

## Chapter 4 → Waste Management

**Waste management** is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity, and the process that is generally undertaken to reduce their effect on health, the environment or aesthetics.

Waste, if not handled or disposed of properly, represents a threat to the environment and human health. The Municipal Solid Waste (Management and Handling) Rules, 2000 provide for safe disposal of municipal waste to prevent contamination of ground water, surface water and ambient air quality and fix the responsibilities on Municipal Authorities, District Administration, State Pollution Control Board and the State Government.

Strategies for waste disposal should focus on waste prevention and minimization through the '3 Rs strategy' -Reduce Reuse and Recycle. According to this hierarchy, waste disposal strategies are 'end of the pipe' solutions and should be the least favoured option. Emphasis on waste prevention and waste minimization would ensure in the first place that less waste which needs to be disposed is being produced.

The use of plastic products as packaging application in the recent years has increased the quantity of plastics in the solid waste stream to a great extent. Besides being non-biodegradable in nature, disposal of plastic wastes at landfill sites are unsafe since toxic chemicals leach out into the soil and underground water and pollute the water bodies. Government of India notified the Recycled Plastics Manufacture & usage Rules, 1999 under Environment (Protection) Act to regulate the manufacture and usage of recycled plastic bags and containers.

### 4.1 Waste Management on Indian Railways

IR generates vast quantities of different types of wastes. The waste is mainly solid waste generated by train passengers, vendors, hawkers etc., during the journey and also at stations across the country. The garbage generated in trains and stations can be categorized as-

- Biodegradable- This consists primarily of left over foods, and paper waste like newspapers, disposable cups, food containers etc. and
- Non-biodegradable- This comprises mainly of plastic waste from mineral water bottles, aluminum foil etc.

The garbage accumulated in the trains and station premises are collected either departmentally or through outside agencies. The garbage collected from station is to be dumped initially at a dumping yard (Vat) and transported later to a centralized dumping yard and/or the notified Municipal dumping yard.

#### 4.2 Organisational Structure

No separate Waste Management Cell exists to look after issues relating to solid and plastic waste management and there is no proposal for under consideration with IR in this regard. At present, waste management and cleaning is being dealt by Medical Department in respect of major A1, A and B category stations and by Commercial and Transportation Department in respect of other stations. There is a Chief Health Director at the Zonal Level and Senior Divisional Medical Officer (H&FW) at divisional level to monitor various health activities. Additional Divisional Railway Manager (ADRM) with the officers of Medical, Commercial and Engineering department monitor the sanitation of stations as well as colonies.

#### 4.3 Findings of RITES and CPCB

Study conducted by RITES<sup>58</sup> in December 2009 on the Assessment of plastic waste and its management at three major railway stations at Delhi (New Delhi, Old Delhi and Hazrat Nizamuddin station) indicated that at railway stations, passengers dump the solid waste into dustbins placed for the purpose at platforms. Since, no separate dustbins were kept for degradable and non degradable waste at railway stations, the solid waste at the first collection point is not segregated. The collected waste from the formal system<sup>59</sup> finally goes to the municipal landfill for disposal.

However, along with the formal system, an informal system of waste collection also exists at the railway stations. Their Study depicted that a major part of value added plastic generated at railway stations in Delhi was collected by rag-pickers and channeled to local recycling units. Nevertheless, the plastic waste like carry

<sup>58</sup> RITES stand for Rail India Technical & Economic Services

<sup>59</sup> Formal system refers to cleaning and garbage disposal through departmental staff or through execution of contract with outside agencies

bags and multilayered metalized plastics which are left behind goes to the landfill along with municipal solid waste.

The RITES Report estimated the total quantity of waste generated at these three railway stations<sup>60</sup> as 23,250 Kg per day. This included generation of plastic waste of 6758 Kg per day. The study estimated that the quantity of plastic waste generated per passenger at New Delhi Railway station varied from 7.8 gms per capita to 9.5 gms per capita. It also estimated the number of dustbins required at New Delhi Railway station on the basis of number of passengers and waste generated per capita as about 400.

In a study report<sup>61</sup> (March 2012), CPCB commented on the open burning of solid waste at Bilaspur station (SECR) and dumping waste unscientifically on the open lands available around the station areas in violation of the Solid waste (Management and Handling) Rules 2000. CPCB also observed that the plastic wastes were not being segregated in almost all the stations test checked.

#### 4.4 Previous Audit Report

Audit Report No.6 of 2007 of Comptroller & Auditor General of India (Railways) on “Cleanliness and sanitation in IR” highlighted the following issues:-

- Absence of any mechanism to assess the quantum of waste generated at Railway stations and trains.
- The solid waste generated at trains and stations was not being segregated into bio-degradable and non-biodegradable. Further, as most of the catering was with IRCTC<sup>62</sup>, the contract entered into with them needs to include provisions regarding disposal and segregation of waste before its disposal.

In their Action Taken Note, Ministry of Railways (MR) stated that the garbage was being disposed off on a regular basis in a phased manner. Regarding segregation of solid wastes, MR stated that IRCTC was advised to include solid waste regulations while framing conditions for the catering contracts.

Public Accounts Committee (PAC) in their eighty third report (2008-09) also pointed out deficiencies in the management of waste. PAC observed that while making use of plastic, the Ministry of Railways must not lose sight of

<sup>60</sup> New Delhi, Old Delhi and Hazrat Nizamuddin station

<sup>61</sup> Study conducted by CPCB at the instance of Audit for assessment of pollution of air, water and noise at 14 major stations over 12 zones.

<sup>62</sup> Indian Railway Catering & Tourism Corporation Limited

environmental concerns and ensure that applicable rules are adhered to. The action taken note of MR was, however, silent regarding use of plastics and plastic waste.

The action taken by the Ministry of Railways on the recommendations of PAC are indicated below:

<b>PAC Observations</b>	<b>PAC Recommendations</b>	<b>Action taken by the MR</b>
There was no mechanism to realistically assess the quantum of garbage generated at stations and segregation of wastes before disposal.	IR must frame a policy on waste management and lay down a mechanism whereby the quantum of garbage generated on stations can be assessed realistically so that adequate collection, segregation and disposal facility along with necessary infrastructure could be put in place by the authorities.	Garbage disposal system was already in place on IR. Its quantification was being done before tendering for fixing the appropriate agency for this work.
Several shortcomings in collection and disposal of garbage.	Recommended for adequate provision of VATs and penal provision in the contracts for garbage disposal through outside agencies and regular review of the performance of contractors. The Committee also recommended transportation of garbage to disposal sites by resorting to highest professional standards.	Garbage disposal system was already in place and was being monitored at various levels. IRCTC had been advised to take corrective measures in adherence to the observations of PAC.
Up gradation of toilet standard in trains.	IR should expedite the process of providing Controlled Discharge Toilet System/Zero Discharge Toilet System in as many trains/coaches as possible.	Field trials were being conducted with different designs/types of environment friendly 'Green Toilets' and based on evaluation of those trials, a final view would be taken.

We examined the initiatives of IR to obtain reasonable assurance whether the instructions issued by RB and the commitments of Ministry of Railways actually translated into improvement of cleanliness and sanitation standard at stations and its impact on passengers and environment at stations. The results of examination are discussed in the succeeding sub-paras.

#### 4.5 Garbage Disposal

As per the Municipal Solid Wastes (Management and Handling) Rules 2000, waste materials should be segregated into bio-degradable and non bio-degradable. There should be sufficient storage facilities established based upon the quantities of waste generated. The storage facilities should be so designed that wastes stored are not exposed to open atmosphere and are aesthetically acceptable and user-friendly. Bins for storage of biodegradable wastes shall be painted green, those for storage of recyclable wastes are painted blue and those for non-bio degradable wastes are painted red.

We examined the system of garbage disposal at 212 stations as per sample selection over 17 zones and observed that the garbage disposal were being handled either departmentally or through outside agencies. Out of 212 stations test checked, 123 stations were in the major category. The major stations (A1, A and B category) handle considerable passenger traffic; proper disposal of garbage at major stations assume importance from the environmental point of view.

Audit examined the system of garbage disposal in 212 stations<sup>63</sup> over 17 zones which revealed the following:

- i. In 64 per cent (135) of the total stations (212) test checked in audit, centralized dumping yard was not available within the station premises resulting in littering near station premises and along tracks. Further, there were instances when transportation of garbage was not being done hygienically i.e. covered by tarpaulin.
- ii. In 105 out of 123 major stations, disposal of garbage from stations to Municipal/ Corporation notified areas was done by engaging outside agencies. The quantity of garbage generated was, however, not assessed and incorporated in the agreements entered into with the outside agencies in 43 out of 105 agreements.

<sup>63</sup> 123 major and 89 minor stations

- iii. In the remaining 18 major stations, disposal of garbage was done in-house. The quantity of waste generated was not estimated wherever garbage disposal was done departmentally.
- iv. In 16 out of 23 contracts entered into in four zones (SER, WR, CR and SR) for disposal of garbage through outside agencies, no separate clause was incorporated for segregation of wastes as biodegradable and non-biodegradable. Even where there was a provision for segregation of waste in one contract at Lokamanya Tilak Terminus (CR), the same was not followed.
- v. Despite entering into a contract with outside agencies, disposal of garbage was being done either by burning or dumping in Railway premises in 37 stations (all categories) across zones<sup>64</sup>.
- vi. At 54 out of 212 stations test checked over 17 zones where the cleaning was done departmentally, besides disposal of garbage in the Municipal/Corporation notified area, the Railway Administration resorted to disposal by burning, dumping into adjacent canal, low lying areas, dumping on Railway land near the track, thereby causing environmental pollution.

Audit conducted a joint inspection with the railway officials at 212 stations over 17 zones to assess the impact of the existing system of disposal of wastes. We observed the following:





Overflowing dust bins at Borivali Station,

- Dustbins were either without lids or were overflowing (NCR, WR, SECR and NWR). Dustbins were also found without poly bags or in a broken condition.
- Plastic waste like carry bags and multilayered metalized plastics which are left behind at stations go to the landfill without any segregation.
- Vats provided at important stations like Bangalore and Hubli (SWR) were inadequate leading to littering of garbage near the Vat. At Bhusawal station (CR) and Erode station (SR) littering and garbage was also noticed outside the Vat area.

<sup>64</sup> Except NCR, SWR, ECoR, CR and NER where requisite information was not available.

- In CR and SR, despite having provision of rag picking works in all the contracts of garbage disposal, tracks were found littered with used paper cups and other wastes.

	
<p>Unscientific Landfill at Tatanagar (A1) Railway station, SER</p>	<p>Burning of garbage, Mangalore Central Station, SR</p>

#### 4.5.1 Segregation of wastes

Plastic packaging is extensively used in the Railways catering services, resulting in significant quantity of plastic waste. Plastic, being non-biodegradable in nature, remains in environment for several years. Disposing plastic wastes at landfill are unsafe since toxic chemicals leach out into the soil and underground water and pollute the water bodies.

Government of India notified the Plastics Manufacture, Sale & Usage Rules, 1999 and Plastic Waste (Management and Handling) Rules 2011 under Environment (Protection) Act 1986 to regulate the manufacture and usage of recycled plastic bags and containers.

CPCB conducted a study (December 2009) regarding disposal of plastic waste and its management at three Railway stations viz. Hazrat Nizamuddin, Old Delhi and New Delhi in Northern railway. Study revealed that IR are the largest source of PET bottles generation (drinking water), food packaging, tumblers, multilayer metalized plastic, plastic carry bags and cups. These plastic wastes go to the landfill along with other municipal solid waste. Study also revealed that the plastic wastes generated from the Railway stations are not collected, segregated, transported, treated, reused and disposed properly.

We examined the system of disposal of plastics at 212 stations over 17 zones and observed the following:

- There was no system of segregation of bio-degradable and non-biodegradable wastes at any station. Plastic wastes go to the landfill without any segregation.
- Rag picking contracts for collection of plastics , pet bottles etc. existed in only 69 per cent (85) of the major stations (123).
- The use of plastic bags within the station premises was not discouraged in the zones except in SWR and NCR where the Railway Administration advised all catering unit licensees to use eco-friendly, bio-degradable carry bags for take away food items from static units. WCR Administration stated that they had issued Joint Procedure Order (December 2011) for segregation of kitchen waste at stations. On verification in audit, it was noticed that no segregation of wastes was being done as instructed through JPO. As a result, large number of PET bottles, food packaging, tumblers, multilayer metalized plastic, plastic carry bags and cup gets accumulated causing environmental problems as these plastic wastes ultimately goes to the nominated municipal landfills.

Thus, we observed that though garbage disposal system was in place, the same was not effective enough due to lack of monitoring to ensure compliance with statutory obligations and provisions of contracts for proper disposal of garbage, deficiencies in infrastructure like adequate provision of vats, dust bins etc. The commitment of Ministry of Railways for assessment and implementation of remedial measures to overcome the shortcomings in collection and disposal of garbage remained mostly unfulfilled due to lack of focussed approach towards healthy environmental at station premises.

#### **4.6 Toilets in Trains**

IR transports about 14 million passengers on 9000 trains every day. Travelling passengers generates approximately 3980 MT of human waste per day that is dumped through 'open discharge' type toilets of these coaches and directly goes onto the rail tracks across the length and breadth of the country. This pollutes environment at station as well as in the areas through which the trains pass. Further this also creates problem of hygiene and has resulted in filing of numerous legal cases against the Railways.

In the writ petition (Civil) No.583 of 2003 between Safai Karmachari Andolan Vs Union of India, the Supreme Court had directed (January 2011) the Delhi High



Court to enforce the directions given by them from time to time, where the IR was identified for the principal employer for implementation of the provisions of Employment of Manual Scavengers and Construction of Dry Latrine (Prohibition) Act, 1993.

It was in this context that IR conceived the idea of introduction of green toilets<sup>65</sup> in trains for keeping clean environment in trains and station premises.

#### 4.6.1 Initiatives of Indian Railways

Since 1993, IR has been experimenting with various environment friendly toilets including purchase of prototypes from USA/Canada, development of toilets in collaboration with Defence Research and Design Establishment (DRDE). In November 2003, environment friendly toilet was included as one of the projects under ‘Technology Mission for Railway Safety’ (TMRS) and RDSO was entrusted with the task of carrying out research and suggest appropriate technology for IR. Subsequently, RB constituted a core Group (November 2009) to carry out the feasibility studies, do the techno-economic analysis and draw up action plan for implementation of environment friendly toilets.

Globally, there are different models of green / biological toilets in use by various Railways. This includes Vacuum toilets, Controlled Discharge Toilet Systems (CDTS), Zero discharge toilets, Aerobic and Anaerobic. IR has conducted trials of these various models of toilets.

**Vacuum toilet** involves suction of waste using vacuum, retention and discharge at terminal. In the Budget speech for 2009-10, Minister for Railways proposed to have trials on vacuum toilets conducted. It was decided that this technology would be tried out on high end coaches, so that mishandling and pilferage related issues remain relatively under control. While vacuum technology is proven and effective with reduced water requirements, the technology is highly “intolerant” to non-degradable items like plastics.

In **CDTS** technology, waste is discharged after the train acquires a speed of 30 kmph and thereby eliminates the problem of discharge at the stations and ensures that the stations are clean. In the Integrated Railway Modernization Plan (IRMP) 2005-10, it was mentioned that the work relating to identifying appropriate

<sup>65</sup> Green Toilets” refer to environment friendly toilets which ensure that human excreta is not discharged on to the railway tracks, but instead, is collected in a separate tank fixed below the floor of the coach and treated/disposed off suitably.

technology for eco friendly toilets would be completed in the initial two years (2005-07) and it would be scaled up during the remaining three years of the plan (2007-10).

As per the IRMP, CDTS were to be installed in 5000 coaches by March 2010. However, due to problems in flushing system and dropping of discharge at more or less the same locations, implementation of CDTS was restricted to Rajdhani, Shatabdi and Duranto coaches only.

IR also experimented with **Zero discharge toilets** which work on the principle of solid liquid separation with solid part being stored-evacuated-transferred and dumped in to pits for composting and the liquid portion is filtered-treated-recycled for flushing purposes. Despite RDSO reporting the performance of this model as satisfactory, the project was abandoned in September 2009, as part of closure of TMRS<sup>66</sup> projects and prototype toilets were remove (March 2010). Subsequently, after examining the trial reports, RDSO entered into an agreement (January 2011) with M/s Urbane Industries, Chennai for conducting field trials in 14 coaches at a cost of ₹ 2.10 crore.

In January 2008, IR conducted trial of another model called Aerobic bio-toilets. In this model, there is a compost chamber beneath the toilet seat where aerobic biodegradation occurs naturally. Though performance of this type of toilet is reported as satisfactory, no initiative was taken for its mass implementation.

#### 4.6.2 Recent Developments

In January 2007, RB placed a development order on M/s Aikon Technology Limited for design, manufacture, supply, installation, commissioning, maintenance and operation of 80 bio toilets with aerobic bio-digester<sup>67</sup> in passenger coaches. So far, eighty of these prototype bio-toilets were procured and installed on Prayagraj Express and Rewa Express. During the trial period, the supplier carried out a number of modifications. There were, however, several

<sup>66</sup> Technology Mission on Railway Safety was taken up jointly by the Indian Institute of Technology (IIT), Kanpur, and the Research Designs and Standards Organisation (RDSO), Lucknow, the research wing of the ministries of railway and industry. Four mission programmes consisting of 14 projects, estimated to cost ` 265 million was planned. The technology mission planned to cover traction and rolling stock, track and bridges, signal and communications and fog vision instrumentation.

<sup>67</sup> This system involves collection of excreta into a tank and breaking it down within six to seven days by enzymes procured by bacterial culture. The liquid is treated with chlorine before disposal.

instances of the effluents not complying with the stipulated test parameters<sup>68</sup>. The performance of the toilet has so far been reported satisfactory.

Further, the MR signed a Memorandum of Understanding (MOU) with the Defence Research and Design Establishment (DRDE), where under, three models have been developed by RDSO and Rail Coach Factory (RCF) in January 2011 which are under trial over North Central Railway Zone in Bundelkhand Express.

The RB announced recently that it would be setting up a separate unit at Motibagh Workshop at a cost of ₹ 14.20 crore to produce green toilets. The IR also announced a plan to install green toilets in 9,000 trains by 2011-13.

Thus, we observed that despite over two decades of experimenting IR is still conducting trials with different types of green toilets and has not been able to finalize the technology for 'green toilets'. The time line (as committed in the Integrated Railway Modernization Plan 2005-10) for selection of appropriate technology by 2007 and large scale implementation by 2010 could not be achieved till March 2012.

While accepting the audit contentions, Ministry of Railways stated that most of the available technologies in the market are proven for foreign conditions. However, the available technology are not subject to heavy usage as is the case in IR; due to very long journey times, choking of toilets due to objects thrown in the toilet and use of toilets by non passengers also. MR also stated that so far nine trains had been fitted with bio-toilets. They added that based on the experience gained and outcome of the trials, it is planned to progressively induct bio toilets. MR committed that all new coaches would be fitted with bio-toilets from 2016-17 onwards and cover the entire fleet by 2021-22 provided there is no major setback.

#### **4.6.3 Impact of Non implementation of Green Toilet**

An expert committee reviewing railway safety observed that the toilet droppings are one among the primary causes for rail corrosion and resulting rail failure. The Anil Kakodkar Committee also observed that human excreta had corroded a significant percentage of the country's total 1.1 lakh kilometers of tracks because of the pH content of the toilet discharge and thereby adding to the cost of running the massive railway network.

Test check in Audit revealed premature renewal of rails in down line of Bhadrak-Kharagpur- Howrah sections (SER), where maximum numbers of overnight trains

<sup>68</sup>E-coli, faecal coli form, ph, BOD and COD

reach Howrah in early mornings. Further, premature renewal was more in comparison of the Up line of the same section as a result of corrosion due to falling of night soils on tracks. Premature renewal of 47 Kilometre of rail had resulted in an excess expenditure of ₹ 35.79 crores during the period 2007-11 alone.

#### 4.7 Conclusion

A fundamental principle of waste management is to reduce/reuse the waste generated. IR is the single largest carrier of passengers in the country and hence generates a large amount of waste including plastic waste. The IR has taken a number of initiatives in reusing the waste generated. Attempts were made to reuse the waste generated by employing rag-pickers. Waste management in IR was, however, primarily confined to disposal of garbage only.

Despite recommendation of PAC that the IR must not lose sight of environmental concerns while using plastic, we observed negligence in adherence to instructions relating to adequate and proper collection, segregation and disposal of plastic waste at railway stations, especially when these were being done departmentally. In most cases, waste was not being segregated into bio-degradable and non-biodegradable which was contrary to the requirement of the Municipal Solid Wastes (Management and Handling) Rules 2000. Besides, assurance of MR on the recommendation of PAC regarding quantification of garbage generated at stations was not fulfilled.

Adequate infrastructure was not available for proper collection of different categories of waste. Both the number of dustbins and vats were found to be inadequate. Further, the Railway Administration frequently resorted to improper disposal of waste by burning, dumping into adjacent canal, low lying areas, and /or near the track, causing environmental pollution.

The monitoring mechanism to enforce effective implementation of garbage disposal system was weak resulting in serious health hazards to the stake holders apart from contamination of ground water, surface water and affecting ambient air quality in and around the station.

Despite prolonged experiment/trials on different models of environment friendly toilets in coaches, IR failed in freezing a suitable option to address the environmental hazards due to defecation in toilets in the train. Apart from the issue of hygiene, open defecation had also serious safety and financial implications due to premature corrosion of rails. IR is also a major violator of the

provisions of Employment of Manual Scavengers and Construction of Dry Latrine (Prohibition) Act, 1993.

#### **4.8 Recommendations**

- A comprehensive waste management policy needs to be framed and a separate waste management cell established in the Railway Board for dealing with all related issues including minimization of the use of plastics within the Railway stations and proper disposal of plastic waste.
- IR needs to put in place a system of estimation of waste generated in IR and also a system for segregation of bio-degradable and non bio-degradable waste. Besides making provision for requisite infrastructure, an effective monitoring system needs to be put in place for ensuring compliance with the statutory regulations issued on the subject from time to time by the government and the recommendations of the Public Accounts Committee.
- IR needs to draw up a definite time frame for finalizing eco-friendly toilets to prevent environmental degradation at stations, tracks and water bodies en route.

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