Solid Waste Management Audit

Country Paper

Supreme Audit Institution of India

CONTENTS

1. Solid Waste and its Environmental Impact

1.1 Introduction

Solid Waste[1] covers all the discarded materials that are no longer required by the owner or user. In India, Solid Wastes are classified into 6 components by Law, namely,

i. Municipal Solid Waste
ii. Hazardous Waste
iii. E-waste
iv. Bio-medical Waste
v. Plastic Waste and
vi. Construction and Demolition Waste.

Municipal Solid waste[2] means and includes solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities.

Hazardous waste[3] means any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment, whether alone or in contact with other wastes or substances.

E-waste[4] means electrical and electronic equipment, including solar photo-voltaic modules or panels or cells, whole or in part discarded as waste, as well as rejects from manufacturing, refurbishment and repair processes.

Bio-medical waste[5] means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps.

Plastic Waste[6] means any plastic discarded after use or after their intended use is over where plastic means material which contains as an essential ingredient of a high polymer such as polyethylene terephthalate, high density polyethylene, vinyl, low density polyethylene,

---

[1] EnviStats India 2023 Vol-II, MoSPI, GoI

[2] Solid Waste Management Rules, 2016

[3] Hazardous and Other Wastes (Management And Transboundary Movement) Rules, 2016

[4] E-waste (Management) Rules 2022

[5] Bio-Medical Waste Management Rules, 2016

[6] Plastic Waste Management (Amendment) Rules, 2018

polypropylene, polystyrene resins, multi-materials like acrylonitrile butadiene styrene, polyphenylene oxide, polycarbonate, polybutylene terephthalate.

Construction and demolition waste[7] means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure.

Solid Waste Management (SWM) is a major environmental challenge all over the world and India is no exception to it. It is an organized process of collection, transportation, processing and safe disposal of solid residuals. An Integrated Solid Waste Management[8] is a strategic approach to Municipal Solid Waste Management in a sustainable manner by considering the following functional elements in an integrated manner:

- Waste generation
- Waste segregation
- Waste transfer and sorting
- Waste treatment
- Recovery, and
- Disposal of waste

Emphasis should be laid on maximizing efficiency of resource use.

1.2 Impact of Solid Waste on Environment

Municipal Solid Waste represents a threat to the environment and human health if not handled or disposed of properly. Surface and groundwater contamination takes place when waste reaches water bodies. Residues from the waste can change the water chemistry, which can affect all levels of an ecosystem. The health of animals and human beings are affected when they drink contaminated water. A specific environmental hazardous substance produced by waste is leachate, which is a liquid that forms, as water trickles through the contaminated areas leaching out the chemicals. Movement of leachate from landfills and waste disposal sites may result in hazardous substances entering surface water, groundwater

[7] Construction and Demolition Waste Management Rules, 2016

[8] Manual on Municipal Solid Waste Management

Image source: Indore Municipal Corporation

or soil. Emissions from the incinerators or other waste-burning devices and landfills can cause air contamination. Thus, to ensure better human health and safety, there is a need for an effective system for managing of solid waste.[9] (Comptroller and Auditor General of India 2019).

Waste management is a crucial public service and is seen as a fundamental component for healthy communities and ecosystems. The status of generation and management of various kind of wastes as per various reports of Central Pollution Control Board (CPCB) is as follows:

- **Solid Waste:** As per Central Pollution Control Board (CPCB) annual report (2021-22) on implementation of Solid Waste management Rules, 2016, the total quantity of solid waste generated in the country is 170339 Tons Per Day (TPD) and the total waste collected is 156449 TPD[10]. This translates to overall efficiency of 92% with regards to waste collection in the country. A total of 91511 TPD (54%) of waste is processed or treated, 41455 TPD (24%) of waste is disposed through sanitary landfill. The gap in solid waste management currently is 37373 TPD, which is 22% of the total waste generated.

  Despite the rise in waste generation, the country has managed to increase both collection and treatment capacities, and has significantly reduced the gaps in waste management.
- **Hazardous Waste**: During 2022-23, about 15.66 Million Metric Tons (MMT) of Hazardous Waste (HW) was generated. Out of 15.66 MMT of generated HW, 42.49%

[9] Report No 2 of 2019-Performance Audit of Solid Waste Management (Government of Manipur)

[10] Annual Report 2021-2022 on Implementation of Solid Waste Management Rules, 2016, https://cpcb.nic.in/uploads/MSW/MSW_AnnualReport_2021-22.pdf

was utilizable HW, 31.74% was recyclable HW, 20.89% was landfillable HW and 4.89% was incinerable HW.[11]

- **E-Waste:** As per the Annual Report of Central Pollution Control Board 2022-23, the quantity of E-Waste dismantled and recycled is 5,27,131.57[12] tons.
- **Bio-Medical Waste**: In year 2022, around 705 tons/day of biomedical waste was generated in the country, out of which 645 tons/day of Bio-Medical Waste was treated and disposed-off through CBWTFs and Captive treatment facilities.[13]
- **Plastic Waste**: As per the Annual Report on Implementation of Plastic Waste Management Rules, 2016, the plastic waste generation during the year 2022-23 was approximately 4136188.83 Tons Per Annum (TPA). [14]

2 Framework and Strategy for Solid Waste Management

2.1 Legislative Framework

Article 51-A (g) (fundamental duties) of the Constitution of India, states that "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures." Article 48A of the Constitution directed the State to protect and improve the environment and to safeguard forests and wildlife.[15]

Waste along with climate change, pollution and loss of biodiversity is one of the critical environmental challenges facing India. The judicial interventions[16] also played a significant role in creation of rules and regulations and effective implementation of waste management in India. The various legislative measures are discussed below:

[11] National Inventory on Generation and Management of Hazardous and Other Wastes (2022-23) https://cpcb.nic.in/uploads/hwmd/Annual_Inventory2022-23.pdf

[12] CPCB Annual Report 2022-23

[13] Annual Report on Biomedical Waste Management for the year 2022 as per Biomedical Waste Management Rules, 2016 https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/AR_BMWM_2022.pdf

[14] https://pib.gov.in/PressReleasePage.aspx?PRID=2083801

[15] Municipal Solid Waste Management in India- A Compendium

[16] (a) Municipal Council, Ratlam vs. Shri Vardichand and others (1980) – Supreme Court opined that lack of finances cannot be the reasons for not discharging statutory duties. (b) B.L. Wadhera vs. Union of India (1994) – Supreme Court issued directives to Delhi Municipal Corporation regarding the collection, transportation and disposal of garbage and hospital waste. (c) Ms. Almitra Patel vs. Union of India (1996) - Supreme Court constituted a committee to look into SWM in Class I cities i.e. cities with a population of over one lakh.

2.1.1 National Environment Policy, 2006

National Environment Policy 2006 is a response to India's national commitment to a clean environment, mandated in the Constitution in Articles 48 A and 51 A strengthened by multiple judicial interpretations.

2.1.2 Environment (Protection) Act, 1986

This is an umbrella Act that seeks to protect and improve the environment and matters connected therewith. It empowers the Central Government to establish authorities [under section 3(3)] charged with the mandate of preventing environmental pollution in all its forms and tackling specific environmental problems.

2.1.3 Waste Management Rules

The Central Government has the power to take measures necessary for protecting and improving the quality of the environment, subject to the provisions of the Environment (Protection) Act, 1986 and accordingly, Central Govt. has notified waste management rules from time to time.

Table 1: Regulatory framework for waste management

Sl. No.	Type of Waste	Regulatory Framework
1	Solid Waste	Solid Waste Management Rules, 2016 Manual of Municipal Solid Waste Management, 2016 issued by GoI in April 2016
2	Plastic Waste	Plastic Waste Management Rules,2016 amended in 2018, 2021 & 2022
3	E-Waste	E-Waste (Management) Rules, 2022
4	Bio-Medical Waste	Bio-Medical Waste Management Rules 2016 amended in 2018 & 2019.
5	Construction and Demolition Waste	Construction and Demolition Waste Management Rules, 2016
6	Hazardous Waste	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

2.2 Institutional Framework

As per the Constitution of India, SWM is a state subject, and it is the primary responsibility of state governments to ensure that appropriate solid waste management practices are introduced in all the cities and towns in the state. The 74th amendment of the constitution also entrusted the urban local bodies to execute this responsibility to plan, design, operate, and maintain the solid waste management system in their respective cities/towns. The solid waste management rules 2016 identify a number of ministries agencies/ departments and

prescribe their roles and responsibilities.[17] The Rules also entrust the village panchayats with the duties and responsibilities to prepare a solid waste management plan as per state policy and strategy on solid waste management. The management of municipal solid waste is one of the main functions of all Urban Local Bodies (ULBs) in the country. All ULBs are required to meticulously plan, implement and monitor all systems of urban service delivery especially that of municipal solid waste.[18]

The framework for administration and management of SWM in India is broadly divided into three tiers- Central, State and Local Bodies. Other stakeholders that play a crucial role are the households, businesses, industries, informal sector, Non-Governmental Organisations (NGOs), Self-Help Groups (SHGs), etc. Involvement of all these stakeholders is necessary at several stages of SWM. The role and responsibilities of stakeholders involved in process of SWM in urban areas are given in the table.[19]

Table 2: Roles and Responsibilities of Solid Waste Management (SWM)

Institution/Stakeholders	Role and responsibilities of SWM
Central Government (MoEFCC, MoUD and CPCB)	Framing of Laws and Rules; Policies and Norms; Guidelines; Manuals; and technical assistance; financial support; Monitoring the implementation of laws and rules.
State Government (Housing & Urban Development Departments headed by Pr. Secretary and State Pollution Control Boards headed by Member Secretary)	Policy framing, monitoring implementation of laws and rules in metropolitan cities; State Policy and SWM strategy; Guidelines, Manuals and technical Assistance; financial Support; reporting on SLBs to the MoUD; capacity Building of local bodies; granting consent to set up treatment and disposal activities.
District Collector or Deputy Commissioner (DC) assisted by Project Director, District urban Development Agency (DUDA)	Review the performance of ULBs on waste management process; facilitate identification and allotment of suitable land for solid waste processing and disposal facilities.
ULBs (headed by Commissioner, Municipal Commissioner or Chief Executive Officers/ Executive Officers) and Village Panchayats	Implementation of MSW Rules, providing SWM services; preparation of SWM plan; framing by-laws; levy and collection of fees; financing SWM system; creating public awareness and involvement of informal sector in SWM.

[17] Municipal Solid Waste Management in India- A Compendium

[18] Performance Audit on Waste Management in Urban Local Bodies, Madhya Pradesh, report No. 2 of 2024

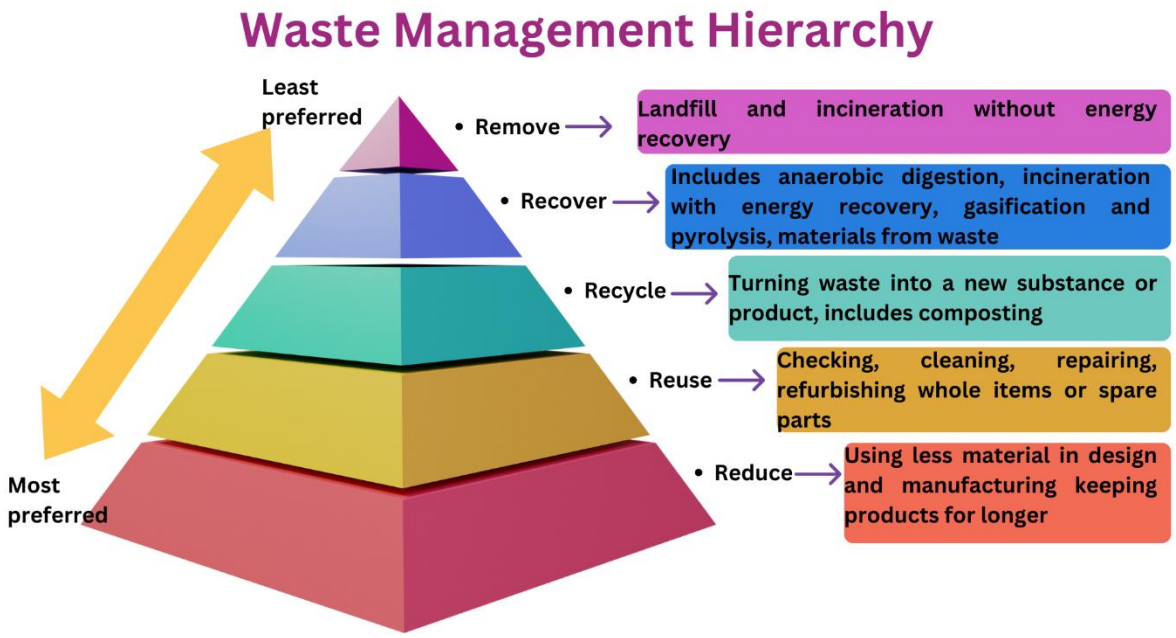
[19] Performance Audit on Waste Management in Urban Areas for the year ended March 2021 Odisha

Informal Sector (waste recyclers, NGOs, and private partners)	Resource recovery and recycling at different stages; providing support to the local recycling industry; involvement of community; creating awareness; collection and transportation of waste and technology providers.

2.3 Strategies for Solid Waste Management

Hierarchy of Waste Management – 5Rs (Reduce, Reuse, Recycle, Recover and Remove)

The Hierarchy of waste management proposes to have a multipronged approach that includes the 5Rs principle[20] - Reduce, Reuse, Recycle, Recover and Remove as shown in the image.



Reduce- The first choice of measures in waste management, is avoidance and waste reduction. This step aims for goods to be designed in a manner that minimizes their waste components. Also, the reduction of the quantity and toxicity of waste generated during the production process is important.

Re-using an article removes it from the waste stream for use in a similar or different purpose without changing its form or properties. The recycling of waste involves separating articles

20

https://www.mospi.gov.in/sites/default/files/main_menu/Seminar/Policy%20on%20Waste%20Management%20-%20MOEFCC.pdf

from the waste stream and processing them as products or raw materials. This approach seeks to recycle a product when it reaches the end of its life span.

Recycling is a process of transforming materials into secondary resources for manufacturing new products. Promotion of waste recycling sector and providing that with institutional support and motivating all the stakeholders to segregate waste at source of generation.

Recovery involves reclaiming particular components or materials, or using the waste as a fuel. Material recovery involves a variety of mechanical or biological processes that remove a variety of materials from the waste stream.

Remove refers to residuals management or the management of materials which remain after the previous 4Rs have been applied.

The purpose of implementing the waste management hierarchy is to use waste as a resource and divert these potential resources from dumpsites / landfills.

3 Initiatives by India for Sustainable Waste Management

3.1 Initiatives at National Front

The Government of India launched the Swachh Bharat Mission-Urban (SBM-U) on October 2, 2014, with the objective to scientifically process all the Municipal Solid Waste (MSW) generated in the country. To carry forward the progress made, Swachh Bharat Mission (SBM-U) 2.0 was launched on October 1, 2021, for a period of five years, up to October 1, 2026, with a vision of achieving Garbage Free Status for all cities through 100 per cent source segregation, door to door collection and scientific management of all fractions of waste, including safe disposal in scientific landfills. It is also aimed at remediation of all legacy dumpsites and converting them into green zones[21].

With a focus on improved waste management and sanitation in rural India, Swachh Bharat Mission-Gramin (SBM-G) was launched on October 2, 2014, with the objective of achieving an Open Defecation Free (ODF) rural India by providing access to safe sanitation and promoting hygiene practices. Swachh Bharat Mission-Gramin (SBM-G) Phase-I (2014-2019) achieved nearly 100%[22] rural sanitation coverage by constructing over 10 crore toilets and declaring all villages and districts Open Defecation Free (ODF) by October 2019. It significantly improved public health, hygiene awareness, and environmental cleanliness. To build on the achievements of the first phase, Swachh Bharat Mission (SBM-G) Phase-II was launched in

[21] Swachh Bharat Mission Urban, https://sbmurban.org/aboutUs

[22] Factsheet, SBM-Grameen Phase-I, https://pib.gov.in/FactsheetDetails.aspx?Id=148579&reg=3&lang=1

2020, to be implemented till 2025, with a focus on sustaining the ODF status and ensuring comprehensive solid and liquid waste management in rural areas[23].

India has also banned manufacture, import, stocking, distribution, sale and use of identified single use plastic items, which have low utility and high littering potential, all across the country from July 1, 2022.[24]

Various steps have been taken by the Government to guide the States on efficient Municipal Solid Waste Management (MSWM) Processing, inter-alia:

- The State Governments/ Union Territory (UT) Administrations submit their component-wise City Solid Waste Action Plans (CSWAP) based on which, Central Assistance under Solid Waste management (SWM) component is released.

- Various manuals and advisories have been brought out covering all aspects of SWM including planning, designing and operation and maintenance.

- Garbage Free Star Rating Protocol to assess the City's Municipal Solid Waste Management by third party verification.

- Various capacity building & Information, Education and Communication (IEC) initiatives have been rolled out. (Ministry of Housing and Urban Affairs 2023)[25]

- Solid Waste Management (SWM) component of SBM-U 2.0 allows setting up of waste processing facilities such as Material Recovery Facilities (MRFs), Transfer Stations, Composting Plants, Bio-methanation Plants, Refused Derived Fuel (RDF) Processing Facilities, Plastic Waste Processing Facilities, Waste to Electricity Plants, Construction and Demolition (C&D) Waste Plants, Sanitary Landfill, Mechanized Sweeping Equipment and Bioremediation/ capping of all legacy dumpsites in all ULBs.

- 'Swachhata Startup Challenge' launched in collaboration with Department for Promotion of Industry and Internal Trade (DPIIT) to promote an enabling environment for development startups and entrepreneurs in the waste management sector.

- SBM-U 2.0 Guidelines encourages adoption of locally innovated, cost-effective technology solutions and business models in sanitation and solid waste management by

[23] SBM-Grameen Phase-II, https://pib.gov.in/PressReleseDetailm.aspx?PRID=1603628&reg=3&lang=1

[24] Ban on Single Use Plastic in India: Step towards Clean India, Green India (Ministry of Environment, Forest and Climate Change)

[25] Ministry of Housing and Urban Affairs-Press Information Bureau- 23 March 2023

startups, through investment in Research & Design (R&D) and facilitation in Government-e-Market (GeM) portal. (Ministry of Housing and Urban Affairs 2023).[26]

3.2 Good Practices

Swachh Survekshan is the annual cleanliness survey conducted by the Ministry of Housing & Urban Affairs (MoHUA) that has today taken shape of the largest urban sanitation survey in the world. Through its multi-pronged data collection approach and robust assessment methodology, Swachh Survekshan has enthused cities with a healthy spirit of competition to improve the status of urban sanitation and ensure best service delivery to their citizens.

The design of Swachh Survekshan is based on key pillars as given:[27]

i. Service level progress – evaluating progress of cities on ODF status, segregated waste collection, processing, disposal of solid waste and sustainable sanitation. Progress claimed is validated through interaction with citizens and on-field visits;

ii. Citizens' Voice - assessment of cities based on direct feedback, engagement with citizens; and

iii. Certifications assessing progress of cities on their performance under Ministry's certification protocols such as Star Rating for Garbage Free Cities and Open Defecation Free ODF/ODF+/ODF++/Water+.

iv. An independent agency verifies the data and validates the progress of each city through on-call/ on-field interaction with citizens and randomly assesses areas in cities, while movement of assessors are geo-tagged.

Swachh Survekshan, initiated since 2016, serves as a mechanism to evaluate and contrast the sanitation conditions, aligning with the objectives of the Swachh Bharat Mission, across various Indian cities. The program has witnessed considerable growth since its inception, extending its reach from an initial 73 cities to a staggering 4,477 cities (including 61 Cantonment Boards and 88 Ganga Towns) in the year 2023. The principal objective of Swachh Survekshan is to assess the cities based on their cleanliness quotient and the efficacy of implementing cleanliness initiatives in a prompt and innovative fashion. Since its establishment, there has been a marked rise in city participation, leading to discernible enhancements in sanitation standards.

[26] Ministry of Housing and Urban Affairs- Press Information Bureau-06 April 2023

[27] Swachh Bharat Mission Urban, https://sbmurban.org/swachh-survekshan

Further, Swachh Sarvekshan Grameen has been launched in 2023 with the following objectives:

- 17508 Villages to be covered under the Survey.
- All India Districts rankings to be published based on their performance .
- Completely digitized and paperless survey.
- Ranking of best nominated Gram Panchayat across all the states.

Indore city of Madhya Pradesh has bagged six consecutive Cleanest City titles, for the years 2017 to 2022. Further, the Indore Municipal Corporation (IMC), is serving as an inspiration for other cities in the country, after establishment (February 2022) of the Asia's biggest Bio-CNG plant[28] of 550 TPD capacity at Indore on public private partnership (PPP) model, under the Centre's 'waste-to-wealth' concept and generating nearly 17,000 kg bio-CNG gas per day.

Image source: Indore Municipal Corporation

[28] Indore Bio-CNG plant

Case Study - Indore Municipal Corporation

Indore has set a benchmark in implementing the components of the Swachh Bharat Mission (SBM) with exemplary efficiency and innovation, contributing significantly to its reputation as one of the cleanest cities in India. Indore's comprehensive approach to implementing the SBM components has made it a model city for urban cleanliness and sanitation in India. Here's how Indore has implemented the various SBM components:[29]

- **Door-to-Door Collection and Segregation**: Indore has achieved nearly 100% segregated door-to-door collection of waste. The city has implemented a strong system where waste is collected daily from households, commercial establishments, and institutions. The waste is segregated at the source into wet, dry (plastic and other dry waste), sanitary waste, DHW and e-waste categories, which has significantly improved the efficiency of waste processing. Indore has a dedicated waste stream collection system in place.
- **Scientific Processing and Disposal**: Indore has set up multiple waste processing facilities, including composting plants, bio-methanation plants, and material recovery facilities (MRFs). The city has also focused on the scientific disposal of waste, ensuring that only the residual waste, which cannot be processed, is sent to landfills.
- **Remediation of Legacy Dumpsites**: Indore has undertaken significant efforts to remediate its legacy dumpsites. The city has transformed old dumpsites into green zones, significantly reducing the environmental impact and reclaiming valuable urban land.
- **Reduction of Single-Use Plastics**: The city has launched extensive campaigns to reduce the use of single-use plastics. Initiatives include banning plastic bags and promoting alternatives like cloth bags.
- The city of Indore has initiated drives to include the informal sector waste pickers into the mainstream of waste management.

[29] Indore Municipal Corporation https://imcindore.mp.gov.in/SwachhBharatMission

4 Initiatives by SAI India in Auditing Waste Management

In the past few years, multiple audits on the theme of waste management have been conducted by SAI India across various states. The following analysis synthesizes key audit objectives, methodologies adopted, findings and recommendations from these audits, with a particular emphasis on the audits conducted in states of Madhya Pradesh, Kerala, Meghalaya, Andhra Pradesh, Odisha, and Uttar Pradesh.

4.1 Audit Objectives

Strategy and Planning: The audits aimed to determine if the strategies and planning for waste management in Urban Local Bodies (ULBs) were:

- Commensurate with the amount and types of waste generated.
- Compliant with existing legal frameworks and policies.
- Supported by adequate institutional mechanisms.

Operational Effectiveness: The audits examined whether the tasks and projects related to waste management, such as segregation, collection, transportation, processing, and disposal, were:

- Effective, efficient, and economical.
- Planned, implemented, and maintained in a financially sustainable manner.
- Adequate to meet the specific needs of the ULBs.
- Carried out scientifically.

Environmental Impact and Risk Mitigation: The audits assessed:

- The adequacy of measures to identify and minimize environmental risks posed by waste.
- The environmental impact of waste disposal practices.

Monitoring and Evaluation: The audits evaluated the effectiveness of:

- Monitoring systems in place to track the implementation of waste management rules, guidelines, and instructions.
- Mechanisms for awareness creation, citizen engagement, and complaint redressal.

Overall, the audits sought to provide a comprehensive assessment of the solid waste management systems in the respective states, covering planning, implementation, environmental considerations, and monitoring aspects.

4.2 Audit Methodology

The audit methodologies employed by various states in assessing their respective Solid Waste Management systems are summarized below:

1. **Sampling Techniques for ULB Selection:** Various sampling methods, such as stratified and simple random sampling, were used to ensure representative selection of urban local bodies (ULBs) based on factors like population, expenditure, and regional distribution.

2. **Document Reviews and Analysis:** Audit teams examined records related to waste management operations, financial data, and compliance reports from relevant government bodies to assess adherence to policies and regulations.

3. **Site Inspections and Physical Verifications:** Joint Field visits with the departmental/ municipal staff were conducted to validate findings through firsthand observations and photographic evidence.

4. **Stakeholder Engagement through Entry and Exit Conferences:** Entry and exit meetings with government officials and stakeholders were conducted to discuss objectives, scope, methodologies, and audit findings for transparency and consensus building.

5. **Collection of information through Audit Queries and its analysis:** Written and verbal responses from audited entities were analyzed to cross-verify the information and clarify discrepancies in compliance and operational processes.

6. Audit of waste management also employed innovative methods, such as water testing of filtration plants and water bodies with the help of expert institutions such as Advanced Materials and Processes Research Institute (AMPRI), to detect microplastics (Madhya Pradesh). The audit also engaged subject matter experts (Meghalaya), to acquaint themselves with relevant information/knowledge regarding waste management especially about management of special waste, such as E-Waste. Hazardous Waste, Bio-medical waste, etc. Further, trainings are continuously held in International Centre for Environmental Audit and Sustainable Development (iCED), Jaipur on the topic of Waste Management regularly.

4.3 Audit findings

The key common themes that emerged during audit of Waste Management by various Urban Local Bodies across the country conducted by SAI India are summarized below:

Strategy and Planning Deficiencies:

- Waste generation estimations were inaccurate across multiple states, with ULBs relying on population-based approximations rather than conducting comprehensive waste surveys.
- There were delays in formulating state-level policies and frameworks for SWM.
- Many states lacked clear policies for integrating the informal waste sector, such as waste pickers, into the formal system, however, some cities like Bhopal and Indore took steps to integrate informal sector waste pickers into mainstream waste management.
- The absence of proper planning for infrastructure and financial sustainability posed challenges for long-term waste management.

Operational Inefficiencies:

- Although good initiatives like distribution of color-coded bins were taken by the authorities, segregation of waste at source was an issue.
- Collection and transportation of waste faced challenges, including poor vehicle maintenance and gaps in service coverage.
- Financial sustainability was weak, with heavy reliance on government grants and inadequate user charge collection.
- Delays in establishing key waste management infrastructure, such as landfills, transfer stations, and processing facilities, were there.
- Non-adherence to the establishment of bar-code system (as per the Bio-Medical Waste Management Rules, 2016), by district hospitals and community health centers in Uttar Pradesh, has led to higher possibility of pilferage/ mismanagement of recyclable Bio-medical waste.

Environmental Impact and Risk Mitigation Issues:

- Many ULBs operated without necessary environmental clearances from pollution control boards.
- There were cases of inadequately maintained sewage treatment plants (STPs) and landfill sites.
- Compliance with environmental regulations, including Consent to Operate (CTO), was weak across multiple states.

Monitoring and Evaluation Gaps:

- Monitoring mechanisms at the state, district, and ULB levels were inadequate, with data collection and reporting inconsistencies.
- Service Level Benchmarks (SLBs) were either not established or based on unverifiable data.
- Stakeholder engagement through advisory boards and task forces was often inactive.

- Public disclosure of SWM-related information by ULBs was lacking.

These findings highlight systemic issues across states, emphasizing the need for improved planning, operational efficiency, environmental safeguards, and robust monitoring to enhance the effectiveness of solid waste management systems.

4.4 Audit Recommendations

The audit recommendations highlighted the need for a **systemic and multi-faceted approach** to address the challenges of solid waste management. They emphasize the importance of **adequate planning**, **efficient operations**, **environmental protection**, **strong monitoring and enforcement, and capacity building** to achieve sustainable and effective SWM systems. Key audit recommendations made by SA I India are follows:

Strengthen Planning and Strategy:

- **Conduct Realistic Waste Assessments:** SAI India emphasized on the need for accurate waste generation and composition studies to address planning, infrastructure design, and resource allocation.
- **Develop Comprehensive SWM Plans:** ULBs should develop short-term and long-term action strategies with defined timelines and responsibilities, incorporate contingency measures to address potential disruptions in waste processing and disposal, and establish sustainable financial frameworks by exploring diverse revenue sources such as user charges and penalties.
- **Frame and Enforce Byelaws:** ULBs should develop and enforce bye-laws that incorporate provisions of the SWM Rules 2016, ensuring consistency with national regulations.

Improve Operational Efficiency:

- **Prioritize Source Segregation:** SAI India recommendations highlighted the need for effective source segregation programs, including public awareness campaigns to educate citizens on proper waste segregation practices and providing adequate infrastructure for segregated waste collection (color-coded bins, separate collection vehicles).
- **Enhance Collection and Transportation:** Recommendations focused on optimizing collection routes and schedules, ensuring timely collection from all designated points and regular maintenance of vehicles, and obtaining necessary permits (fitness/pollution certificates, insurance).
- **Develop Adequate Processing and Disposal Infrastructure:** This includes establishing sanitary landfills that meet environmental standards, investing in appropriate waste processing technologies (composting, biomethanation, waste-to-energy) based on

waste characteristics and local needs and promoting decentralized processing options, especially in large residential complexes or institutions.

- **Integrate the Informal Sector:** The need to formally incorporate informal waste workers into SWM systems, providing them with training, safety equipment, and social security benefits.

Ensure Environmental Sustainability:

- **Obtain Necessary Authorizations:** ULBs must secure authorization from State Pollution Control Boards (SPCBs) for waste processing and disposal facilities, ensuring compliance with environmental regulations.
- **Implement Safe Disposal Practices:** This includes phasing out open dumping, promoting environmentally sound waste processing, and ensuring the safe handling and disposal of special waste categories (e.g., biomedical waste, construction, and demolition waste).

Enhance Monitoring and Evaluation:

Robust Monitoring Systems should be developed to track key performance indicators (KPIs), including waste generation, collection, processing, and disposal rates. Efforts should be made to improve data collection methods. SPCBs and other relevant authorities should conduct regular inspections of waste management facilities to ensure compliance with regulations and environmental standards. Transparency and accountability can be promoted by making SWM-related information, including performance reports, financial data, and environmental monitoring results, publicly available. Additionally, adopting and tracking service level benchmarks will help measure the quality of services and identify areas that require improvement.

Capacity Building and Collaboration:

- **Invest in Capacity Building:** Provide training and skill development programs for sanitation workers, ULB staff, and other stakeholders involved in SWM, focusing on technical, operational, and environmental aspects.
- **Facilitate Inter-Agency Coordination:** Establish mechanisms for effective collaboration and communication among various government departments, ULBs, and regulatory bodies involved in SWM, ensuring a coordinated and integrated approach.

5 Challenges

- **Large Geographic coverage:** The vast size of Indian states, with a large number of Urban Local Bodies (more than 4000[30] ULBs and 92000 wards) and Panchayat institutions (more

[30] https://ss2023.sbmurban.org/#/home

than 17000[31]), poses a significant challenge for auditors to conduct audits, often resulting in sampling-based audits rather than comprehensive coverage.

- **Availability of reliable and sufficient data:** Auditors often struggle with accessing accurate and reliable data from waste management authorities (such as data on microplastics and hazardous wastes) and a lack of integration between various stakeholders involved in the waste management process.
- **Evolving Regulatory Framework for Special Wastes:** The rules and regulations on waste management, particularly for special waste categories like E-Waste, Biomedical Waste, and Hazardous Waste etc. are dynamic in nature and evolving. This makes it challenging for auditors to keep pace with the changes and ensure timely compliance. Additionally, the shortage of qualified experts in these specialized fields among the auditors further complicates the audit processes.
- **Need for Capacity Building for auditors in view of the Technical Complexity and Expertise Gaps:** Auditing waste management systems requires specialized knowledge of environmental regulations, different kinds of wastes, waste processing technologies, and sustainability practices, which can pose challenges for auditors without adequate technical expertise. Auditors need to be acquainted on these issues through regular Capacity Building programmes/exercises.

[31] https://www.ssg2023.in/

References

1. Solid Waste Management Rules, 2016
2. Plastic Waste Management (Amendment) Rules, 2018
3. E-Waste (Management) Rules, 2022
4. Bio-Medical Waste Management Rules, 2016
5. Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
6. Construction and Demolition Waste Management Rules, 2016
7. Swachh Bharat Mission Guidelines, Reports and Dashboard
8. Environment (Protection) Act, 1986
9. Manual of Municipal Solid Waste Management, 2016
10. Central Pollution Control Board (CPCB) Annual Report for 2020–21
11. National Environment Policy, 2006
12. Swachh Sarvekshan Reports, Ministry of Housing and Urban Affairs
13. Municipal Solid Waste Management in India - A Compendium Report by iCED, Jaipur in collaboration with TERI, New Delhi
14. State of Waste Management Report, TERI 2023
15. Annual Report 2023-24, NITI Aayog
16. C&AG's Audit Report on Local Government Institutions, Andhra Pradesh for the period ended March 2022
17. C&AG's Audit Report on Solid Waste Management in Urban Areas of Meghalaya, Report No. 2 of 2024
18. C&AG's Audit Report on Public Health Infrastructure and Management of Health Services in Uttar Pradesh, Report No. 8 of 2024
19. C&AG's Audit Report on Waste Management in Urban Local Bodies, Government of Kerala, Report No. 9 of 2022
20. C&AG's Audit Report on Waste Management in Urban Local Bodies, Government of Madhya Pradesh, Report No. 2 of 2024
21. C&AG's Audit Report on Waste Management in Urban Areas, Government of Odisha, Report No. 6 of 2022