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An overview of solid waste management system in Delhi

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ABSTRACT

Delhi is the second most populous city and second most populous urban agglomeration in India and 3rd largest urban area in the world. The population of India is expected to rise from 1029 million to 1400 million during the period 2001–2026, an increase of 36% in 26 years, at the rate of 3.35% annually. In Delhi, during the last two decades (1991–2011) the annual growth rate in population was almost double the national average. It is also a commercial hub, with a lot of employment opportunities that has accelerated the pace of urbanization and increased the municipal solid waste (MSW) generation. At present the residents of Delhi generate about 7000 tonnes/day of MSW, which has been projected to increase to about 17,000–25,000 tonnes/day by end of 2021. The solid waste management in Delhi has remained one of the most neglected areas of the Delhi Municipal Corporation. Nearly about 70–80% of generated solid wastes are collected and the rest remains unattended on the roadside, streets or small open dumps. Just about 9% of the collected MSW is treated through composting and rest is disposed off in open landfill sites at the outskirts of Delhi. Due to several operational problems, the existing composting plants are unable to function at their optimum treatment capacity. Therefore, the bulk of MSW along with residual wastes from the composting process is disposed off in landfills. Due to absence of landfill gas collection systems and of leachate, these landfills sites have become the main source of groundwater contamination and air pollution (toxic and greenhouse gases). This paper is an attempt to understand and describe the status of municipal solid waste management in Delhi, summarizes the legal provisions to manage waste, proposed policies, measures and initiatives of the Municipal Corporations and Government of Delhi to improve the present condition of MSW management system.

1. Introduction

The population of India is expected to rise from 1029 million to 1400 million during the period 2001–2026, an increase of 36% in 26 years, at the rate of 3.35% annually (Census of India, 2011). The level of urbanization has increased from 17.35% to 31.2% in the last 60 years and is expected that as much as 50% of Indian population will live in cities in next 10 years (Khurshid and Sethuraman, 2011). The problem of solid waste management is very serious in nature and if Delhi Master Plan fails to address it, then these wastes will end up on streets, roads and in our drainage across the city. The authorities concerned should focus on the alternative and decentralised waste treatment methods like reuse, reduction and recycle including, fossilisation and composting and vermiculture. The disposed solid wastes of garbage in the capital are gaining an enormous size like a mountain, since the solid waste management is becoming a serious problem particularly the handling of plastic waste. The solid dumps in Delhi have become the largest, least regulated and most hazardous in the world since everything is dumped without any segregation at the landfills. It has happened despite a huge workforce of waste collectors, scrap dealers and recyclers and also a very rigorous campaign by various municipal authorities to segregate various wastes at the source. In a review report (2016), the Central Pollution Control Board (CPCB) has estimated that solid waste produced in the country amounts to 135,198 tonnes per day (TPD), of which 47,456 TPD is landfilled. It's a matter of great concern since cities have limited availability of land for solid waste disposal and existing landfill sites have been running beyond their maximum capacity for over a decade, landfilling is still practiced. In Delhi where people generates more than 9,620 tonnes of solid waste per day, the landfilling has become very problematic (CPCB, 2016).

2. Solid waste management: present scenario

In India, a rapid rate of urbanization, industrialization and population explosion has led to the migration of people from villages to cities, which generate thousands of tons of municipal solid waste (MSW) daily (Gupta and Arora, 2016). The MSW amount is expected to increase significantly in the near future as the country strives to attain an industrialized nation status by the year 2020 (CPCB, 2004). The 2014 report by the "Task Force on Waste to Energy," under the Planning Commission estimates that urban India will generate about 2,76,342 tonnes per day (TPD) of waste by 2021; 4,50,132 TPD by 2031; and 11,95,000 TPD by 2050. The per capita waste generation is 450 grams per day, and has increased at a rate of 1.3 percent per annum. The average garbage generation has been projected at 0.68 kg per capita per day and total volume of solid waste is about 15,750 tons/day by the year 2021. Out of 24 landfill sites, 16 are already filled up.

It has been estimated that in Delhi, more than 9,500 tonnes per day (TPD) of garbage is generated. Out of that about 8,000 TPD of garbage waste is collected, transported and dumped to the three landfill sites at Bhalswa, Okhla and Ghazipur. However, actual waste generation in the city could be much higher, since a bulk of the solid waste is managed by the informal sector. According to an estimate, there are about 150,000 rag pickers in Delhi. The three main landfills sites of Delhi, located at Ghazipur, Bhalaswa and Okhla, were commissioned in 1984, 1994 and 1996, respectively. The situation is becoming worst since; the three landfill sites are not designed as per specifications mentioned in the Solid Waste Management Rules, 2016. Therefore, the Delhi Pollution Control Committee refused to grant permission to use these three landfills that are being used illegally. The Central Pollution Control Board (CPCB) has also pointed out that in the absence of availability for landfill sites all three Municipal Corporations of Delhi were using these overused landfill sites for waste disposal. According to the Master Plan for Delhi 2021, these landfill sites had exceeded their maximum capacity way back in 2008. Most of these waste dumping sites have polluted and contaminated the aquifers and groundwater in and around their neighbourhoods.

As per the latest draft manual on municipal solid waste management prepared by the Union Ministry of Urban Development, three million tonnes of waste can be accommodated on 40 ha of land (keeping in mind that the life of a landfill is 20 years). Delhi needs 800 ha of land, which would cost Rs 80,000 crore as per the present circle rate. In addition, municipalities are also required to generate revenue to meet the recurring operational expenses on labour and machinery at the landfill, estimated to be about Rs 300 per tonne of waste. Expenditure on transportation is nearly Rs 800 per tonne (according to Tufail Ahmed, who has been managing landfills in Delhi for almost three decades now). According to the Centre for Science and Environment (CSE), New Delhi assessment, every tonne of waste disposed of at a landfill sites would cost the MCD around Rs 14,500, which is very high cost to sustain.

The Supreme Court of India has also repeatedly pointed out that the current situation of waste management is extremely disheartening. The dumping of unsegregated waste into the landfill, combined with the exceeding maximum limits of landfills (Livelaw, 2018) has become a health hazard (Livelaw, 2016) for the residents of the city. It has been estimated that about 50 per cent of gases emitted from these landfills is methane, 45 per cent is carbon dioxide and the remaining gases are nitrogen, hydrogen and other gases (Nath, 2016).

The use of waste-to-energy incinerators have been planned to ease the loads of landfills. However, it has also been pointed out that burning waste in incinerators would further increase air pollution problems by increasing highly toxic ash residues, dioxins and furans, which are carcinogenic and tend to remain in the environment (Sharma, 2017). Since, the continued exposure to and inhalation of dioxins and furans can cause respiratory and reproductive health issues. The residents of Sukhdev Vihar, (located close to the Okhla waste-to-energy plant), moved to the National Green Tribunal (NGT) in 2013, to stop the toxic emissions of dioxins and furans coming from the Okhla plant (NGT, 2017). In March 2013, the Central Pollution Control Board had found toxic emissions to be in excess, 120 times the safe levels (Sharma, 2017). The NGT conditionally allowed the plant to function and directed it to pay an environmental compensation of INR 25 lakh to the DPCC for its inefficient operation. The penalty so paid to the DPCC was planned and intended to be used for prevention and control of pollution in the area (NGT, 2017). As per the policy, the incinerators and waste to energy plants need to be installed at a minimum distance of 300-500m (CPCB, 2017) from residential areas as seen as a general practice in China, Canada, Malaysia and the United Kingdom. The Okhla plant stands at a close distance of just 35m from the Sukhdev Vihar colony and should discontinue functioning (Sambyal, 2017).

3. Issue of Solid waste segregation

The Solid Waste Management Rules (2000) mandated segregation of solid waste in India. It entrusted the responsibility of segregation of wastes on the municipal authorities, who were directed to undertake a phased programme to ensure community participation. The revised SWM Rules (2016) shifted the responsibility on waste generators to segregate waste into six different categories: non-biodegradable, biodegradable, domestic-hazardous, sanitary, construction-demolition and horticulture (MoEFCC, 2016). In addition, bye-laws for solid waste management in Delhi were enacted, where focus was again put on the waste generators' to segregate waste into biodegradable, non-biodegradable and domestic waste generated at source (NDMC, 2018). However, despite the existence of penal provisions in the bye-laws aimed at promoting the waste segregation and separation, recycling of waste, and preventing the entry of biodegradable and recyclable waste into the landfill, the current status of the three sanitary landfills (at Okhla, Ghazipur and Bhalaswa) clearly shows that the authorities have not implementation them rigorously. The management becomes cumbersome in the absence of proper segregation of waste, when the renewable, hazardous, organic and recyclable wastes are all dumped together.

The situation also attracted the attention of the Parliamentary Standing Committee on Urban Development (2014-15) who labeled the three major landfills as 'monstrous trash mountains' and sought responses from the Delhi Development Authority (DDA) regarding failure to solve the burning problems of solid waste management in the city. The DDA cited lack of an alternative landfill site, due to the very high price of land in the city. The DDA proposed the reclamation of landfill sites and construction of an integrated solid waste processing complex at the site available for a new landfill. But neither proposal came to any fruition. The Standing Committee also pointed out the fact that construction waste such as bricks, concrete, wood and rubble were not being segregated before being dumped in the landfill sites. The United Kingdom reuses about 70 per cent of its construction waste and Singapore over 90 per cent. However, because the total waste generated in the city is not segregated, of the 3,000 tonnes of construction waste created daily in Delhi, a large proportion is not reused for building purposes (Ministry of Urban Development, 2015). The Delhi Master Plan 2021 acknowledges that due to increasing population, rapid urbanisation, changing lifestyles and consumption behavior, the problem of solid waste management is increasing at severe

proportions. The environmental degradation is further accelerated due to the garbage generated from unauthorized colonies, illegal developments, slums, JJ settlements, etc, which is not collected by the authorities concerned.

4. Initiatives taken to manage solid wastes

The New Delhi Municipal Council has installed 40 sensor based underground bins to manage the waste collection effectively while maintaining the aesthetics of the city. The Okhla Landfill site, spread over an area of 40 acres, was an empty site in 1996 when it was allotted to South Delhi Municipal Corporation (SDMC) for dumping and managing waste. Nearly two decades later, more than 1200 tonnes of the 3,500 tonnes of waste collected per day by SDMC, was being dumped in the Okhla landfill until 2018, despite it being declared as 'exhausted' by experts earlier in 2010. With the landfill peaking at a height of 58 meters, which is about three times the permissible limit, authorities eventually took cognizance of views of experts in 2018 and initiated the action including the development of an ecological park to control the 'garbage hill'. The civic body has been carrying out bio-mining, a technique of extracting various materials from the dumped garbage to clear out the site to construct an ecological park.

At a time when the national capital is reeling under the increasing load of garbage and looking for a scientific solution for its proper disposal, the municipal authorities have initiated a new drive to tackle the problem of solid wastes. The model ward initiative emerged after an order was passed by the National Green Tribunal (NGT) directing the civic bodies to notify at least three zones or wards under their jurisdiction as 'model wards' where solid waste management rules would be fully complied.

A Bench headed by NGT Chairperson Justice Adarsh Kumar Goel had given observation on the report was submitted by the Delhi government that: "From the status report furnished by the Chief Secretary, a huge gap is noticed in the steps taken and the steps required to be taken in terms of [relevant] rules and for ensuring sustainable development. Unless such steps are taken, the unsatisfactory state of the environment in the country in general and in Delhi in particular may not improve." The NGT directed the Chief Secretary to monitor strict compliance, saying that the "model wards" must be compliant within six months, while the remaining wards or zones must be made "fully compliant within one year with respect to environmental standards".

The three municipal corporations have undertaken various steps to turn the notified wards into 'model wards' such as focusing on segregation of domestic and commercial level waste at the source to fully comply with municipal solid waste management by-laws. An intensive drive has been launched by all the three corporations for Information, Education and Communication (IEC. It includes performance of street plays or *nukkad nataks*, distribution of pamphlets carrying information on how to go about source segregation. In the three wards the municipal corporation has targeted source segregation in up to 60,000 households. So far, the corporation records state that it is taking place in more than 13,500 households. Earlier, attempts were made by the corporation to train waste pickers with the help of NGOs, the official said. However, the trainees were dispersed to different wards and the move went futile.

The EDMC has roped in waste pickers and issued identification cards to 70 of them to find a solution and achieve the target. They will be trained in waste segregation at source and tasked with communicating it to the household waste generators. Wet waste from the selected wards is to be kept in a separate section of the garbage dumps and will be transferred to compost pits. Dry waste will go to waste-to-energy plants. As per the municipal solid waste by-laws, violation of source segregation attracts penalties, which would be implemented very soon. Varied fines structures apply to different types of waste generators. The SDMC is also attempting to go beyond the NGT's mandate to ensure the civil bodies have three model wards ready by six months.

5. Measures to manage solid wastes

There is a need to adopt hybrid solutions. A landfill site is required but only for rejects and inerts wastes. The city needs waste to energy facility, but such plants must ensure that they operate only on segregated waste. As more than 50 per cent of the domestic wastes are biodegradable, there is high potential to compost or produce biogas from the segregated wet waste. All this would not work, unless we segregate wastes at source. It's high time to think something innovative, since already thousands of crores had been spent on waste collection and transportation,. We must take lessons from other cities across India that are doing exceptionally well on waste management. For example, in Panjim, the municipal corporation not only ensures waste segregation at source, but also segregates dry waste into 30 different categories. The best model in the country on decentralised waste management is Alleypey model, where residents have themselves taken responsibility to segregate and treat waste at source. There are other places such as Bobbili, Mysuru, Suryapet and a lot of other cities that are doing a commendable job. They have adopted local solutions to become zero-waste cities. As a sincere citizen, we need to take responsibility for waste management in our hands.

The municipal corporations are unable to implement the concept of 'Waste-to-energy' due to various technical difficulties. Sukhdev Vihar residents know the plight of a WTE plant in their locality. Due to environmental pollution, they have could not open their windows throughout the years. The Okhla Waste-to-Energy plant is uses upto 2000 TPD of garbage waste mainly collected from South Delhi. While the South Delhi Municipal Corporation (SDMC) sends in nearly 1,800 metric tonnes per day (MTD), about 200 MTD is collected from the New Delhi Municipal Corporation (NDMC). The plant has the capacity to generate about five MW of electricity by incinerating 450 tonnes of the solid waste in an hour. A total of Rs 250 crore has been investment in the plant on a land of 5.6 hectares. The Sukhdev Vihar Residents Welfare Association has filed a petition to the NGT, seeking the closure of the waste-to-energy plant, complaining that it uses inefficient mass-burning technology that causes air pollution. However, the plant is still running and even the green court has not asked for any action.

As per the NGT order in 2015, states were directed to adopt a cluster approach for solid waste management. The generation of more solid waste would lead to requirement of more land for waste disposal. Hence, many clusters will be required. It has been experienced that the cost of transport is a key factor in waste management and farther the site, the higher

will be the transportation cost. Therefore, decentralization of solid waste management would also cut transportation costs and make households and institutions part of the solution. Every state and UT has been asked to implement the SWM Rules, 2016 in all respects. The Environment Ministry in April 2016 had revised the previous rules for solid waste management with an objective to start more solid waste treatment plants across the country and set agendas for central ministries, state governments and local bodies. Also, in accordance to the rules, the states and UTs were given one year for ensuring compliance of the prepared action plans. The NGT judgment has extended this time frame to July 1, 2017. Any State or UT, which fails to comply with the statutory obligations, shall be liable to be proceeded against in accordance with Section 15 of the Environment (Protection) Act, 1986. Besides that, it would also be liable to pay environmental compensation, as may be imposed by this tribunal.

The NGT has also directed the imposition of an environmental compensation fine for open burning of wastes. For each violation, the culprits shall be liable to pay environmental compensation of Rs 5,000 in case of simple, and Rs 25,000 in case of bulk waste burning. The environmental compensation shall be recovered as arrears of land revenue by the competent authority as per the law. The WTE plants across the country were also directed to run on segregated waste only.

6. The legal rules and provisions for solid waste management

One of the initial legal provisions in the waste management sector was the Hazardous Waste (Management & Handling) Rules, 1989 followed by Bio-Medical Waste Handling Rules, 1998. However, the guidelines regarding the roles and responsibility for waste management and the processes to be followed in municipal waste collection, segregation, processing and disposal were missing. As the result un-segregated waste included biomedical, industrial and e-waste, it was a serious environment concern and a threat to public health. Thus, public interest litigation (PIL) was filed in the Supreme Court in 1996 against the Govt. of India and municipal corporations who were responsible for solid waste management; following which a committee was appointed to look into the matter. The committee submitted the final recommendation in 1999. The Ministry of Environment and Forest was then directed to act on the recommendations and develop appropriate rules for management of municipal solid waste.

Municipal Solid Wastes (Management and Handling) Rules, 2000 directed that all the municipal authorities in the country were to manage solid waste in their respective jurisdictional areas according to the rules. The MSW rules covered all the aspects of solid waste from collection to waste disposal. The Batteries (Management and Handling) Rules, 2001 was applicable to every manufacturer, importer, re-conditioner, assembler, dealer, auctioneer, consumer, and bulk consumer involved in the manufacture, processing, sale, purchase and use of batteries or components so as to regulate and ensure the environmentally safe disposal of used batteries. The Plastic Waste Rules, 2011 mainly specified the minimum thickness of plastic bags as to be of 40 microns as opposed to the previous 20 microns specified by Plastics Rules, 1999. These rules do not allowed the carry bags for consumers, co-retailers at free of cost. As per these rules, use of recycled or compostable plastics for storing, carrying or packing foodstuffs is prohibited. The E-Waste Rules, 2011 gives the definition of terms mainly authorization, bulk consumer, historical e-waste, environmentally sound management, e-waste, electrical and electronic equipment, recycler etc. It is the duty of producer to carry out recycling or disposal, collection of e-waste generated from 'end of life' of their products in line with the principle of 'Extended Producer Responsibility'.

The Solid Waste Management Rules, 2016 emphasizes source segregation of waste. It also describes sanitary landfills as the final and safe disposal of discarded solid waste and inert wastes on a land having technical facilities with protective measures against environmental pollution, contamination of groundwater and surface water, bird menace, pests or rodents and greenhouse gas emissions. It says that the landfill site shall be 100 meters away from a river, 200 meters from a pond, 500, 200 meters away from highways, habitations, public parks and water supply wells and 20 km away from airports/airbase. Emission standards are completely amended and include parameters for dioxins, furans, reduced limits for particulate matters from 150 to 100 and now 50. Also, the compost standards have been amended to align with Fertilizer Control Order. The three landfills sites in Delhi at Ghazipur, Okhla and Bhalaswa, do not fulfils the mandated parameters provided by the UNEP or the SWM Rules, 2016. Discharge of toxic gases, recurrent fires and landfill slides repeatedly occurs, posing a major health hazard for residents living in the region (Nath, 2016; Sunny, 2017; Sharma, 2017). The primary cause is the uninhibited practice of non-segregation of waste materials. In fact, of the 9,620 tonnes of waste generated every day in Delhi, a major fraction (~51 per cent) is compostable, including food, vegetable market and yard waste; recyclables such as paper, plastic or glass and inerts such as ash, silt and stones constitute about 17.5 per cent and 31 per cent of the waste respectively (Annepu 2012; Sharma, 2017).

However, until 2015, Delhi reportedly had only one compost plant handling 150 tonnes of waste per day and an integrated waste processing plant dealing with 1,250 tonnes of waste per day (DPCC, 2015). The remaining organic waste enters the landfills in a blatant violation of the SWM Rules. Under the 2000 SWM Rules, landfilling was permitted only for non-usable, non-biodegradable and inert waste that are not suitable for recycling or biological processing. This point was reiterated in the revised 2016 SWM Rules (MoEFCC, 2016), with the addition of pre-processing rejects and residues to the categories of waste that could be disposed into the landfills. The Rules also state that every effort needs to be made to recycle or reuse the rejects to achieve the desired objective of zero waste going into the landfill. This also means that more than half (4,080 tonnes) of the waste generated in Delhi is legally prohibited from entering the landfills. However, owing to the non-segregation of waste and lack of adequate infrastructure for composting or recycling, almost the entire waste generated daily in the city enters the landfill, adding to the woes of the already saturated sites.

7. Conclusion

The solid waste management system in Delhi is in a critical state, as the Municipal corporations have largely failed to manage solid waste efficiently. The solid waste management rules were notified in 2016 but could not be implemented in an effective manner. For effective waste management, its segregation at the community level is imperative. The decentralized waste management has to be encouraged by municipal authorities, waste shall be segregated and collected, in separate containers and involvement of garbage collectors and rag pickers with RWAs, CBOs and NGOs is to be encouraged as per the master plan 2021. Delhi is a very small city and it cannot spare any more space for landfills. Being heavily dependent on the governments for funding, these local bodies lack the resources to acquire new land for landfills or obtain the technologies required for effective SWM. To improve the present situation for solid waste management, institutional and financial issues must be addressed on priority. To enhance the efficiency of SWM in Delhi, citizen's participation should be promoted, particularly in waste segregation and treatment processes. For sustainable SWM we must work to minimise wastage and littering, and increase reuse and recycling.

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