

**INDIA'S LEGACY  
WASTE CRISIS:**

**A CALL  
FOR ACTION**





# **India's Legacy Waste Crisis: A Call for Action**

Anushree Aggrawal

Pooja Verma

Center for Study of Science, Technology and Policy (CSTEP)

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**Editor:** Shayantani Chatterjee

**Designer:** Alok Kumar Saha

### **Bengaluru**

No. 18, 10th Cross, Mayura Street  
Papanna Layout, Nagashettyhalli  
RMV Stage 2, Bengaluru 560094  
Karnataka (India)

### **Noida**

1st Floor, Tower-A  
Smartworks Corporate Park  
Sector 125, Noida 201303  
Uttar Pradesh (India)

Tel.: +91 (80) 6690 2500

Email: [cpe@cstep.in](mailto:cpe@cstep.in)

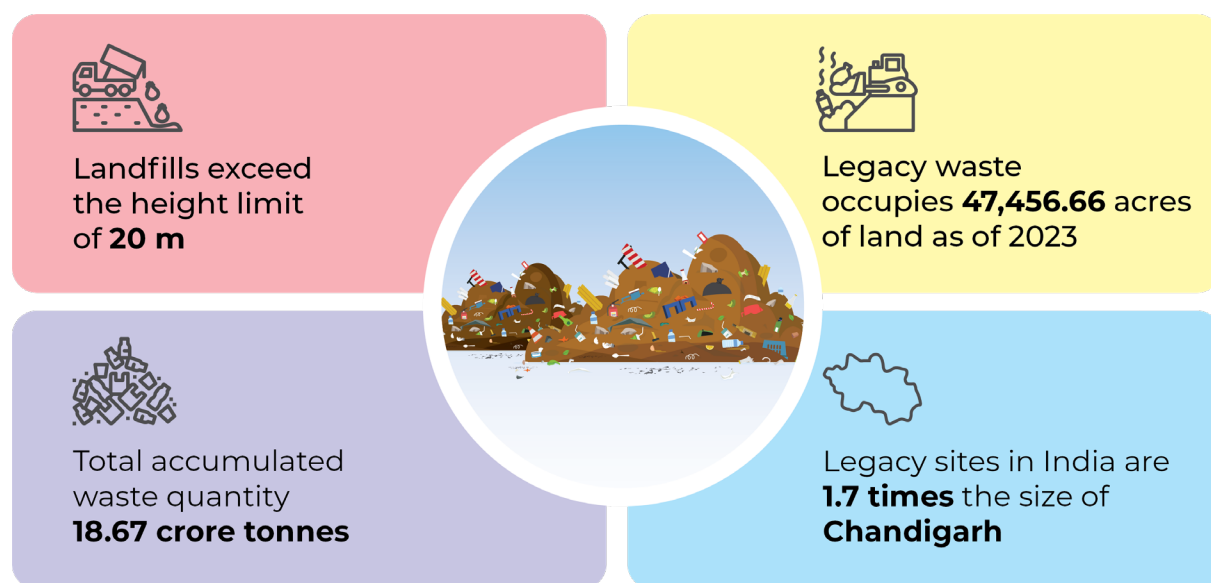
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# 1. Introduction

India's legacy waste occupies **47,456.66 acres** of land as of 2023 (Ministry of Parliamentary Affairs, Government of India, 2023), which is almost **1.7** times the area of Chandigarh. A majority of these sites have exceeded their designed capacity and the accepted height limit of **20 m** (Ministry of Parliamentary Affairs, Government of India, 2023). The total waste accumulated amounts to a staggering **18.67 crore tonnes** (Ministry of Parliamentary Affairs, Government of India, 2023). Thus, legacy waste is not a static historical residue. This issue brief explains how it represents a dynamic, continuously polluting system, which simultaneously threatens water security, air quality, climate goals, and future urban development, and discusses the policy challenges and possible interventions.



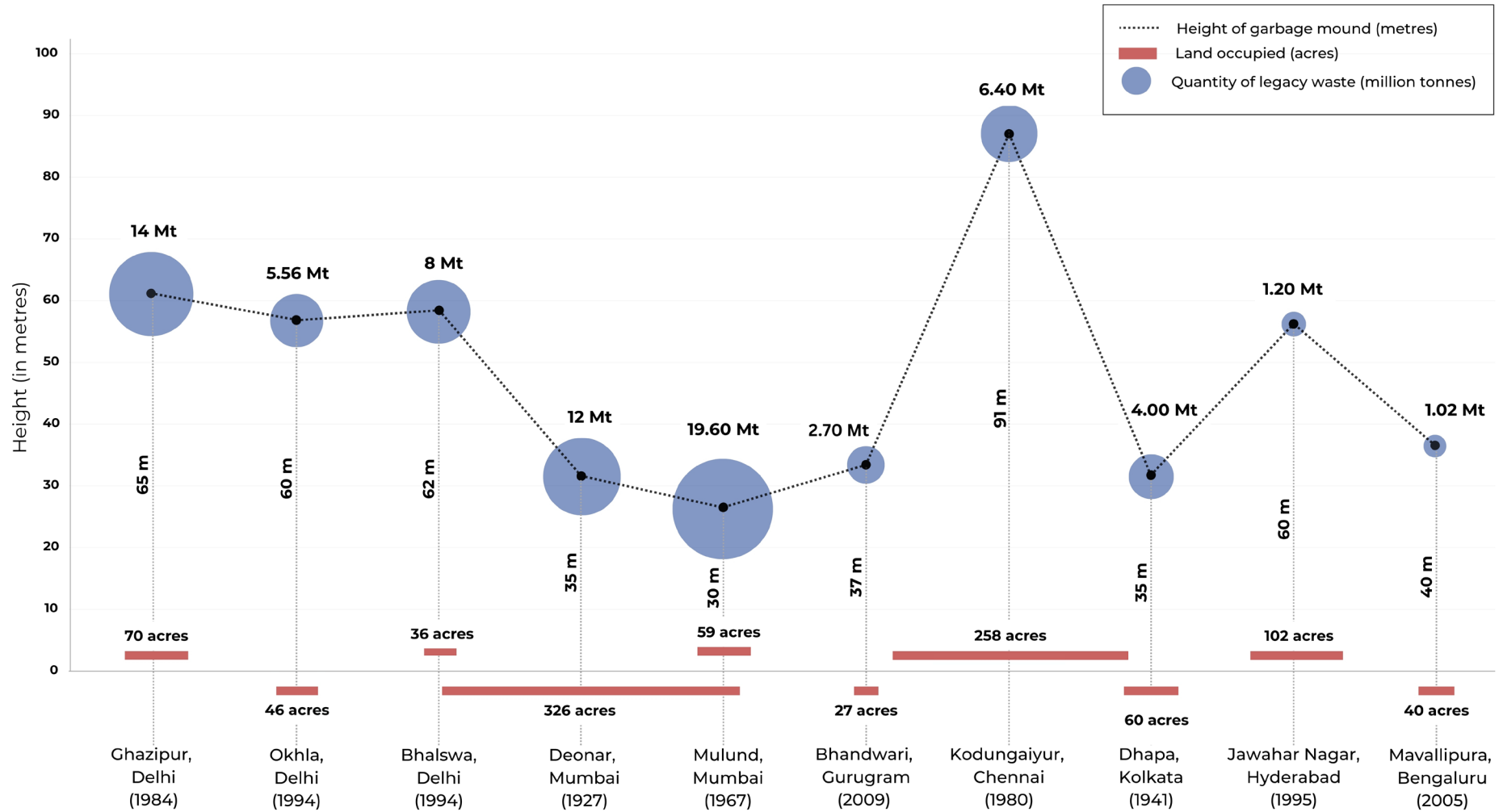
## 1.1. What is legacy waste?

Legacy waste is long-accumulated waste lying in dumpsites over several years with no disposal. Despite **40%–70%** (Singh Sambyal, 2019) of India's waste being biodegradable and potentially recoverable, most of it still ends up in landfills. This highlights the scale of the challenge India faces in managing municipal solid waste (MSW), driven by population growth and unregulated dumping patterns (Ojha et al., 2024). A fundamental issue underlying legacy waste management is the absence of a formal definition. Although the term is generally used to describe aged MSW accumulated in landfills or dumping grounds, there is no official criterion specifying the age or condition of such waste. Figure 1 illustrates the scale of major dumpsites across India, highlighting both their spatial footprint and the magnitude of waste stockpiled at each site.





**Figure 1: Status of major dumpsites in India**



*Urban India produces about **55 Mt** of MSW annually, yet only **25%** is processed and the majority is either dumped or burned.*

India had very few dumpsites in the past, as most household waste was biodegradable and returned to the soil through compost pits (Central Pollution Control Board, 2019). However, the introduction of plastics in the 1970s drastically altered the dumping patterns. Waste began to be discarded with or within plastic, which blanketed organic matter, altering its natural composition by hindering decomposition, thereby significantly increasing landfill volume (Image 1). As shown in the image, plastic-wrapped waste is dumped openly on the street, forcing minimally protected sanitation workers to manually collect and load the hazardous debris into municipal vehicles.



Image 1: Unsegregated solid waste on roadsides and disposal methods (Source: Authors)

## 1.2. Key environmental and public health issues

Legacy dumpsites pose multidimensional risks that extend far beyond waste accumulation. This section highlights key environmental and public health challenges that emerge from these dumpsites.

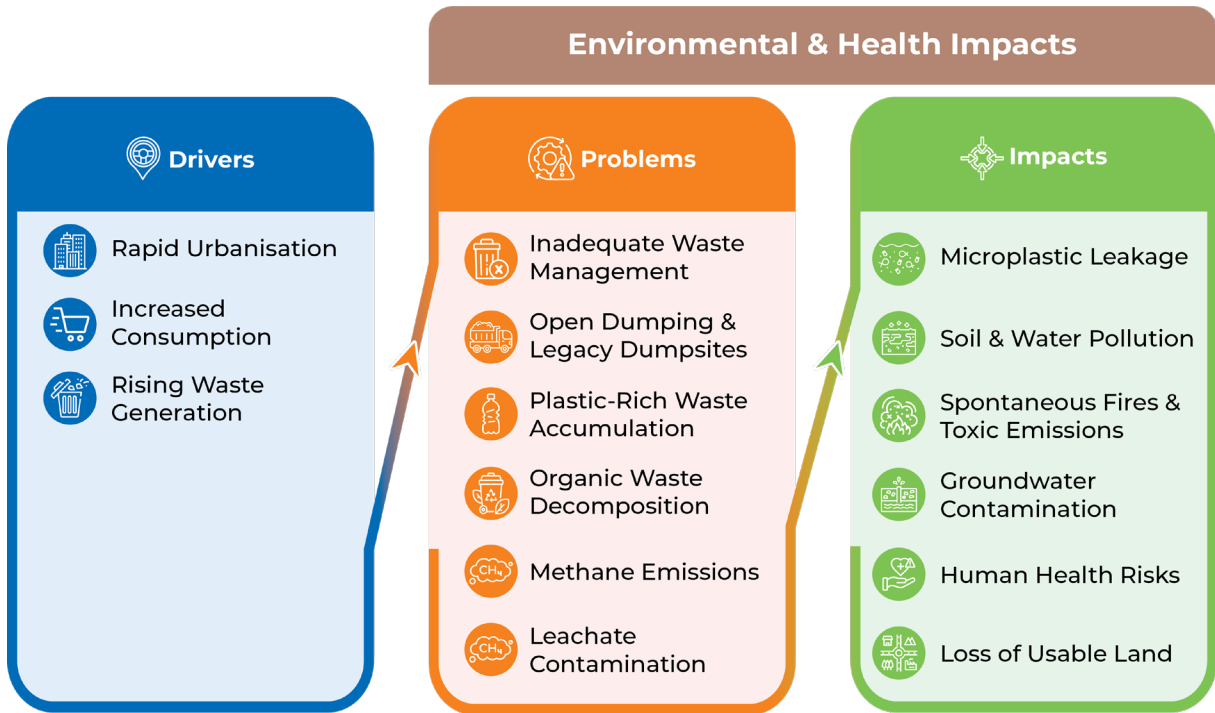
Legacy dumpsites in Indian cities have evolved into long-term ecological and public health hazards owing to inadequate infrastructure, plastic accumulation, and improper disposal practices. The plastic-rich composition of legacy waste also leads to extensive microplastic leakage (Gupta et al., 2025), making it a persistent source of microplastics in both terrestrial and aquatic ecosystems. These foul-smelling heaps act as uncontrolled anaerobic reactors, constantly releasing methane as organic waste decomposes. Methane's global warming potential is 28 times higher than that of carbon dioxide (Mar et al., 2022). Legacy dumps contribute disproportionately to greenhouse gas emissions, even though no new waste is dumped in many of them. Another critical issue is the fire breakout at these sites—methane trapped below and plastics with high calorific value create ideal conditions for spontaneous ignition, particularly during the summer. Once ignited, these dumps can burn for days or even weeks, emitting dioxins, furans, and particulate matter, along with toxic fumes (CSIR-National Institute for Interdisciplinary Science and Technology, 2021), all of which pose respiratory and cardiovascular health risks to nearby communities.

Equally concerning is the contamination of soil and groundwater through toxic leachate, which contains heavy metals, pathogens (El-Saadony et al., 2023), and organic pollutants. Most legacy dumpsites were established before the introduction of environmental safeguards and, to this day, lack essential infrastructure such as liners, leachate collection systems, and treatment facilities. As a result, leachate infiltrates directly into aquifers and adjacent farmlands. The Central Pollution Control Board (CPCB, 2022) reports that leachate from dumpsites across multiple Indian cities exceeds permissible limits for contaminants such as lead, chromium, and ammonia, posing long-term risks to drinking water quality and local ecosystems.

Furthermore, legacy dumpsites represent a permanent loss of land at a time when cities are rapidly densifying and land demands are surging. Estimates from the National Green Tribunal indicate that thousands of hectares (Centre for Science and Environment, 2022) of urban land remain locked under legacy waste, much of it located in already stressed urban cores or along critical growth corridors. This significantly constrains opportunities for land reclamation and directly impedes effective urban planning. Figure 2 illustrates the key challenges associated with one of India's oldest dumpsites located in Ghazipur, Delhi.

*While 'legacy' often signifies something of value passed down through generations, legacy waste is a stark contradiction—a toxic inheritance of neglect, polluting our land, air, and water for decades.*

**Figure 2:** Key drivers, problems, and impacts of legacy waste: The case of Ghazipur, Delhi



## 2. Current Management Practices and Operational Challenges

Dumpsites in India follow a three-track management approach (Central Pollution Control Board, 2019), as mandated by CPCB guidelines. This approach aims to support focused excavations and biomining/bioremediation wherever resource recovery is feasible; scientific capping and containment where active remediation is not feasible; or a combination of these approaches for partial excavation along with long-term monitoring and capping. Under each of these approaches, documented closure and post-closure monitoring are mandatory and entail site assessment and responsibility assignment to Urban Local Bodies (ULBs) and State Pollution Control Boards.

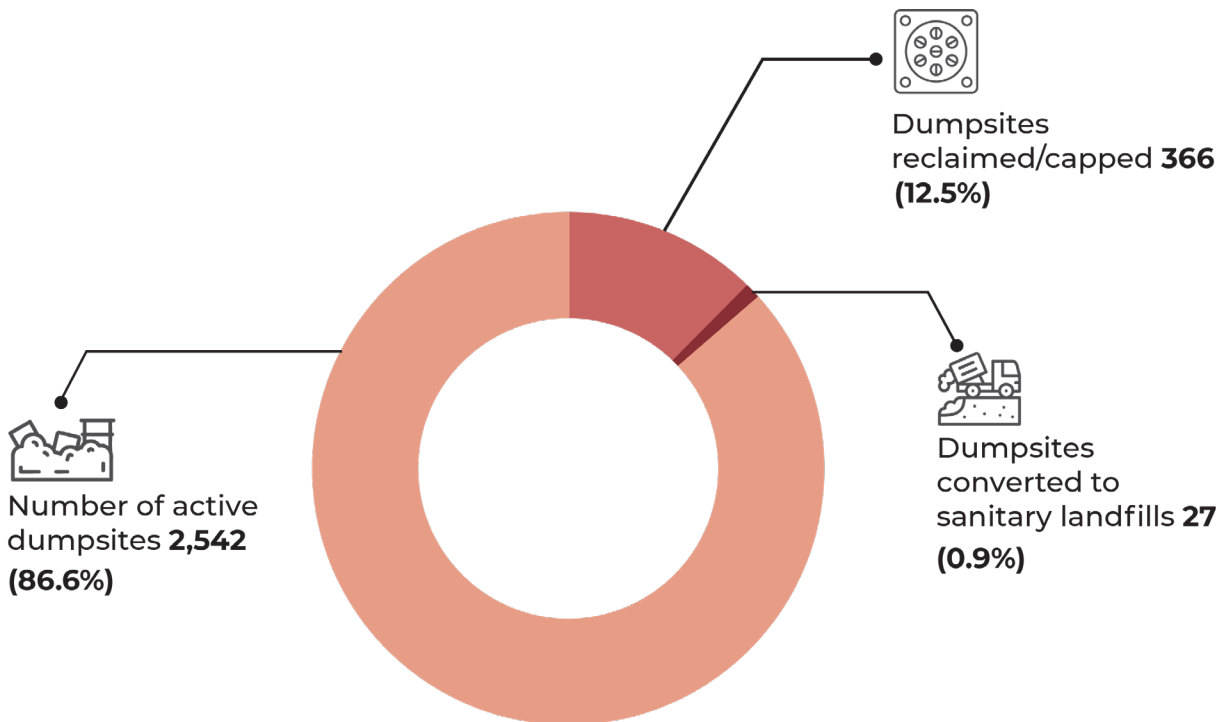
The primary challenge in effectively managing and deriving value from legacy MSW dumpsites is the absence of detailed waste characterisation data (Central Pollution Control Board, 2019). Unlike new waste, the composition of aged legacy waste changes significantly, often comprising a high percentage of fine, soil-like material mixed with inert and semi-decomposed organic matter, alongside recoverable materials such as plastics, metals, and inert construction waste (Centre for Science and Environment, 2022). Therefore, the unknown material fractions, density, moisture content, and contamination impede the development of an efficient and economically feasible treatment strategy. Consequently, such dumpsites are considered worthless land liabilities.

A detailed understanding of legacy waste composition could support its transition from an environmental liability to a strategic resource base (United Nations Environment Programme, 2024). The efficient recovery and reuse of secondary materials remarkably lower the dependence on virgin material extraction, thereby reducing emissions related to material consumption and primary production and supporting circular business models. However, to gain market acceptance, reliable and safe recovery of materials originating from waste is non-negotiable. This effort will build confidence among financiers, industries, and policymakers for large-scale investments in this sector.

This characterisation-driven recovery operation can also generate local employment across excavation, sorting, processing, logistics, and quality-testing activities. Recovered materials can establish a revenue stream, which is essential to developing a viable business model. Value-chain linkages can create strong multiplier effects, stimulating downstream recycling and manufacturing sectors and enhancing the overall economic viability of dumpsite reclamation. The current status of reclaimed, capped, and converted landfills is shown in Figure 3.



**Figure 3:** Dumpsites reclaimed, capped, and converted into sanitary landfills in India (Source: CPCB 2021–22)



## 2.1. Biomining and resource recovery

The Solid Waste Management Rules (2016) strongly emphasise the clearance of legacy dumpsites through biomining and bioremediation, rather than merely capping them, given the high potential for resource recovery and leachate management. Biomining involves excavation, screening, windrow composting, and sorting (Central Pollution Control Board, 2016). Studies indicate that, of the waste processed annually, excavated legacy waste contains around 15% combustible material (dry, high-calorific fractions), such as Refuse-Derived Fuel (RDF) or Alternative Fuel and Raw Material, along with compostable fines (small-sized, organic-rich fraction of waste suitable for biological treatment; Centre for Science and Environment, 2022; Mankhair & Chandel, 2024; Singh Sambyal, 2019).

Despite the potential of the abovementioned waste streams, only a small fraction of the total legacy waste in most large dumpsites is successfully processed, highlighting the difficulty of scaling operations (Down To Earth, 2022). Challenges include high waste heterogeneity, variable moisture content, equipment downtime, seasonal variations (Ministry of Urban Development, 2016), and a lengthy contractor mobilisation process, all of which raise costs and delay schedules. Field reports emphasise the critical need for staged excavation, pre-screening, and on-site pre-processing (Ministry of Housing and Urban Affairs, Government of India, 2018).

## 2.2. Capping and containment

Scientific capping is recommended as an alternative where excavation is infeasible. It involves installing multilayer cover systems (geomembranes [impermeable synthetic polymer sheets], drainage layers, and gas vents) designed to reduce infiltration, control leachate, prevent landfill gas migration, and enable monitored post-closure care (Central Pollution Control Board, 2019).

Containment alone presents long-term risks: cap failure due to poor maintenance, settling-induced cracks, and continued release of gas and leachate for decades can negate the preliminary benefits. Proper cap designs must adhere to international and World Bank closure manuals, such as the US Environmental Protection Agency Manual, World Bank

Manual on Landfill Design, and International Best Practices Guide for Landfill Gas Energy Projects (Global Methane Initiative & U.S. Environmental Protection Agency, 2012), which outline specific requirements for design life, long-term monitoring, and maintenance.

### 2.3. Criticality of waste characterisation

A fundamental barrier to effective remediation is the lack of systematic, stratified baseline characterisation (sampled by depth, zone, and age) across many legacy dumpsites, despite CPCB mandates (Central Pollution Control Board, 2019). Without reliable compositional data, technology selection, resource recovery potential, and risk assessment remain uncertain. Studies show significant heterogeneity within waste masses; for example, older layers typically contain fewer combustibles due to degradation and prior informal recycling (Ghosh & Kartha, 2023). Highly inert content reduces recovery value, whereas uncharacterised hazardous fractions constrain safe co-processing options.

India's waste management sector, projected to reach nearly INR 620 billion by 2030 (Rastogi, 2025), is increasingly exploring material and energy recovery from legacy dumps. These sites can yield construction-grade aggregates, metals, compostable fines, and high-calorific RDF. Co-processing in cement kilns and RDF-to-energy facilities is viable in India, provided feedstock quality, pre-treatment, emission control, and logistics are adequately managed (Baidya et al., 2017). Legacy dumps also present a significant opportunity for methane mitigation. World Bank estimates suggest that 1 million tonnes of in-place municipal waste can generate ~6 million m<sup>3</sup> of landfill gas annually (~2,140 tonnes of methane) (Zhu et al., 2008), underscoring the scale of recovery. Prioritising landfill gas recovery can also reduce greenhouse gases while creating revenue streams, provided there is investment in gas collection systems and a supportive carbon market mechanism.



### 3. Policy Landscape and Regulatory Gaps

Legacy waste management in India is governed through various regulatory instruments established by the government, judiciary, and specialised agencies. These policies are ultimately designed for programme implementation and enforcement. Table 1 delineates the clear scope and focus of these mandates and frameworks and identifies crucial gaps.

*Table 1. Policy landscape and regulatory gaps for legacy waste management in India*

	<b>Solid Waste Management (SWM) Rules, 2016</b>	<b>Central Pollution Control Board (CPCB) Guidelines, 2019</b>	<b>National Green Tribunal Directives</b>	<b>Swachh Bharat Mission (Urban) 2.0</b>	<b>SWM Rules, 2026</b>
<b>Scope of Authority and Applicability</b>	Applies nationally to urban local bodies (ULBs), rural areas, special economic zones, railway units, ports, and other waste generators.	<ul style="list-style-type: none"> <li>Provides technical standards, operational procedures, and monitoring frameworks for the enforcement of environmental laws, including SWM.</li> <li>Supports State Pollution Control Boards (SPCBs) and local bodies in implementation.</li> </ul>	<ul style="list-style-type: none"> <li>Jurisdiction to enforce all environmental laws, including SWM Rules.</li> <li>Directs specific actions, penalties, and compliance timelines through binding orders and suo-motu interventions.</li> </ul>	<ul style="list-style-type: none"> <li>Concentrates on the city-wide implementation of sanitation measures and SWM.</li> <li>Provides funding, capacity building, citizen engagement tools, and performance monitoring but relies on statutory laws for enforcement.</li> </ul>	Applies nationally to ULBs, rural areas, special economic zones, railway units, ports, and other bulk waste generators (BWGs, including central and state government departments, public sector undertakings, institutions, commercial establishments, and residential societies).

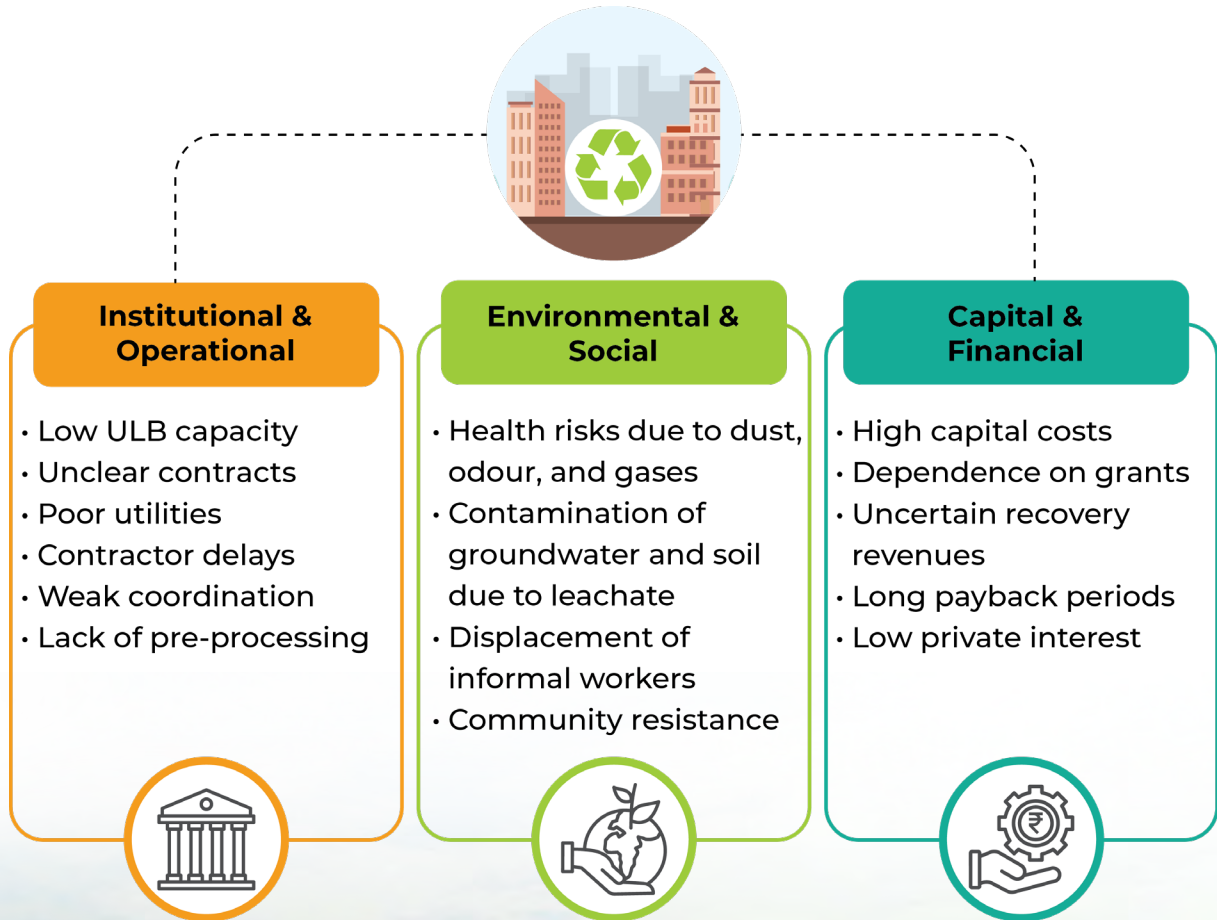
	<b>Solid Waste Management (SWM) Rules, 2016</b>	<b>Central Pollution Control Board (CPCB) Guidelines, 2019</b>	<b>National Green Tribunal Directives</b>	<b>Swachh Bharat Mission (Urban) 2.0</b>	<b>SWM Rules, 2026</b>
<b>Key Focus</b>	<ul style="list-style-type: none"> <li>Mandatory segregation at source into wet, dry, and hazardous waste.</li> <li>Mandates bio-methanation, composting, biomining, and proper landfill siting criteria.</li> </ul>	<ul style="list-style-type: none"> <li>Requires on-site treatment for waste generation of over 5 tonnes per day.</li> <li>Provides standard operating procedures for biomining and legacy waste remediation.</li> <li>Annual performance reporting to the Ministry of Environment, Forest and Climate Change of India via State Boards.</li> </ul>	<ul style="list-style-type: none"> <li>Enforces timelines and penalties as per SWM Rules.</li> <li>Mandates 100% segregation, door-to-door collection, and landfill site identification.</li> <li>Orders compensation for failures (INR 10 lakh per defaulting local body).</li> </ul>	<ul style="list-style-type: none"> <li>Behaviour Change Communication (BCC) framework for citizen participation.</li> <li>Emphasis on legacy dump site remediation and circular economy linkages.</li> </ul>	<ul style="list-style-type: none"> <li>Focuses on BWGs and provides a clear definition of BWGs (solid waste generation of 100 kg/day or more, entities with floor area of 20,000 m<sup>2</sup> or more, or water usage of 40,000 litres/day).</li> <li>Introduces the concept of Extended Bulk Waste Generator Responsibility.</li> <li>BWGs are held responsible for collection, transportation, and processing of waste in a safe manner, reducing the burden on ULBs.</li> <li>Focuses on restrictions on landfilling and remediation of legacy waste dumpsites.</li> </ul>

	<b>Solid Waste Management (SWM) Rules, 2016</b>	<b>Central Pollution Control Board (CPCB) Guidelines, 2019</b>	<b>National Green Tribunal Directives</b>	<b>Swachh Bharat Mission (Urban) 2.0</b>	<b>SWM Rules, 2026</b>
<b>Practical Implementation</b>	<ul style="list-style-type: none"> <li>Provides statutory responsibility for waste segregation, collection, and treatment.</li> <li>Empowers local bodies to implement user fees and waste audits.</li> </ul>	Strengthens compliance via monitoring, data reporting, and inspection frameworks.	<ul style="list-style-type: none"> <li>Provides judicial push for enforcement using penalty mechanisms.</li> <li>Frequent state-level progress reviews with CPCB and SPCBs.</li> </ul>	Decentralised approach to collection, recycling, and composting incentives.	<ul style="list-style-type: none"> <li>Provides statutory responsibility for waste segregation, collection, and treatment.</li> <li>Online monitoring using the centralised online portal.</li> <li>Empowers local bodies to implement user fees on waste generators.</li> </ul>
<b>Circularity Aspect</b>	Mentions Material Recovery Facility (MRF) for non-compostable solid waste and waste-to-energy plants.	<ul style="list-style-type: none"> <li>Mentions the setting up of MRFs depending on the quantum of the waste at city level</li> <li>Refers to Extended Producer Responsibility for plastic waste</li> </ul>	NA	Mentions waste to compost, MRF, and waste to energy.	<ul style="list-style-type: none"> <li>These revised rules integrate the principles of circular economy, and EPR with specific focus on efficient waste segregation and management.</li> <li>Usage of RDF by industries.</li> </ul>
<b>Gaps</b>	<ul style="list-style-type: none"> <li>Lack of accountability, leading to vagueness in responsibility and weak enforcement (Comptroller and Auditor General of India, n.d.)</li> </ul>	<ul style="list-style-type: none"> <li>Compliance documentation often remains incomplete.</li> </ul>	<ul style="list-style-type: none"> <li>Delayed reporting by local bodies, indicating patchy compliance.</li> </ul>	<ul style="list-style-type: none"> <li>Mainly relies on behavioural change (Ministry of Housing and Urban Affairs, Government of India, 2022).</li> </ul>	<ul style="list-style-type: none"> <li>Infrastructure and institutional capacity to process and treat the waste remain lacking.</li> </ul>

	<b>Solid Waste Management (SWM) Rules, 2016</b>	<b>Central Pollution Control Board (CPCB) Guidelines, 2019</b>	<b>National Green Tribunal Directives</b>	<b>Swachh Bharat Mission (Urban) 2.0</b>	<b>SWM Rules, 2026</b>
<b>Gaps</b>	<ul style="list-style-type: none"> <li>Poor monitoring of segregation inadequate storage, and decentralised processing, adding to the burden on ULBs.</li> <li>Improper supervision of mandatory biomining and capping regulations.</li> </ul>	<ul style="list-style-type: none"> <li>Small municipalities lack capacity for technical implementation, especially legacy waste management.</li> </ul>	<ul style="list-style-type: none"> <li>Legal developments are given more prominence than institutional monitoring frameworks.</li> <li>No funding support and capacity building initiatives.</li> </ul>	<ul style="list-style-type: none"> <li>Composting is inefficient due to weak revenue.</li> <li>Informality and limited data access among ULBs reduce operational efficiency.</li> </ul>	<ul style="list-style-type: none"> <li>Placing additional compliance burdens on BWGs merely addresses downstream interventions and does not address upstream factors, which are essential for embedding circular economy principles.</li> <li>Lack of technical expertise and capital for operation can be another hurdle for smaller residential complexes and institutions.</li> <li>Even with online monitoring, transparency can be an issue as the rules rely on self-reporting, which could lead to false reporting or under-reporting.</li> </ul>
<b>Funding</b>	Depends on government grants.	NA	NA	Integrates central/state funding, project-based financing, and public-private partnership models, to support sustainable waste management.	Depends on government grants.

Legacy waste continues to face systemic challenges across governance, capital, and the environment (Figure 4). The sector's uncertain revenue stream restricts private sector entry, leaving it entirely reliant on public funding. Also, various challenges, such as leachate management, health issues, and lengthy biomining processes, make remediation impractical. Collectively, these issues weaken the scalability and sustainability of legacy waste clean-up.

**Figure 4:** Systemic bottlenecks



## 4. Recommendations

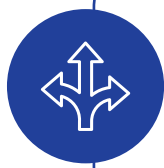
The current policy and implementation process lack site-specific and data-driven planning to ensure proper remediation of legacy dumpsites. To move beyond generic mandates, the following targeted interventions are critical:



**Baseline characterisation and feasibility assessment:** Detailed site-level waste characterisation (based on composition, moisture, and calorific value) should be performed using standardised sampling protocols. This is essential for determining the viability of biomining, estimating recoverable fractions, and understanding the project's feasibility, thereby attracting private investment and making this sector financially attractive.



**Structured pre-processing systems:** Pre-processing must be prioritised through mechanised screening and segregation using mobile equipment to generate defined output streams (RDF, metals, and inerts). This improves material quality, reduces contamination, and enhances market acceptance of recovered fractions.



**Market-linked recovery pathways:** Establish contractual linkages between recovered materials and end-use industries (e.g. cement plants for RDF and recyclers for metals or plastics). This should be supported by enforcing strict quality control to ensure consistent uptake and prevent stockpiling of processed waste.



**Defined role of capping as a contingency:** Position landfill capping as a fallback option only for non-recoverable or environmentally unstable fractions, with dedicated financial provisioning for long-term monitoring, leachate management, and methane control. Additionally, compliance with proper biomining guidelines and pre-processing to segregate and recover materials can reduce hazards.



**Performance-based monitoring and incentives:** A shift towards outcome-based contracts with clear metrics (e.g. recovery rates, landfill diversion, and environmental compliance) should be promoted to improve accountability and long-term sustainability of remediation efforts.

Finally, building technical and institutional capacity at the ULB level for project design, tendering, promoting investments, and monitoring is necessary in the long run and can be achieved by enhancing institutional capacity and integrating informal workers through engagement.



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**Center for Study of Science, Technology & Policy**

**Bengaluru**

#18, 10th Cross, Mayura Street, Papanna Layout,  
Nagashettyhalli (RMV II Stage),  
Bengaluru – 560094, Karnataka, India

**Noida**

1st Floor, Tower-A, Smartworks  
Corporate Park, Sector-125,  
Noida – 201303, Uttar Pradesh, India



[www.cstep.in](http://www.cstep.in)



+91-8066902500



[cpe@cstep.in](mailto:cpe@cstep.in)