The Untold Story of Waste Treatment Plants

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About the series 'Books for the Concerned Citizen'

Leveraging the diverse expertise of its members in the subject domains and in publishing, the TERI Alumni Association proposes to publish a series of books on topics related to energy, resources, and the environment. The idea is to share information and, even more important, critical insights and understanding, with citizens who are keen to know more about some of the critical issues facing society and the world today but are lost in the deluge of information.

Our target audience is educated adults who are concerned about topical issues but lack the understanding to make sense of what they read or watch in the mass media—the series aims to equip them with conceptual tools and essential information not only to enrich their understanding but also to encourage them to act and thereby, albeit indirectly, further the UN Sustainable Development Goals.

The topics to be covered in this series and their respective subject-matter-specialist authors are listed below.

- *Your City, Your Impact*: Priyanka Kochhar
- *Responding to Climate Change in South Asia: lessons from India*: Divya Sharma, Raina Singh, and Aditya Raghwa
- *Keeping Cities on the Move*: O P Agarwal
- *The Grey Lens: ageing, sustainability, and climate in our shared tomorrow*: Arvindd Narayanan and Ambika Shankar
- *People Power: customers' perspective and role in determining electricity tariffs*: Gaurav Bhatiani
- *The Untold Story of Waste Treatment Plants*: Hina Zia and Priyanka Kochhar

The untold story of Waste Treatment Plants

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FOREWORD

The Untold Story of Waste Management Plants by Hina Zia and Priyanka Kochhar is a lucid, accessible, and deeply relevant account of one of the defining challenges of our times. Using the city of Delhi as a compelling case study, the authors show how rapid urbanization, population growth, rising consumerism, and industrial expansion have dramatically intensified the production of waste even as systems of collection, management, and disposal remain dangerously inadequate. Through their detailed examination of waste management practices and sites, they demonstrate that the crisis is not merely environmental, but intimately connected to public health, urban planning, and the quality of everyday life. Timely and thought-provoking, this important book will not only deepen the awareness of the 'concerned citizens' to whom the TERI Alumni Association series is addressed, but also inspire readers to recognize their role as active stakeholders in creating a more sustainable future.

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Cities and solid waste

Human civilization has witnessed waste as an intrinsic part of the story of the development of civilization, and the quest for ways of managing waste efficiently has always been with us. Waste in earlier times comprised ash, bones, wood, and vegetable matter. The edible parts were eaten, and what remained was buried for decomposition. The modern waste management industry has come a long way from the earlier times both in its complexity and scale. Waste, or garbage, was not a threat until urban population grew rapidly. Historical records of plagues and contaminated water supplies are testimony to the rise of urbanization and the need for effective waste management to prevent the spread of diseases.

Waste can be understood as unwanted remnants of human activities, or unwanted by-products of production, consumption, and disposal of materials. Waste represents the end-of-life materials that society must manage responsibly to prevent environmental contamination and hazards to public health. The definition of waste is not static; it evolves with economic development, consumer behaviour, and regulatory frameworks. In the context of urban environments, waste encompasses a diverse range of materials from residential, commercial, industrial, and institutional sources.

Evolving of municipal waste generation in urbanized societies

Municipal waste, also referred to as municipal solid waste (MSW), comprises all solid waste generated within municipal areas excluding hazardous industrial waste and includes, according to the Solid Waste Management Rules, 2026, solid or semisolid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential waste, street sweepings, silt removed or collected from surface drains, garden waste, farm and dairy waste, treated biomedical waste excluding industrial waste, biomedical waste and e-waste, battery waste, radioactive waste, and construction and demolition waste. All these kinds of waste are governed by separate rules. The rules further state that solid-waste management by local authorities includes environmentally sound management of solid waste such as dry waste, wet waste, special-care waste, sanitary waste, and garden waste as well as the management of sanitary landfills and remediation of existing or legacy waste dumpsites. The earlier rules did not cover solid waste generated in areas outside municipal boundaries, a lacuna that has now been filled in the latest revision of the rules.

Urbanization and waste generation go hand in hand. Urban lifestyles are responsible for generating large quantities of waste, driven by increased consumption, commercial activities, and industrial operations. As urbanization progresses, the composition and quantity of waste generated are transformed significantly.

The amount of waste generated per capita in Indian cities and towns varies greatly. The Ministry of Housing and Urban Affairs reports the rates of generation of urban MSW per capita per day for three categories of urban centres based on their population: greater than a million,0.55 kg; 0.1–1 million,0.45 kg; and less than 0.1 million, 0.30 kg (MoHUA 2021).

Shahab and Anjum (2022) estimated the rate of increase in waste generation in urban areas at 5% every year and that in per-capita generation at 0.7 kg by 2025.Larger cities including megacities such as Delhi and metropolitan cities such as Bengaluru and Hyderabad are expanding more at their peripheries or fringes, and some of those areas may not be within the municipal boundaries and therefore outside the purview of the rules mentioned earlier. Indian cities and towns are thus not only generating increasing amounts of waste but also face the associated challenges related to jurisdiction, governance, land for disposal sites, material recovery facilities (MRFs), and the siting and operation of waste treatment plants.

Do we understand our city waste?

Municipal waste is heterogeneous: it is made up of all kinds of things, their proportions a reflection of socio-economic status, lifestyles, climate, and the level of development across different neighbourhoods within a single city. As with any growing economy, the quantity and the composition of waste generated in cities and towns undergo changes. For instance, long term studies by NEERI (National Environmental Engineering Research Institute) and CPCB (Central Pollution Control Board) show that, with urbanization, the share of paper and plastics in MSW increases sharply, while that of other inert material declines. Between 1996 and 2011, the share of paper in MSW increased by over 380% and that of plastics by about 1650%, reflecting greater use of packaged consumer products. The approximate composition of MSW in a typical Indian city is as follows: organic waste, 40%–60%;recyclables (paper, plastics, metals, glass), 20%–25%;other inert material, 25%–30%.As city dwellers become more affluent, the share of recyclables and combustibles goes up. The Task Force on Waste to Energy explicitly links this trend to changes in lifestyle, noting that the increasing shares of paper and plastic raise the calorific value of waste and justify combining composting and waste to energy (WtE) as the two approaches to waste management in large cities (Planning Commission 2014).

Another important aspect related to the changing composition and management of city waste is the paucity of empirical studies in India to understand the waste stream, composition, characteristics, calorific value, etc. Recent studies by the World Health Organization (Foellmer and others 2022) suggest that cultural contexts such as increasing consumption, endorsement of fast fashion, and disposability affect the generation of waste as well as have profound impacts on the disposal, recycling and dumping of the generated waste. In India, the only significant studies on characterization of waste in key cities of India were carried out by NEERI (Zhu and others 2008), which are often quoted and reported in later studies.

The nature of urban waste continues to evolve and changes more markedly during global disruptions: for instance, India's economic liberalization in 1991 spurred a consumer boom, dramatically boosting plastic packaging waste per capita from approximately 0.8 kg in 1990 to about 5 kg by 2001 and raising the share of plastics in MSW from 0.7% in 1971 to 4% in 1995, driven by societal shifts towards packaged goods and supermarkets (Mutha, Patel, and Premnath 2006). More recently, the COVID-19 pandemic introduced new waste streams including disposable face masks, gloves, hand sanitizers, and excessive plastic packaging from increased home-delivery services (Angmo and Shah 2025). Such changes demonstrate how waste generation is intricately linked to societal practices, economic conditions, and unforeseen global events.

How much waste our cities collect, process, and discard

Any efficient management plan requires information on the 'what' that needs to be managed. The reporting on that 'what' in the context of municipal solid waste is the responsibility of the urban local body, and it is based on this information an appropriate treatment technology(ies) is chosen and recycling facilities and landfills are designed.

The Central Pollution Control Board, the apex body under the union Ministry of Environment, Forests and Climate Change (MOEFCC), is responsible for setting standards, developing guidelines, and monitoring the implementation of solid waste management rules. There are varied estimates on the generation of municipal waste in India. According to current World Bank estimates, MSW in India will increase to approximately 231 million tonnes in 2030 and over 370 million tonnes in 2050 based on current urbanization and population growth rates (Figure 1) (Cook and others 2026). India generated 170,000 tonnes of MSW a day in 2021/22: of that, about 156,000 tonnes was collected, of which nearly 54% was treated and 24% disposed of using landfills or dumpsites (CPCB 2024). In 2015/16, only 20% of the generated waste was treated, and unaccounted-for waste amounted to 42%, a share that decreased to 22% in 2021/22. This unaccounted-for waste remains untraceable in the solid waste management chain. There is no reporting on recycled quantities because almost the entire recycling economy runs informally. Even the data collated by the CPCB in its annual reports are based on reporting by urban local bodies and contain a great deal of discrepancies, as do the data from the Directorate of Local Bodies found in the audit reports conducted by the Comptroller and Accountant General of India. These challenges related to data and lack of reliability are also highlighted by Hujare and Telsang (2020). Unreliable estimates of the quantities of waste and of the shares of different waste streams lead to ineffective designs of waste treatment plants and non-implementable waste management systems.

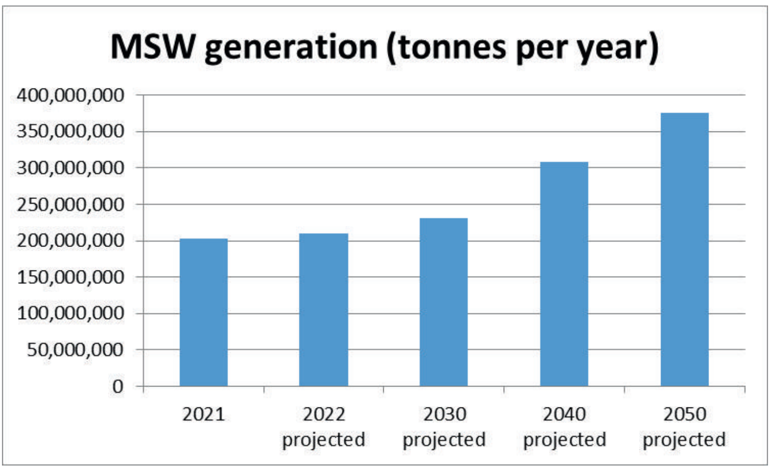

Figure 1 Annual generation (**million tonnes**) of municipal solid waste in India:2021–2050
SOURCE Cook and others 2026

The collection and treatment capacities have increased considerably owing to the Swachh Bharat Mission (SBM) 1.0 and 2.0 (the mission, launched in 2014, is the union government's ongoing flagship programme; under SBM Urban 2.0, India aims to make all its cities garbage-free by 2026).The mission has led to greater quantities of waste being treated and smaller amounts going to landfills. However, the progress is well below the targets.

Although urban local bodies have made some progress in terms of the amount of waste collected, materials recovery and processing have largely remained stagnant, leading to ever increasing numbers of landfills (dumpsites). Larger cities are struggling with their legacy waste, unable to find new sites for dumping end-of-life waste. Take the case of Delhi, India's capital city. All the city's three landfills have outlived their life and are supposed to be closed down soon: Bhalswa by December 2026, Okhla by July 2026, and Ghazipur in 2027. Large quantities of waste from these legacy sites are being dumped on illegal sites near the Yamuna, as reported in the Times of India of 2 April (Mishra 2026). Finding a site for a landfill or even for a waste treatment plant is becoming increasingly difficult in any of the larger cities. With increased public awareness of the consequences of unscientific waste management or treatment, people in planned housing colonies and even in rural areas strongly object to having a landfill or a treatment plant close by. The burden then falls on people living in unplanned colonies, slums, and those who work in the informal waste recycling sector who cannot object to such facilities being set up close to where they live.

Mixing of solid waste with construction and demolition waste is rampant across the country owing to inadequate facilities for managing construction and demolition waste. The latter is governed by a different set of rules, but reporting and implementation are poor. The number of MRFs has also gone up across the country but many of them are not functional or are open to intrusion by stray animals.

Segregation at source: the mantra for success but a distant dream

Segregating waste at source, or at the point of its generation, into different categories (biodegradable, non-biodegradable, construction waste, hazardous waste, etc.) is considered fundamental to successful waste management. Segregation enables appropriate treatment of different waste streams, facilitates recycling and resource recovery, reduces the burden on landfills, and minimizes environmental and health impacts. The Solid Waste Management Rules, 2016, mandate segregation of waste into three categories, namely wet, dry, and domestic hazardous, whereas the new Solid Waste Management Rules, 2026, mandate segregation of municipal solid waste into at least four categories: dry, wet, sanitary, and special care. Sanitary waste is the new addition, comprising such items as diapers, sanitary napkins, condoms, incontinence sheets, and any other items related to similar waste. However, actual segregation achieved is yet not 100%; segregation for the category(domestic hazardous waste) is also often missing for a variety of reasons including behavioural issues by those who generate it and absence of an appropriate collection system (for segregated waste). Mixing of municipal non-hazardous waste with hazardous waste leads to contamination of the entire waste stream and jeopardizes the overall treatment efficiency.

In megacities such as Delhi, achieving comprehensive segregation faces significant challenges. At Okhla landfill in Delhi, Angmo and Shah (2025) reported that 93.4% of the workers surveyed said that waste received at the facility was completely unsegregated. Only 2.8% said that they received partly segregated waste, and 3.8% said they received segregated waste only occasionally. This lack of segregation at source complicates the treatment of waste and limits the effectiveness of individual waste management facilities.

Such failure to segregate can be attributed to multiple factors including inadequate public awareness, lack of infrastructure for storage and collection of segregated waste, informal waste sector dynamics in which waste pickers informally segregate materials from mixed streams, and limited enforcement of segregation mandates. Despite regulatory requirements under the Solid Waste Management Rules, 2016, primary segregation at household level remains minimal in most cities, with informal waste pickers collecting waste from door to door and communal bin systems, then informally segregating recyclables to supplement their income.

Data on recycling, as stated earlier, are missing from any of the annual reports of the CPCB. However, the burden of recycling is often carried by the vast pool of people working informally at various levels in the waste recycling sector. They recycle everything that has market value, right from plastics and metals to glass and paper. India is estimated to have about 4 million people, including waste pickers, local kabadiwaalas (small-time scrap aggregators), larger aggregators, and intermediate dealers or other intermediaries are estimated to be active in the sector, playing a significant role in the recovery and recycling of resources (Hasan and Ghosal 2023).

A few cities including Pune have attempted to successfully integrate the informal waste sector into their formal systems. Pune Municipal Corporation signed an agreement with the SWaCH cooperative, one of India's first unions of waste pickers, which handles about 70% of waste collected in Pune. The organization integrates waste pickers into formal systems while driving waste reduction and source segregation (Khan, Mishra, and Singh 2025). Similarly, Visakhapatnam has established a plastic waste recycling unit at one of the dumping yards by collaborating with local NGOs (non-governmental organizations).

Formal recycling plants and the increasing number of MRFs, however, do not present a rosy picture in terms of recycling targets achieved formally. The plants and facilities often fail for a variety of reasons such as poor segregation at source, inadequate infrastructure, insufficient finances, poor participation by people, and weak enforcement. The burden of recycling continues to fall on the informal sector. The large pool of people engaged in the informal waste recycling sector remains largely unrecognized and unintegrated with any formal waste management system.

The road less travelled: success stories of waste management at decentralized scales

Alappuzha

Alappuzha in Kerala is one of the earliest examples of how decentralized waste management can overcome existing barriers to centralized waste management systems in India. The city is famous, amongst many things, for the 'Clean Home Clean City' project, a successful model prioritizing segregation at source and local processing to eliminate dumpsites. In 2012, the city was forced to adopt a creative decentralized system in the wake of protests from people living around the dumping yard at Sarvodayapuram. The project's success lies in active community participation and local leadership to manage waste. The resident associations and Kudumbashree, the women's groups, also played an important role in this campaign. The city deployed numerous decentralized composting units (over 450 units in 36 localities) rather than relying on a centralized processing plant or the fashionable but cost-intensive WtE plants and pelletization plants. The composting units produce organic compost, which is distributed to local farmers free of charge. The municipality provides for collection of only dry wastes. Waste is segregated at source not only by households but also by commercial entities and bulk waste generators. The decentralized model has significantly reduced transport, dependency on landfills, and financial burden while achieving a cleaner city with better health outcomes.

Navjivan Vihar, a zero-waste colony in south Delhi

Navjivan Vihar is a pioneering zero-waste housing colony in which 280 families, generating a total of 300 kg waste a day, have prevented any garbage from reaching landfills for the last seven years. The housing colony was led by Dr Ruby Makhija (a medical doctor by profession and also the secretary of the resident welfare association). The colony segregates 100% of its household waste into wet, dry, and hazardous waste and has managed to successfully turn the entire wet waste into compost, which is used for maintaining the gardens within the housing colony. Dry waste is recycled or reused by donating unused clothes, books, furniture, etc., with over 30 tonnes of items repurposed. The colony has given away 17 tonnes of plastic for recycling and diverted 3 tonnes of e-waste from landfills. To obtain community support, an awareness programme and engagement with residents (Figure 2) of the entire colony have been constant endeavours. The community's success has made it a model for other neighbourhoods seeking sustainable waste management solutions. It is noteworthy that decentralized options, which are less cost intensive than the high-cost centralized systems of incineration or waste treatment, are possible. Besides, the option also avoids the adverse impacts on health associated with some of these treatment technologies.

Figure 2 Active participation of residents in segregating waste at source in Navjivan Vihar
SOURCE https://thebetterindia.com/changemakers/navjivan-vihar-zero-waste-delhi-colony-landfills-dr-ruby-makhija-10516941

Centralized waste treatment plants: the new messiah or old genie in the form of waste-to-energy plants

With burgeoning legacy waste and new untreated municipal waste increasing every day, WtE plants are being promoted rapidly in India. Both the earlier SWM Rules, 2016, and the new SWM Rules, 2026, promote suitable technologies such as incinerator-based WtE plants for treating non-recyclable, high-calorific-value MSW. These plants are engineered to process such waste thermally and recover energy in the form of electricity or heat.

The technical and environmental feasibility of such plants depends on critical factors such as source segregation, pre-processing of waste to achieve the requisite calorific value (1500 kcal/kg or more), installation of advanced air pollution control devices, and continuous emissions monitoring systems. As of 2025, India had the capacity to treat 12,727 tonnes of waste a day through 21 WtE plants (CPCB 2025). The Timarpur Okhla plant in Delhi is one of the earliest such plants and, despite the huge investments made by the state in various phases, continues to face challenges including resistance by the nearby residential colonies on account of health problems due to inadequate control of air pollution and burning of plastics as part of commingled waste.

Although the technology has been available for a while, success stories in India have been few and far between. One of the primary reasons for the failure is non-availability of high-calorific-value waste: to compensate for that, the waste is augmented with combustible substances and fuel. The cost of environmental compliances also makes the operation prohibitive. The other technology being widely used primarily for biodegradable or organic waste is biomethanation or biomining.

Delhi, a city of contradictions

Delhi exemplifies the contradictions inherent in urban waste management in rapidly developing megacities. With a population exceeding 16 million, Delhi generates about 14,100 tonnes of MSW daily, at 0.5 kg per capita, yet faces severe constraints in waste treatment capacity and landfill availability.

The National Capital Territory of Delhi collects an estimated 11,852 tonnes per day (TPD) of MSW. Local bodies report that of the total, 7611 tonnes of waste is processed or treated and 4241 tonnes of waste is dumped. All these figures represent under-reporting because large quantities of waste find their way to open grounds and drains, blocking drainage lines and entering water bodies.

The city operates multiple landfill sites (Okhla, Ghazipur, and Bhalswa) that have long since exhausted their designed capacities and now operate far beyond the maximum permissible height of 20 metres. The Okhla landfill, for example, now stands at 58 metres, nearly three times the permissible limit. All three are being closed down but biomining of the sites continues, albeit slower than expected. Biomining and biomethanation are distinct biotechnological processes that utilize microorganisms to turn waste or raw materials into valuable products. Two other engineered landfills are operational in Bawana and Tehkhand. This situation compounds the problems, namely accumulation of legacy waste and the associated environmental contamination, persistent environmental and health hazards for surrounding communities and workers, and less space for new ways of disposing of waste.

Simultaneously, Delhi pursues the development of WtE plants as a solution to lower the burden on landfills and generate renewable electricity. However, such plants introduce new potential sources that can pollute air and water and add to noise pollution. The plants therefore face resistance from nearby communities and require strict environmental monitoring and control, controls that are difficult to implement. The city thus embodies the tension between the necessity of managing waste and that of protecting the environment, or the tension between the pressure of development and concerns related to maintaining liveable conditions.

Despite recommendations in the master plan for Delhi, proposed sites for WtE plants and landfills often violate the recommendations given in various manuals prepared by CPHEEO, the Central Public Health and Environmental Engineering Organisation. These recommendations include a buffer zone of at least 500 metres around such sites, their location downwind of the prevailing wind direction, and avoiding locations with low water tables to safeguard against contamination of groundwater.

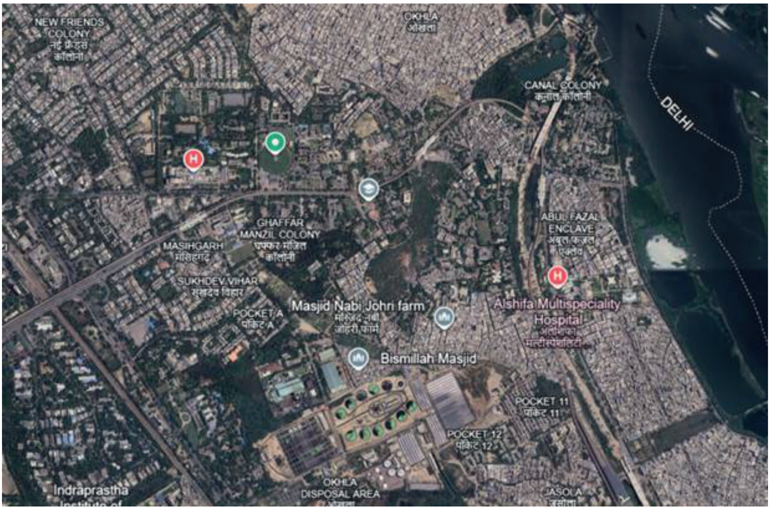

Figure 3 Location of Okhla landfill and waste-to-energy plant in close to residential and institutional areas
SOURCE Google Earth

The massive Okhla landfill site – now closed – was designated in the master plan as 'utility' land use, providing a legal designation for infrastructure development. However, the urban-industrial location with proximity to residential areas of Haji Colony, Sukhdev Vihar, and Jasola Village creates conflicts between the much-needed infrastructure for waste management and the need to protect the people living nearby from the hazards associated with that infrastructure. The incinerator-based WtE plant in Okhla lies within 300 metres of residential areas (both informal settlements and planned colonies) (Figures 3 and 4). The Municipal Corporation of Delhi is also developing a major 300-tonnes-per-day biogas-cum-CNG plant (compressed natural gas) in Okhla, in collaboration with Indo Enviro Integrated Solutions Ltd. The plant, located on the site of a formerly dysfunctional composting plant, is designed to convert wet waste into compressed biogas. The site sits next to a dense residential informal settlement.

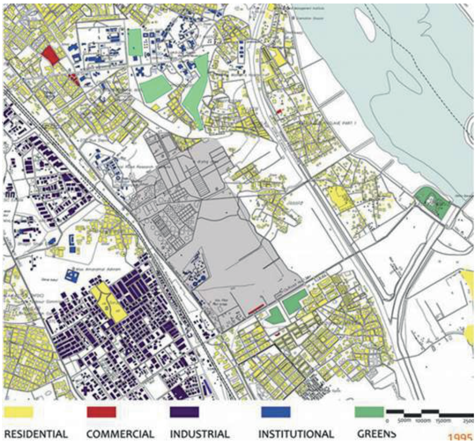

Figure 4 Residential and commercial land-use close to the waste treatment plant, Okhla, New Delhi

City plans typically stipulate that waste treatment facilities be located in areas with proper buffering for 'sensitive receptors' (people and areas that more vulnerable to adverse effects of pollution), equipped with adequate infrastructure for environmental monitoring and pollution control, and offer access to transport for waste collection and product distribution. The challenge in implementing such stipulations arises from competing land-use demands, finite availability of land in dense urban areas, and the political difficulty of siting such unwelcome facilities close to where people live.

The case of Okhla in south Delhi

Delhi's waste treatment infrastructure includes multiple facilities with varying technologies and operational status. Treatment plants that account for more than half of the centralized treatment capacity are in Okhla. The primary WtE facility run by Timarpur-Okhla Waste Management Company Ltd (TOWMCL) processes about 1950 tonnes of MSW a day using reciprocating grate incineration and a combustion technology based on RDF (refuse-derived fuel), generating approximately 23 MW of electricity. The facility is to be provided with MRFs for pre-sorting and segregation, RDF production units, and power generation systems. This plant is being expanded to increase its capacity to 2950 tonnes a day by March 2027 (DPCC 2025). There is also a new WtE plant of 2000 TPD capacity operational in Tehkhand, Okhla.

The Okhla landfill was established in 1994 and officially commissioned in 1996 on a 16.2-hectare plot in Okhla Phase-1 in south Delhi. The facility was developed before the promulgation of the Solid Waste Management Rules, 2000, and well before the comprehensive SWM Rules, 2016; therefore, modern design features including composite liners, leachate collection systems, and gas recovery infrastructure were not mandatory. The landfill accepted unsegregated and unsorted waste from across south Delhi, accumulated massive quantities of legacy waste as the primary disposal site for the city's southern region, and continued operations beyond its designed capacity until it was officially closed in 2018.

Parallel to landfill operations, the development of WtE technology in Delhi led to the establishment of the Timarpur-Okhla WtE facility (Figure 5), a 100-TPD composting plant (currently closed and being expanded to a 300-TPD biomethanation plant) and a 2000-TPD plant in Tehkhand. The Timarpur-Okhla WtE represents the integration of multiple technologies.

Figure 5 Waste-to-energy plant in Okhla, New Delhi

Environmental clearance was sought to increase the power-generating capacity of the Timarpur WtE plant to 40 MW, which would require processing an additional 1000–1200 TPD of MSW. However, since the public hearing in August 2022, these proposals have been stalled owing to ongoing opposition from the community (Sukhdev Vihar Residents Welfare Association), legal challenges (National Green Tribunal OA 606/2018), continued emissions of pollutant in quantities that exceed the maximum permissible limits (thereby attracting fines by the Delhi Pollution Control Committee), and restrictions imposed by the MOEFCC limiting further additions to capacity without offsite waste solutions (DPCC 2023).

All wastewater streams (boiler blowdown, cooling tower blowdown, floor washing, MSW pit leachate, and biomethanation overflow) have to be directed to a common monitoring basin, in which the pH and TDS (total dissolved solids) are adjusted to comply with the standards laid down by the CPCB for zero-discharge systems. (The resident welfare association alleges that the WtE plant does not comply with these regulations.)

Going by the environmental impact assessment, bottom ash (about 135 TPD) generated from the plant was expected to be processed in a facility similar to a construction-and-demolition plant for reducing the volume of waste, screening it for recovering 'fines' (particles smaller than 75 micrometres), separating recyclable materials, and disposing of inert residues in landfills. Fly ash (about 45 TPD) was supposed to be utilized on site for making hollow bricks and interlocking paver blocks (Mantec Consultants Pvt. Ltd 2022). Reports further suggest that contrary to the environment impact assessment, the biomethanation plant and RDF units did not exist, and commingled (unsegregated) waste is simply burned in the incinerator (ToxicsWatch Alliance 2026).

The facility operates under the ownership and management of TOWMCL (an undertaking of Jindal Urban Infrastructure Ltd), a private entity contracted by the South Delhi Municipal Corporation and the New Delhi Municipal Corporation to manage waste treatment. An environmental management group is responsible for implementing environmental monitoring programmes, taking mitigation measures, checking compliance with applicable regulations, and ensuring health and safety of workers.

Operational management of such plants requires dedicated units for operating RDF plants and the main plant, segregating waste, handling ash, manufacturing bricks, treating the leachate, controlling air and noise pollution, and general housekeeping. The waste-to-energy facility is also required to comply with applicable interconnected regulatory frameworks such as SWM Rules, 2016, and the CPHEEO manual for managing MSW. It is mandatory to segregate recyclables before combustion, design furnaces for complete burnout and stable operation, ensure that emissions of flue gas meet the CPCB or MOEFCC stipulations specified in SWM Rules, 2016 (Schedule II), dispose of the leachate properly, and produce compost that meets the SWM requirements. However, many of the regulations are flouted. It is also mandatory to have an online continuous emission monitoring system connected to the servers of the CPCB and of the DPCC. Monitoring in 2018 revealed that levels of suspended particulate matter exceeded the permissible limits laid down in the NAAQS (National Ambient Air Quality Standards) at 3 out of 5 monitoring locations and those of respirable particles (RSPM), at 2 out of 5 locations (Mantec Consultants 2022). The residents also mention black smoke, respiratory problems, asthma attacks, and multiple other every day and long-term adverse impacts of the plant. The Sukhdev Vihar Resident Welfare Association has been fighting a case against the plant since 2015.

In assessing the environmental impact of such WtE plants, environmental monitoring and reporting is mandatory. The plants must maintain comprehensive environmental monitoring programmes including testing the emissions from stacks (every 3 months or as specified), assessing the quality of soil and groundwater, and monitoring ambient air quality (24-hour sampling at fixed monitoring stations), noise levels (round the clock at sensitive locations), water quality (monthly for all sourced and recycled water), and the biological environment. Records must be maintained and regulatory agencies (DPCC, CPCB) notified of any instances of non-compliance and of exceeding the permissible limits (Mantec Consultants 2022).

Science on likely impacts of waste-to-energy plants

Technologies to treat waste have evolved over time. Converting waste to energy involves either of the two main processes – biological or thermochemical – depending on the composition of waste and its moisture content. Selecting the suitable process depends on the feedstock (waste as an input).Technologies such as gasification, pyrolysis, anaerobic digestion, and composting require that waste be segregated at source. Incinerating waste in a fluidized bed combustor also requires such segregation whereas incinerating waste in amass-burn combustor does not, because it can handle mixed waste. In India, due to the absence of source-segregated waste, incineration in mass-burn combustors is more common. Although only a few studies have examined the impact of exposure to emissions from WtE plants, the limited evidence suggests that well-designed and properly operated WtE facilities using segregated waste as feedstock are critical to reducing potential adverse impacts on health (including cancers and diseases other than cancers): these plants produce smaller amounts of hazardous combustion-related emissions than do landfills or plants using unsegregated waste. Low-quality feedstock may emit concentrated toxins such as dioxins or furans and heavy metals, which pose serious potential risks to health; these toxins may also remain in bottom ash, which is a by-product of combustion. Let us look at what scientific evidence tells us about the impacts of WtE plants and incinerators (Beyene, Werkneh, and Ambaye 2018; Cole-Hunter and others 2020),

Air quality and impacts on respiratory health

Scientific literature and monitoring data from waste treatment facilities show that their operations could potentially emit hazardous substances and have measurable health impacts on people living nearby.

Emissions from combustion processes The combustion of mixed or unsegregated MSW in incineration plants produces multiple pollutants (NDWPC 2006) including

- particulate matter, with particles smaller than 10 micrometres (PM_{10}) or smaller than 2.5 micrometres ($PM_{2.5}$) from incomplete capture of particles and secondary formation in flue gases
- nitrogen oxides (NOx) from high-temperature combustion reactions
- sulfur dioxide (SO_2) and hydrogen chloride (HCl) from oxidation of sulfur-containing compounds and chlorine in plastics
- volatile organic compounds (VOCs) from incomplete combustion and vaporization of organic compounds
- dioxins and furans from de novo synthesis during cooling of flue gases and recombination of precursor compounds
- heavy metals (mercury, cadmium, lead) from vaporization and subsequent capture or atmospheric release depending on control system efficiency (Beyene, Werkneh, and Ambaye 2018).

Respiratory and systemic health effects Landfill and waste facility workers, as well as residents in nearby communities, face documented health risks, including

- respiratory infections and allergies (prevalent in 62% of landfill workers in Okhla in 2005)
- airway inflammation and declined lung function
- eye irritation, dermatological conditions, and hair loss
- cardiac and neurological symptoms potentially linked to chronic air pollution exposure.

In a comprehensive survey of 107 landfill workers in Okhla (2020–2021), the prevalence of different occupational health hazards was as follows: skin allergies, 36%; respiratory illnesses, 32%;red eyes and hair loss, 23.5%; and cardiac problems, 8.5%. The survey further revealed that 76.6% of landfill workers reported health issues often attributable to landfill (Angmo and Shah 2025).

Ambient air monitoring data Monitoring at the Okhla WtE facility and landfill sites showed the following baseline (pre-operation) parameters of ambient air quality:

- PM_{10} (RSPM) exceeding the permissible limits in Haji Colony (AAQMS 4), Sarita Vihar (AAQMS 2), and other monitoring stations
- NOx concentrations within the range acceptable for industrial areas
- Sulfur dioxide and carbon monoxide (CO) levels generally below the permissible limits
- Particulate matter levels varying with traffic patterns and season

Recent CPCB–DPCC joint monitoring reports (2020–2025) indicate that although the Okhla WtE facility demonstrates greater compliance than before with the permissible limits for emissions from the stack, the emissions of the following pollutants occasionally exceed the permissible limits: HCl, NOx, and $PM_{2.5}$ with emissions of dioxin or furan occasionally approaching or exceeding the limit of 0.1 nanograms per cubic metre (expressed as TEQ, or International Toxic Equivalent).

Occupational health and safety hazards
Workers engaged in biomining, waste processing plants, and landfill operations face multiple categories of occupational hazards including the following.

Chemical and biological hazards Exposure to hazardous gases including methane (CH_4), carbon dioxide (CO_2), hydrogen sulfide (H_2S), and VOCs; pathogenic microorganisms including bacteria (*E. coli*, *Salmonella* sp., *Staphylococcus aureus*, *Pseudomonas* sp.) and viruses associated with municipal waste; and heavy metals accumulated in waste and dust

Physical and ergonomic hazards Injuries while operating such machines as bulldozers and trommel screens (a rotating circular mesh drum that can sort materials based on their size) and while handling sharp objects and bulky items, exposure to heat stress, particularly during summer, and to noise from equipment operating continuously or in multiple shifts.

In a survey of 107 landfill workers at Okhla (Angmo and Shah 2025),51% of workers reported poor restroom conditions, only 33.5% rated rest facilities as 'good', and 47.5% rated the conditions as 'poor or unhygienic'.

Use of protective gear The operators and management of waste treatment plants provide personal protective equipment (PPE) to workers but it is often not used for a variety of reasons including discomfort and low quality of the PPE (torn or becoming unusable within days of issue). Although such equipment is required to be replaced routinely, it is not, mainly to keep the costs down.

Gaps in monitoring health Despite occupational hazards, no regular health inspections by occupational health physicians are conducted at such treatment plants. This failure represents a critical gap in occupational health management at a major hazardous waste handling facility.

Impacts on ecosystems and biodiversity
Waste treatment plants and landfills affect ecosystems directly through loss of habitat and indirectly through degradation of habitats due to pollution and disruption of corridors used by the wildlife in areas close to biodiversity hotspots. For instance, the following ecologically sensitive areas are all within a radius of about 10 km from the Okhla WtE facility: Okhla bird sanctuary, Asola wildlife sanctuary, Jahapanah reserve forest, Tilpat forest, and Central Ridge reserve forest. The report on the environmental impact of the WtE plant mentions the following ways in which the

plant could potentially affect various entities or components of the nearby sensitive areas.

- Atmospheric deposition of particulate matter and heavy metals on vegetation and water bodies
- Disturbance in the form of noise and light pollution to the corridors used by wildlife
- Seepage of leachate or contamination from run-off from stormwater drains lowering the quality of water from the Yamuna (only 1.6 km away)

However, no studies have been conducted in even the closest biodiversity area (Okhla bird sanctuary) after the plant became operational.

Reactions of local residents to waste-to-energy plants

Local resistance to WtE plants is widespread, often driven by the sentiment often labelled NIMBY, short for 'not in my backyard', particularly in India. Such projects (landfills or WtE plants) are frequently opposed on the grounds of health hazards, environmental concerns, and the fear of becoming the area becoming a dumping ground and thereby lowering real estate prices drastically. Residents often argue that these plants, which burn MSW, pollute the air, ground, and water, causing ailments such as cancer, respiratory issues, and skin diseases. Those living near facilities such as the Okhla plant in Delhi have reported toxic smoke, hazardous fly ash, and unbearable stench. Projects in Kannahalli, Doddabidarakallu, and Mavallipura in Bengaluru (Ramani 2020) and in Peringamala in Kerala (Cuttapan 2018) faced intense opposition, with residents clamouring for decentralized waste management rather than incinerators

Case of the waste-to-energy plant in Okhla, New Delhi

As stated earlier, the WtE plant in Okhla (Figures 6 and 7) is close to several residential areas, which are within less than 500 metres

Figure 6 Section of an unplanned (informal) residential colony (Haji Colony) near the Okhla waste-to-energy plant

from the plant. The affected areas represent planned colonies (Sukhdev Vihar),unplanned colonies (Haji Colony), and a category intermediate between the two (Jasola Village, a rural or semirural settlement).

Haji Colony

Haji Colony represents a community with minimal institutional resources, limited access to formal mechanisms of redressing grievances, and high population density. Situated directly adjacent to the Okhla WtE facility, the residents are directly exposed to fugitive emissions, foul odours, traffic-related air pollution from waste collection trucks, and noise. Ambient air quality monitoring at Haji Colony (AAQMS 4) showed that the concentration of fine particulate matter (PM_{10}) exceeded the permissible limits during the 2018 baseline period. Community health surveys documented respiratory issues in nearly a third (32%) of the residents, skin allergies in 36%, and eye irritation in 23%, the prevalence of these maladies potentially linked to proximity to waste treatment operations and legacy landfill emissions (Angmo and Shah 2025).

Figure 7 Okhla waste-to-energy plant as seen from the roof of a house in Sukhdev Vihar
SOURCE *The Print*, July 2024, what it's like living near Delhi's Okhla waste-to-energy plant

The residents undertake diverse informal economy activities, and some waste workers and waste pickers are part of the waste management chains in the informal sector that overlap with formal operations of the South Delhi Municipal Corporation. The resident showed only limited awareness of waste management operations and health risks, reflecting the wider information gaps in unplanned settlements.

Sukhdev Vihar

Sukhdev Vihar represents a planned, mixed-income residential area developed under Delhi's master plan, with formal housing units and defined municipal services, yet located within the wider impact zone of the Okhla plant, within 2 km from it, close enough so as to be within the dispersal zone for air pollutants under prevailing wind patterns (predominantly south-westerly during winter and north easterly during the monsoon).

Ambient air quality monitoring at Sukhdev Vihar showed that the concentrations of PM_{10} and $PM_{2.5}$ are potentially influenced by emissions from the plant as well as by the background urban pollution. Residents report respiratory ailments, eye irritation, and concerns about long-term health effects, particularly during unfavourable meteorological conditions (temperature inversions in winter months) that trap pollutants close to the ground (CPCB 2020).

Unlike those living in unplanned settlements, residents of Sukhdev Vihar have greater capacity for formal organization and advocacy through residents' associations and legal channels. Community groups have submitted petitions and representations to municipal authorities, DPCC, National Green Tribunal, and law courts expressing concerns about planned expansion of the facility and requesting stricter monitoring and emission controls.

Jasola Village

Jasola Village, a rural or semi-rural area within Delhi's city limits, has experienced significant urbanization but retains some farmland and settlement patterns traditional to rural areas. The village is within 500 m of the Okhla WtE facility impact zone. In the past, residents relied on groundwater as a source of both drinking water and irrigation, making them particularly vulnerable to contamination from leachate from the adjacent legacy landfill. Residents of Jasola Village expressed concerns about the potential threat to their water supply from such contamination (Angmo, Kharayat, and Shah 2021).

The village also suffers from poor ambient air quality due to the frequent trips made by trucks to transport waste as well as from operations of the treatment plant. Monitoring at Okhla Phase-3 and Jasola area showed variable levels of both particulate matter and other pollutants, depending on the meteorological conditions and operational status of the plant.

Problems common to all communities

In looking at various studies across the country and specifically at the WtE plant in Okhla, multiple issues emerge consistently across diverse communities, irrespective of whether they represent planned communities or urban villages.

Air quality and respiratory health All the three communities documented health concerns related to respiratory function, with ambient air monitoring showing that concentrations of particular matter occasionally exceed their permissible limits. Community residents report seasonal variations in health symptoms correlated with meteorological conditions and operational status of the treatment plant.

Information asymmetry Formal data from environmental monitoring generated by proponents of the project (baseline studies, compliance reports, etc.) remain inaccessible to the affected communities. Community members lack the technical capacity to interpret complex data on air quality and health, which makes the members dependent on informal knowledge networks and mass media.

Grievance mechanisms and accountability Unplanned and informal settlements (Haji Colony) have minimal formal mechanisms for expressing concerns or seeking redress; planned communities (Sukhdev Vihar) have stronger institutional capacity for advocacy through residents' associations; and semi-rural areas (Jasola Village) face a declining base of farmland and weakening traditional governance structures.

Cumulative pollution burdens Communities face multiple pollution sources concurrently, including emissions from the WtE facility, contamination from legacy landfills, vehicular pollution from the heavy traffic on adjacent highways (the Delhi–Mathura stretch of National Highway No. 2), and background urban pollution, making it challenging scientifically as well as legally to attribute the adverse effects on health to specific sources.

The way forward

Addressing the contradictions and challenges exemplified by the Okhla WtE plant requires coordinated action across multiple stakeholder groups with often conflicting interests and priorities. However, some potential pathways forward are offered here.

1/ Integrated waste management planning and implementation

Mandates such as SWM Rules, 2026 (and the earlier SWM Rules, 2016) exist but are neither effectively implemented nor followed by local bodies for a variety of reasons. Adopting comprehensive and integrated systems for managing solid waste is essential, and such systems must address generation of waste, its segregation at source, collection, segregation by waste pickers and by the formal sector, biological treatment of organic fractions, energy recovery from non-recyclable combustible fractions, and final disposal of inert residues. Coordinated action is required across the agencies involved in collecting municipal waste, developing and operating treatment plants, and managing landfills.

2/ Segregation infrastructure and enforcement

Urban local bodies must prioritize the development of a mechanism and the required infrastructure for segregating waste at household, community, and municipal levels. The persistent failure of segregation reflects inadequate investment, weak enforcement, and insufficient incentives for compliance. Successful segregation systems require

- community-level facilities for composting wet waste (organic)
- formal integration of waste pickers with the system, which should also offer them conducive working conditions and security of livelihood
- specialized collection systems for segregated fractions
- sustained campaigns to bring about the desired change in behaviour
- fiscal incentives (such as rebates, extended producer responsibility, and pay as you throw, Deposit Refund Systems.) for reducing generation of waste and for segregating waste at source.

3/ Environmental monitoring and public disclosure

Regulatory frameworks must mandate continued environmental monitoring by third parties with public disclosure of results.

Current practices relying on self-monitoring by the operators and periodic manual testing create gaps in accountability. Such monitoring should include

- continuous automatic monitoring of emissions from stacks with real-time dashboards accessible to the public
- independent monitoring of ambient air quality at multiple community locations
- regular health surveys of workers and of residents in settlements near treatment plants
- monitoring the quality of groundwater and for leachates with public reporting
- integration with data systems of ministries of health to assess health outcomes.

4/ Siting standards and community consent

Policy must establish clear standards that prioritize environmental protection and community welfare in choosing suitable sites for waste treatment plants and in implementing waste treatment projects. Such standards should stipulate

- minimum buffer distances between plants and the entities likely to be impacted by such plants
- environmental impact assessments that specifically address health of workers, impacts on air quality, and cumulative burden of pollution
- mandatory community consultation and consent before establishing or expanding waste treatment facilities
- compensation for communities that bear disproportionate environmental burdens.

5/ Role of urban local bodies and city management

Urban local bodies must take ownership of segregation systems as a prerequisite to functional and integrated solid waste management. For instance, the South Delhi Municipal Corporation, although technically responsible for waste management, has delegated most of its functions to private entities with limited supervision of their performance. Urban local bodies should

- establish community-level facilities in multiple wards for composting wet waste
- provide collection bins differentiated by waste type and appropriate logistics to collect them and transport them to designated locations
- engage and formalize associations of waste pickers and offer them training, safety equipment, and livelihood support
- monitor the quality and efficiency of segregation at source and the subsequent treatment of waste
- invest in citizen awareness campaigns specifically targeting behavioural changes that ensure segregation at source.

Urban local bodies must establish mandatory standards for occupational health of all workers at landfills and waste treatment facilities. These standards should include

- baseline health assessments (a physical examination, pulmonary function, blood parameters, etc.) at the time of joining
- annual health monitoring with screening for respiratory, cardiac, dermatological, and systemic conditions
- mandatory supply of quality PPE with proper fitting and replacement schedules
- regular training on health hazards, the use of PPE, and safe work practices
- access to occupational health clinics staffed by qualified occupational-health physicians
- mechanisms for workers' compensation that recognize work-related health conditions.

The expansion of any existing WtE facilities should be conditional on community acceptance. The proposed expansion of the Okhla WtE facility to increase its capacity to generate 40 MW has been stalled since 2019 largely due to opposition from the community. The barrier is not so much technical or legal as the loss of community trust and absence of demonstrable benefits.

The local urban body may therefore

- ◐ conduct genuine consultations, in good faith, with affected communities about any proposed expansion
- ◐ establish independent environmental monitoring systems that provide real-time data to communities
- ◐ negotiate community benefit agreements that directly improve environmental quality and livelihood opportunities and conditions in the neighbourhood
- ◐ create environmental advisory boards with adequate representation from the community and vested with formal authority to take decisions related to the operations and expansions of treatment facilities
- ◐ commit to making the existing facility compliant with relevant regulations and deliver on those commitments before seeking approval for expansion.

6/ Role of citizens and community advocates

Citizens and community-based organizations can leverage scientific evidence and legal frameworks to advance environmental protection and community health by

- ◐ demanding access to environmental monitoring data and their timely public disclosure
- ◐ commissioning independent studies on environmental health to document exposure and health effects
- ◐ engaging with mass media to increase public awareness of the impacts of waste treatment plants and concerns of the community filing representations with regulatory agencies such as DPCC, CPCB, NGT (National Green Tribunal), and courts of law based on documented evidence
- ◐ building coalitions across multiple affected communities to consolidate political influence.

Citizens must recognize that infrastructure for handling waste, by itself, cannot solve the problems related to waste unless waste generation and composition are addressed at source, Citizens must therefore

- ◐ strive to reduce generation of waste (avoiding single-use materials, repairing or reusing items, buying only the required quantities, etc.)
- ◐ participate in waste segregation systems when available, with the understanding that segregation enables recycling, composting, and energy recovery
- ◐ support the development of local waste management infrastructure (community composting, local repair services, markets for second-hand, etc.)

Citizens, particularly in planned communities with greater organizational capacity, can support landfill and waste facility workers by

- ◐ advocating for recognition of waste workers as essential service providers deserving safe working conditions and secure livelihoods
- ◐ supporting the formation and formalization of waste worker associations and unions
- ◐ monitoring workers' health and safety through community observation and advocacy
- ◐ opposing exploitative practices by private waste management contractors and supporting improved wages and working conditions for workers
- ◐ recognizing waste workers as stakeholders in managing the environment at the treatment plants instead of treating the workers merely as labour.

Communities bearing disproportionate environmental burdens from waste management infrastructure should articulate their demands through the frameworks for environmental justice by the following means.

- ◐ Document how informal and planned communities experience different environmental burdens.
- ◐ Connect the decisions related to the choice of sites for waste management plants to broader patterns of environmental inequity and spatial segregation in cities.

- ◐ Demand that environmental costs be distributed equitably across all city neighbourhoods and not confined to lower-income areas, which are often closer to waste treatment plants.
- ◐ Advocate for fair compensation if communities continue to host waste treatment facilities despite their demonstrated adverse environmental and health impacts.
- ◐ Support the development of alternative waste management models that reduce the need for centralized disposal or treatment facilities.

A critical reflection

"Those who cannot learn from history are doomed to repeat it."

— George Santayana

If one looks objectively at the successes and failures of all the WtE plants running in India, one will realize that the root of the problem is unsegregated waste. Besides, the inert content of such unsegregated waste is high, and most of the recyclables (with any market value) are already retrieved from the waste by the informal recycling sector. Also, single-use plastics are widely used and end up in the waste that reaches the treatment plants, because such plastics are of no value and therefore not retrieved by waste pickers. Burning of such commingled waste (along with plastics) releases carcinogenic dioxins and furans. The calorific value of such waste is not high enough, and it requires additional fuel for burning. The calorific value of waste in India ranges from 1411–2150 kcal/kg – far too low to burn – compared to 1900–3800 kcal/kg in European countries and the United States, where incinerators have been more common (Pandey and Shaz 2022).With feedstock of low calorific value, the treatment plants need supplementary energy to burn the waste. Also, the cost of meeting the stipulated norms of pollution control is high, with the result that the norms are frequently flouted. The siting of such plants often overlooks scientific considerations such as hydrogeology and wind direction, and the chosen sites are often close to inhabited areas. In the absence of adequate environmental checks, the impacts on the health of those living in the vicinity are high. Thus, both financial feasibility and health considerations are particularly important to wide-scale adoption of waste treatment plants by cities and towns.

The other important lesson is that segregation at source is the key to success of any integrated system of waste management—a lesson that cannot be emphasized enough. In spite of the SWM Rules, 2016, and the recent SWM Rules, 2026, segregation at source and the collection of waste thus segregated are rare. As a result, recycling and reuse become more difficult; most important, the quality of waste reaching the WtE plants fails to match the quality assumed in the feasibility studies conducted initially for any WtE plant. It is essential to conduct regular scientific studies on the changing quantities of waste, characterization of waste found in different cities and towns, and available infrastructure (segregation at source, secondary collection and storage of segregated waste, MRF and landfills or dumpsites) to make informed planning and management decisions for integrated solid waste management. Further, engaging with the affected community as the primary stakeholder is of utmost importance.

In recent times, many significant attempts have been made in the field of circular economy in the waste sector. More than 4000 MRFs exist in India, but recycling is successful only in the informal recycling sector, a fact often overlooked in formal planning. Whereas the informal sector recycles an estimated 20%–30% of waste, formal projects are yet to replicate such efficiency at scale.

Most important, the widespread health implications, especially of improper waste management and of technologies such as incinerators and WtE plants, need to be recognized. Despite pollution abatement measures, the release of pollutants into air, soil, and water is an unavoidable consequence of waste incineration. Among other pollutants, dioxins, heavy metals, and particulate matter cause well-known respiratory diseases and cancers, damage the immune system and the reproductive system, and impair normal developmental (Fundacio 2015). It is for this reason that the European Union has been advancing filtration systems and improved WtE technologies to reduce the environmental impacts of such facilities and has also imposed higher taxes to pay for the higher costs of such advances and improvements (European Commission 2019).

We need to rethink urgently how to reduce the generation of waste, make frugality fashionable again, move away from the overconsumption-based lifestyles, and, most important, internalize the exorbitant 'cost' of not managing the burgeoning volumes of waste. Decentralized models of waste management, which leverage local communities and the existing fleet of informal waste pickers and recyclers, could bypass some of the bottlenecks faced by large-scale WtE projects often resisted by local communities. Incentives for segregation, fiscal or otherwise, might change public behaviour. Understanding our own waste profile and finding more low-cost and indigenous technologies is the need of the hour. Above all, recycling must be integrated into a broader waste management strategy that prioritizes reduction and reuse over endless processing of ever-growing waste streams. The new SWM Rules, 2026, promise to integrate the principles of circular economy with special focus on segregation of waste and effective management and more stringent regulations for waste processing and landfills —let us hope that we all strive to fulfil that promise!

References

Angmo S and Shah S. 2025. A case study on hazardous grounds: stabilized legacy waste and occupational health concerns at the Okhla landfill, New Delhi. *Environment Conservation Journal* **26**: 734–749 https://journal.environcj.in/index.php/ecj/article/view/2983/2351

Angmo S, Kharayat Y, and Shah S. 2021. Assessment of contamination potential in Okhla landfill, New Delhi by using Leachate Pollution Index. *Current World Environment* **16** (1): 116–132 https://pdfs.semanticscholar.org/eeae/ea42c82f1c3fa59a536c12fb77e483ef1a45.pdf

Beyene H D, Werkneh A A, and Ambaye T G. 2018. Current updates on waste to energy (WtE) technologies: a review. *Renewable Energy Focus* **24**: [11 pp.]

Cole-Hunter T, Johnston F H, Marks G B, Morawska L, Morgan G G, Overs M, Porta-Cubas A, Cowie C T. 2020. *Environmental Science Letters* **15**: 123006. [18 pp.] https://iopscience.iop.org/article/10.1088/1748-9326/abae9f/pdf

Cook E, Ionkova K, Bhada-Tata P, Yadav S, and van Woerden F. 2026. *What a Waste 3.0: Global snapshot of solid waste management toward circularity until 2050*. Washington, DC: World Bank. 346 pp. https://openknowledge.worldbank.org/bitstreams/ab9bce34-0921-4887-8c0d-65ed7b303aaf/download

CPCB. 2020. *Report of Waste to Energy Plants in Delhi by CPCB in OA No. 640 of 2018 (Earlier O.A. No. 22 of 2013(THC), Sukhdev Vihar Residents Welfare Association vs State of NCT of Delhi).* (www.greentribunal .gov.in)

CPCB. 2024. *Annual Report 2021-2022 on Implementation of Solid Waste Management Rules, 2016*. New Delhi: Central Pollution Control Board. 120 pp. https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2021-22.pdf

CPCB. 2025. *Guidelines on Municipal Solid Waste (MSW) Incineration Based Waste To Energy Plants*. New Delhi: Central Pollution Control Board. 38 pp. https://legalupdate.qhsealert.com/file/325_MSW_Waste_to_Energy_Guidelines_2025_Explained.pdf

Cuttapan R. 2018. We are not the city's dumping ground: Tribals protest against an energy plant in Kerala. *The Caravan*, 10 Oct. https://caravanmagazine.in/government-policy/we-are-not-the-citys-dumping-ground-tribals-protests-against-a-waste-to-energy-plant-in-kerala

DPCC. 2023. *Information in respect of Delhi for the quarter ending December 2022 (October to December, 2022) regarding submission of compliance report on solid waste management and sewage management in the matter of OA No. 606/2018* [submitted to CPCB], pp. 1–6. Delhi: Department of Environment, Govt of the National Capital Territory of Delhi. 14 pp. https://tinyurl.com/mw5hy7fz

DPCC. 2025. *Annual Report in Form V in Respect of NCT of Delhi for the Year 2024-2025 on the Implementation of Solid Waste Management Rules, 2016.* New Delhi: Delhi Pollution Control Committee. https://dpcc.delhi.gov.in/sites/default/files/DPCC/generic_multiple_files/dpcc-letter-dated_with-annual-report-swm.pdf

European Commission. 2019. *A circular economy for a cleaner Europe: waste management in the EU.* https://ec.europa.eu/environment/waste/circular_economy_en.htm

Foellmer J, Liboiron M, Rechenburg A, Kistemann T. 2022. *How do the cultural contexts of waste practices affect health and well-being?* Copenhagen: WHO Regional Office for Europe. 56 pp. [Health Evidence Network Evidence Synthesis Report 75] https://www.who.int/europe/publications/i/item/9789289058025

Fundacio E N T. 2015. *Air pollution from waste disposal: not for public breath. Brussels: ZeroWaste Europe.* 32 pp. https://zerowasteeurope.eu/wp-content/uploads/2019/10/zero_waste_europe_report_air-brances_en.pdf

Hasan M S and Ghosal S. 2023. Informal plastic waste recycling firms in rural eastern India: Implications for livelihood and health. *Clinical Epidemiology and Global Health* **21**: 101286 [7 pp.] https://www.ceghonline.com/article/S2213-3984(23)00073-8/fulltext

Hujare R and Telsang K. 2020. Solid waste generation data variability in India: an unnoticed hurdle, pp. 435–459 in *Recent Developments in Waste Management: Select Proceedings of Recycle 2018*, edited by Ajay S Kalamdhad. Singapore: Springer. 540 pp. [Lecture Notes in Civil

Engineering series, vol. 57]

Khan A, Mishra S, and Singh P. 2025. *Tailoring Solid Waste Management in India: learnings from cities with a million-plus population.* New Delhi: Council on Energy, Environment and Water. 48 pp. https://www.ceew.in/sites/default/files/CEEW-Tailoring-Waste-Management-web-file.pdf

Mantec Consultants. 2022. Draft EIA/EMP Report for Expansion of Waste to Energy Plant upto 40 MW at Old NDMC Compost Plant, Behind CRRI, Okhla, New Delhi. Noida: Environment Division, Mantec Consultants. 294 pp. [Prepared for Timarpur Okhla Waste Management Company] https://www.dpcc.delhigovt.nic.in/uploads/pdf/Draft_EIA-EMP_Report_14-07-2022.pdf

Mishra N. 2026. Okhla landfill waste dumped near Yamuna. *Times of India*, Delhi, 2 April https://timesofindia.indiatimes.com/city/delhi/okhla-landfill-waste-dumped-near-yamuna/articleshow/129965813.cms

MoHUA. 2021. *Swachh Bharat Mission - Urban 2.0: Making Cities Garbage Free: operational guidelines.* New Delhi: Ministry of Housing and Urban Affairs. 138 pp. https://sbmurban.org/storage/app/media/pdf/swachh-bharat-2.pdf

Mutha N H, Patel M, and Premnath V. 2006. Plastics materials flow analysis for India. *Resources, Conservation and Recycling* **47**: 222–247

NDWPC. 2006. *Executive Summary: Environmental Impact Assessment of Integrated Municipal Solid Waste Processing Facility, Okhla*, Delhi: New Delhi Waste Processing Company Ltd. 26 pp. [Submitted to Delhi Pollution Control Committee] https://www.nswai.org/docs/eia-okhla-plant.pdf

Pandey K and Shaz S. 2022. Can a waste-to-energy plant address piling concerns from a landfill site? https://india.mongabay.com/2022/07/video-can-a-waste-to-energy-plant-address-piling-concerns-from-a-landfill-site/

Planning Commission. 2014. *Report of the Task Force on Waste to Energy* [chaired by K Kasturirangan], vol. 1. New Delhi: Planning Commission. 154 pp. https://sbmurban.org/storage/app/media/pdf/Task_force_report_on_WTE.pdf

Ramani C V. 2020. Widespread opposition to waste-to-energy plants by local communities. *The Hindu*, Bangalore, 10 April. https://www.thehindu.com/news/cities/bangalore/widespread-opposition-to-waste-to-energy-plants-by-local-communities/article33293826.ece

Shahab A and Anjum M. 2022. Solid waste management scenario in India and illegal dump detection using deep learning: an AI approach towards the sustainable waste management. *Sustainability* **14** (23): 15896. [28 pp.] https://www.mdpi.com/2071-1050/14/23/15896

ToxicWatch Alliance. 2016. TWA's submission on violation of environmental clearance conditions by Jindal's waste to energy plant in Delhi's Okhla residential & ecologically fragile area. ToxicsWatch, Journal of Earth, Science, Economy and Justice. https://www.toxicswatch.org/2016/06/twas-submission-on-violation-of.html

Zhu D, Asnani P U, Zurbrügg C, Anapolsky S, Mani S. 2008. *Improving Municipal Solid Waste Management in India: a sourcebook for policy makers and practitioners*. Washington, DC: World Bank. 176 pp. https://documents1.worldbank.org/curated/en/682051468267572634/pdf/425660PUB0Wast12732601OFFICIAL0USE1.pdf

TERI Publishing Solutions

TERI Publishing Solutions (PuBSo), the publishing arm of TERI, is committed to publishing the best-quality books on energy, environment, and sustainable development. Over the years, we have metamorphosed into a world-class publisher of books, magazines, journals, and periodicals. We have received both national and international recognition for our high-quality products, including children's books, which are extensively researched and beautifully illustrated. They cater to a wide range of groups, from the very young children to the young adults.

Green publishing: PuBSo has always looked to adopt new and innovative measures in publishing, especially with regard to environmental sensitivity. For example, our books are printed mostly on recycled paper. This is one of the several efforts that have led to PuBSo establishing itself as 'India's leading green publisher'.

Our mission: Our books offer a glimpse of our beautiful yet fragile planet to young minds. They inform, educate, and stimulate students and sensitize them to the environment and its related problems. The aim is to transform children and young adults into conscientious individuals who can grow up to be future green citizens.

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The TERI Alumni Association is a society registered under the Societies Act, and donations to the association qualify for tax rebate as the association is recognized as a charitable institution under Sections 12A and 80G of the Income Tax Act. The Association has about 500 members, comprising about 400 alumni and 100 current employees of TERI. The President (currently Dr Priyanka Kochhar, CEO and Co-founder of The Habitat Emprise, Delhi) and the Secretary (currently Ms Ambika Shankar, Founder and CEO, A Writing Venture (AWV) and Head, Content and Communications, Pratyusha Foundation, Delhi) are the elected office-bearers of the Executive Committee whereas other office-bearers are nominated by TERI.

Who is the 'killer' and who is the 'saviour'?

Given the burgeoning quantities of waste generated in cities, thanks to the unsustainable urban lifestyles, waste treatment plants are unavoidable. But the land available for landfills and waste treatment plants is scarce, especially within or close to urban centres.

A high-technology waste treatment plant is an excellent solution for tackling the growing mountains of waste. However, when we start burning unsegregated waste –read plastic – in these plants, the 'solution' creates another problem.

The Untold Story of Waste Treatment Plants speaks in an uncomplicated way of hopes, accomplishments of some successful waste treatment plants, the frustrations of those living close to them, and the ignorance of those living far away, oblivious of the appalling air quality due to burning all kinds of waste.

What then is the solution? Working on yet another technological miracle to happen or acknowledging the bigger culprits, namely consumption-intensive lifestyles, the omnipresent plastics of all kinds, and failure to segregate wastes at source? It is the citizens who first need to understand how we are getting impacted, to realize the health implications of those impacts, and to accept that we need to change our ways. But what can we change and what *should* we change? What potential role can the state, the civil society, and individual citizens play? You will find the answers within the pages of this book.

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