recyclable material too. Organic matter has also high value. Volatite substances are very high which is obnoxious. The pH value is 6.7 i.e acidic which is near to normal. Calorific value is also high. So, overall the content of SW is most suitable for composting plant. Total nitrogen, phosperouys and potassium (NPK) value is marginal.

5.4 Processing and Disposal

1000 TPD Combined solid waste management facility plant set up at Bhandwari (Faridabad-Gurgaon toll road) for processing the MSW for Faridabad (another town) and Gurgaon Municipal corporation in PPP model under JNNURM (Jawaharlal Nehru Urban Renewal Mission) scheme for a project cost of euro. 5.3 million where 50 % fund has been funded by Govt: of India, 30 % by Municiapl council of Faridabad (town of Haryana) , 20 % by Govt: of Haryana and the Land is provided by MCG at free of cost with an agreement between MCF & MCG . The MCG is using the facility for dumping the MSW at the processing plant where no charges incurring for processing the garbage for MCG. The AKC Developers is the Operator for the plant for 30 years and the National Building Construction corporation (NBCC) is the consultant for the setting of the plant. All monitoring & Administrative control is under MCF. This plant is RDF (Refuse Derived Fuel) plant which is taken 600 tons from Faridabad waste and 400 tonns from Gurgaon waste.

In developing countries like India with MSW which has a low calorific value (7.3 MJ/kg compared to values greater than 10 MJ/kg in Europe, Japan and US) and high percentage of inerts, processing of waste is necessary to make it suitable as a fuel. This makes RDF an important alternative to WTE combustion. One of the less expensive and well-established technologies to produce RDF from MSW is mechanical biological treatment (MBT). An MBT plant separates out metals and inert materials, screens out organic fractions (for stabilization using composting processes), and separates out high-calorific fractions for RDF. RDF can also result from a 'dry stabilization process' in which residual waste (after separating out metals and inert materials) is dried through a composting process leaving the residual mass with a higher calorific value

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(USEPA, 2010). The RDF thus produced is either used directly as floc/fluff or is compressed to make pellets. RDF fluff (as it is called in India) can be directly combusted in dedicated WTE plants whereas making RDF pellets increases the marketability of the product as they can be used for co-combustion in various solid fuel industries like cement kilns, coal fired power plants, etc.

RDF plants which make fluff are located near Hyderabad, Vijayawada, Jaipur and Chandigarh (other city in India). RDF produced at Hyderabad and Vijayawada is taken to dedicated WTE plants for electricity generation, whereas RDF from Jaipur and Chandigarh plants is transported to cement plants to be used in place of coal.

National Solid Waste Association of India (NSWAI) assuming 6 % of all MSW generated in India is treated in MBT facilities, out of which, 60 % is compost rejects which could be used as refuse derived fuel (RDF), India is currently generating 2.48 million TPY of RDF. Such a huge source of energy is being generated and landfilled every year. This is equivalent to landfilling nearly 4 million barrels of oil because there are no facilities which could use them. This RDF can be used in the already well established solid fuel industry in India. India would have landfilled 58 million barrels of oil in the form of RDF alone by 2041 if there were no RDF co-combustion or WTE facilities to generate energy out of it (NSWAI, 2010). Review the fact RDF is the best posible option for Gurgaon Wsate processing technlogy. It is being calculated that about 1-2 % area of total geographical area of urban premise are occupied by crude landfill site. By using different processing unit the requirement for dumping inert material is about 10 % to total present area. Gurgaon inert material is still disposed nearby RDF plant which should be placed as regional dumping yard far away from city boundary of Gurgaon and other town.

6 ENVIRONMENTAL CHALLENGES

The rapid urbanization process lead too many problems in which solid waste is one of the aspects which are changing the environment of Cyber City Gurgaon. The solid waste management is a low priority but can create social and environmental problem with risks to public health and environment. The existing solid waste management is constrained by institutional weakness, lack of proper funding, lack of proper management and operational systems, public apathy, lack of municipal will to become financially self-sufficient through municipal taxation and whole sole no administrative control on ultimate waste management stage i.e. disposal and processing system. Waste dumping is the only favorable method to urban local body without any further action. Day by day increasing trend practice of dump to dump yard won't sustain the function. The MSW facility with waste recycling plant is planned at a 30-acre (12 Hac) site in Bandwari village at Gurgaon-Faridabad road. Already 50 % land is occupied within 2 years of operation as dunmpyard where it is carrying two towns garbage. So there is a requirement of taking integrated policy and technology to use less land as land is precious. Different part of India's dumpyard has started to reclaimed and process of SWM to reach zero waste city tag. Recycling, composting and ultimate power generation makes this city also zero waste city status. Sanitary landfill system does not make sustainable mechanism process in city development plan as per Agenda 21. Different techonology has initiated in India to become energy efficient mechanism of ISWM process. Delhi the Capital of India has also started year marking step to run RDF. Footstep to sustainable development it is an imperative requirement to understand the basic concepts concerned to the solid waste management practice and bare minimum requirement of land at each level. The following options with respect to solid waste management for cyber city have been described:

- Processing of MSW and recycling of construction and demolition debris (C&D) has been emphasized upon to minimize landfill space requirement.
- Reservation of land for processing and disposal of solid waste in the Zonal Plans suggested.
- The most important concern currently is reduction in land requirement for disposal by maximize appropriate treatment of different waste streams, in order to reduce volumes of waste requiring being land-filled. MCG has privatized collection and transportation in 4 zones under Public Private Partnership (PPP) module. The balance areas are also under consideration for privatization. It is envisaged that gaps in these aspects will be met by the private sector in such a manner that required performance criteria are met. Under transportation total availability of trucks are available but there is shortfall of management.

- The basic thing in waste disposal is separation of polythene, iron and metal, using densifiers and magnetic system. Between bio-degradable and non-degradable, inert material is dumped, while degradable waste will be processed to make manure. By 2021 Processing capacity to be increased to take care of total generation through PPP (1000 TPD) for one city itself. In order to mitigate adverse impact to the environment, the immediate development of incineration process is proposed. Alongside this, the closure, capping and landscaping of existing dump-sites would have to be undertaken. Composting plant is proposed with segreagated compostable waste.
- Household level segragation should mandatory in policy planning stage. Removal of community bin is proposed. This would have to be accompanied by intermidiate transport vehicle to carry out to dispose in ultimate destination (composting plant or landfill site).
- Improvement of service delivery is critical in ensuring that quality of the environment in the city is maintained and should monitor by citizen charter itself. The proper wing under MCG should be developed. In order to build this, sustained training for all the municipal staff as well as staff of any private operator involved in waste management for their capacity building and planning capability, has also been proposed.
- Overall contrary to RDF plant only Biomethanation Technology for electricity from waste should be operated in Bandwari village.

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