

Report of the  
Comptroller and Auditor General  
of India

on

**ENVIRONMENT MANAGEMENT IN INDIAN RAILWAYS –  
STATIONS, TRAINS AND TRACKS**

for the year ended March 2011

Laid in Lok Sabha/ Rajya Sabha on \_\_\_\_\_

**Union Government (Railways)**  
No.21 of 2012-13  
(Performance Audit)

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**PREFACE**

This Report (No. 21 of 2012-13- Performance Audit for the year ended 31 March 2011) has been prepared for submission to the President under Article 151 (1) of the Constitution of India. The report contains results of the review of Environment Management in Indian Railways – Stations, Trains and Tracks.

The observations included in this Report have been based on the findings of the test-audit conducted during 2011-12 as well as the results of audit conducted in earlier years, which could not be included in the previous Reports.

### **Abbreviations used in the Report**

IR	Indian Railways
CR	Central Railway
ER	Eastern Railway
ECR	East Central Railway
ECoR	East Coast Railway
NR	Northern Railway
NCR	North Central Railway
NER	North Eastern Railway
NFR	Northeast Frontier Railway
NWR	North Western Railway
SR	Southern Railway
SCR	South Central Railway
SER	South Eastern Railway
SECR	South East Central Railway
SWR	South Western Railway
WR	Western Railway
WCR	West Central Railway
RPU	Railway Production Units

## **EXECUTIVE SUMMARY**

### ***I Environment Management in Indian Railways***

*Environment is a key survival issue and its challenges and significance have assumed greater importance in recent years. The National Environment Policy, 2006 articulated the idea that environmental protection shall form an integral part of the developmental process and cannot be considered in isolation.*

*Indian Railways (IR) is the single largest carrier of freight and passengers in the country. It is a bulk carrier of several pollution intensive commodities like coal, iron ore, cement, fertilizers, petroleum etc. Being a major consumer of water and energy, policies adopted by the IR have a substantial impact on our environment and on the conservation of both water and energy in the country. The approach of IR towards protection of the environment, therefore, assumes great importance for tackling environment challenges to the country.*

*A review on “Cleanliness and sanitation in IR” was earlier taken up and results included in Audit Report No.6 of 2007 of Comptroller & Auditor General of India (Railways). The report, inter-alia, had highlighted several deficiencies of IR in the management of wastes. Public Accounts Committee in their eighty third report (2008-09) also pointed out similar deficiencies. Nevertheless, adequate action was not taken by IR to integrate environmental concerns with their operational policies.*

*In this background a comprehensive audit exercise was undertaken to assess the performance of IR in managing environmental risks. A phase wise review of the entire gamut of environmental issues related to operation and maintenance of Railways has been planned. This report presents the results of the first part of this exercise.*

### ***II Current Report***

*The operations of IR not only cause air pollution but also cause water and noise pollution. Air pollution mainly arises due to handling of commodities like coal, iron ore, cement, fertiliser etc. at sidings/goods sheds and transportation of these commodities in open wagons. Rules/guidelines framed for transportation of commodities in IR were, prima-facie, guided by commercial considerations. No criteria were laid by the Railway Board to enable it to assess the performance of each zonal railway in minimizing environmental pollution. Absence of clear criteria has been a limiting factor in our audit.*

*Comprehensive guidelines specific to operation of sidings for handling and transport of pollution intensive commodities have not been issued either by the*

*Railway Board, the Central Pollution Control Board (CPCB) or the State Pollution Control Boards (SPCBs). As per statutory provisions all sidings and Railway Good sheds are required to obtain Consent for Operation from their respective SPCBs. Compliance with these guidelines was partial. Even the existing statutory provisions and guidelines issued by the SPCBs of West Bengal, Jharkhand and Odisha were not fully complied by the Railway Administration. At the request of Audit, CPCB assessed the level of pollution and compliance with the statutory provisions at fourteen major stations of IR. Their study revealed that IR generally failed to comply with the statutory provisions. Study also revealed that the values of various gaseous pollutants were in excess of the national ambient air quality standards.*

*There was no system for monitoring the quality and quantum of waste water generated at stations. Railway Board's instruction for installation of Effluent Treatment Plant at all major stations were also not adhered to. Frequently effluents were discharged from major stations to the nearby low lying areas/water bodies and municipal discharge systems resulting in contamination of surrounding surface and ground water.*

*IR is a major user of both water and energy. IR has adopted a number of best practices in the field of conservation of water for improving the efficiency of water use and reducing the use of fresh water by way of recycling of water and rain water harvesting. IR, however, has not made significant progress in implementing water conservation methods. In the past decade, IR has been exploring the use of renewable sources of energy. The use of eco- friendly fuel i.e. blended biodiesel has been in use on the Railways since 2003. It, however, could not make any significant progress in this field. Measures taken by the IR to conserve the flora and fauna alongside the tracks were not adequate, as animal mortality due to train hits remained high.*

*Railway operations generate vast quantities of different types of wastes –both solid and plastic wastes. The Public Accounts Committee in their eighty third report (2008-09) had observed that while making use of plastics, the Ministry of Railways must not lose sight of environmental concern and ensure that applicable rules are adhered to. However, negligence in adherence to instructions relating to adequate and proper collection and segregation and disposal of plastic wastes were observed. Non segregation of degradable and non degradable wastes, inadequate storage facilities and improper disposal of garbage were common at railway stations.*

*IR transports about 14 Million of passengers every day and generates about 3980 MT of human wastes per day which is discharged directly on to the rail tracks. This pollutes the environment at both stations and alongside the tracks. IR has*

been experimenting since 1993 with various models of environmental friendly toilets. Despite prolonged experiments/trials for over two decades on different models of toilets for its coaches, IR has failed to freeze a suitable option to address the environmental hazards caused by defecation in toilets on trains.

### **III Major Audit Findings**

- *IR is yet to formulate comprehensive environmental guidelines for handling and transportation of bulk commodities which are pollution intensive. Thus, no specific criteria have been laid down by the Railway Board to assess the performance of each zone in minimizing environmental pollution. Environmental aspects such as the prevention and control of pollution are only incidental to the core area of operation of each directorate at the Railway Board and zonal levels. There is no separate directorate or cell at the Railway Board level to co-ordinate various environmental issues involved in their operations.*

**(Para 2.1 and 2.2)**

- *As per Air (Prevention and Control of Pollution) Act, 1981, all sidings and good sheds should obtain Consent for Operation from their respective SPCBs. The Zonal Railway Administrations failed to adhere to the statutory provisions in respect of fifty per cent of the sidings test checked. Guidelines issued by the SPCBs of West Bengal and Jharkhand were also not fully complied with in both ER and SER in the good sheds and sidings test checked. In most of the zones coal and iron ore were being carried in open wagons without covering with tarpaulin sheets, thus posing a health hazard to passengers/residents in neighbouring areas.*

**(Para 2.3.1.1, 2.3.1.2 and 2.3.1.3)**

- *The Railway Board had instructed that Effluent Treatment Plants (ETP) be installed at all major stations. On an average, one Effluent Treatment Plant was installed in each zone leaving most of the major stations without an ETP. In their absence, effluents were being discharged in the nearby low lying areas /water bodies and municipal drainage system resulting in contamination of surrounding surface and ground water.*

**(Para 2.5.1)**

- *Railway Board had directed that Water Recycling Plants (WRP) be provided at locations where water is scarce. Test check revealed that in 12*

*out of 17 zones no provision of WRP had been made. The WRPs installed in three zones were sub-optimally utilized. Despite Railway Boards' instructions that Automatic Coach Wash Plants (ACWP) be planned for all coaching Depots; only eight ACWPs had been commissioned over five zones. Similarly, out of 212 stations test checked, rain water harvesting systems were installed at only seven stations in five zones. This was indicative of low level of urgency attached to water conservation.*

**(Para 3.2.1 and 3.2.2)**

- *The energy conservation policy of IR envisaged the use of non-conventional energy sources. Test check revealed that bio-diesel was used in only five zones and its consumption was insignificant. The initiatives of IR for production of bio-diesel remained largely unsuccessful due to short supply of raw material and slow progress in setting up of new esterification plants. It was seen that the overall achievement in electrification of level crossings with solar panels was far below the targets set for the period 2007-11. IR also failed in making major progress in tapping wind energy. During the period of review, only four wind power plants were sanctioned in three zones.*

**(Para 2.3.3.1 and 3.6)**

- *62 elephants died during the review period due to train hits. The majority of elephant deaths occurred in NEFR followed by SR. Despite some initiatives like imposition of permanent speed restrictions, display of signage, regular clearance of vegetation along the track etc., animal mortality rate due to train hits had not declined.*

**(Para 3.7.1)**

- *Despite recommendation of PAC to segregate waste into biodegradable and non- biodegradable, a test check revealed that in 16 out of 23 contracts entered into in four zones for disposal of garbage through outside agencies, no separate clause was incorporated for segregation of wastes. Disposal of garbage by outside agencies was being done either by burning or dumping in Railway premises in 37 stations (all categories) across all zones. At 54 out of 212 stations test checked, 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.*

**(Para 4.5)**

- *IR is yet to finalise the technology for 'green toilets', despite two decades of experimentation. Open discharge of toilets from running trains led to premature renewal of 47 Kilometers of rail (SER) and resulted in an excess expenditure of ₹35.79 crores during the period 2007-11 alone.*

**(Para 4.6.3)**

#### **IV Gist of Recommendations**

- *IR needs to formulate a comprehensive environmental policy. It also needs to bring out appropriate guidelines for controlling air and water pollution on its station, yard, work places or in operations in coordination with Central and various State Pollution Control Boards.*
- *A monitoring mechanism needs to be put in place at all levels within IR including the Railway Board for checking compliance with pollution control laws/ guidelines and implementation of its guidelines/instructions on environment.*
- *Environment management may be recognized, monitored and reckoned as a key result area for all Zonal and Divisional Railway Authorities and schemes devised to incentivize better performance in this regard.*
- *To conserve water, measures like Water Recycling Plant, Automatic Coach Wash Plants and Rain Water harvesting system need to be implemented expeditiously by IR.*
- *IR needs to take urgent and effective steps to explore across the country scope for and to maximizing the use of alternative sources of energy besides taking initiatives in conservation of energy. The targets set for adopting energy efficiency measures need to be effectively implemented.*
- *Adequate effort needs to be put in to implement the long term measures for prevention of animal mortality. For this, the monitoring mechanism at the Railway Board's level should be strengthened.*
- *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.*

## Chapter 1 ⇒ Introduction

Environment in general refers to the surroundings of an object which may be natural or the built environment. Environmental management is essentially the management of interaction by modern human societies with, and its impact upon the environment. The National Environment Policy 2006 which articulated our national commitment to a clean environment as mandated by the Constitution<sup>1</sup> was intended to mainstream environmental concerns in all current and developmental activities.

The principal objectives of the National Environment Policy include conservation of critical environmental resources and to integrate environmental concerns into policies and projects for economic and social development. Further, one of the principles of this policy clearly states that environmental protection shall form an integral part of the developmental process to achieve sustainable development and cannot be considered in isolation.

### 1.1 Need for Environment Management in Indian Railways

The Railways as a means of public transportation are perceived to be environmentally friendly. The recommendations of the Expert Committee set up by the Planning Commission under the chairmanship of Dr. Kirit S. Parikh to formulate an integrated energy policy for promotion of the system of urban mass transport, energy efficient vehicles and freight movement by railways underline the significance of railways to over all environmental management in the country as well as of environment related issues in the internal governance of the Indian Railways (IR).

IR covers 64460 route kilometers and traverses through high density urban areas as well as vast rural and forest areas. It handles 7651 million passengers and carries 922 million metric tonnes of goods traffic per annum. It is the second

<sup>1</sup> Articles 48 A: The state shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country.

Article 51 A (g): It shall be the duty of every citizen of India to protect and improve the natural environment including forests, rivers, lakes and wild life, and to have compassion for living creatures.

largest carrier of passengers in the world and carries about 35 per cent of the total freight in the country. Operation and maintenance of the entire railway system in the country has considerable impact on environment as the IR is the bulk consumer of energy besides generator of waste in stupendous proportion. Central Pollution Control Board (CPCB) sponsored a study through RITES<sup>2</sup> on plastic waste generated at three railway stations (New Delhi, Old Delhi and Hazrat Nizamuddin station). The report (December 2009) indicated that about 6758 Kg. of plastic waste was being generated by these stations per day and there was no system in place to segregate degradable and non-biodegradable wastes generated at these stations.

‘Environment’ is a key survival issue and its significance has never been felt more acutely. IR has initiated a number of measures for protection of the environment by adopting cleaner technologies, conserving energy, harnessing renewable sources of energy. The Minister for Railways, in her Budget Speech on 25 February 2011, declared 2011-12 as the “**Year of Green Energy**” and reiterated her commitment to energy conservation. However, IR is yet to frame any comprehensive policy for environment management in compliance to various statutory provisions and orders issued by the Government of India. The role of CPCB and SPCBs<sup>3</sup> in monitoring and control of environmental pollution within the IR has been very insignificant. None except three<sup>4</sup> SPCBs, have come out with any guidelines for controlling air pollution in handling and transportation of polluting commodities from sidings/sheds.

In this background we have undertaken a comprehensive audit exercise spread over three phases with a view to assess the performance of IR in managing environmental risks to itself and the country as whole, to highlight good practices as well as to flag areas of concern and to make appropriate recommendations wherever necessary. This draft report reflects the results of the first part of this exercise. In the next phase environment management in workshops, sheds and production units of Railways will be undertaken and in the final phase environment management in offices, colonies, hospitals will be taken up.

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<sup>2</sup> RITES stand for Rail India Technical & Economic Services

<sup>3</sup> SPCB stands for State Pollution Control Board

<sup>4</sup> West Bengal, Jharkhand and Odisha

## 1.2 Study Report of Central Pollution Control Board

For independent assessment of pollution of air, water and noise at station premises/sidings/sheds, CPCB in March 2012, conducted a study at the instance of Audit at 14 major stations spread over 12 zones. The study revealed that the IR was not complying with statutory guidelines for prevention and control of pollution. CPCB observed that none of the stations had applied for consents under The Air (Prevention and control of Pollution) Act, 1981 and The Water (Prevention and control of Pollution) Cess Act, 1977 and also for hazardous waste authorization under The Hazardous Wastes (Management and Handling) Rules, 1989. Monitoring of ambient air quality and noise by CPCB also revealed that various gaseous pollutants and noise level were exceeding the limit prescribed by it. The report also commented on the discharge of effluents from the stations without proper treatment. Details of the findings of CPCB in regard to air, water and noise pollution have been factored in this audit exercise and highlighted at places in this report (see paragraphs 2.3.2 and 2.5.2).

## 1.3 Scope of Audit

In this Performance Audit, we have examined the commitment of IR towards ensuring environmental protection as an integral part of its development/operational process. We examined the entire gamut of interaction – IR's with the public through its stations, trains and tracks and its impact on the environment during the period 2006-07 to 2010-11. The scope of the Performance Audit thus covered-

- Evaluation of the policy framework governing environmental management in IR that includes stations, trains and tracks with regard to –
  - Pollution of air, water and noise,
  - Conservation of Natural Resources and;
  - Waste Management
- Evaluating the compliance of IR with the laws/rules/regulations governing environmental management in India.
- The compliance of IR with respect to the policies/regulations issued by it.

In IR, there is no separate environment management cell for framing policies/guidelines, co-ordinating and monitoring implementation of different issues related to environment. In absence of any comprehensive guidelines relative to prevention and control of air, water and noise pollution specifically for

Railways, provisions laid down in various acts<sup>5</sup>, rules, regulations issued by government and notifications issued by the CPCB and SPCBs, which are binding on IR, were considered for assessing the performance of IR in controlling pollution.

In the absence of a monitoring mechanism in IR in regard to air, noise and water pollution, it was not possible to obtain reasonable assurance regarding compliance with the provisions of various statutory regulations concerning environmental issues. The extent of pollution caused due to handling of pollution intensive commodities was excluded from the purview of audit due to lack of evidence. The scope of audit suffered further limitation due to non maintenance of records at Railways installations relating to generation of waste particularly plastic wastes and savings due to adoption of energy conservation measures.

#### **1.4 Audit Objectives**

The Performance Audit covering the period 2006-07 to 2010-11 was taken up with the broad objective of forming an opinion on the existence and adequacy of commitment, initiative apparatus put in place by IR for:

- I. Prevention and control of air, water and noise pollution;
- II. Management and conservation of natural resources for sustainable development with specific reference to conservation of water, energy and wild life;
- III. Management of waste generated on IR.

The observations of Audit on each of the above three objectives of the Performance Audit have been presented in the succeeding chapters.

#### **1.5 Audit Criteria**

The Ministry of Environment & Forests is the nodal agency in the Government of India for the planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. The Performance Review was conducted on the basis of parameters prescribed under various acts,

<sup>5</sup> The Air (Prevention and control of Pollution) Act 1981, The water (Prevention and control of Pollution) Act 1974, The Noise (Prevention and Controls) Rules, 2000 and The Hazardous Wastes (Management and Handling) Rules, 1989

rules, regulations and notifications<sup>6</sup> issued by the Central/State Pollution Control Boards and Ministry of Environment and Forests for control of pollution in air and water, protection of environment and conservation of wildlife.

In addition, policies of IR, guidelines as well as instructions issued by it from time to time besides the guidelines issued by the CPCB and SPCBs, were taken into consideration to assess the performance of IR in its environmental management.

### **1.6 Audit Methodology**

The performance audit of the environment management on IR began with an entry conference with the Railway Board (RB) and identical conferences with the respective Head of Departments at the zonal level. During those meetings the audit methodology, scope, objectives and criteria were explained.

Apart from its instructions for project planning, rules and regulations issued by the RB and their correlation with various isolated policy pronouncements, if any, were examined. Records relating to guidelines/instructions issued by different Directorates of Ministry of Railways involved in policy formulation and issue of directives to zones for implementation were also examined between August 2011 and March 2012 to ascertain the initiatives and performance of IR towards environmental management. At the Zonal level, audit checked the compliance of each zone with the various directives issued by the RB.

Joint inspection at Stations and trains was also conducted with Railway officials for real time assessment of the initiatives taken by IR and its performance. Besides, feedback was also obtained from passengers through survey conducted at some important stations and in Mail/Express trains.

In absence of any system of monitoring and documentation regarding air, water and noise pollution in station premises/sidings, study of the pollution level at stations/sidings was conducted through CPCB.

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<sup>6</sup> The Environment (Protection) Act, 1986, The Air (Prevention and control of Pollution) Act, 1981, The Water (Prevention and control of Pollution) Act, 1974, The Water (Prevention and control of Pollution) Cess Act, 1977, The Noise Pollution (Regulation and Controls) Rules, 2000, The Forest (Conservation) Act, 1980, The Wild Life (Protection) Act, 1972, The Hazardous Wastes (Management and Handling) Rules, 1989, The Municipal Solid Wastes (Management and Handling) Rules, 2000 and The Plastic Manufacture, Sale and Usage Rules, 1999

## 1.7 Sample Selection

For our macro level examination, data was collected from various departments of Zonal and Divisional offices all over IR. For examination of certain issues at micro level, a sample of 212 stations from various categories<sup>7</sup> as indicated in the table below was selected for undertaking the review to ascertain the level of compliance with the statutory regulations on environmental issues in 34 sidings and 31 Goods Sheds. Following sampling technique was adopted:

Sl. No.	Description	Category	Sample Size
1.	Number of stations under different categories selected for audit that included stations, Joint Inspection by audit and Railway authorities.	A1	25% subject to minimum of 2 stations
		A & B	10% subject to a maximum of 5 stations, covering at least one station from each divisions, to the extent possible
		C, D & E	2 stations from each category
2.	Sidings		2 sidings - dealing with loose commodities such as iron ore, coal, coke, fly ash, chemicals/petroleum etc.
3.	Goods sheds		2 sheds dealing with cement, fertilizers, iron ore, coal, coke, fly ash, etc.,
4.	Trains including Joint Inspection	Five Express/ Mail/ Passenger Trains	<ul style="list-style-type: none"> <li>• Tains having OBHS<sup>8</sup>/ CDTS<sup>9</sup>/Pantry Car</li> <li>• Rajdhani /Shatabdi/JanShatabdi/ Ordinary passenger trains</li> <li>• Platform return trains</li> </ul>
5.	Section	SSE & P.Way Section <sup>10</sup>	Sections covering reserve forest/sanctuaries, elephant corridors, tunnels, RUBs <sup>11</sup> .

<sup>7</sup> IR categorize stations on the basis of earnings. This categorization has been followed in the selection of audit sample size as it also broadly reflects the number of passengers using a station.

<sup>8</sup> OBHS refers to On Board House Keeping Service

<sup>9</sup> CDTS refers to Controlled Discharge Toilet System

<sup>10</sup> Senior Section Engineer /Permanent Way Sections

<sup>11</sup> RUB refers to Road Under Bridges

In addition, 35 Permanent Way sections were selected for examining the issues pertaining to ecology of forest areas, tunnels, road under bridges etc.

Further, a joint inspection by audit along with railway officials of 212 stations and 88 trains was also conducted for on the spot verification of the sensitivity of IR towards clean and safe environment.

Feedback from passengers was obtained through a passenger survey conducted in all zones, as per the following sample size:

Passenger feedback	No. of passengers to be surveyed
At 2 Major stations dealing with maximum number of passengers per day.	75 passengers in each station.
5 Trains - Rajdhani, Mail/Express trains (including long distance trains), Shatabdi/ Jan Shatabdi, Day train.	AC Passengers – 100 Non-AC Passengers – 250

### 1.8 Acknowledgement

The audit objectives, scope of study and methodology were discussed with Advisor (Finance) at Railway Board as well as the General Managers/concerned departmental heads in the zones by the Principal Directors of Audit during entry conferences. The inputs provided on various aspects and the cooperation extended by railways is acknowledged with thanks. The audit findings and recommendations were discussed with Advisor (Finance) in an exit conference held in October 2012 in Railway Board. Similar exit conferences were also held by the Principal Directors of Audit in the zones, with concerned zonal authorities. The draft report was issued to the Ministry of Railways in June 2012. A partial reply of the Ministry was received in October 2012. Their views have been incorporated in the report.

## Chapter 2 → Prevention and Control of Pollution

**Pollution** is the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organisms. It can take the form of chemical substances or energy, such as noise, heat or light.

The growing concerns regarding the adverse impact of pollution have led India to pass a number of legislations to protect the environment. This includes laws to control and prevent air, noise and water pollution besides other statutes passed by the legislature to protect the environment.

IR which is the single largest carrier of freight and passengers in the country and by the very nature of its operations, generates an immense challenge to the overall management of the environment in the country; hence, it has a clear responsibility towards conservation of the environment. Its approach to pollution control is significant for tackling environmental challenges to the country.

Our audit objective was to obtain reasonable assurance to the compliance with the pollution laws/directions of the Pollution Control Boards and existence of effective environment management system in IR. This chapter highlights the approach of IR in dealing with and eliminating or minimizing different forms of pollution.

### 2.1 Policies and Guidelines

In IR, environmental problems arise mainly while transporting passengers and in handling and transporting pollution intensive commodities such as coal, iron ore, cement, fertilizers, petroleum etc. RB is yet to issue any comprehensive guidelines specifically for sidings, handling and transport of these commodities.

So far no standard instructions regarding packing and transporting of different kinds of goods have been detailed by the Railways in their codes and manuals<sup>12</sup>.

<sup>12</sup> Indian Railways Code for Traffic Department, Indian Railways Commercial Manuals Vol.II ,and Red Tariff detailing rules and conditions for carriage of dangerous and explosive goods.

The instructions included in these manuals which date as far back as 1939, have been periodically revised. These instructions cover various aspects of transportation of different types of commodities. Environmental aspects involved in carriage of goods were not specifically and adequately addressed in these rules. For instance, there are separate detailed instructions for carriage of commodities like coal, iron ore, cement, POL, fertilizer etc. These instructions focus on the type of wagon to be used and packing conditions for transportation of these commodities. These were prima-facie, guided by both technical and commercial considerations<sup>13</sup>. Subsequent revisions also have not adequately focused these issues, despite the growing incident of environment pollution. For instance, coal is still generally carried in uncovered wagons despite directions to the contrary of some SPCBs.

Thus, no specific criteria have been laid by the RB to enable itself to assess the performance of each zonal railway in minimizing environmental pollution. Absence of clear criteria has been a limiting factor in our audit. We observed that the CPCB also neither issued any specific guidelines for the transport of pollution intensive commodities by rail. However, SPCB of West Bengal, Jharkhand and Odisha have issued detailed guidelines regarding handling of goods at sidings and their transportation.

## **2.2 Organizational Structure**

There is no separate directorate or cell either at the RB level or at the Zonal level to co-ordinate various environmental issues involved in the operations of IR. At the RB level, the policy issues and guidelines regarding core operations are addressed through a number of Directorates in the RB. The responsibility for implementation of various environmental measures relating to stations, trains and tracks is dispersed over a number of directorates in the RB viz. Mechanical, Civil Engineering, Commercial and Electrical Directorates. While Mechanical Directorate is responsible for formulating policies, issuing guidelines and implementation of measures in locomotives and coaches, such responsibility regarding sidings and goods sheds rests with Commercial and Civil Engineering Directorate. The Electrical Directorate plays a significant role in electrification of tracks which helps in prevention of air pollution due to emission from diesel exhaust.

Our examination of the charter of duties and range of issues handled by various directorates revealed that environmental aspects such as the prevention and

<sup>13</sup> Minimization of loss in transit and consequent claim by the consignors/consignees.

control of air, water and noise pollution are only incidental to the core area of operation of each directorate.

At the zonal level, the heads of the respective departments are similarly responsible for environmental issues which are handled in a manner similar to that in the RB. Hence, such issues are dealt with in a manner that is only tangential to their core activities.

### **2.3 Air Pollution**

The Air (Prevention and Control of Pollution) Act, 1981 has defined "air pollutant" as any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be injurious to human beings or other living creatures or plants or property or environment. Thus the presence of 'particulate matter', sulphur-dioxide, nitrogen-dioxide, carbon-monoxide, hydrocarbons, lead, etc., in the atmosphere in high enough concentrations and for a duration long enough to cause undesirable effects can be called air pollution. It could have an adverse impact on human health, of other living entities, man-made heritage, and life-support systems, such as global climate.

In this section, we examined the approach of IR towards air pollution and measures taken both at the Board level and at the operational level to mitigate this problem.

#### **2.3.1 Air Pollution at Stations, Sidings and Goods Sheds**

An Indian Railway station is typically over crowded with large number of visitors, coolies and vendors. The pollution profile of a railway station is likely to follow that of the neighborhood as no major pollution source exists at a railway station. Pollution issues arise mainly while handling and transporting freight such as coal, iron ore, cement, fertilizers, etc. These commodities are mainly handled at Railway/Private sidings<sup>14</sup> and Good sheds. These materials create serious air pollution when carried by rail in open wagons and during loading/unloading operation. Further, fugitive emission<sup>15</sup> is also caused by these commodities. Such dust, when deposited on the track, impedes drains as it fills the interstices within the track ballast.

<sup>14</sup> A siding is a place which is used to receive, temporarily store and load/unload materials in the rakes and dispatch materials.

<sup>15</sup> emissions of gases or vapors from pressurized equipment due to leaks and various other unintended or irregular releases of gases

In absence of uniform guidelines issued by the RB, CPCB and SPCBs, we were constrained to assess the level of compliance with the statutory regulations<sup>16</sup> and guidelines issued by some SPCBs related to handling and transportation of commodities at sidings and goods sheds.

### 2.3.1.1 Non-compliance with Statutory Regulations

As per section 21<sup>17</sup> of the *Air (Prevention and Control of Pollution) Act, 1981*, all sidings and Railway Good sheds require Consent for Operation (CFO) from the concerned SPCB. RB had stipulated (June 2009) that before issue of Railway Receipt for booking of freight (iron ore, steel and cement) Railway Administration should ensure one time submission of CFO to the Senior Divisional Commercial Manager of the Division in which the loading takes place.

Test check of 34 sidings over 16 zones<sup>18</sup> handling pollution intensive commodities like coal, coal dust, iron ore, cement, fertilizers, petroleum etc. revealed that CFO was obtained only for nineteen (55 per cent) out of the 34 sidings test checked.<sup>19</sup> 10 out of the remaining 15 sidings (SR-3, ECR-2, SECR-2, SCR-1 and ECoR-2) had not obtained CFO on the ground of absence of specific instructions from the RB/ Pollution Control Boards. No action was taken against the sidings for non adherence to either the instructions of the RB or the statutory provisions. No action was also forthcoming from the concerned pollution control board for ensuring compliance with the statutory guidelines.

In fact, the RBs instructions of June 2009 were interpreted by a couple of the Railway Administrations<sup>20</sup> (SECR, NWR and NCR) as though obtaining of CFO was not required for sidings with only unloading facilities.

### 2.3.1.2 Non-compliance with SPCB Guidelines

The SPCBs of West Bengal, Jharkhand and Odisha issued detailed guidelines regarding handling of goods at sidings and their transportation. These guidelines, inter-alia, provided for covering of open wagons carrying pollution intensive

<sup>16</sup> Air (Prevention and Control of Pollution) Act, 1981,

<sup>17</sup> Section 21 provides that no person shall, without the previous consent of State Pollution Control Board, establish or operate any industrial plant in an air pollution control area. Railway sidings/goods sheds are covered under the provision of this section.

<sup>18</sup> Metro Railways excluded as there was no siding

<sup>19</sup> Sidings are dealing in coal and petroleum oil/petroleum products

<sup>20</sup> Railway Administration refers to the Zonal Railway Administration

commodities. The guidelines<sup>21</sup> issued by Pollution Control Boards of West Bengal, Jharkhand and Odisha between August 2010 and June 2011 provide for installation of water sprinkling system, plantation, construction of boundary wall, drainage and proper approach roads, covering of all minerals when not in use etc. On verification of the status of implementation of prescribed guidelines in six sidings and six goods sheds test checked<sup>22</sup> in the three zones (SER, ER and ECoR) falling within the jurisdiction of the Pollution Control Boards of West Bengal, Jharkhand and Odisha, we observed that except ECoR, the guidelines were not completely followed in the remaining two zones as mentioned below:

- i. In SER, despite instructions (June 2011) from Jharkhand State Pollution Control Board (JSPCB) to Noamundi Iron Ore Mines of M/s Tata Steel Limited in Jharkhand, minerals like coal, coal dust, iron ores etc. were



Iron ore partially covered at Noamundi (TISCO) siding in Jharkhand, SER

not covered with tarpaulin when not in use. The siding authority also failed to comply with instructions of JSPCB for construction of boundary wall, drainage, plantation and water sprinkling. Besides, CFO granted by the JSPCB expired in June 2011 and the

application for renewal was pending before JSCPB as of March 2012. The operation of the siding is however, still continuing (March 2012). A test check of another two goods sheds<sup>23</sup> handling coal and coal dust; it was observed that water sprinklers were either out of order (Bhojudi Coal Washery) or not provided (Nimpura Goods shed).

- ii. In ER, on the basis of complaints lodged in 2008 by the residents of surrounding area of Chitpur Yard, WBPCB<sup>24</sup> issued directives (February 2011) for taking remedial measures. This included undertaking feasibility study for using a mopping machine on the wharf as a substitute to sprinkling and for growing creepers on top of the wall fencing. These have not been taken up (March 2012). Regarding the New Alipore Coaching

<sup>21</sup> Guidelines of Odisha (OSPCB), West Bengal WBSPCB) and Jharkhand Pollution Control Boards (JSPCB) were issued in August 2010, February 2011 and June 2011 respectively.

<sup>22</sup> Two sidings and two goods sheds test checked in each zone

<sup>23</sup> Bhojudi Coal Washery and Nimpura Goods shed

<sup>24</sup> West Bengal Pollution Control Board

Complex, it was seen that the Station Manager informed (November 2010) the divisional authorities regarding accumulation of huge cement dust due to offloading of cement from rakes. This frequently led to a storm of cement which often engulfed not only the station area but also the adjoining areas. Railway Administration did not take any remedial measures in this regard (March 2012).

### 2.3.1.3 Pollution scenario in zones not covered by any guidelines

The SPCBs are yet to issue any guidelines for handling and transportation of pollution intensive commodities in respect of 13 zones<sup>25</sup>. We examined the impact on environmental pollution due to operations of sidings/goods sheds and efforts of the Railway Administration to minimise pollution. Deficiencies in adopting measures for controlling air pollution in sidings/goods sheds noticed in respect of the 13 zones where the SPCBs had not issued any guidelines are discussed below:

- i. The transport of commodities like coal and iron ore was examined in all zones. A test check of 34 sidings covering 16 zones revealed that in 13 zones (except NER, NEFR and ECoR) commodities like coal and iron ores were being carried in open wagons without covering with tarpaulin sheets. Handling of these loose commodities at sidings and their transportation without covering posed near-in hazards to the neighbouring residents and also for the line staff and passengers of adjacent platforms. There was no system in place to measure the extent of pollution due to open carriage of polluting commodities.
- 

Coal carried in open wagon without cover
- ii. The Railway Administration (NWR) failed to control fugitive emission at the time of unloading of coal at Merta Road Goods Shed resulting in public complaints. In fact, on one occasion, the court imposed penalty of ₹ 5 lakh against the Railway Administration and ₹ 25 lakh against the consignor. On being pointed out by Audit, Railway Administration stated (March 2012) that they had issued instructions for adoption of some remedial measures like provision of water sprinkler, plantation and

<sup>25</sup>Excluding ER, SER and ECoR

construction of boundary walls. It was, however, observed that the remedial measures are yet to be implemented (August 2012).



Cement dust at Salt Cotaurs Goods shed, Chennai

iii. In SCR, SPCB carried out ambient air quality monitoring (May 2009) at the Jaggiahpet siding. They found that the value of Total Suspended Particulate

Matter was 2179 micro gram per cum as against the norm of 500 micro gram per cum. Consequently, SPCB issued directives (June 2009) to make provisions of permanent water sprinkling system, erection of permanent wind breaking barriers along with geo-net screens, covering of trucks loaded with coal with tarpaulin etc. During subsequent inspection (May 2010), SPCB observed that the Railway Administration had not complied with its guidelines issued in June 2009 and therefore, issued a show-cause notice to stop loading / unloading activities. Even after a lapse of two years, the Railway Administration had not fully complied with the directives of SPCB in respect of provision of geo net screen for wind braking barriers, plantation, development of concrete approach road, repair of permanent water sprinkler etc. On being pointed out in Audit, Railway Administration stated (April 2012) that the activities of the sidings had almost been stopped.

- iv. In two Goods Sheds (Salt Cotaurs and Bunder goods shed, Mangalore) of SR handling commodities such as cement, soda ash and fertilizers etc. large quantities of cement dust were found strewn all over the area. Though there were no public complaints against these two sheds, the accumulated cement dust was a health hazard to the public as well as the staff posted there.
- v. In two Railway goods shed at Moga and Jagraon over NR handling food grain (outward traffic) and fertiliser (inward traffic), it was observed that no water sprinkling system had been installed. Metal roads provided in the goods shed were found in damaged condition causing dust (air) pollution along the track.
- vi. In CR, no remedial action was taken on three public complaints received from passengers in 2008 and 2009 in connection with the increase in air pollution because of coal dust in the Wani station area emanating from the

coal loading point at Wani Goods Shed, near Wani station. Dust spread at Wani Station was also noticed during Audit Inspection (November 2011).

- vii. In Kankaria and Jogeshwari A.T. goods shed of WR, no action was taken by the Railway Administration to assess the air quality standard due to loading/unloading of cement and fertilizer. Measures like plantation around unloading areas to prevent fugitive dust, provision of wind barriers, covered sheds, water sprinkling, etc were not taken up by the Railway Administration to check the environmental pollution.

Thus, the Railway Administrations failed to adhere to the statutory provisions i.e. obtaining CFO from the SPCBs in nearly fifty per cent of the sidings test checked. In response to a reference from WR regarding the necessity of covering open wagons, RB stated that the issue of covering of open wagons may be dealt with at Zonal Railway level and that the covering should be done by the consignor/rail-user. Adequate measures were also not taken by the Railway Administration to follow the guidelines issued by the SPCBs in respect of sidings/goods sheds. Despite widespread pollution intensive activities and receipt of numerous complaints, IR is yet to frame comprehensive guidelines relating to handling and transportation of pollution intensive commodities.

While agreeing to the audit observations regarding carriage of dusty cargo in open wagons, Ministry of Railways (MR) replied (October 2012) that the Railway Administration had already advised the customer to arrange for measures like provision of sprinklers for water sprays, dust screens/green cover to avoid coal dust pollution. MR also stated that petroleum products and chemicals were being transported in tanks and special type of covered wagons and therefore, there was no issue of pollution involved.

The contention of MR is not tenable as instructions issued are merely an ad-hoc reaction to the audit observations. No attempt has been made by the MR to address the issue holistically and to issue consolidated instructions at the RB level in consultation with CPCB. Several instances, as highlighted in the preceding sub-paras, were noticed where remedial measures for reduction of pollution were not taken up.

### **2.3.2 Study Report of Central Pollution Control Board**

At the instance of Audit, CPCB had carried out a study in March 2012 for assessment of ambient air quality at 14 major stations over 12 zones of IR.

Monitoring was done for 2 days. On the first day samples were collected on 24 hour basis and on the second day, samples were collected on eight hour basis.

CPCB observed that none of the stations covered in the study had applied for consents under Air (Prevention and control of Pollution) Act and Water (Prevention and control of Pollution) Act and also authorization<sup>26</sup> for handling hazardous waste. Further, the values of various gaseous pollutants exceeded the national ambient air quality standards prescribed<sup>27</sup> by the CPCB (November 2009) at a number of stations.

The observations of CPCB on the individual stations as a result of study are detailed below:

Stations/Zone	Observations
Bilaspur/SECR	RSPM <sup>28</sup> and SPM exceeded the prescribed limit <sup>29</sup> at most of the monitoring places. However, SO <sub>2</sub> and NO <sub>x</sub> values were observed to be within the limits.
Jabalpur /WCR	The value of RSPM was higher than the prescribed limit.
Jaipur / NWR	Air quality monitored at three locations around the station revealed that the values of gaseous pollutant were well within the prescribed limit of CPCB.
Howrah & Sealdah / ER	The ambient air quality exceeded the prescribed limits for RSPM & NO <sub>x</sub> while SO <sub>x</sub> was within the prescribed limit.
Khurda & Bhubaneswar (ECoR)	The ambient air quality for RSPM, NO <sub>x</sub> and SO <sub>x</sub> was within the prescribed limit.
Patna (ECR)	RSPM values was in excess of the prescribed limit.
Vadodara(WR)	SPM & RSPM value were found to exceed the prescribed limits.
Ahmadabad(WR)	RSPM value was in excess of the prescribed limit and the values of NO <sub>x</sub> and SO <sub>x</sub> were found well within the prescribed limit.

<sup>26</sup> Rule 5 of Hazardous Waste(Management, Handling and Transboundary) Rules,2008 requires that every occupier handling hazardous wastes shall make an application for grant of authorization for handling hazardous wastes

<sup>27</sup>The National Ambient Air Quality Standard (24 hours average) for RSPM for industrial and residential area is 100 micro gm per cubic metre and 80 micro gm per cubic metre respectively.For oxides of Sulphur (SO<sub>x</sub> ) and Nitrogen (NO<sub>x</sub>), prescribed limit is 80 micro gm per cubic metre while for PM<sub>10</sub> , the limit is 100 micro gm per cubic metre

<sup>28</sup> RSPM refers to Respirable Suspended Particulate Matter

<sup>29</sup> Prescribed limit refers to National Ambient Air Quality Standard

Secunderabad /SCR	The values of PM <sub>10</sub> exceeded the prescribed limit.
Hubli /SWR	Ambient air quality monitoring revealed that the values of PM <sub>10</sub> <sup>30</sup> exceeded the prescribed limit.
Guwahati / NEFR	The value of PM <sub>10</sub> exceeded the prescribed limit of 100 micro gram /cum by 64 per cent. CPCB also observed that the high amount of NO <sub>x</sub> was due to burning of diesel as fuel.
Chennai/SR	The values of PM <sub>10</sub> , NO <sub>x</sub> and SO <sub>x</sub> were found within the prescribed limit.

From the above observations of CPCB, it is seen that the ambient air quality in respect suspended particulate matter (SPM/RSPM/ PM<sub>10</sub>) at most of the railway stations was above the national ambient air quality standards. It was also observed in Audit that there was no system of monitoring pollution level at stations.

### 2.3.3 Pollution from Trains

The trains on IR are powered mainly by diesel and electricity. IR has been emphasizing increased electrification of its tracks which is an eco-friendly option

#### Air conditioning in trains

The release of Chlorofluorocarbons (CFC) damages the earth's ozone layer. In IR, AC coaches with R12 CFC refrigerant and R22 HCFC refrigerant are being used. Till March 2011, 76 per cent under slung AC coaches had been converted to eco-friendly R134a refrigerant and the balance RMPU AC coaches were fitted with HCFC R22 refrigerant. The CFC refrigerant R-12 had been phased out completely in all zones.

for the consumer. The use of diesel, on the other hand leads to substantial emissions in the form of unburnt hydro carbons, carbon monoxide and particulate matters etc. which add to air pollution. Air conditioning in trains also adds to air pollution. As per Montreal Protocol, the deadline for phasing out CFC refrigerant R-12 was 2010 and that of HCFC refrigerant R-22 is 2040. The initiative of IR in phasing out of CFC R12 refrigerant was appreciable towards green environment.

<sup>30</sup> PM<sub>10</sub> refers to particulate matter(size less than 10 micro gram)

### 2.3.3.1 Emission from Diesel Locomotives

Diesel is used to power traction in about 70 per cent of the track on IR. Scrutiny in audit revealed that IR had neither initiated any measure to fix standards for

#### Research & Design

- ❖ For control of harmful emission from locomotives, RDSO has undertaken two projects-Use of fuel catalyst and catalytic convertor and Procurement of emission test car & reduction of emission of ALCO engine with target of completion by September 2012 and March 2013 respectively.
- ❖ Initiatives of RDSO resulted in reduction of noise level of power car and compressor for AC EMUs/MEMUs from 140db to 75-80 db and less than 66db respectively.

emissions from the use of diesel for traction purposes nor any system had been set up to monitor the emissions from diesel locos and assess or compare the extent of emission with the international standard. South Central Railway Administration stated that there were no instructions for

regular monitoring of emission levels and there was no such monitoring anywhere in IR.

IR has taken the initiative for using bio diesel to minimise air pollution and related public health risks as it reduces green house gas emission. After examining the potential applicability of bio diesel as a fuel for locomotives and conducting trials, RDSO<sup>31</sup> concluded (December 2003) that bio-diesel could be used without engine modification and could attain full operating power. It was also concluded that a blend of 20 per cent biodiesel was compatible with the locomotives operating on IR and India's climate condition. The action plan of Mechanical Directorate of RB for Vision 2020 envisaged setting in motion the initiative of IR for achieving 10 per cent blending of bio diesel.

We observed that out of 16 zones<sup>32</sup>, bio-diesel was used only in five zones (SER, SECR, ER SR and NR). During the period 2006-11, the production of bio-diesel over these five zones was only 155.123.Kl besides procurement of 47.46 Kl from outside agencies. The usage of bio-diesel was very insignificant (0.01 per cent) when compared with the total consumption of 109.30 lakh kilo litres of HSD oil. The percentage of blend during the period of review varied between 5 to 10 per cent in locos.

From the reply of the Zonal Railway Administration, it revealed that the factors limiting the usage of bio-diesel were:

<sup>31</sup> Research, Design & Standard Organisation

<sup>32</sup> Excluding metro railways where no diesel engine is used

- i. Absence of specific instructions for adopting 20 percent blends for bio-diesel (NWR).
- ii. The trials conducted for bio-diesel were not encouraging (CR).
- iii. There was no production and utilization of bio-diesel as the plantation of Jatropha had not been successful due to high mortality rate (ECR).
- iv. Poor yield of bio-diesel due to poor quality of Jatropha seeds (SER).

Thus, the negligible use of bio-diesel clearly corroborates veracity of the contention of the Railway Administrations. The Railways had taken a number of initiatives for encouraging the use of bio-diesel—like setting up of Jatropha plantations and setting up of esterification plants. However, the main reason for the limited and declining usage of bio-diesel was not addressed i.e. no instructions were issued to the field offices from the RB for using blended biodiesel. In addition, no system was set in place for monitoring emissions from diesel locomotives.

Initiatives of IR for production of bio-diesel as an alternative fuel and the constraints in production of bio-diesel are discussed in sub-para-3.6.

### **2.3.3.2 Electrification of Track**

Electric traction is environmentally friendly, pollution-free and energy efficient and offers an excellent alternative to fossil fuels as a source of energy. Its use as a motive power is eco friendly for the consumer. As compared to diesel, electric traction is capital intensive and requires higher investment in terms of locomotives, overhead equipment, electric loco sheds, and other equipment.

IR has progressively electrified 19607 Route Km (RKM) out of 64,460 RKMs till March 2011. During the XI Five Year Plan period (2007-12), IR targeted to achieve electrification of 3500 RKMs at the rate of 700 RKMs per year. During the period 2007-11, 3391 RKMs were electrified.

We observed that electrification was being carried out selectively for sections of a route instead of electrifying the whole route. Patch wise electrification of routes resulted in hauling of diesel engines on electrified route leading to avoidable pollution due to emission from diesel besides higher operational costs on account of higher line haul cost under diesel traction.

CR Administration stated that Diesel locomotives over electrified routes were being used for operational requirements to avoid intermediate detention of trains due to change in traction. Contention of the Railway Administration side testify to the fact that situation could have been avoided had the Railway Administration had resorted to strategy of route wise electrification.

The movement of diesel locos under electrified route led to continued dependence on diesel locos resulting in increased environmental pollution.

### 2.3.3.3 Ventilation of Tunnel

The essential requirements of a ventilation system of tunnels are to ensure sufficient air flow to prevent locomotives from over-heating and to keep thermal effects within desirable limits. The ventilation system should ensure sufficient airflow relative to moving train to keep the concentration of pollutant gases<sup>33</sup> inside the tunnel within permissible limits. Monitoring of air quality and temperature inside the tunnel was, therefore, important to assess the need and adequacy of ventilation of tunnels. As per Para 1007 B of Indian Railway Bridge Manual, ventilation of the tunnel is one of the important aspects relating to passenger and crew comfort during movement of train inside the tunnel.

During test check of provision of ventilation in 181 tunnels out of 479 tunnels over 16 zones, we observed that neither air quality nor temperature monitoring was carried out in the tunnels to verify whether:-

- The pollutants inside the tunnels were within threshold levels and
- The temperature was limited to 50 degree centigrade to prevent overheating and to keep thermal effects within the permissible limits.

We also examined the status of functioning of ventilation provided in tunnels and observed that the artificial ventilation provided at a cost of ₹ 5.33 crore in two tunnels<sup>34</sup> in ECoR could not be commissioned till March 2012 due to non-availability of power. Records of the Railway Administration revealed that the absence of ventilation had caused suffocation to maintenance staff after passing of trains.

SCR administration stated that in longer tunnels, artificial ventilation was being provided depending upon the requirement and as such, there was no necessity of monitoring of air quality and temperature in tunnel. They further stated that monitoring of air quality /temperature was not being done anywhere in IR.

<sup>33</sup> Oxides of carbon, nitrogen, sulphur and hydrocarbons

<sup>34</sup> Tunnel No. 23 (1.6 Km) and 25 (1.5 Km) in Koraput-Raygada section

Contention of the Railway Administration was not tenable as the requirement or adequacy of ventilation could be judged only on the basis of monitoring of air quality/temperature in the tunnel.

Thus, the failure of the Railway Administration in monitoring of air quality/temperature in tunnel and commissioning of ventilation was indicative of the lack of concern of IR to protect its passengers and crew against potential health hazards.

#### **2.3.3.4 Dust level in passenger coaches**

At the instance of Commissioner of Railway Safety (CRS), RDSO conducted trials between March and June 2010 for measurement of dust ingress in coaches. On the basis of the trials, it was observed that in IR the average dust concentration in non-AC coaches was almost double the limits<sup>35</sup> prescribed by the CPCB as the speed increases from 80 to 100 kmph. The value of Particulate Matter (PM<sub>10</sub>) was also found three times of CPCB prescribed limit and also higher than the standard for PM<sub>10</sub> (150 micrograms per cubic meter) prescribed in other international rail systems. Based on the findings, CRS instructed (November 2010) RDSO to evolve standards to be maintained for dust particles inside non-AC coaches and develop dust mitigating measures to reduce the total dust values. However, no standards have been developed till now (March 2012).

Passenger surveys of 3217 Non-AC passengers and 1322 AC passengers conducted by Audit between August 2011 and March 2012 over 17 zones revealed that 39 per cent of Non- AC passengers and 35 per cent AC passengers felt that the quality of the air inside the coaches ‘Requires improvement’.

Response of the passengers was indicative of the deficiency in initiatives of IR in minimizing dust level in coaches.

### **2.4 Noise pollution**

As per Rules 3(1) and 4(1) of the Noise Pollution (Regulation and Controls) Rules 2000, different ambient air quality standards in respect of noise levels have been prescribed for different areas such as industrial, commercial, residential and silent zones. The noise levels in those areas should not exceed the standards

<sup>35</sup>The National Ambient Air Quality Standard (24 hours average) for RSPM for industrial and residential area is 100 micro gm per cubic metre and 80 micro gm per cubic metre respectively. For oxides of Sulphur (SO<sub>x</sub>) and Nitrogen (NO<sub>x</sub>), prescribed limit is 80 micro gm per cubic metre while for PM<sub>10</sub>, the limit is 100 micro gm per cubic metre

prescribed<sup>36</sup>. The principal contributors to ambient sound pressure levels at stations are the movement of trains, blowing of horns by trains and announcements.

#### **2.4.1 Noise Pollution at Stations**

An independent study by Annamalai University during September 2002 at three important stations-Chennai Central, Tiruchirappalli and Villupuram over Southern Railway revealed that the average sound level at platforms, driver's rest room, etc., were in the upper limits of the prescribed levels as applicable to commercial areas<sup>37</sup>.

During March 2012, CPCB conducted noise monitoring at different locations of 14 major stations over 12 zones at different points of time in a day. Study revealed that noise levels were in excess of the prescribed limit at all stations and there was no system of monitoring the noise level.

In absence of any monitoring mechanism of the sound level at stations, audit conducted a survey<sup>38</sup> of 2439 passengers at 34 Railway Stations across 17 zones. The survey revealed that 31 percent of the passengers were of the view that the noise level at stations was unbearable.

#### **2.4.2 Noise level in passenger coaches**

During the course of trials in two trains between March and June 2010 for measurement of noise in coaches, RDSO observed that the noise level increased from 76.8dB to 80.3 dB as the speed increased from 80 to 110 Kmph and at an identical speed, the noise level in AC coaches increased from 71 to 72 dB. The above noise levels were well above the UIC (Union Internationale des Chemins de Fer/International Union of Railways) prescribed levels of 68 dB for interiors of second class passenger coaches.

In response to our survey questionnaire to 3352 Non AC passengers and 1295 AC passengers in 80 trains as per sample selection, on an average 26 per cent and 10 per cent of Non AC and AC passengers respectively were of the view that the noise level inside the coaches was unbearable.

<sup>36</sup>As per Noise pollution Act, the ambient air quality standards in respect of noise for industrial area should be 75db(A) Leq during the day time and 70db(A) Leq during the night time.

<sup>37</sup> The ambient air quality standard in respect of noise for commercial area is 65 and 55 db(A) Leq for day time and night time respectively

<sup>38</sup> Collection of opinions of passengers through questionnaire

In the absence of any specific instructions either from Pollution Control Boards or from RB, the zones did not initiate any remedial measures to reduce noise pollution.

### **2.4.3 Noise control measures near habitation/silence zones**

CPCB code of practice for controlling noise from sources other than industries and automobiles suggests erection of acoustic barriers, reduction of speed and avoiding whistling within and along the Municipal limits and habitation zones for Railway operations.

Scrutiny of records revealed that no instructions had been issued at the level of RB regarding noise control measures near habitation/silence zones.

## **2.5 Water Pollution**

**Water pollution** is the contamination of water bodies namely lakes, rivers, oceans, and groundwater. Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds. Besides being a crucial resource, maintenance of its quality is also a major concern.

As per Sections 24, 25 and 26 of The Water (Prevention and Control of Pollution) Act, 1974, no person shall knowingly cause or permit flow of any poisonous, noxious or polluting matter into any stream or well or sewer or land without treating it.

Sewage is an excellent medium for the development of bacteria, some of which may be pathogenic. Raw sewage is harmful, as it consists of pathogen bacteria, which are capable of causing diseases such as typhoid fever, dysentery, diarrhea and cholera.

IR is a major user of water for cleaning of trains and stations. IR also generates a large quantity of sewage both on trains and stations.

### **2.5.1 Effluent Treatment**

Train servicing and maintenance processes generate effluents such as oil, antifreeze and cleaning chemicals which can pollute the environment, if not carefully controlled. IR, therefore, needs to ensure that the effluent from Railway stations/sidings is discharged after proper treatment into the municipal sewers. RB instructed (June 2009) installation of Effluent Treatment Plants (ETP) at all major

stations for treatment of effluents before being discharged into sewers/water bodies.

In SECR, petroleum products were found deposited alongside the track. These were deposited during unloading at the POL Siding at Bhilai. Oil spillages were also noticed during loading activities at GR siding, Bajwa (WR). It was noticed that there were no specific instructions from the RB regarding treatment of oil spillages at sidings. In WR, it was observed that the spilled oil along with other wastes was being treated through the effluent treatment plant.



Discharge of waste water from Kharagpur Station (SER)

and ground water.

Scrutiny revealed that no records regarding quantity of water treated and chemical used were maintained in SCR. During joint inspection by Audit along with the railway officials, it was observed that in absence of any ETP in SER, effluents were being discharged from the major stations<sup>39</sup> to the nearby low lying areas /water bodies and municipal drainage system resulting in contamination of surrounding surface

While applying for CFO, the siding owners are required to furnish details of sources of water pollution, types of pollutants generated, method of treatment and disposal to control pollution etc. In this regard, PCBs of Odisha and West Bengal directed that in case the waste water contains any substance which is harmful to the environment, the same should be treated to remove the substance so as to meet the prescribed norms. Test check of two sidings<sup>40</sup> in ER, revealed that guidelines were not followed in both these sidings.

Scrutiny in audit revealed that no assessment was made by the RB regarding the requirement of ETPs. Out of 17 ETPs sanctioned over five zones (SCR, SECR, WR, NWR and ER), 14 ETPs were installed in three zones (SCR, WR and ER) till March 2012. The sanction of only 17 ETPs at an all India level barely averages one ETP per zone and leaves most of the major stations (A1, A & B category) like Bilaspur / SECR, Jabalpur /WCR, Ahmadabad (WR) & Vadodara

<sup>39</sup> Chakradharpur, Panskura, Tatanagar and kharagpur Stations

<sup>40</sup> Budge Budge and Sodepur siding

(WR), Hubli/SWR, Chennai /SR, Guwahati / NEFR etc. without an ETP. There was little initiative for making provision of ETPs in the remaining 12 zones.

MR stated that the railways drainage systems are connected with the drains of the local municipal authorities in major cities and such plants have been set up by local authorities. They further added that ETPs were being sanctioned as per the recommendations of the Railway Administration. Contention of the MR was not tenable as no attempt was made to assess the actual requirement of ETPs at major stations taking into account the capacity constraints of the municipal authorities. Further, in a number of stations, the effluents from the station premises were being drained directly into nearby water bodies /low lying areas polluting the ground water.

### 2.5.2 Study Report of Central Pollution Control Board

CPCB carried out a study (March 2012) of method of treatment and mode of discharge of waste water generated at station. Study in 14 major stations over 12 zones of IR revealed that the waste water /effluents were being discharged to public sewer. There was no system for monitoring quality and quantum of waste water generated at stations. The results of study were as follows:

Stations/Zone	Observations
Bilaspur / SECR	<ul style="list-style-type: none"> <li>• Effluents were being discharged directly in the nallah passing through Titli Chowk without any treatment that finally joins River Arpa.</li> <li>• Examination of the waste water quality at the point of generation revealed that the oil and grease concentration was found higher than the standards.</li> </ul>
Jabalpur /WCR	<ul style="list-style-type: none"> <li>• Wastewater from only one side is being treated. However, waste water from Itarsi side was collected through pipelines and discharged in to nallah without any treatment.</li> <li>• The analysis of waste water at station premises revealed that the parameters like COD, BOD, TSS etc. exceeded the prescribed limits.</li> </ul>
Jaipur / NWR	Waste water let out into municipal drains.
Ahmadabad(WR) & Vadodara (WR)	<ul style="list-style-type: none"> <li>• No system of quantification of waste water generation.</li> <li>• The waste water from all operations at station is being discharged directly into the municipal sewerage system without any treatment.</li> </ul>

Secunderabad /SCR	<ul style="list-style-type: none"> <li>• Only part of the waster coming from aprons and coach yard was treated through water recycling plant and the remaining was being discharged into the municipal sewer.</li> <li>• The treated waste water was being used for apron cleaning, coach exterior washing and gardening.</li> <li>• No data available in respect of waste water treated and recycled.</li> </ul>
Hubli/SWR	<ul style="list-style-type: none"> <li>• No system of quantification of waste water generation</li> <li>• The waste water is being discharged directly into the municipal sewerage system as there was no waste water treatment facilities.</li> </ul>
Chennai /SR	No water treatment facility. Water is pumped into municipal sewer.
Guwahati / NEFR	<ul style="list-style-type: none"> <li>• Liquid waste let into municipal drain without any treatment and the municipal drains finally let drain to nearby wetlands.</li> <li>• Acid of the lead acid batteries are directly discharged to municipal drains without any treatment, violating the provisions<sup>41</sup> contained in Batteries (Management &amp; Handling) Rules 2001 for disposal of batteries.</li> </ul>

Note: Study of mode of discharge of waste water was not carried out at Patna (ECR), Bhubeneshwar (ECoR),Khurda(ECoR),Howrah(ER),Sealdah(ER)

The results of the study of CPCB were indicative of lack of awareness of the IR towards its environment. The study supports our contention in the above para that installation of ETPs is important for the control of water pollution. The study also emphasizes the need for treatment of water before it is discharged into the municipal drains.

### 2.5.3 Toilet discharge from running trains

IR transports about 14 million passengers on 9000 trains every day. It uses over 40000 coaches regularly for providing passenger services with each coach having four toilets. About 3980 MT of human waste is generated everyday by travelling passengers from ‘Open discharge’ module toilets of these coaches that directly goes onto the rail tracks polluting the stations and the areas through which the

<sup>41</sup> Rule 4(b) provides that it shall be the responsibility of consumers to return their used batteries only to the dealers or deliver at designated collection centers.

trains pass. In order to avoid open discharge of toilets on track, introduction of 'Green Toilets' has been under consideration of IR. Five models of toilets had so far been experimented with and none of these have proved satisfactory resulting in continued pollution of the environment. Details of the initiatives of IR in this regard and their performance have been discussed in sub-para 4.6.

In the existing scenario, the discharge from toilets falls directly into the water bodies or road running below the Road under Bridges (RUBs). The IRs Bridge Manual provides that rivers and road under bridges should be covered by suitable and approved means to prevent droppings, falling from passing trains on water bodies or roads.

We examined the initiative of IR in preventing contamination of water bodies and nuisance to road users due to open discharge of toilets from trains passing over bridges.

Study in 16 zones revealed that out of 1196, 20 per cent (243) of Road Under Bridges (RUBs) were not covered at the bottom to prevent toilet discharge from the passing trains falling on the road users. Further, out of 424 and 5437 steel girder bridges across water bodies under 'Important' and under 'Major' category respectively, 326 (76 per cent) and 3772 (69 per cent) number of bridges were not covered at the bottom leading to water pollution by toilet discharges falling from passing trains.

In response to a writ petition seeking a directive to IR for prevention of dumping of toilet waste from running trains into the open environment, a bench of High Court of Kerala directed (October 2011) the Railways and the Union Ministry of Environment and Forests to file an affidavit proposing a solution to the problem. The Division Bench observed that the problem was very acute in Kerala as the railway lines passed through thickly populated areas and over rivers which were the main source of drinking water.

The case though yet to be disposed off, clearly reflects the lack of sensitivity of the Railway towards a healthy environment and also lack of monitoring in implementing standard instructions issued by itself for prevention and control water pollution.

During the exit conference, SCR Administration opined that there was no need to cover the bottom of the bridges passing over water bodies as the pollution from toilet discharge was negligible compared to the volume of the stream. WCR Administration, on the other hand, stated that with the provision of green toilet covering of bridges would not be required.

The contentions of the Railway Administrations were not in conformity with the provisions contained in the IR Bridge Manual. IR is yet to finalise the design and specification of toilet even after experimenting on different models for about two decades. Non compliance of provisions contained in the IR Bridge Manual on the plea of implementation of green toilet was, detrimental to the aquatic environment.

## 2.6 Conclusion

Environment is a key survival issue and its challenges and significance has assumed greater importance in recent years. IR is the largest carrier of bulk commodities like coal, iron ore, cement, POL and fertilizer which are basically pollution intensive.

Despite the growing concerns over pollution and its increasingly adverse impact on the environment; RB failed to mainstream these issues. No substantive action was taken to integrate environmental concerns with operational policies. Even though, the RB is an established organization that is known for many best practices and social responsibility, it ought to have taken the lead; but was a laggard. Most internal instructions/directions did not have an environmental orientation and were guided by commercial/administrative considerations. No guidelines were framed by the RB to address the issue of pollution during transportation/handling of commodities at railway / private sidings or goods sheds/ yards.

In a majority of the cases the Railway Administration failed to comply with the existing guidelines of obtaining CFO from the concerned SPCB, were not taken before operating the sidings /goods sheds. In some of the cases, there was inconsistent and variable understanding of issues and their urgency. This led some of the Railway Administrations to presume that Consent to Operate was not required for all sidings/good sheds. Further, the Report of the CPCB, conducted at the behest of audit; highlighted that the standards prescribed for control of pollution –water, air and noise were not being followed at a large number of Railway stations indicating negligence on the part of IR in minimizing pollution level.

The CPCB also failed in framing guidelines for the transport of bulk commodities which are pollution intensive. Most of the SPCBs, also did not play an active role. Besides non issues of guidelines, SPCBs were indifferent to compliance even with the existing regulations.

Non-existence of higher directions from the RB, inconsistent and variable understanding of issues and their importance at the zonal level led to non-compliance with the existing pollution control laws. Even the existing guidelines issued by some of the SPCBs were not complied with.

### **2.7 Recommendations**

- IR needs to formulate a comprehensive environmental policy. It also needs to bring out appropriate guidelines for controlling air and water pollution on its station, yard, work places or in operations in coordination with Central and various State Pollution Control Boards.
- A monitoring mechanism needs to be put in place at all levels within IR including the Railway Board for checking compliance with pollution control laws/ guidelines and implementation of its guidelines/instructions on environment.
- Environment management may be recognized, monitored and reckoned as a key result area for all Zonal and Divisional Railway Authorities and schemes devised to incentivize better performance in this regard.

## Chapter 3 → Management and Conservation of Resources

**Conservation** is an ethic of resource use, allocation, and protection. Its primary focus is upon maintaining the health of the natural world, its fisheries, habitats, and biological diversity. Secondary focus is on materials conservation and energy conservation, which are seen as important to protect the natural world. The consumer conservation ethic is sometimes expressed by the *four R's*: "Rethink, Reduce, Recycle, Repair".

IR is the single largest user of both energy and water in the country. IR consumed about 1.61 billion KWh<sup>42</sup> of electricity during 2010-11 as against the national consumption of 568 billion KWh<sup>43</sup>. Thus the policies adopted by it have a substantial impact on the conservation of both water and energy in the country. The tracks of IR traverse the length and breadth of the country. Thus its policies regarding conservation of forests and wildlife play an important catalytic role in conserving the natural habitat in the country and should act as a trend setter for the rest of the country.

### 3.1 Organisational Structure

In IR, multiple directorates are involved in management and conservation of resources like water, energy, flora and fauna. The Land and Amenities Directorate and Mechanical Directorate are responsible for creation of infrastructure for conservation of water through water recycling plant, rain water harvesting, automatic coach wash plants etc. Electrical Directorate is responsible for formulating policies and implementation of various energy conservation measures. Civil Engineering Directorate is primarily responsible for protection of ecology of flora and fauna alongside the railway tracks.

<sup>42</sup> Figures extracted from Indian Railways Year Book 2010-11

<sup>43</sup> www.indexmundi.com

### 3.2 Conservation of Water

Water conservation can be defined as any beneficial reduction in water loss, use or waste as well as the preservation of water quality. It is a reduction in water use accomplished by implementation of water conservation or water efficiency measures. It refers to reducing the usage of water and recycling of waste water for different purposes such as cleaning, manufacturing, and agricultural irrigation.

There is a general shortage of water in India and in some parts, even drinking water is scarce. Rain water harvesting, waste water recycling, low-water-use flushing, usage of efficient equipment to minimize use of water, etc. are essential for conservation of water.

IR is a major user of water- both for drinking and for cleaning purposes. Water is used for cleaning of coaches and in toilets at stations and trains. Due to the presence of large number of passengers, attendants and vendors etc. the demand for water at stations and trains for sanitary purposes is substantial.

IR has adopted a number of best practices in the field of conservation of water and has issued a number of instructions for improving the efficiency of water use by installing of automatic coach washing plants and reducing the use of fresh water by way of recycling of water and rain water harvesting.

We examined the extent of implementation of the instructions of RB besides efficiency and effectiveness of initiatives of IR implemented in Zonal Railways. Besides at RB, examinations of the records at the zonal level were also examined to assess the quantum of conservation measures initiated or implemented in the zones. In all 212 major and minor stations test checked over 17 zones. The results of examination are discussed below:

#### 3.2.1 Water Recycling Plant

Water recycling refers to reclaiming waste water from industrial, residential, municipal sources, by treating and purifying the wastewater for reuse. Based on the extent of the treatment, the recycled water can be reclaimed and used in the industrial processes, gardening, etc.

RB in July/August 2006 reiterated its instructions that the zones should provide water recycling plants especially at locations like stations and sheds where water is scarce and provision of the same is to be economically justified. Ministry also emphasized the need for use of fresh water optimally and for use of recycled water for non- domestic purposes at stations.

Test check of 212 stations over 17 zones revealed that 13 water recycling plants (WRP) were sanctioned in only five zones. While five WRPs were installed in four zones<sup>44</sup>, the work for installation of eight WRPs was either not started or in progress as indicated below:

Station (Zone)	Year of sanction	Status
<b><i>Work not commenced</i></b>		
Hyderabad (SCR)	2008-09	Discharge of tender thrice for technical reasons and crunch of funds.
Bilaspur (SECR)	2009-10	Pending for want of approved design and drawing.
Lokmanya Tilak Terminus Pune	2009-10	Contract is yet to be awarded.
Ballaharshah (CR)	2011-12	
<b><i>Work in progress</i></b>		
Katni	2008-09	Progress – 50 per cent.
Bhopal	2008-09	Progress – 85 per cent.
Satna (WCR)	2008-09	Progress – 60 per cent.

In 12 zones no provision of WRP has been made (March 2012). No WRP has yet been sanctioned in NWR. Railway Administration stated (March 2012) that the proposal for WRP would be included in phased manner based on availability of funds. Jurisdiction of NWR covers largely desert and semi-dry areas. We observed that despite there being perennial water shortage; no action has so far been taken (March 2012) for installation of WRP at major stations as directed by the RB.

Similarly, none of the major stations in SR, where shortage of water is acutely felt in summer months, were identified for provision of WRP. During Joint Inspection with Railway Officials, we observed that instead of recycled water from WRP, only fresh water drawn from bore wells /Municipal /Corporation sources was being used for all operations such as cleaning of platforms, cement concrete aprons and coaches.

<sup>44</sup> SCR, WCR, SWR and CR

In WCR, the actual availability of water was 80.24 lakh litres per day against the requirement of 110.15 lakh litres of water; only one out of four WRPs sanctioned has so far been installed.

While examining the efficiency of the functioning of WRPs installed in five zones (SCR, SECR, WCR, SWR and CR), we observed that:

- In SWR (Bangalore) and CR (Chatrapati Sivaji Terminus), WRPs were working at 60 and 50 per cent of their installed capacity respectively.
- The WRP installed at Secunderabad (SCR) at a cost of ₹ 0.96 crore was utilized upto only 22 per cent of its installed capacity. This resulted in procurement of water from Municipal Corporation leading to extra avoidable expenditure of ₹ 0.56 crore during the period May 2008 to March 2011.

Thus, we observed that the IR had not made significant progress in making provision of WRP at places where water is scarce. WRPs installed in three zones could not be utilized optimally. Besides lack of initiatives on the part of zonal railways, there was no further initiative at the RB level to expedite the provision of WRPs.

### 3.2.2 Automatic Coach Wash Plants

Cleanliness in trains has often been adversely commented upon by the Parliamentary Committees, other dignitaries and passengers. In September 2008, RB emphasized that the quality of cleanliness and hygiene in trains depends to a large extent on the method of cleanliness adopted in the depots during the maintenance of rakes and directed that Automatic Coach Wash Plants (ACWP) must be part of all green field coaching depots to improve the quality of coach exterior cleaning and to optimize utilization of resources viz. water consumption, saving of time and manpower etc. RB further instructed that ACWPs should be planned for all existing coaching depots in a time frame of the next three years. RB reiterated that the Zonal Railways should place their indents on COFMOW for ACWPs.



We examined the progress of setting up of ACWP in the zones and their performance. We observed that in eight zones (SCR, NCR, NER, SR, SWR, NR,

ECoR and ECR), no provision was made for setting up of ACWPs. The status of provision of ACWP in zones is tabulated below:

Sl. No.	Zone	No. of ACWP sanctioned	No. of ACWP installed	Remarks
1.	NWR	2	NIL	Installation of ACWP was delayed due to yard modeling works at Udaipur and modification of tender conditions in case of plants at Jodhpur.
2.	MR	1	NIL	Target for commissioning by December 2013.
3.	SECR	1	NIL	Not procured due to space constraints for installation at Coaching Depot/Bilaspur & Durg.
4.	WCR	1	NIL	Tender is yet to be finalized.
5.	SER	3	1	Not installed for want of suitable sites.
6.	NEFR	2	1	Remaining plant is out of order since February 2008.
7.	ER	3	2	Tender is yet to be finalized.
8.	CR	2	2	
9.	WR	2	2	
<b>TOTAL</b>		<b>17</b>	<b>8</b>	

From the table above, it was observed that out of total 17 ACWPs sanctioned by the RB, eight ACWPs had been commissioned in five zones and the works in respect of the balance 9 ACWPs in seven zones were either in progress or not taken up for delay in selection of site/ specification and selection of the plant, etc.

The impact of not commissioning of ACWPs on the water conservation efforts of IR was examined and the following were observed

- i. In SER, out of the three ACWPs sanctioned, only one was commissioned at Hatia. The works for installation of the remaining two plants at Tatanagar and Santragachi were held up due to failure in selection of sites. This resulted in non-achievement of savings of 10512 Kilo litre of water per annum, as assessed by the Railway Administration;

- ii. In CR, out of two ACWPs sanctioned; only one was commissioned at Lokamanya Tilak Coaching Depot. It was observed that the installation of ACWP led to a saving of 276 Kilo Liters consumption of water per day besides reduction in the cost of cleaning from ₹ 132 to ₹ 52 per coach;
- iii. In NEFR, an ACWP installed at New Guwahati in 2006 at a cost of ₹ 0.30 crore had remained unutilized since May 2008 due to a technical breakdown;
- iv. An ACWP with a capacity to wash 4 to 5 rakes per day was installed in October 2008 at Bandra Terminus Coaching Depot of WR. The saving in consumption of water was projected at 5400 liter per rake. The plant remained idle since April 2011 as the Railway Administration executed a mechanised cleaning contract which included external cleaning of coaches;
- v. In SR, an ACWP imported from UK at a cost of ₹ 2.25 Crore could not be commissioned at Basin Bridge Coaching Depot due to space constraint. It remained idle between March 2007 and July 2010 before being transferred to Central Railway. This aspect was highlighted in Para 4.1.3 of the Comptroller and Auditor General of India's Report No. CA 19 of 2008-09. The plant is yet to be installed and thereby defeating its objective of improvement of coach washing with minimum use of water.

Thus, we observed that the benefits of ACWPs are yet to be availed of in 12 zones. Delay in installation of nine ACWPs was indicative of a lack of urgency in water conservation. Further, in some zones, ACWPs installed were either not utilized or sub-optimally utilized thereby defeating the objective of constructing ACWPs.

### 3.2.3 Rain Water Harvesting

Rainwater harvesting (RWH) is the accumulation and storage of rainwater for reuse before it reaches the aquifer. The rain water so harvested is stored at surface or in sub-surface aquifers. RWH mitigates the effect of drought, improves ground water level and is environment friendly.

In May 2003, Ministry of Water Resources requested IR to make provision for rain water harvesting in all future Railway constructions. Accordingly, RB issued (February 2005) instructions to zones for implementation of RWH system.

Review of the status of implementation of RB's directives at 212 selected stations revealed that roof top water harvesting systems were installed at only seven

stations in five zones (SER, WCR, SR, SWR and WR). There was no system of monitoring implementation of the instruction of the RB.

The slow implementation of water conservation measures was indicative of the low level of urgency attached to water conservation, despite huge imbalance between demand and supply of water.

### 3.3 Conservation of Energy

Sustained economic growth of any economy is largely dependent upon availability of adequate energy and its efficient use. An Expert Committee<sup>45</sup> set up by the Planning Commission to formulate an integrated energy policy highlighted the importance of lowering the energy intensity of GDP growth through higher energy efficiency. The Report noted that a unit of energy saved by a user is greater than a unit produced, as it saves on production losses as well as transport, transmission and distribution losses. In the context of the IR, the Committee recommended promotion of the system of urban mass transport, energy efficient vehicles and freight movement by Railways through scheduled freight trains. The Committee also emphasized greater reliance on renewable sources of energy.

In IR, the expenditure on fuel constitutes a major portion of their Working expenditure. The total expenditure on fuel during 2010-11 was ₹ 10503 crore and constituted about 15 per cent of their total ordinary working expenses. Thus, fuel being a major cost element, needs greater focus for detection of areas of high energy wastage and adoption of energy saving techniques to realize a cost effective energy system with least environmental impact. In fact, the Energy Conservation Act, 2001 classifies IR as an energy intensive industry. IRs had issued various guidelines from time to time and fixed targets/norms for efficient use of fuels /electricity.

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<sup>45</sup> Under the chairmanship of Dr. Kirit S. Parikh

### 3.3.1 Use of Energy Efficient Fittings

In May and July 2008, RB advised the Zonal Railways to fix action plan / targets for energy consumption (non-traction) by adopting various energy conservation measures through energy efficient devices. Some major energy efficient measures implemented in the zones were segregation of 70/30 lighting circuits<sup>46</sup> at platform, replacement of HPMV lamps with metal halides lamps, use of CFL fittings in place of 60/40 watt incandescent lamps, use of T-5 fluorescent tube etc. RB had also fixed target for implementation of the above measures.



Sensor for 70/30 segregation at Kurnal Station, SCR

We have examined the extent of implementation of energy efficient measures by the zones with reference to the target set by the Zonal Railway administration. IR assessed a saving of 860.25 lakh KWh of energy worth ₹70.20 Crore in 17 zones as a result of adoption of following energy efficient measure. Status of implementation of energy efficient measures is indicated below:

Sl. No.	Areas of activities	Target of the Railway Administration	Status (As of March 2011)
1.	Segregation of 70/30 lighting circuits at platform	100 per cent by December 2009	All zones except SER, ECR and NR achieved the targets set.
2.	Use of solar panels at stations	5 nos. of 10 kw solar panels per division in 2009-10	Only SWR achieved the target. While there was no progress in four zones (NCR, ECoR, SER and ECR), the status of progress in five zones (SECR, NEFR, NR, WR and CR) ranged between 20 and 50 per cent and the progress in SR was only 7 per cent. The records relating to progress in six zones (SCR, NWR, MR, WCR, NER and ER) were not available.

<sup>46</sup> Automatic illumination of station sensing the train arrival and an automatic switch of 70 per cent of lights after three minutes of the departure of train.

3.	Replacement of HPMV lamps with metal halides lamps	100 per cent by March 2011	Out of twelve zones, where the achievement could be assessed, in 10 zones+, achievement was more than 70 per cent and in one zone (SECR), there was no progress.
4.	Use of CFL fittings in place of 60/40 watt incandescent lamps	100 per cent by March 2011	Except Metro Railway (12 per cent) and WR (35.45 per cent), other zones almost achieved their target.
5.	Use of T-5 fluorescent tube	100 per cent by March 2012	While the achievement of six zones (SECR,SR,SWR,ECR,CR and NR) was in the range of 23 per cent to 46 per cent, the achievement in seven other zones (SER, NCR, MR, NEFR, NER, ECoR and WR) was 57 to 86 per cent. Achievement in respect of remaining four zones could not be ascertained.
6.	Timer switches in High Mast Towers	100 per cent by March 2012	Out of eleven zones where records relating to achievement were available, achievement in 4* zones was 6 to 42 per cent and in the remaining seven zones (SER, SWR, NEFR, ECoR, ECR, SECR and CR), achievement was between 60 and 97 per cent.

+SER,NCR,SR,NEFR, ECoR, ECR, CR ,SWR and NR \*SECR,SR,NCR and NR

Thus, the achievement of IR in implementation of vital energy efficient measures was commendable excepting the areas like use of solar panels at stations and use of T-5 fluorescent tube. Further, non-availability/non-maintenance of records relating to the achievements and quantification of savings due to adoption of energy efficient measures was indicative of lack of priority in implementation and monitoring at RB level.

While admitting the audit contention regarding slow progress in adopting energy conservation measures in some areas, Ministry of Railways (MR) stated (October 2012) that works related to energy conservation were being planned regularly and progressively by the Railway Administration subject to availability of funds. MR also stated that the high cost, frequent theft, shortage of skilled labour and availability of funds were the primary reasons for under achievement in the use of solar panels. MR asserted that non traction energy consumption during the period 2008-12 remained almost constant despite 4-5 percent increase in connected load

per annum. The fact however, remains that it has not been possible to quantify the energy saved due to adoption of energy conservation measures.

### 3.3.2 Use of Renewable energy

A natural resource is a renewable resource, if it is replaced by natural processes at a rate comparable or faster than its rate of consumption by humans. IR is the single largest consumer of diesel and electricity in the country and thus its energy policy has a significant impact on the energy scenario of the nation. To handle its vast freight and passenger traffic, IR operates as many as 5,137 diesel powered and 4033 number of electric locomotives. These locomotives consume 2567.37 million liters of diesel & 16105.00 million units of electricity<sup>47</sup>.

The Expert Committee set up by the Planning Commission emphasized the need of greater reliance on renewable sources of energy. Unlike fossil fuels, most renewable energy sources do not release carbon dioxide and other air pollutants as by-products into the atmosphere.

In the “IR Vision 2020 statement”, several measures for reducing carbon foot print were envisaged. One of the measures was to use at least 10 percent energy from renewable sources such as solar power, biomass, CNG and wind energy etc. The Minister for Railways, in her Budget Speech, declared 2011-12 as the “**Year of Green Energy**” and brought out some of the green measures viz. use of solar energy at level crossing gates, windmill etc. initiated by the IR. The energy conservation policy of IR envisaged use of non-conventional energy sources including the use of solar panels at stations, LC gates, use of wind energy for non traction purposes etc.



Different types of solar water heaters provided at Tiruchhcirappalli,SR

<sup>47</sup> Figures quoted from the Indian Railways Year Book 2010-11 and pertain to the year 2010-11.

### 3.3.2.1 Use of renewable energy at manned level crossing gates

RB issued instructions (March/May 2007) to provide solar based water heating systems for running rooms, rest houses, hospitals and base kitchens and also for provision of solar panels at level crossing (LC) gates. As per instructions (March 2007), the Zonal Railways were directed to install solar based lighting system at all manned Level Crossings.

RB also proposed (September 2008) that CR, NWR, ECoR, SR, SCR, SWR and WR should gain experience by providing a hybrid system<sup>48</sup> consisting of solar and wind energy at 3 locations each on trial basis for electrification of LC gate or wayside halt stations, etc.

We examined the extent of implementation of solar based/hybrid lighting system at all manned Level Crossings during the years 2007-11 as per RB's instructions and their performance. The status of achievement of electrification of solar based / hybrid lighting system at all manned Level Crossings are tabulated below:

Zone	Target for electrification of manned LC		Target Achieved		Whether Target achieved	Shortfall in achievements (in %)	
	Using Solar	Using Hybrid	LC electrified using Solar	LC electrified using Hybrid		LC electrified using Solar	LC electrified using Hybrid
SCR	No Target		190	1	NA		
NWR	33	0	57	0	Yes		
SER	25	0	48	0	Yes		
SR	5	3	40	1	Yes		66.67
NFR	175	0	251	0	Yes		
WR	76	0	143	1	Yes		
NER	319	0	328	0	Yes		
CR	91	1	91	1	Yes		
ER	91	3	91	3	Yes		
NCR	389	0	329	0	No	15.42	
SECR	103	0	58	0	No	43.69	
WCR	354	1	208	1	No	41.24	
SWR	70	5	22	1	No	68.57	80.00

<sup>48</sup> Hybrid system uses both solar and wind energy

ECOR	80	0	67	0	No	16.25	
ECR	1896	0	428	0	No	77.43	
NR	1984	0	594	0	No	70.06	
Totals	5691	13	2945	9		48.25	30.77

From the status of implementation, we observed the following:

- Out of a target of 5704 manned level crossings, 51 per cent (Solar-2945, Hybrid-9) were electrified using solar energy and hybrid system during 2007-11. The works in respect of 704 level crossings (Solar-602, Hybrid-102) are in progress.
- 7 out of 15 zones<sup>49</sup> could not achieve the target set for electrification of manned level crossings.
- In seven zones (SCR, WCR, SR, ER, CR, WR and SWR), 9 out of a target of 13 level crossings were electrified with hybrid system. There was shortfall in achievement in respect of SR and SWR, where out of eight manned level crossings; only two level crossings were electrified with hybrid system.
- Seven zones (NCR, SECR, WCR, SWR, ECoR, ECR and NR) could not achieve the target of electrification of level crossings using solar energy. In five zones (SECR, WCR, SWR, ECR and NR), the shortfall ranged between 41.24 to 77.43 per cent.



Solar Panel at manned level crossing between Darazpur - Mustafabad section, NR

Further scrutiny revealed that:

- In SCR, there was a decline in the pace of electrification of LC gates through solar power during the period of review. During 2007-08 and 2008-09, 94 and 72 LCs was electrified through solar power whereas in 2009-10 and 2010-11, only 18 and 6 LCs respectively were electrified. The reasons for declining trend could not be ascertained from the records of the Railway Administration.

<sup>49</sup> Achievement in respect of SCR could not be assessed due to absence of target

- 22 solar panels out of total 91 installed in electrification of level crossings in ER had been stolen.

Thus, the overall achievement of the IR in electrification of level crossings with solar panel was far below the target set for the period 2007 to 2011. There was no system in place to monitor or document performance of level crossings energized with solar panels or hybrid system. There was also no system of quantification of benefit accrued to Railways as a result of implementation of solar panels/hybrid system in electrification of level crossings.

Ministry of Railways stated (October 2012) that the level crossing gates only in non-electrified territory were being provided with solar panel/hybrid system on need basis subject to availability of funds. The reply of the MR was, however, silent about the reasons for failure to achieve the *target of electrification with solar panels/hybrid system*.

### 3.3.2.2 Wind Power Plants

Power generation through wind is one of the most rapidly adopted and cost effective renewable energy technologies. The wind potential is particularly high in coastal states of Tamil Nadu, Andhra Pradesh, and Karnataka, some parts of Maharashtra, Gujarat and in Rajasthan. It has added advantage of earning for the technology user, additional revenue in the form of carbon credit that could accrue from production of wind energy.

We examined the initiative of IR in tapping wind energy and the progress in setting up of wind power plants. Examination of the records of the Railway Administration revealed the following:

- Four wind power plants had been sanctioned during 2010-12 in three zones (NWR, SR and WR). While the works relating to two plants (WR and NWR) were in the early stages of progress, the progress in respect of the remaining two plants was in contractual stage.
- The proposals of two zones (SWR-3 and NEFR-1) for setting up of four wind power plants are still under process at the RB level.
- In SR, two small wind mill units of 2 KW capacities were installed at Aduthurai and Kallukuzhi Stations in Tiruchirappalli Division in April 2010. No record was being maintained regarding energy generated out of these two units.

- RB did not approve the proposal of SCR for setting up of one wind power plant.

Thus, IR failed to make a major progress in tapping wind energy. During the period of review (2007-12) only four wind power plants were sanctioned in 3 zones. This indicated a lack of urgency on the part of IR in exploiting cleaner and alternative renewable sources of energy.

### 3.4 Carbon Credit under Clean Development Mechanism

Clean Development Mechanism (CDM) defined in Article 12 of the Kyoto protocol<sup>50</sup> allows a country with an emission reduction under obligation to implement an emission-reduction project in developing countries. Such a project can earn tradable certified emission reduction (CER), each equivalent to one MT of CO<sub>2</sub>. The purpose of this program was to reduce emissions of Green House Gases (GHGs) as well as to promote sustainable development in the host countries. Therefore, developing countries, such as India are expected to gain financial and environmental benefits by reducing the emission of GHGs.

IR has the potential to save energy by introducing locos with regenerative braking features, setting up of wind mills, installation of solar panels, etc. In order to claim CER, the project is required to be registered with National Clean Development Mechanism Authority (NCDMA) and obtain a host country approval.

In IR, only two projects have so far been registered under CDM. One project is replacement of incandescent lamps (ICLs) with compact Fluorescent lamps (CFLs) in Railway's residential quarters and the other project involves using EMUs with three-phase insulated gate bi-polar transistor (IGBT) technology and regenerative braking, for use along the Western and Central Railway corridors in suburban Mumbai. The regenerated electricity reduces the consumption of an equivalent amount of grid electrical energy, thereby conserving electrical energy and reducing net greenhouse gas emissions. The progress of induction of three phase electric locos with regenerative braking features is discussed below.

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<sup>50</sup> The Kyoto protocol is a legally binding agreement that arose out of the United Nations Framework Convention on Climate Change (UNFCCC) to tackle climate change through a reduction of green house gas emissions.

### **3.4.1 Three Phase EMUs/Electric Locos with Regenerative braking**

MR decided to replace the existing Electrical Multiple Units (EMUs) with the new ones fitted with regenerative brakes by adopting three phase technology with Insulated Gate Bi-polar Transistor (IGBT) based system initially in Mumbai suburban area of Western & Central Railways. This was later extended to other zones. During braking, the system is capable of regenerating 25 to 30 per cent of the energy used and these passenger trains have the ability to draw the same from the Over Head Equipment (OHE). The regenerated electrical energy reduces the consumption of equivalent grid electrical energy required by the powering train, thereby conserving electrical energy. This is expected to save the Railways ₹ 200 crore annually on energy.

The Designated National Authority (DNA) which is under Ministry of Environment & Forests has accorded host country approval (January 2009) for this project under Clean Development Mechanism (CDM). World Bank is working for registration of this project with United Nations Framework Convention on Climate Change (UNFCCC).

Review of consumption of energy by adopting three phase locomotives revealed that IRs had inducted 1566 three phase electric locomotives in nine zones (March 2011). The average savings in consumption of energy ranged between 12 to 26 per cent as against the envisaged level of 25 to 30 per cent.

However, savings in energy consumption due to regenerative braking features installed in three phase EMU rakes in suburban sections was much higher. In CR, energy savings ranged between 30 and 50 per cent during the review period and the range was between 31 to 36 per cent in WR.

The project of regenerated braking feature was submitted for validation in April 2010. Till March 2012, no carbon credit could be earned or realized.

## **3.5 Energy Audit**

Energy audit encompasses verification, monitoring and analysis of use of energy, including submission of recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption. On the basis of guidelines issued by Bureau of Energy Efficiency (BEE), RB directed (July 2007/2008) all Zonal Railways to conduct energy audit of areas like major administrative buildings, hospitals, pumping installations, loco sheds, major railway stations and workshops as a onetime exercise and send the reports to

them. Subsequently, RB (July 2008) directed that energy audit of all Traction sub stations and workshops<sup>51</sup> of IR was also to be taken up periodically. All these establishments had been notified by BEE as energy intensive consumers.

The progress of energy audit conducted in 17 zones and status of implementation of recommendations of energy auditors revealed the following:-

- No energy audit was conducted in three zones (SER, ECR and SECR).
- In the remaining 14 zones, 30 energy audits were conducted in workshops, traction sub-stations, pump houses, service buildings, etc. of the zones. Energy auditors made 149 recommendations for improving energy efficiency.
- While 48 out of 149 recommendations were not implemented in seven zones<sup>52</sup>, partial implementation was noticed in respect of 18 recommendations. The reasons for non-implementation of recommendations of energy auditors were attributed to constraint of funds, lack of feasibility to implement etc.
- Energy audit of 12 Traction Sub- Stations was conducted. In all cases, recommendations were either partially implemented or no targets were fixed for implementation of the recommendation of the energy auditors.

Thus, there was a lack of system at the RB level for monitoring the progress of energy audit and implementation of their recommendations. The slow progress of energy audit and implementation of their recommendations indicated a lack of urgency towards conservation of energy.

Ministry of Railways (MR) stated (October 2012), that the IR had adopted the technique of sample energy audit for one type of asset as the cost of energy audit per installation varied between two to four lakhs and the findings of one/two energy audits of a similar type of asset was sufficient to make an action plan for energy conservation. MR also stated that the scope of energy conservation in traction substation was limited. Regarding implementation of the recommendations of energy audit, MR asserted that some suggestions were not accepted due to operational requirement.

Contention of the MR was not acceptable as it was contradictory to its own instructions (July 2008). Further, no action plan for energy conservation measures

<sup>51</sup> Traction sub-station and workshops are energy intensified units due to consumption of substantial electrical energy

<sup>52</sup> NR,CR,SR,WCR,MR,NWR and SCR

had been drawn for implementing across zones on the basis of the recommendations of energy auditors.

### 3.6 Bio-diesel

Bio-diesel is a plant based renewable and cost effective fuel. It is biodegradable and non-toxic. Bio-diesel can help reduce emissions of many air pollutants such as particulate matter, carbon monoxide, hydrocarbons, sulphur oxides, nitrogen oxides, and air toxics. Bio-diesel can be made from renewable resources, including non-edible oils of *Jatropha*, *Curcas*, *Karanja* plants, *Sal*, *Mahua*, *Neem*, *Rubber*, *Linseed*, *Castor*, etc. Bio-diesel can also be manufactured from Lard and other waste animal fats, waste fish oil and vegetable fats.

The use of bio diesel blend of up to 20 percent does not require any engine modification. A blend of 20 percent biodiesel and 80 percent petro-diesel (B20) is generally used in IR. A B20 blend would be able to achieve an overall annual reduction in consumption of 489.84 million litres of petro-diesel<sup>53</sup>.

For production of bio-diesel, two bio-diesel plants were established in June 2006 and November 2003 at Kharagpur (SER) and Loco Works, Perambur respectively.

We examined the performance of bio-diesel plants and observed the following:

- The Bio-diesel Esterification Plant of 2000 litre capacity commissioned in 2006 at Kharagpur at a cost of ` 0.29 crore produced 8803 litre of bio-diesel during 2006-10. No Bio-diesel was produced thereafter, due to non-availability of good quality seeds;
- In Loco Works, Perambur (SR), bio-diesel was being produced using Pungam seeds procured from the open market and used edible oil obtained free of cost from hotels. During the years 2008-11, the capacity utilization of the bio-diesel plant was only in the range of 12 to 16 percent. The under utilisation was due to short supply of raw material which was not envisaged at the time of setting up of the plant. Besides Southern Railway, various non governmental organizations resorted to large scale plantations with the aid of Tamil Nadu State Government. Government of India also identified Tamil Nadu for large scale plantations of bio-diesel plant. As a result of non-utilisation of the plants to its full capacity, the objective of development of an alternative fuel could not be effectively achieved.

<sup>53</sup> RDSO Report on Bio-diesel (2003)

- During 2006-07, RB sanctioned two projects for use of bio-diesel as an alternative fuel for traction purposes. One project was for the conversion of 100 Diesel Electric Multiple Units (DEMUs) to dual fuel mode using CNG and diesel and the other was for setting up of four bio-diesel esterification plants for the production of bio-diesel. To implement these projects, an organization viz., Indian Railways Organization on Alternate Fuels (IROAF) was set up in 2008 by RB. The aim of the organization was to harness the bio-diesel potential and extend the use of CNG and other alternate fuels /non conventional sources of energy.

We also observed that the contracts were executed in April 2011 and May 2011 for setting up of plants at Tondiarpet (SR) and Raipur (SECR) respectively. While the work of setting up of bio-diesel plant at Raipur was in progress, there was no progress in respect of plant at Tondiarpet as of March 2012 except identification of land.

Thus, the initiative of IR for production of bio-diesel remained largely unsuccessful as the existing bio-diesel plants could not yield desired results due to short supply of raw materials, a prime factor which should have been taken into consideration before setting up of plants.

### **3.6.1 Jatropha plantation**

In January 2003, RB directed all the Zonal Railways to take up work of plantation of Jatropha Curcas on as much Railway land as possible for production of bio-diesel. RB's correspondence (November 2005) revealed that one jatropha plant can generate at least one litre of bio-diesel during a year and each tree starts bearing fruits in two years.

In February 2003, RB signed an Memorandum of Understanding (MOU) with Indian Oil Corporation (IOC) whereby Railway agreed to provide 500 hectare of land to IOC at a nominal lease charge of ` 1 per annum for a period of 15 years for Jatropha plantation and setting up of facilities for production of biodiesel. The IOC however had taken possession of only 188.49 hectares and planted trees only in 70 hectares across various zones. The effort of the Railways as well as of IOC towards production of bio-diesel were not found satisfactory as the plants on which an expenditure of ` 4.35 crore was incurred died prematurely. This was highlighted vide Para No. 3.5.2 of Comptroller & Auditor General of India's Report No. 6 of 2008 (Railways). Though the MR contended that the IR had not

incurred any expenditure and the Railway land got protected due to plantation, the very objective of exploring an alternative source of fuel was defeated.

We examined the records relating to Jathropa plantation over 16 zones and their survival rate and observed the following:

- Except NEFR, none of the zones could achieve the target set by the RB for plantation of Jathropa during the period 2006-11. Further, the survival rate was very low (up to 38 percent) in seven zones (NWR, WCR, SECR, NEFR, ER, ECR and WR). Low survival rate was attributed mainly to inadequate manpower for maintenance. Survival rate in five zones (SER, NCR, SR, ECoR and NR) ranged between 61 to 97 per cent. No records were being maintained in zones in respect of yield of seeds and their usage.
- In NEFR, 23.02 lakh Jathropa were planted during the period 2006-11 incurring an expenditure of ₹ 2.67 Crore. Only 23 per cent of them survived yielding only 6783 Kg. of seeds which were sold for ₹ 0.24 lakh.
- 61.22 per cent (95.93 lakh) of 136.61 lakh jathropa plantation done over 16 zones during 2006--09 could not survive. As a result, IR could not generate 9593.24 KL of bio-diesel which could have saved equivalent quantity of diesel oil worth ₹ 30.28 crore<sup>54</sup>.

Thus, IR failed in achieving desired objective of developing alternative source of fuel through production of bio-diesel from Jathropa. Despite its insignificant use for production of bio-diesel, the need of continuance of Jathropa plantation was not reviewed and the wasteful expenditure on Jathropa plantation continued.

### 3.7 Conservation of Forests and Wildlife

Article 48 of the Constitution of India specifies that, "The state shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country" and Article 51-A 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".

Conservation of wildlife involves the protection of entire ecosystems. Trains can disrupt local ecosystems in irreparable ways. A diversity of flora and fauna live alongside the railway lines. The flora and fauna in some areas is sufficiently

<sup>54</sup> Calculated as per rate contract dated 11.08.2009 for procurement of HSD Oil @ ` 31561.49 per KL.

distinctive to be of scientific value. To maintain operational safety, line side vegetations have to be managed in a sympathetic manner.

### 3.7.1 Railways' approach to protection of wild animals

A Railway line passing through a rural/forest area can interrupt migration patterns, destroy habitat and even kill animals attempting to cross the track. In India, a large number of wild species are being killed annually due to accidents in Railway track and highways, but data maintained are very meager. Data are, however, available only for large animals like elephants.

Animal mortality due to train hits, apart from causing loss of animals can also cause severe loss to the Railways. In certain cases it could lead to derailment of the train, damage to the track, wagons and coaches; injury and death of passengers and/or detention of the train. Sixty-seven animals died during the review period, 2006-11, which included 62 elephants and one lion. The majority of elephant deaths occurred in NEFR where 43 elephants died followed by SR where 10 elephants died.

In March 2010, Ministry of Railways and Ministry of Environment & Forests jointly issued general advisories to prevent train accidents involving elephants. General advisories included measures like clearance of vegetation alongside the tracks sensitising programmes for train drivers/guards, keeping the track free from food wastes and engagement of elephant trackers.

We test checked the extent of implementation of above measures in three zones (SER, SR and NEFR) where the rate of animal mortality was high.

- The measures as mentioned in the general advisories were implemented in NEFR except the construction of forest underpasses/over passes across railway tracks<sup>55</sup> which were under progress.
- SR had taken a number of preventive measures like imposition of speed restriction, provision of warning boards, regular clearing of vegetation on sides of track for better visibility etc. The issue was also taken up by audit with Southern Railway Administration in June 2011 through a Study

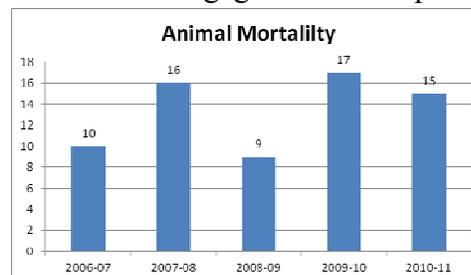


Guided Crossing of elephant by forest officials, Nilambur, Palghat Division, SR

<sup>55</sup> For safe passage of elephants in accident prone areas between Alipurduar and Siliguri section

Report. In response, Railway Administration stated (September 2011) that the long term measures were under scrutiny. They also stated that rail fencing had already been provided in forest areas between Ettimadai and Madukarai stations in Palakkad- Podanur section.

- In SER, it was however, observed that neither any sensitizing programme was being conducted nor any action was taken for engagement of elephant trackers. Besides, no specific clause was incorporated in the agreements with IRCTC for proper disposal of wastes in order to keep railway tracks free from food wastes.



Despite implementation of a number of preventive measures, the animal mortality due train hits had not declined.

### 3.8 Setting up of Eco park

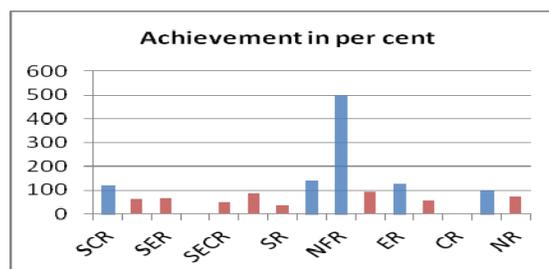
Railway Minister, in her Budget speech of 2010-11, announced the setting up of 10 Rail Eco-parks to conserve, protect and promote Railways’ wet lands and forest areas. The Parks were planned in different zones. Proposed Eco-Parks would provide facilities like herbal garden, nursery with rare plants, jogging track, gymnasium, health club, meditation centre, amphi-theatre etc. so as to develop natural environment with regional flora and fauna in the eco-parks, to provide a harmonious and natural environment.

We observed that no eco-park has so far been set up in IR.

### 3.9 Afforestation

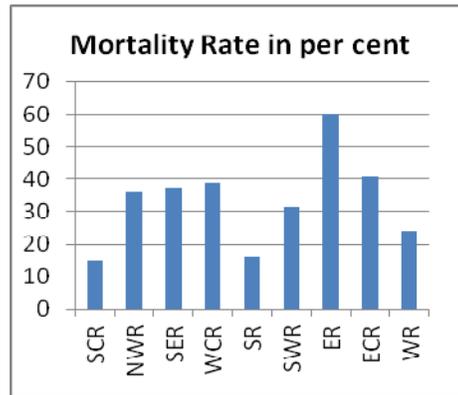
In terms of Para 702 of Indian Railway Works Manual (IRWM), each Division should prepare 'tree planting plan' for every subdivision and plantation work should be carried out accordingly. On all construction projects, provision should be made in the estimate for bulk afforestation in vacant land as an environmental improvement measure. Accordingly, afforestation measures were taken up in zones.

We examined the afforestation measures taken up by the zones and their achievement with reference to



the RB’s target besides assessment of mortality rate. We observed that:

- Out of 15 zones, target for plantation was achieved<sup>56</sup> in five zones (WR,ER,NEFR, SWR and SCR);
- In the remaining 10 zones<sup>57</sup>, achievement was in the range of 59 to 96 per cent except in SECR and SR where the achievement was 49 per cent and 37 per cent respectively ;



- Average mortality rate of plantation was in the range of 15 to 41 per cent in eight zones (SCR, NWR, SER, WCR, SR, SWR, ECR and WR) except in ER where average mortality rate was 60 per cent.

### 3.10 Conclusion

IR has issued a large number of guidelines for the conservation of resources- both energy and water. However, their implementation is very low key and slow, indicating Railways lack of enthusiasm. Though guidelines have been issued for reducing the consumption of both water and energy and steps have been initiated for recycling water usage in the absence of proper emphasis and monitoring, its implementation leaves much to be desired. The actual performance on the ground is below par.

The installation of the Automatic Coach Wash Plant leads to a substantial reduction in water use. There has, however, been a substantial delay in both sanctioning and installation of ACWPs. Further, IR also initiated a number of measures like provision of Water Recycling Plants and Rain Water Harvesting systems etc. for conservation of water. However their pace of implementation was also slow.

A number of detailed instructions have been issued by IR for conservation of energy and greater use of renewable energy. However, IR was unable to achieve its targets for adopting energy efficient devices. Audit also observed that the focus here was on use of energy for non-traction purposes on which only a small proportion of expenditure is incurred. Further, the IR has still not been able to

<sup>56</sup> Indicated by Blue bar

<sup>57</sup> Except NCR and CR where relevant records were not available

earn any Carbon Credit under Clean Development Mechanism, despite two projects being registered with CDMA for that purpose.

The implementation of recommendations of Energy Auditors was patchy and slow which indicated the inconsistent attitude of IR towards the conservation of energy. We also observed that the production of bio-diesel was low and that the constructions of two more sanctioned plants were progressing very slowly.

Railway tracks traverse through dense forests and hence conservation of forests and wildlife assumes importance. Steps taken by the IR to protect the flora and fauna were not adequate, as animal mortality due to train hits remained high.

### **3.11 Recommendations**

- To conserve water, measures like Water Recycling Plant, Automatic Coach Wash Plants and Rain Water harvesting system need to be implemented expeditiously by IR.
- IR needs to take urgent and effective steps to explore across the country scope for and to maximizing the use of alternative sources of energy besides taking initiatives in conservation of energy. The targets set for adopting energy efficiency measures need to be effectively implemented.
- Adequate effort needs to be put in to implement the long term measures for prevention of animal mortality. For this, the monitoring mechanism at the Railway Board's level should be strengthened.

## 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.

**(B.B. PANDIT)**

**New Delhi**

**Deputy Comptroller and Auditor General**

**Dated:**

**Countersigned**

**(VINOD RAI)**

**New Delhi**

**Comptroller and Auditor General of India**

**Dated:**

Environment Management in Indian Railways

Zone	Stations						Sidings		Goods sheds		Trains		Section	
	A-I	A	B	C	D	E	Name	location	Name	Commodity	T.No.	Name	SSE/P.Way	name
SCR	Secunderabad	Nanded	Kurnool Town	NIL	Hi-Tech City	Akkannapet	Global Coal mining Ltd.	Asifabad	Jaggayyapet Town	Cement, Clinker, IW Coal	12285/86	Duoronto Exp.	SSE/P.Way	Akot
	Vijayawada	Kacheguda	Machilipatnam		Miryalooguda	Rangapuram	BPCL, HPCL	Cherlapalli	Pandaripavani	OW Coal	12715/16	Sachkhand Exp.	SSE/P.Way	Bellampalli
		Guntur	Dornakal Jn.								12759/60	Charminar Exp.		
		Guntakal	Nagarsole								17607/08	Tungabhadra Exp.		
											347	Pass.		
RPU	no caterization					NO			NO		NO		NO	
NER	Lucknow Junction	Kathgodam	Bhatni	Badshahnagar	Tanakpur	Gauri Bazaar		Lalkuan	Deoria	Cement, fertilizer	15035	KGM-DLI	SSE/P.Way	Tikonia
	Gorakhpur	Basti	Kasganj	Lucknow City	Nautanwa	Maghar		Baitalpur	Basti	Iron Ore, coal, coke, fly ash	12511	GKP-TVC	SSE/P.Way	Pilibhit
		Deoria	Manakpur								55189	GD-BE		
											11016	GKP-LTT		
											15007	MUH-LJN		
SECR	Bilaspur	Raigarh	Dongargarh	NIL	Pendra Raod	Jairamnagar	POL Siding	Bhilai	Kharisa	Cement, fertilizer, iren ore, coal, coke, flyash	18239/40	Nagpur Exp.	SSE/P.Way	BSP
	Raipur	Durg			Akaltara	Belha	New Kusumunda Colliery	Korba	Baraduar		12855/56	Intercity Exp.		Raipur
		Gondia									8236/35	Pass.		Nagpur
											18234/33	Narmoda Exp		
											2851/52	Superfast Exp		
											2849/50	Superfast Exp		
											2069/70	Jan Shatabdi		
											405/06	Pass.		
											401/02	Pass.		
											1ABAM/2	Pass.		
SER	Tatanagar	Kharagpur	Chakradharpur	Santragachi	Muri	Salboni	TISCO	Noamundi	Nimpura	Cement, Slag, Clinker, Coal, Coke	12841	Coromondal Exp	SSE/P.Way	Manoharpur
		Rourkela		Panskura	Bishnupur	Madpur	Bhojudih washeries served by Santaldih	SNTD/ADA	Jhargram	iron ore,	12021	Jan Shatabdi	SSE/P.Way	Muri
		Chakradharpu									58021	Pass.		
		Bokaro Steel City									12871	Ispat Exp		
		Adra									18001	Kandari Exp		
NR	New Delhi	Delhi Shahadara	Kurushhetra	NIL	Ganaur	Garhi Harsaru	GACL	Roopnagar	Moga	cement, iron ore, fertilizer, coal, coke fly ash	12236	Rajdhani	SSE/P.Way	Haridwar
	Lucknow	Firozpur Cant	Faridkot		Dhandari Kalan	Goraya	NFL	Bhatinda	Jagran		12011	Kalka Shatabdi		Dehradun

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	Varanasi	Barabanki	Abohar								12925	Pashchim Exp		Jammu Tawi
		Moradabad									19105	ADI mail		UHP
		Rajpura									305	Pass.		
CR	Mumbai CST	Bhusawal	Pandharpur	Ambernath	Igatpuri	Ankai	TATA TPS	Trombay	Cement	NGSM	12105/06	Vidarbha Exp	SSE/P.Way	Lonawala
	Pune	Ballarshah	Sewagram	Shivajinagar	Roha	Hotgi	TTPS		Coal, Iron, Steel	Wani goods	12071/72	Jan Shatabdi	SSE/P.Way	Thane
							HPCL	Loni			11327/28	Pass.		
											12123/24	Deccan Queen		
NCR	CNB	FTP	PHD	NIL	BDL	TBT	Thermal Power House	IOC-BAD	Jhansi	Iron, Coal, Fly ash	11124	Chhapra Exp.	SSE/P.Way	ALD
	Jhansi	LAR	Babina		KSV	Bad			Mathura		12033	Shatabdi	SSE/P.Way	MBA
		AGC									361/51901	Pass.		
											12625	Kerala Exp		
NWR	Jaipur	Ajmer	Nagour	NIL	Devpura	Rana Pratap Nagar	Shree Cement	BNGM	Kanakpura		19708	Exp.	SSE/P.Way	Rana pratap Ngr.
	Jodhpur	Bikaner	Hanumangarh		Karjoda	Jalore	Suratgarh Thermal Power		Merta Road		12988	Exp.	SSE/P.Way	Jodhpur
		Alwer									14854/64	Exp.		
		Jaisalmer									12240	Exp.		
WCR	Jabalpur	Katni	Gangapur City	NIL	Ashoknagar	Niwar	loose commodity	Bhitoni	Kachhpura	cement, fertilizer, iron ore, coal, coke fly ash	12061	Exp.	SSE/P.Way	Ramganj mandi
	Bhopal	Itarsi			Hindan City	Bundi		ACC Lakhery	Kota		12189	Exp.	SSE/P.Way	Beohari
		Kota									11466	Exp.		
											12181	Exp.		
NFR	Guwahati	Rangiya	BPRD	NIL	KYQ	CGS	Bharat Petroleum	NJP	NJP	Cement	12067/68	Jan Shatabdi	SSE/P.Way	APDJ-SDUJ
	New Jalpaiguri	New Coch Bihar	SGUJ		AUB	Jhaua	Tirap Tikok	Ledo	RNY	Coal	12505/06	NE Exp.	SSE/P.Way	GHY-GLPT-NBQ
		Tinsukia									12509/10	Ghy-Banga Exp		
		KIR									12501/02	Sampark Kranti		
ER	Howrah	Naihati	Bandel	Barrackpure	Sainthia	Khanna	Electro Steel Casting	Sodepore	Chitpur		12314	Sealdah Raj	SSE/P.Way	Dum Dum
	Sealdah	Bardhwar		Shrirampur	Andal	Pandavaswai	IOC	Budge Budge	New Alipore		12304	Purva Exp.	SSE/P.Way	Bardhman
		Malda Town									12023	Jan Shatabdi		
		Assansol									13008	Tofan Exp		
SR	Chennai Central	Erode	Rameswaram	Tiruvallikeni	Ariyalur	Coimbatore North	Ennore Port Ltd	Attipattu	Mangalore Central	bunder goods shed	12615/16	Grand Trank Exp	SSE/P.Way	Palghat
	Coimbatore jn.	Mangalore Central	Guruvayoor	Chennai Beach	Sivakasi	Chidambaram	Oil siding at	Irumpanam	Chennai	Salt cotauras	12007/08	Shatabdi	SSE/P.Way	MAS
		Ernakulam Town									12671/72	Nilgiri Exp.		
		Tiruchchirappal									12635/36	Vaigai Exp.		
										66021/22	Pass.			

