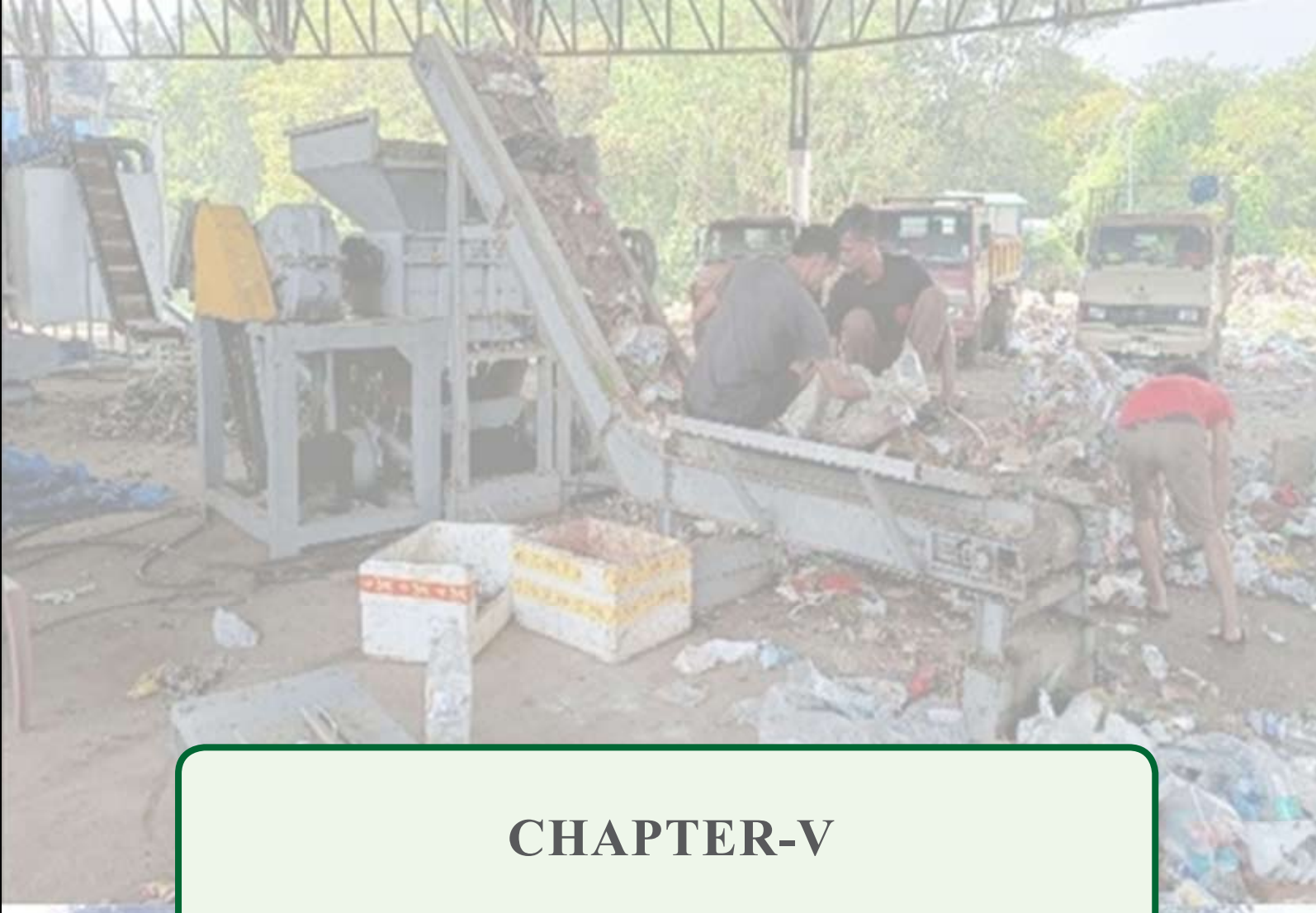

CHAPTER-V

SEGREGATION, COLLECTION AND TRANSPORTATION OF WASTE

Chapter-V
Segregation, collection and transportation of waste

NITI Aayog in its Report on Waste-Wise Cities 2021, has cited the example of Indore as the number one city in waste management. One of the success parameters of waste management in Indore was effective and persuasive awareness programme to encourage residents to adopt waste segregation. Once segregation was achieved, the city undertook a study to ascertain the population and the amount of waste generated in each ward, based on which a route plan was developed. Vehicle and staff demand was arrived at to meet the waste collection demand of each ward. Through source segregation, participation of all stakeholders and good governance, Indore has become a champion and number one city in the waste management sector in India.

Audit examined the waste management practices in the urban agglomerations in Meghalaya with respect to the statutory requirements and in comparison to the benchmarks of good practices across the country.

The Audit findings are discussed in this Chapter.

5.1 Segregation

Indiscriminate dumping of solid waste in landfills is not only hazardous for surrounding areas and residential dwellings, it has a far reaching climate impact. Biodegradable waste in landfills releases methane which has a 34 times higher global warming impact over 100 years than carbon dioxide[34].

Segregation of waste at source is key to scientific waste management process. Proper source segregation results in waste minimisation thereby improving the efficiency of processing and treatment of waste which translates into longer life spans of landfills. Rule 4 (a) of the Solid Waste Management Rules, 2016 mandates the segregation of waste into bio-degradable, non-biodegradable and domestic hazardous waste at source. The Meghalaya State Waste Management Strategy and Policy, 2019[35] also mandates segregation of waste into 3 streams:

- Bio-degradable waste
- Non-biodegradable waste
- Domestic hazardous waste

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[34] Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

[35] Meghalaya State Waste Management Strategy and Policy, 2019 was notified by the Government of Meghalaya on 17 June 2019.

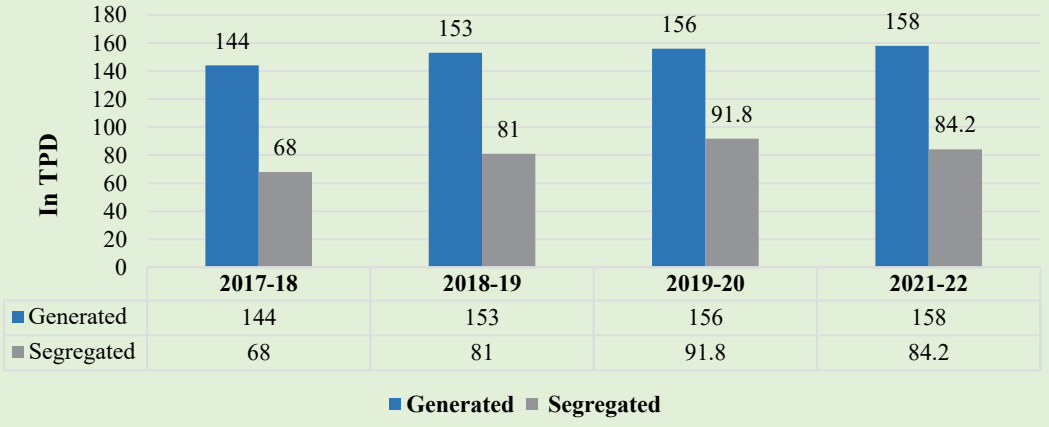
5.1.1 Segregation of waste at source in the urban areas

Insufficient segregation of solid waste at source by households and institutions and no facilities for segregating domestic hazardous waste indicated weak enforcement of SWM Rules in Meghalaya, on one hand, and other hand an absence of effective awareness raising programmed among the households and citizens. Despite distribution of dual-coloured household bins for source segregation of waste, the effectiveness of segregation of waste at source was inadequate. Data available with the department on waste segregation at source was unreliable.

According to the Reports of Meghalaya Pollution Control Board, during the period 2017-18 to 2021-22, the waste collection in urban areas of the state was to the extent of 83 to 89 *per cent*.

As per data available in various agencies, the extent of source segregation of waste in the test checked urban areas was as depicted in **Chart 5.1** and **Chart 5.2**.

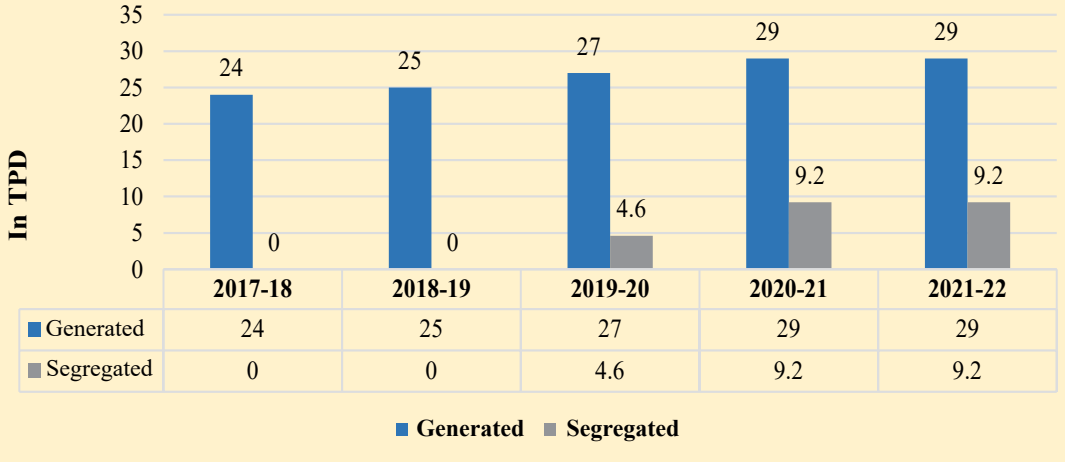
Chart 5.1: Status of source segregation in Shillong Urban Agglomeration



	2017-18	2018-19	2019-20	2021-22
Generated	144	153	156	158
Segregated	68	81	91.8	84.2

Source: Information furnished by SIPMIU.

Chart 5.2: Status of source segregation in Tura



	2017-18	2018-19	2019-20	2020-21	2021-22
Generated	24	25	27	29	29
Segregated	0	0	4.6	9.2	9.2

Source: Information furnished by Tura Municipal Board.

According to municipal records/ SIPMIU records there were 84,571 number of domestic households under Shillong Urban Agglomeration as of 2022. According to the records of Shillong Municipal Board, 80,282 households (95 *per cent*) in Shillong urban agglomeration area were provided with dual coloured[36] household bins free of cost during 2015-16 & 2017-18 under the NERCCDIP project[37]. In Jowai Municipal area, 12,800 dual coloured household bins were purchased for Jowai town under the 14 Finance Commission during 2021-22 for a sum of ₹ 40.96 lakh. From scrutiny of the stock register of Jowai Municipal Board, it was observed that 7,050 of the 12,800 bins purchased had been distributed free of cost to 3,252 out of 5,057 domestic households (70 *per cent*) in Jowai Municipal area. During audit, there were no records to indicate that bins were procured in Tura and Nongpoh.

Table 5.1 Details of expenditure on household bins in the test-checked urban areas

Urban area	No. of households covered	No. of households issued to	Name of scheme	Expenditure incurred
Shillong UA	84,571	80,282	NERCCDIP	₹ 3.58 crores
Jowai	5,057	3,525	14th FC	₹ 0.41 crores

However, as seen from **Charts 5.1** and **Chart 5.2** above, the rate of segregation of waste at source in Shillong and Tura urban areas was between 47-59 *per cent* and 0-32 *per cent*, respectively during 2017-18 to 2020-21. In Jowai town, despite the distribution of 7,050 bins, no segregation was carried out.

Exhibit 5.1: Household bins lying unutilised in the Jowai Municipal Board office premises.

Thus, it was clear that despite the state government's initiative of free distribution of waste bins for segregating waste at source in the domestic households, the actual extent of segregation of municipal waste at source was far from hundred *per cent*.

During the Exit Conference (May 2023), the Department accepted the observation that segregation of waste into recyclable and non-recyclable waste was not being done completely. However, it was stated that in some localities in Shillong, dry and wet waste was collected on different days.

It was thus evident that due to poor segregation of waste in the urban areas, untreated waste was being collected and dumped in the landfills. Poor segregation of waste limited any opportunity for waste recycling and composting of biodegradable waste as economic activities in the value chain.

[36] Green bins for bio-degradable waste and blue bins for non-bio-degradable waste as per Clause 4 (ii) of the Meghalaya Solid Waste Management Bye Law 2020.

[37] North-Eastern Capital Cities Development Investment Programme (an Asian Development Bank funded project).

As far as statistics on waste segregation was concerned, the Department stated these statistics were based on the periodic reports that MSPCB was collecting from different agencies. However, MSPCB stated that they had no mechanism to verify the validity of information submitted. The lack of reliability of data submitted by the ULBs to the MSPCB has been reflected in various parts of this report.

5.1.2 Segregation of domestic hazardous waste and sanitary waste

Absence of notified lists of hazardous waste items, and failure to establish waste deposition centers as required by regulations, and inadequate awareness resulted in non- implementation of source segregation and management of domestic hazardous waste.

Section 2.2.1.1 of the Solid Waste Management Manual, 2016 stipulates that all waste generators practice source segregation of domestic hazardous waste[38]. Domestic hazardous waste is to be segregated in separate bins at the household level. Further, as per Rule 15 (i) of the Solid Waste Management Rules, 2016, it is the responsibility of the ULBs to establish waste deposition centres for domestic hazardous waste and give direction for waste generators to deposit domestic hazardous wastes at this centre for its safe disposal. Also, as per decisions taken in a meeting chaired by the Chief Secretary (24 July 2019), the Deputy Commissioners of all districts, in consultation with the concerned ULBs, were tasked with identifying suitable sites for establishment of deposition centres for domestic hazardous waste for every 20 sq. km area in each of 22 cities/towns in the State, and to initiate process for establishment and operation of such centres at each identified location. Section 2.2.1.1 of the Solid Waste Management Manual, 2016 stipulates that sanitary waste generated from the households must be wrapped up properly and handed over to the waste collectors and should be preferably disposed in biomedical or MSW incinerators, as applicable to the local context or as directed by the State Pollution Control Board.

The extent of non-segregation of domestic municipal waste has already been pointed out in **Para 5.1.1** above. Audit further found that no waste deposition centres for domestic hazardous waste had been established by the municipal authorities in any of the test checked urban areas. As a result, domestic hazardous waste was mixed with municipal solid waste.

[38] Domestic hazardous waste consists of any chemical or product such as discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, *etc*., generated at the household level that can cause serious illness or pose an environmental threat if improperly disposed or treated.

Exhibit 5.2 Unsegregated sanitary waste at Nongpoh dumping ground (Umshangling)

Exhibit 5.3 Unsegregated domestic waste at Tura (Rongkhon Songittal)

This can be attributed to general lack of awareness of what constitutes domestic hazardous waste as apart from Shillong Municipal Board, the other test checked ULBs have not notified and publicised the list of items classified as domestic hazardous waste to be segregated at source.

Exhibit 5.4: Segregation of waste at Rongkhon Songgital, Tura

Exhibit 5.5: Mixed waste being loaded on to a compactor, Shillong

5.2 Collection of solid municipal waste

An efficient system of waste collection is an essential step in the solid waste management hierarchy. Improper waste collection mechanism adversely affects the aesthetics and public health of towns and cities. Clause 5 of the Meghalaya Solid Waste Management Bye Law, 2020 states that waste collection is the responsibility of the Local Authority *i.e.* Municipality in municipal areas and local traditional institutions in association with District Council with technical support from Agencies of Department of Urban Affairs or any agency authorised outside the municipal area.

Waste collection is categorised into primary and secondary collection. Primary collection pertains to the collection and removal of segregated solid waste from source of its generation including households, shops, offices, markets, *etc*. and taking the waste to a storage depot or transfer station or directly to the disposal site or to a designated sorting/transfer facility. Secondary collection is the collection of waste from community bins, sorting/transfer points to the processing and disposal sites.

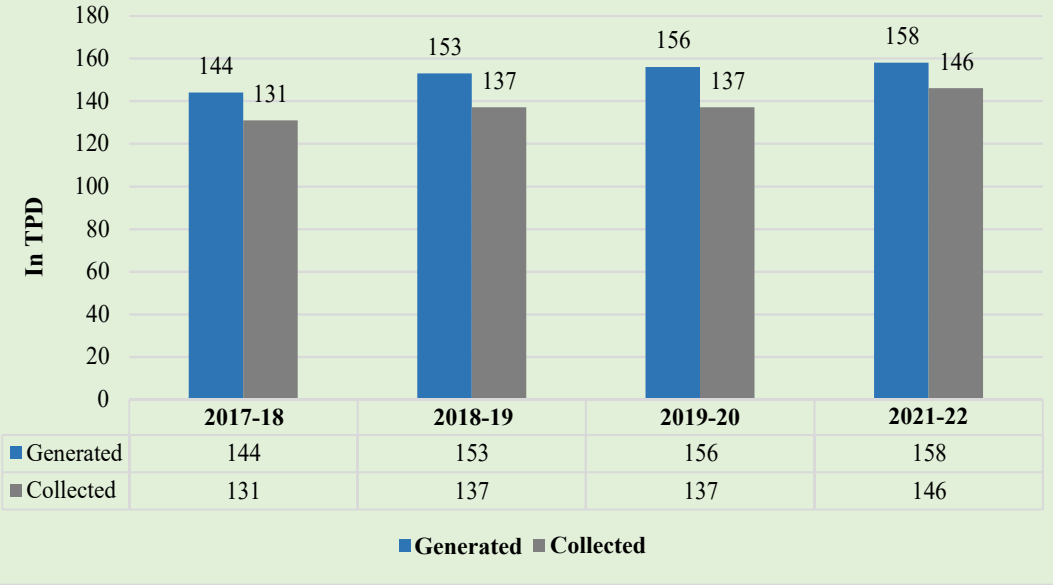
5.2.1 Extent of collection of municipal waste at source

Municipal Boards and Dorbar Shnongs played primary role in collection of municipal waste from households under Municipal areas and most ULBs reported almost hundred percent collection of municipal waste at source, absence of a reliable system for assessment of quantum of waste imposed limitation on the reliability of the data available, including absence of weighbridges methods, including the absence of functioning weighbridges, has led to uncertainties in quantifying the actual amount of waste collected, raising concerns about waste management accuracy and effectiveness.

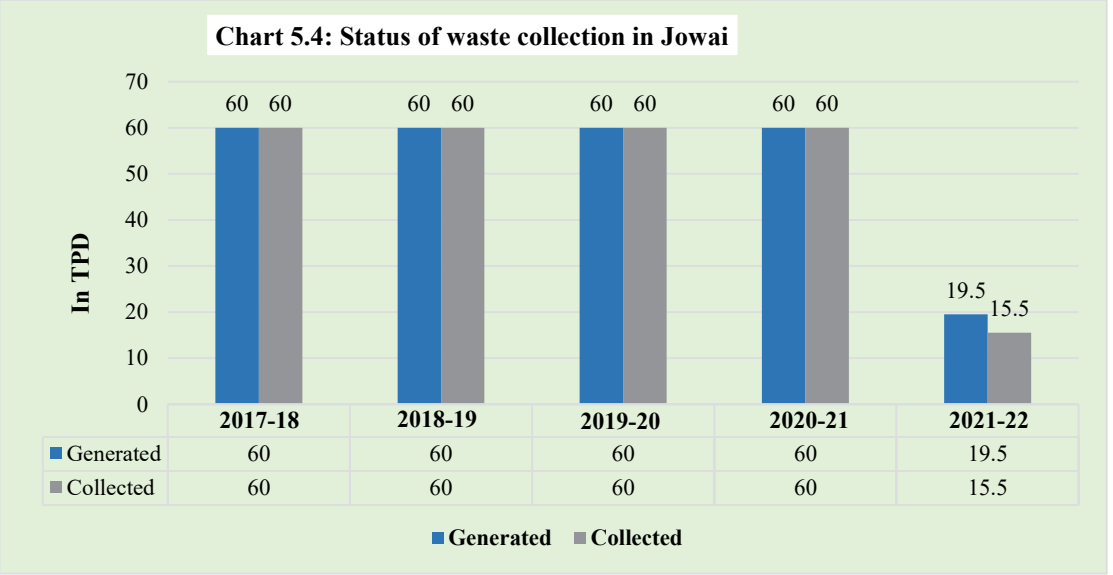
In Meghalaya, the municipal boards and traditional bodies (Dorbar Shnongs) under municipal and town committees/non-municipal areas respectively, were the designated primary agencies involved in the collection and transport of municipal solid waste.

The details of waste collection in relation to the quantum of waste generated in the test checked urban areas for the years 2017-18 to 2021-22 as per information furnished by the ULBs and Town Committee are shown in **Chart 5.3, Chart 5.4** and **Chart 5.5**.

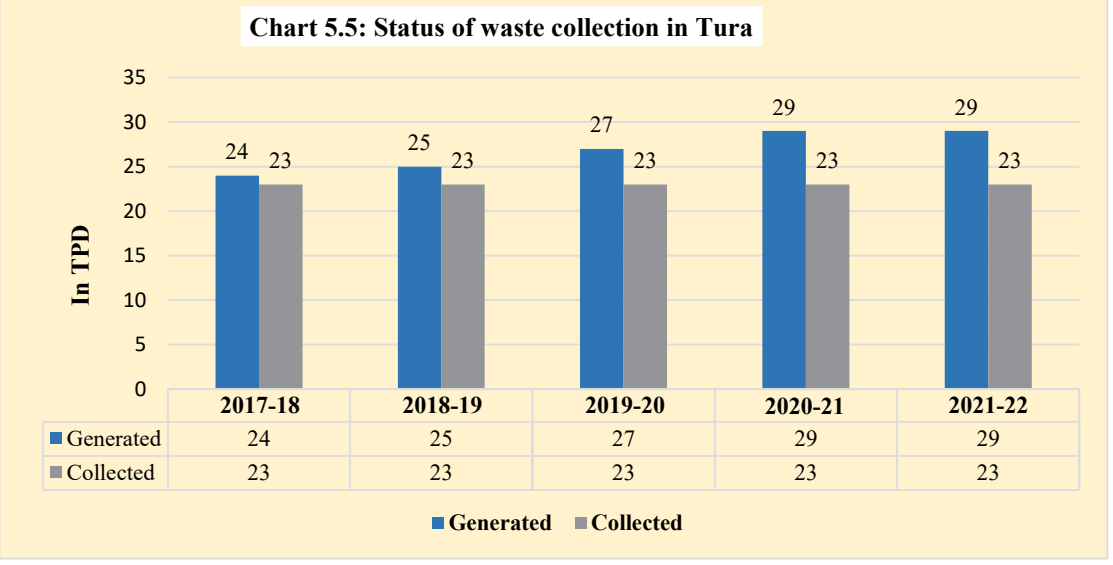
Chart 5.3: Status of waste collection in Shillong Urban Agglomeration



Source: Information furnished by SIPMIU.



Source: Information furnished by Jowai Municipal Board.



Source: Information furnished by Tura Municipal Board.

Data was not available with respect to Nongpoh Town Committee for the year 2017-18 to 2020-21. During 2021-22, four TPD of waste was collected in Nongpoh out of the seven TPD of waste generated.

For Shillong urban agglomeration, the SIPMIU data indicated that on an average 90 *per cent* of municipal waste generated in TPD was being collected by the ULB. Similarly, JMB data showed hundred *per cent* collection of waste that in four out of five years while the collection of waste in Tura was shown as 23 TPD for the period under audit review.

A requirement under Section 4.5.2.10.6 of the Solid Waste Management Manual, 2016 is that there should be a weighbridge in every landfill must have a weighbridge for assessing the quantum of waste collected. Audit observed from JPV of the processing and disposal sites that there were no functioning weighbridges available around landfills

test checked by audit, a fact accepted by the Department during the Exit Meeting. As such, the ULBs and Town Committee had no proper means to quantify the actual amount of waste collected.

Thus, while the statistics of municipal waste collection are encouraging, the reliability of these remain questionable due to weakness of data collection system and absence of any validation mechanism.

5.3 Infrastructure for Collection and Transportation of municipal solid waste.

Lack of source segregation in the tested urban areas resulted in mixed waste being sent to treatment facilities, leading to manual sorting by informal workers during processing and disposal, consequently affecting the quality of processed waste.

Segregation of waste at source cannot be successful unless the institutional mechanisms for collection and transportation of municipal waste is not in place. According to NITI Aayog[39], "Inadequate infrastructure, operational inefficiencies, and poor services for collection and transportation of segregated waste can have a direct bearing on waste segregation behaviour".

Meghalaya Solid Waste Management Bye Laws, 2020, states that non-biodegradable waste, both recyclable and non-recyclable shall be stored and delivered by every generator of waste to the dry waste collection vehicle, which shall be provided by the Local Authority, or any agency appointed by them, twice or thrice a week. Similarly, segregated biodegradable waste shall be stored by generators of such waste within their premises and its delivery shall be ensured by every such generator to the sanitary workers or collection vehicles provided by the Local Authority. Section 2.3.2 of the Solid Waste Management Manual, 2016, stipulates that vehicles used for transportation of waste be covered so that waste is not visible to the public and should have the facility for preventing spillage of waste. As such, it is the responsibility of the designated Local Authority to ensure that the vehicles deployed for collection and transportation are equipped with the prescribed facilities.

Audit found that in the municipal areas under SMB, JMB and TMB, frequency of collection of household waste was daily for localities under SMB, three times a week with alternative days for dry and wet waste in Jowai, while waste was collected daily in Tura.

Further, in survey of 26 localities under traditional local authority, *i.e.* Dorbar Shnongs under Mawlai and Umpling Census Towns, Audit found that out of 15 respondents, three (20 *per cent*) Dorbar Shnongs carried out daily door to door collection; one (7 *per cent*) Dorbar Shnong carried out door to door collection four times a week; five (33 *per cent*) Dorbar Shnongs carried out door to door collection twice a week.

Amongst the remaining six authorities, four Dorbar Shnongs (27 *per cent*) stated that they were collecting waste only once a week while two (13 *per cent*) were not collecting

[39] Policy Guidelines on "Promoting Behaviour Change for strengthening waste segregation at source" issued by NITI Aayog in November 2021.

any waste. In these two Dorbar Shnongs, it was stated that the waste was self-disposed by the households or openly dumped. Thus, there was no uniform practice of waste collection across the different local authorities, resulting in unpredictiveness of waste collection for the residents.

During Audit's Physical Verification of vehicles used for collection and transportation in the few sampled urban areas[40], it was observed that majority of the vehicles deployed for collection of municipal waste had no partition for storing segregated dry and wet household waste. Thus, even if segregated waste was collected from the households, it was mixed up during collection stage in the transportation vehicles due to absence of partitions in the collection vehicles, thereby rendering the source segregation efforts futile. Segregated waste from primary collection vehicles was also mixed while unloading on to the compactors in the transit points. It was also observed that most vehicles were not covered during transportation resulting in foul odour emanating from the uncovered waste.

Exhibit 5.6: Unsegregated waste being transported to dumpsites in a uncovered and un-partitioned vehicle, Jowai

Exhibit 5.7: Waste Collection truck without cover and partition, SUA

During the Exit Conference held in May 2023, the Department accepted the Audit observation regarding mixing of segregated waste during collection and transportation. The Member Secretary, MSPCB agreed that segregated waste collected from the households were mixed in the transportation vehicles. The Director, Urban Affairs Department, however, stated that the segregation of waste by the public was a good step in the right direction which would be fruitful when the Compost Plant/Processing Plants are functioning at full capacity.

Thus, while ULBs and traditional bodies involved in collection of waste carried out the exercise of waste collection from the localities being served by them, absence of a predictable routine coupled with unhygienic conditions of the transport vehicles carrying solid waste indicated that inefficient and insufficient mechanism which could not attract much response from people.

[40] Jaiaw Shyiap, Mission Compound, Lower Mawprem, Nongrim Hills, Laitumkhrah, Rongkhon Songittal, Ladthalaboh West.

5.3.1 Facilities for waste collectors and handlers

Insufficient source segregation and unscientific collection of municipal waste resulted not only in mixed waste being sent to treatment facilities, but also necessitating manual sorting of waste in unhygienic conditions. Personal Protective Equipment kits were not found to be used by the waste handlers thus exposing them to several health hazards.

As stipulated in Rule 15 (zd) of Solid Waste Management Rules, 2016, local bodies shall ensure that the operators of municipal solid waste collection and processing facilities provide personal protection equipment including uniform, fluorescent jacket, hand gloves, raincoats, appropriate footwear, and masks to all workers handling solid waste and the same are used by the workforce.

Audit conducted a Joint Physical Verification (JPV) of waste segregation centres in Shillong and Tura and found that workers were manually sorting waste in the processing and disposal facilities in Shillong[41] and Tura[42]. Due to poorly segregated waste, the quality of processed waste was also adversely affected. During JPVs of selected wards Audit found that majority of the workers involved in collection of waste were not utilising the available safety equipment like boots, gloves and face masks.

Exhibit 5.8: SWM workers handling waste without protective equipment, SMB

Exhibit 5.9: SWM workers handling waste without protective equipment, SMB

Scrutiny of records of JMB revealed that PPE kits such as coat with caps, gumboots, glow jackets, helmet, gloves, masks, *etc*. were procured at a cost of ₹ 3.08 lakhs during 2017-18 to 2021-22 from the Boards' own fund/ Swachh Bharat Mission.

Absence of hygienic waste handling facilities for the workers involved in collection and transportation of waste was a significant gap in the institutional mechanism put in place by the state for ensuring safety of the workers.

[41] A 170 TPD Compost plant at Marten landfill site.
[42] A Refuse Derived Fuel (RDF) plant at Rongkhon Songgital dumpsite.

5.3.2 Monitoring of transportation vehicles through Management Information System

The ULBs and Autonomous District Councils in Meghalaya were ill-equipped to manage and monitor transport vehicles carrying municipal waste from collection points to dumping sites. Absence of Management Information Systems and essential facilities in waste transportation vehicles, along with the lack of GPS and GIS, limited their capacity for identification of garbage vulnerable points and regulated movement of transport vehicles as part of solid waste management services.

In its Report of 2021, the NITI Aayog[43] pointed out that monitoring of waste management practices has been one of the significant challenges in most urban areas. In 2020, to monitor the services and synchronise coordination among different waste management concessionaires, Bruhat Bengaluru Mahanagara Palike (BBMP) employed several Information, Communication, and Technology (ICT) solutions, including an RFID-based attendance system and geotagging of collection routes to monitor the waste management services. In addition, a mobile-based application called Ezetap has been designed to monitor garbage-vulnerable points and impose penalties on offenders.

Even under Solid Waste Management Manual, 2016 (Section 2.3.12.1), guidance has been provided for putting in place an appropriate management information systems (MIS) including deploying geographic information system (GIS), Global Positioning System (GPS), radio frequency identification (RFID) and general packet radio services (GPRS) to manage municipal solid waste. The head of the SWM department as well as the head of the ULB must be informed of the day-to-day performance of the SWM service and daily reports on some aspects of the waste transportation system need to be compiled to take stock of existing performance and take corrective measures.

The fact of municipal waste collection vehicles without partition has already been stated in **Para 5.3**. Audit further sought to examine the mechanism deployed by the local authorities in monitoring and tracking of these vehicles. Scrutiny of information provided by the selected ULBs and Town Committee revealed that none of the vehicles used by the local authorities for collection and transportation of municipal waste were equipped with tracking devices like GPS or RFID. Due to lack of GPS and GIS, the local authorities were not in apposition to accurately track the movement of vehicles, which could have enabled these authorities to efficiently plan and deploy these vehicles.

Exhibit 5.10 Waste transportation trucks, Jowai.

[43] NITI Aayog's Waste-Wise Cities Best Practices in Municipal Solid Waste Management.

Information obtained from SIPMIU revealed that most of the vehicles in SMB and adjoining areas under SUA had been purchased in the year 2015 from the NERCCIPD funds. Subsequently, no budget allocation was made by State Government or ULBs for regular maintenance and upgrade of these vehicles.

Vehicles operating without proper fitness certificates indicated lackadaisical approach of the ULBs towards monitoring minimum working standards of the vehicles deployed by them for waste management services.

During the Exit Conference (May 2023), the Director, Urban Affairs Department stated that the vehicles would be equipped with GPS monitoring systems under Smart City Mission.

Convergence of solid waste management infrastructure under the Smart City Mission for Shillong is a welcome step, and should be taken up in all earnestness by the Government. At the same time, the State Government needs to converge better resources under FC grants, Swachh Bharat Mission scheme and state budgetary resources to modernise and upgrade the infrastructure meant for solid waste segregation, collection and transport in all the urban areas along with the active involvement of the autonomous district councils / traditional bodies.

5.4 Conclusion

Segregation of waste at different levels was either absent or partial in all the test-checked ULBs. Segregation of domestic hazardous waste was not done and sanitary waste was not collected separately. Hence, mixed waste was transported to landfills. Household bins for source segregation were purchased and distributed only in Shillong and Jowai but not in Tura and Nongpoh. Even though bins were distributed in Jowai, source segregation of waste had not yet been carried out.

During joint physical verification, majority of the workers handling waste were not utilising the available safety equipment even though protective gears were procured by the ULBs. The vehicles were not covered during transportation resulting in foul odour emanating from the uncovered waste. None of the available vehicles were equipped with Management Information Systems such as GPS and GIS, due to which tracking of transportation vehicles was not carried out.

Recommendations:

6. ***The State Government should encourage segregation of waste at source by devising a system for incentivising waste generators and collectors for proper segregation of waste and through public awareness campaigns and regular meetings with local traditional bodies, group housing associations, and NGOs.***
7. ***Municipal Boards may consider option of installing community waste bins for collection of waste in a segregated manner apart from providing bins to each household.***
8. ***ULBs should sensitise workers involved in handling waste to ensure compliance to occupational health and safety protocols by wearing safety gear and other protective equipment.***
9. ***The vehicles procured should be suitably designed to collect and transport segregated waste efficiently so as to prevent mixing of segregated waste during various stages of SWM.***