Report of the
Comptroller and Auditor General of India

on

ENVIRONMENT MANAGEMENT IN INDIAN RAILWAYS – WORKSHOPS, SHEDS AND PRODUCTION UNITS

for the year ended March 2013

Laid in Lok Sabha/Rajya Sabha on_____

Union Government (Railways)
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PREFACE

This Report for the year ended March 2013 has been prepared for submission to the President of India under Article 151 of the Constitution of India.

This Report of the Comptroller and Auditor General of India contains the results of performance audit of Environment Management in Indian Railways – Workshops, Sheds and Production Units in 2007-2012.

The instances mentioned in this Report are those, which came to the notice in the course of test audit for the period 2012-13 as well as those which came to the notice in earlier years, but could not be reported in the previous Audit Reports; matters relating to the period subsequent to 2012-13 have also been included, wherever necessary.

The audit has been conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Audit wishes to acknowledge the cooperation received from Ministry of Railways at each stage of the audit process.

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Abbreviations used in the Report

ADV	Advisor	KZJ	Kazipet
AGC	Agra Cantt	LJN	Lucknow (NE)
AJJ	Arrakkonam	LGD	Lallaguda
BBS	Bhubneshwar	LTT	Lokmanya Tilak Terminus
BBQ	Basin Bridge Jn	ME	Mechanical Engineering
BGKT	Bhagat Ki Kothi	MEMU	Mainline Electric Multiple Unit
BKSC	Bokaro Steel City	MFT	Mettuguda
BPL	Bhopal	MR	Metro Railways
BNDM	Bondamunda	MLY	Maula Ali
CE	Chief Engineer	MYS	Mysore
CEE	Chief Electrical Engineer	NR	Northern Railway
Chg	Coaching	NCR	North Central Railway
CFL	Compact Fluorescent Lamp	NER	North Eastern Railway
COS	Controller of Stores	NFR	Northeast Frontier Railway
CPME	Chief Motive Power Engineer /Diesel	NWR	North Western Railway
CPO	Chief Personnel Officer	PER	Perumbur
CPCB	Central Pollution Control Board	PON	Pandu
CR	Central Railway	PTJ	Podanur
CRSE	Chief Rolling Stock Engineer	PU	Production Unit
CRW	Carriage Repair Shop	RB	Railway Board
CRWS	Coach Rehabilitation Workshop	ROH	Routine Over Haul
DME	Director Mechanical Engineering	RPU	Railway Production Units
DEMU	Diesel Electric Multiple Unit	RYP	Rayanapad
Dev	Development	RSK	Rail Spring Karkhana
DLS	Diesel Loco Shed	RWH	Rain Water Harvesting
ECoR	East Coast Railway	SR	Southern Railway
ECR	East Central Railway	SCR	South Central Railway
ED	Erode	SER	South Eastern Railway
EDME	Executive Director Mechanical Engineering	SPCB	State Pollution Control Board
ER	Eastern Railway	SPJ	Samastipur
ELS	Electric Loco Shed	STLI	Sithouli
ERS	Ernakulam	SECR	South East Central Railway
ET	Itarsi	SWR	South Western Railway
ETP	Effluent Treatment Plant	Tr	Training
Fr	Freight	TNP	TONDIARPET

EMU	Electric Multiple Unit	TBM	Tambaram
EWS	Electrical Workshop	UBL	Hubli
GOC	Ponmlai Golden Rock	VSKP	Vishakhapatnam
GY	Gooty	WCR	West Central Railway
JHS	Jhansi	WD	Washing Depot
HPMV	High Pressure Mercury Vapour	WR	Western Railway
IR	Indian Railways	W	Works
ISO	International Organisation for Standardization	WRS	Waris Eleganj
KJM	Krishnarajapuram	WRP	Water Recycling Plant
KGP	Kharagpur	WS	Workshops

EXECUTIVE SUMMARY

1. Environment Management in Indian Railways -Workshops, sheds and Production units

Parliamentary Standing Committee (1997-98) in their Fourteenth Report on Modernisation and Capacity Utilisation of workshops in Indian Railways observed that working conditions in workshops posed hazards to the health of workers. The Committee recommended efforts to be made to improve working conditions and to create new facilities so that smoke emission and sewage disposal would confirm to environment requirements.

In Indian Railways (IR), there are 432 workshops/ sheds and six production units. Operation and maintenance of these units cause air, water and noise pollution and generate significant waste. Being a bulk consumer of energy, these units have the potential to conserve energy by adopting energy efficient measures. There was also a high risk of non-compliance with statutory provisions relating to control of pollution and waste management and with the instructions/guidelines issued from time to time by Railway Board (RB).

This report presents the results of the review of "Environment Management in Workshops, Sheds and Production units" which was taken up as a second phase of the audit exercise to assess the performance of IR in addressing the environmental impact of its operations and maintenance activities at workshops, sheds and production units.

It was observed that RB had issued guidelines and instructions on pollution control, waste management and energy conservation. It was also noticed that some progress had been made by workshops, sheds and production units on these issues. The important deficiencies noticed in environment management are elaborated below.

Statutory obligation to obtain Consent to Establish (CTE) and Consent for Operation(CFO) was not adhered to by 88 *per cent* (CTE) and 68 *per cent* (CFO) of the workshops and sheds test checked. *Absence of effective monitoring of the Zonal Railways and the RB resulted in non-compliance with the conditions specified while granting consent. Monitoring of air quality and noise pollution in workshops and sheds along with the provision of pollution control equipment was inadequate. In addition, existing pollution control equipment was not maintained in working condition.*

Effluent Treatment Plants (ETP) were either not installed or wherever installed, quality of discharge was not monitored leading to improper disposal of ETP sludge in open area. The progress on implementation of RB's instructions/guidelines on Water Recycling Plant (WRP) and Rain Water Harvesting (RWH) was insignificant.

Initiatives of workshops and sheds to generate electricity from solar energy were partial. In the absence of concrete action plan and monitoring at RB level, significant progress in the field of energy audit and implementation of their recommendations was not observed.

There was a lack of proper disposal of wastes coupled with partial maintenance and submission of records/returns and handling of hazardous wastes. The procedures adopted by the workshops and sheds for disposal of wastes were not environment friendly. Manifest system was also not followed in 128 out of 138 workshops and sheds test checked

Periodical inspections by Medical Officers of the workshops, sheds and production units to ensure the health and safety of the employees were not complied with even though health units were attached to 89 per cent of the workshops and sheds. Deficiencies were observed in maintenance of medical records relating to preventive medical examination of workers. In all, 10,420 accidents occurred during 2007-12 and of them, 51 per cent of the accidents occurred in 12 workshops and 18 sheds across Central, Eastern and Northern Railways.

2. Major Audit Findings

2.1 Prevention and Control of Pollution

- *Statutory provisions of obtaining Consent to Establish were not followed in 88 per cent of the units test checked and in 68 per cent of the units Consent for Operation was not obtained. Periodical renewal of consent under Air Act and Water Act was not obtained in 15 units and 16 units respectively.* ***(Para 2.1.1)***

- *Conditions attached with consent remained largely unfulfilled in 11 workshops and nine sheds out of 23 workshops and 21 sheds (45 per cent) which were granted Consent for Operation.* ***(Para 2.1.3)***

- *Air pollution control equipments such as wet scrubber, fume extractors, dust collectors etc. were not provided in 30 workshops and 65 sheds (69 per cent). Control equipments were not in working condition in production units such as CLW/Chittaranjan and DLW/Varanasi. Out of 23 workshops and 21 sheds which obtained Consent for Operation, only seven workshops and six sheds conducted air quality check. In three workshops and three sheds, the shortfall in conducting air quality check ranged between 25 and 99 per cent.* ***(Para 2.2.1 and 2.2.2)***

- *Initiatives of IR in maintaining noise level check were inadequate. Noise level was beyond the tolerance limit in 387* out *of the 1,105 locations where the quality of noise was monitored. Out of 30 workshops and 60 sheds having DG set, stack height was found less than the prescribed height in seven workshops and seventeen sheds. Acoustic enclosures for noise reduction in DG sets were provided only in 22 workshops and 37 sheds checked (66 per cent).*
(Para 2.2.3 and 2.2.4)

- *There were no specific instructions/guidelines for installation of ETP at workshops, sheds and production units. ETP was not available in 26 workshops and 57 sheds (60 per cent of the units test checked). In 20 workshops and 33 sheds where ETP was provided, sources of effluents were not connected to the ETP in six workshops and two sheds. Quality of discharge was monitored only in seven workshops and eight sheds. ETP sludge was disposed off in open area leading to contamination of ground water.*
(Para 2.2.5)

2.2 Conservation of Resources

- *There is no system in place at the RB level to monitor or initiate corrective action on the shortfall in achieving targets related to conservation of energy by the Zonal Railways. Efforts of Workshops and sheds to conduct energy audit and implement their recommendations were slow and inadequate resulting in non-achievement of projected savings. Initiatives of workshops and sheds to generate and use solar energy were insignificant. There was no system to quantify savings due to implementation of energy conservation measures.*

(Para 3. 1, 3.1.1 and 3.1.2)

- *Despite clear instructions by RB, recycling of water through WRP was provided only in one depot. RWH system was not provided in 39 workshops and 73 sheds over 13 Zonal Railways. In three Zonal Railways, RWH was provided in five workshops and three sheds.*

(Para 3.2.1 and 3.2.2)

2.3 Waste Management

- *Authorization from the State Pollution Control Boards (SPCBs) for handling hazardous wastes was obtained by only 15 workshops and 17 sheds (23 per cent). Complete records of hazardous wastes were not maintained in 13 workshops and 12 sheds out of 32 (78 per cent) workshops and sheds test checked. Only nine workshops and three sheds submitted the requisite return regarding handling of hazardous wastes.* ***(Para 4.1.1and 4.1.3)***

- *Environment Impact Assessment was conducted only in two workshops and two sheds out of 15 workshops and 17 sheds authorised for handling hazardous waste.*

(Para 4.1.5)

- *Statutory provisions relating to maintenance of records, submission of returns to SPCBs, handling and disposal of used batteries were not complied.* ***(Para 4.2)***

2.4 Health and Safety

- *Layout plan of the workshops and sheds was not approved by the Director/Inspector of Factories in respect of 23 workshops and 47 sheds .* ***(Para 5.1)***

- *Periodical inspection by doctors was carried out only in nine workshops and nine sheds (13 per cent) over eight Zonal Railways. Monitoring of implementation of the recommended safety measures was done only in 10 workshops and 7 sheds (12 per cent) over seven Zonal Railways.* ***(Para 5.2)***

3. *Gist of Recommendations*

- ***Mechanical Directorate of RB needs to establish a system of effective monitoring to ensure compliance with the statutory obligations relating to air, water and noise pollution in workshops, sheds and production units. Provision of control equipment and keeping them in working condition needs to be given due importance;***

- ***Workshops, sheds and production units need to take effective steps for proper disposal of ETP sludge as per the guidelines issued by the SPCB/CPCB in order to prevent contamination of ground water;***

- ***All workshops, sheds and production units need to frame a well defined target for implementing energy conservation measures. Electrical Directorate of RB needs to closely monitor the achievement of target and analyse the impact of shortfall in achieving target.***

- ***A time bound action plan needs to be drawn for harnessing renewable energy such as wind and solar energy so as to achieve the 2020 vision of IR;***

- ***Mechanical Directorate of RB need to effectively ensure that its instructions on setting up of Water Recycling Plants and Rain Water Harvesting structures are complied in a time bound manner;***

- ***Mechanical Directorate and Stores Directorate of RB needs to establish a monitoring mechanism for strict observance of statutory provisions regarding proper accounting, handling and disposal of hazardous wastes;***

- ***Health Directorate of RB needs to ensure maintenance of medical records of the workers of all workshops, sheds and production units.***

Chapter 1 ⟹ Introduction

Parliamentary Standing Committee (1997-98) in their Fourteenth Report on Modernisation and Capacity Utilisation of Workshops in Indian Railways (IR) observed that the working conditions in some of the workshops were very pathetic and hazardous to the health of the workers. The Committee, therefore, strongly recommended that conscientious efforts are required to be made to improve the prevalent working conditions. The Committee also recommended that new facilities should be created so that smoke emission and sewage discharge/disposal standard would confirm to environmental requirements.

A review of the management of environment at stations, trains and tracks was undertaken and audit findings were included in the Audit Report No.21 of 2012-13. The present review focuses on the performance of Workshops[1], Sheds and Production Units (PUs) in the management of the environmental impact due to its operations and maintenance activities.

1.1 Organization Setup

At Railway Board (RB) level, there are two Directorates viz. Mechanical Engineering[2] (ME) and Mechanical Engineering (PU and W) for overseeing the activities of Workshops, Sheds and PUs. Each directorate is headed by an Additional Member reporting directly to the Member Mechanical who is overall in charge of these two Directorates.

At the Zonal Level, Chief Mechanical Engineer (CME) is the head of workshops including coaching depots and sheds.

All the PUs of IR directly report to Mechanical Directorate (PU and W)/Electrical Directorate of the RB. PUs are headed by General Manager and assisted by Principal Officers responsible for overall functioning of departments such as mechanical, stores, electrical, personnel etc. Organisation setup of Workshops, Sheds and PUs are shown in the ***Appendix – I***.

[1] Including Coaching Depots.
[2] Responsible for all issues relating to coaching stock, wagons, locomotives, fuels and safety.

1.2 Audit Objectives

The Review was conducted to verify whether:

I. The laws, rules and regulations relating to prevention and control of air, water and noise pollution were complied by the workshops, sheds and PUs;

II. The resources were managed effectively by optimizing the use of renewable sources of energy;

III. The disposal of wastes generated at the workshops, sheds and PUs were managed in compliance with laws, rules and regulations; and

IV. The health and safety of workers was monitored as per the requirements of Indian Factories Act 1948 and in accordance with the provisions laid down in the Manuals of Indian Railways.

1.3 Sources of Audit Criteria

The review was based on parameters prescribed under various Acts, Rules, Regulations and Notifications[3] issued by the Ministry of Environment and Forests for control of pollution in air and water and also by the Central/State Pollution Control Boards. Guidelines and instructions issued by the IR from time to time were taken into consideration while assessing the performance of workshops, sheds and PUs in addressing environmental concerns.

1.4 Scope and Audit Methodology

Audit examined the measures taken by IR during 2007-12 for prevention and control of air, water and noise pollution, conservation of resources such as energy and water including the use of renewable energy. Audit also examined the management and disposal of hazardous and other wastes, occupational health and safety of employees in workshops, sheds and PUs.

In Indian Railways, there are 66 workshops[4], 366 sheds[5] and six PUs as on 31 March 2013. A sample of 49 workshops, 89 sheds (including Coaching and

[3] 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, Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 issued by the Government of India in the Ministry of Environment and Forest.

[4] 41 Mechanical Workshops, 10 S&T Workshops and 15 Engineering Workshops including Bridge

[5] 64 Diesel Loco Sheds, 30 Electrical Loco Sheds, 30 EMU/DEMU/MEMU Car Shed,94 Wagon Depot and 148 Coaching Depots.

Wagon Depot) and six PUs (selected units) as mentioned in the ***Appendix – II and III*** were selected for detailed examination.

The Performance Audit commenced with an Entry Conference (October 2012) with the concerned executives of the RB and respective Head of Departments at the Zonal and Production Unit level wherein the audit objectives, scope of study and methodology were discussed. Records of all the 17 Zonal Railways (ZRs) relevant to the scope of this performance review were examined to verify the extent of statutory compliance of State and Central Pollution Control Boards including the status of implementation of the instructions/guidelines issued from time to time by the RB. Records relating to monitoring at the RB level regarding statutory compliance of the ZRs in dealing with the environmental issues at workshops sheds and PUs were also examined.

In addition to obtaining feedback from the workers through survey questionnaire, joint inspection was also conducted with Railway officials at Workshops, Sheds and PUs.

The Draft Review Report was issued to RB in September 2013. The audit findings were discussed in an Exit Conference held in November 2013 with the concerned Executives at the RB. Similar Exit Conferences were also held by the Principal Directors of Audit in the zones with the concerned Head of the departments at the Zonal levels. The views of the RB on the audit findings have been incorporated in the report.

1.5 Acknowledgement

The co-operation extended by the ZRs and also by RB in conducting this Performance Audit is acknowledged.

Chapter 2 ⟹ Prevention and Control of Pollution

Audit Objective 1

To verify whether the workshops, sheds and PUs complied with the existing laws, rules and regulations relating to prevention and control of air, water and noise pollution

Pollution refers to introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem. The growing concerns on the adverse impact of pollution in the environment resulted in legislative enactments[6] at the national level to protect the environment. Workshops, sheds and production units in Indian Railways (IR) conduct various maintenance and production activities. Pollution issues arise mainly while performing various activities including Smith[7], Foundry[8], Furnace, Welding etc. The initiatives of workshops, sheds and PUs in controlling pollution have significant impact in tackling environmental challenges of the country.

2.1 Statutory Compliance

2.1.1 Consent to Establish and Operation

As per section 21 of the Air (Prevention and Control of Pollution) Act, 1981, no person shall except with the previous consent of the State Pollution Control Board (SPCB), establish or operate any industrial plant in an air pollution control area. Sections 24, 25 and 26 of the Water (Prevention and Control of Pollution) Act, 1974 provide that no person shall knowingly cause or permit flow of any poisonous, toxic or polluting matter into any stream, well, sewer and land without treating it.

Scrutiny of records relating to Consent to Establish (CTE) and Consent for Operation (CFO) obtained by the selected units from the State Pollution Control Boards revealed the following position:

[6] 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 and the Noise Pollution (Regulation and Controls) Rules, 2000

[7] Working on metal such as shaping of metallic objects by heating or hammering

[8] Casting of metallic objects

I. Consent to Establish under Air and Water Act was not obtained in 40 workshops and 82 sheds (88 *per cent*). The three ZRs (CR, ER and NER) were of the view that CTE was not obtained as the workshops were established prior to enactment of the Act. Contention of the ZRs was, however, not in line with the provisions of Section 21 of the Air (Prevention and Control of Pollution) Act 1981 and Sections 25 and 26 of Water Act which stipulates that the industries that started functioning prior to the commencement of the Acts, must obtain CTE within three months of the commencement of the Act;

II. Consent for Operation under Air and Water Act was not obtained in 26 workshops and 68 sheds (68 *per cent*) across all ZRs. In respect of remaining 23 workshops and 21 sheds where consent was obtained, periodical renewal of Consent for Operation under Air Act and Water Act was not obtained in 11 workshops & four sheds and 11 workshops & five sheds respectively.

III. WBPCB had not granted CFO to Liluah Workshop (ER) in spite of expiry of earlier consent in December 2011 as the workshop did not obtain CTE for commissioning new infrastructure and machinery. Environmental clearance for the new activities/expansion/modernization had also not been obtained from MoEF under Environment Impact Assessment (EIA) notification 2006 as amended from time to time.

IV. Out of six PUs, though CFO was obtained by all units, CTE under Air and Water Act was obtained only by two PUs[9]. CFO obtained by DLW/Varanasi was not renewed (under Air Act) beyond 2010 due to failure in making provision for acoustic enclosure of DG Sets. CFO under Water Act was also not renewed beyond 2011 by CLW/Chittaranjan due to non compliance with the WBPCBs directives for rectification of Sewage Treatment Plant (STP). On this being pointed out by Audit (September 2013), CLW authority obtained CFO in April 2014 with retrospective effect with the same stipulations which implied that the STP plant was not rectified till grant of CFO in April 2014. Further, there was no provision in Air (Prevention and Control of Pollution) Act 1981 for obtaining CFO with retrospective effect.

RB in their reply (November 2013) stated that CFO and CTE was not taken for Sheds/Depots as they are not covered under Factory Act. Contention of RB was, however, not acceptable as Section 21 of the Air (Prevention and Control of Pollution) Act 1981 stipulates that any industrial plant in an air

[9] ICF, Perambur/Chennai (SR) and CLW Chittaranjan (RPU)

pollution area requires previous consent from the concerned SPCB. Moreover, it was seen in audit that out of test checked units, 23 workshops/21 sheds obtained CFO and nine workshops/seven sheds obtained CTE from the concerned Pollution Control Boards.

Thus, the statutory provisions in obtaining CFO were not adhered by 26 workshops & 68 sheds and 40 workshops & 82 sheds in obtaining CTE. There were also lapses in renewal of CFO and CTE in respect of 68 *per cent* and 88 *per cent* of the workshops and sheds test checked.

2.1.2 Environmental Statement

Rule 14 of The Environment (Protection) Rules 1986 provides that every organisation carrying on an industry, operation or process requiring consent under Water (Prevention and Control of Pollution) Act, 1974 or under Air (Prevention and Control of Pollution) Act, 1981 or both should submit to the concerned Pollution Control Boards an Environmental Statement in Form V[10] every financial year on or before the 30th September.

Accordingly, 23 workshops and 21 sheds which obtained Consent for Operation (CFO) under Air and Water Act[11] were required to submit Environmental statements of which only three workshops and three sheds[12] (14 *per cent*) submitted the statement to the concerned SPCBs during the review period. All PUs submitted the Environmental Statement in Form V to the concerned Pollution Control Boards.

Reply of RB for non-submission of the Environmental Statement was not received. (June 2014).

2.1.3 Compliance of Consent and Renewal Conditions

SPCB lay down certain instructions and conditions at the time of granting CFO and its periodical renewal of authorization under Air and Water Act as mentioned in the ***Appendix IV***. Review of the extent of compliance of the conditions by the selected units for the period 2007-12 revealed the following:

[10] The statement discloses water and raw material consumption, pollutants discharged to the environment and quantum of solid wastes and hazardous wastes generated by the units.
[11] Air Act and Water Act refers to Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974
[12] Workshops (WRS/RYP/SR, WS/GOC,SR and RSK/STLI/NCR) and sheds (Diesel loco shed /BGKT/NWR , DLS/GY/SCR, Diesel loco shed /New Katni/WCR)

I. Out of 23 workshops and 21 sheds in nine ZRs[13] where CFO was obtained, conditions of SPCB at the time of renewal were complied in only eleven workshops and nine sheds;

II. Non-compliance with the instructions/prescribed standards of SPCB was also observed in PUs as mentioned below:

   a. Sewage Treatment Plant (STP) for treatment of waste water was not renovated and prior permission for installation of new machines as instructed by SPCB in May 2010 was not obtained (CLW/Chittaranjan);

   b. Acoustic barrier was not provided and emission levels were not monitored (DLW/Varanasi); and

   c. RWF/Yelahanka/SWR did not comply with the standards specified by the SPCB regarding avoidance of fugitive emission, operation of Arc Furnace, storage of furnace slag etc. An agreement was executed (June 2012) with a firm for conducting feasibility study for providing secondary fume extraction system. The report was submitted in March 2013 and an amount of ₹ 0.11 crore was paid to the firm. But the fume extraction system has not been installed (June 2014). Regarding disposal of slag, RWF authority approached the University of Agricultural Science, Bangalore and the final decision in this regard is yet (June 2014) to be taken.

Reply of RB on the Audit findings was not received (June 2014).

Thus, the workshops, sheds and PUs failed in complying with the guidelines/instructions of renewal of consent in 45 *per cent* of the units test checked. Non-compliance of the statutory obligations by the ZRs indicated weakness in the existing system of monitoring both at the Zonal and RB level.

2.2 Monitoring Pollution

2.2.1 Air Pollution Control Equipment

In terms of Section 22 (5) of Air (Prevention and Control of Pollution)Act 1981, every person to whom consent has been granted shall, inter-alia provide for control equipment of such specifications as the State Pollution Control Board

[13] NCR, CR, ER, ECOR, SCR, SR, SWR, WCR and WR

may approve in this behalf. It was also stipulated that the control equipment shall be kept at all times in good condition.

Examination of records in selected units revealed the following issues:

I. Air pollution control equipment were not provided in 30 workshops and 65 sheds (69 *per cent*) as detailed in ***Appendix V.***

II. In the remaining 19 workshops and 24 sheds, pollution control equipment were provided. Incinerator installed at Diesel Loco Shed/ Kharagpur (SER) for controlling air pollution remained idle since July 2010 due to non-availability of facility for checking emissions.

III. The position of six PUs are as follows:

- At DMW/Patiala, RWF/Yelahanka and ICF/Perambur all the air pollution control devices/equipment provided were found to be in working order;

  At RCF, Kapurthala, all stacks, Chimneys and Fume extractors[14] were in working condition except two stacks and three filters of one dust collector;

- At DLW (Loco Frame Shop)/ Varanasi, two out of five fume extractors[15] were not in working condition; and

- Fume Extractor installed in 2004 at a cost of ₹0.46 crore at CLW[16]/ Chittaranjan was not in working condition since November 2010.

The Reply of RB for not providing pollution control equipment in 30 workshops and 65 sheds is awaited (June 2014).

2.2.2 Air Quality Monitoring

As per the National Ambient Air Quality Standard (24 hours average), the concentration of Particulate Matter (PM^{10}) for industrial and residential area is 100 micro gm per cubic metre and the prescribed limit for oxides of Sulphur and Nitrogen is 80 micro gm per cubic metre.

The records relating to the adverse impact on the quality of air due to non-provision of pollution control equipment was examined for the period 2011-12 in

[14] 27 Fume Extractors, 6 Dust Collectors and 76 stack/Chimneys provided in RCF.
[15] Welding Fume Extractor is a pollution control machine used to clean welding fumes generated in the workshops, sheds and PUs which contain fluoride, and metals or oxides of metals. In addition, hazardous gases namely carbon monoxide, oxides of nitrogen, or ozone may also be present during welding. There is also a risk of asphyxiation when shielding gases such as argon are used, particularly in an enclosed or confined space.
[16] Melting shop with Electric Arc Furnace

23 workshops and 21 sheds that obtained consent for operation under Air and Water Act. Scrutiny revealed the following:

I. Only seven workshops and six sheds over seven ZRs[17] had conducted the ambient air quality check as per periodicity prescribed by the SPCB;

II. In three workshops and three sheds over five ZRs[18], the shortfall in conducting ambient air check as prescribed by the SPCB ranged from 25 to 99 *per cent.* Out of these six workshops and sheds, in one workshop and one shed, (CRWS/Bhopal/WCR and DLS/BNDM/SER) air pollution control equipment were not provided;

III. In four workshops and four sheds [19] air quality check was not conducted. Audit also observed that in two workshops and two sheds[20] pollution control equipment had not been provided;

IV. In the remaining eight workshops and nine sheds, air quality check was not carried out as the number of air quality check to be conducted was not prescribed by the SPCB at the time of granting consent for operation and/or at the time of renewal. Of them, in five workshops and five sheds [21], air pollution control equipment were also not provided;

V. Air quality as stipulated in the consent for operation was monitored in all PUs[22]. All parameters of air quality were within the tolerance limit except at DLW/Varanasi, where two out of five fume extractors[23] were not in working condition as mentioned in sub-para 2.2.1 (iii) and Particulate Matter exceeded the tolerance limits by 150 to 375 *per cent* during 2009-12.

In the absence of adequate provision of pollution control devices and monitoring, the required quality of air could not be examined. Adverse impact on quality of air due to non-provision of pollution control equipment was not monitored by the concerned authorities at the Zonal and RB level.

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[17] CR, NR, NWR, SCR, SER, SWR and WCR

[18] CR, SER, SR, NCR and WCR

[19] CRW/BBS (ECoR), Kancharapara Workshop (ER), WRS/Raipur (SECR), DLS/ERS (SR), CW/PER (SR), EMD Loco Shed/UBL (SWR), DLS/KJM (SWR) and ELS/ET (WCR)

[20] CRW/BBS/ECoR, Kanchapara WS (ER), DLS/ERS/SR, DLS/ET (WCR)

[21] C&W Workshop, Liluah, Jamalpur Workshop, Bardhaman Diesel Shed (ER), Mechanical Workshop, Gorakhpur, Mechanical Workshop, Izzatnagar, Locoshed, IZN (NER), Diesel Loco Shed, Ludhiana, Ferozpur Division (NR), NG Diesel Loco shed/Motibagh at Nagpur (SECR), Central Workshop / Mysore (SWR), Diesel Loco Shed Vatva (WR).

22 In CLW, as data was not available in shop Nos.8,16,23 and 25, it could not be stated whether the air quality was within the permissible limits in these shops.

[23] Welding Fume Extractor is a pollution control machine used to clean welding fumes generated in the workshops, sheds and PUs which contain fluoride, and metals or oxides of metals. In addition, hazardous gases namely carbon monoxide, oxides of nitrogen, or ozone may also be present during welding. There is also a risk of asphyxiation when shielding gases such as argon are used, particularly in an enclosed or confined space.

RB stated (November 2013) that the quality of air in all diesel sheds were being regularly monitored by the concerned SPCBs. However the fact remained that the ambient air quality check was not conducted in 12 workshops and 13 sheds.

2.2.3 Controlling Noise Pollution from DG Sets

Central Pollution Control Board (CPCB) prescribed 'Systems and procedures for compliance with noise limits for diesel generator sets'. As per these standards, users shall make efforts to bring down noise levels of Diesel Generator (DG) sets, within the ambient noise requirement by adopting adequate control measures such as provision of standard acoustic enclosures, suitable exhaust muffler and stack with minimum prescribed height[24] above the building. For installation of DG sets, 'No Objection Certificate' (NOC) is required to be obtained from Regional Inspectorial Organisation of the concerned State Electricity Board.

Scrutiny of records in selected units revealed that DG sets were provided in 30 workshops and 60 sheds and in six PUs. Assessment of the adequacy of measures taken by the selected units to control the noise level from DG sets revealed the following:

I. In seven workshops and seventeen sheds over eight ZRs[25], the prescribed stack height of DG sets was not maintained;

II. Sound level monitoring of DG sets was not done in 30 workshops and 52 sheds (91 *per cent*). In the balance eight sheds[26] over four ZRs (NCR, NWR, SCR and WCR), monitoring of sound level was done.

III. Acoustic enclosures for noise reduction in DG sets were provided only in 22 workshops and 37 sheds.

IV. Only three workshops and five sheds[27] had obtained "No Objection Certificate (NOC)" from Regional Inspectorial Organisation for operation of DG sets.;

[24] Central Pollution Control Board prescribed minimum stack height for different range of generators. For generator of 50KVA capacity, prescribed height is the height of the building plus 1.5m. The additional height above the building will be increased by 0.5m for every 50KVA increase in capacity of DG Set.
[25] CR, ECR, NCR, NER, SCR, SECR, SER and WR.
[26] DEMU shed (AGC), ELS (JHS), DLS shed (BGKT), DS (Abu Road), DLS (GY), DLS (Itarsi),DLS (New Katni Jn), Coaching Depot (Habibgunj).
[27] JHS/WS, RSK/STLI (NCR), CD/LJN (NER), DLS/Ludhiana (NR), DLS/BGKT (NWR), WRS/RYP, DLS/GY (SCR), WS/GOC (SR).

V. All the six PUs did not obtain 'NOC' from Regional Inspectorial Organisation for operation of DG sets. The noise levels exceeded the tolerance limits[28] at DLW/Varanasi[29] and CLW/Chittaranjan. The height of all 76 stack/chimney at RCF/ Kapurthala ranged from 13 to 20 meters which was less than 30 meters prescribed by CPCB.

Reply of RB for not providing adequate noise control measures is awaited (June 2014).

Thus, the ZRs failed to adhere to the standards prescribed for controlling noise pollution from DG sets. There was lack of established system in the workshops and sheds for monitoring noise level prescribed by the SPCBs.

2.2.4 Noise level Monitoring

Schedule to rules 3(1) & 4(1) of Noise Pollution (Regulation and Controls) Rules 2000 prescribed that noise level in industrial area should not exceed 75 dB during day time and 70 dB during night time. The main sources of noise pollution at workshops and sheds are Diesel Generator (DG) sets heavy machineries etc. While granting CFO, SPCBs generally specify the frequency at which noise level check is to be conducted during a particular period.

Scrutiny of records to assess the extent of compliance with the prescribed standards for the period 2011-12 in selected units revealed the following:

I. While granting CFO under Air Act, SPCBs prescribed the frequency of noise level checks in respect of six workshops and eight sheds over four ZRs[30]. In three workshops and three sheds over three ZRs[31], noise quality checks were not conducted as per prescribed frequency. The resultant shortfall ranged between 92 and 100 *per cent;*

II. During the entire review period 2007-12, noise level checks were conducted at 1105 locations in 13 workshops and 14 sheds over 10 ZRs[32]. The noise level was within the prescribed limits only in one workshop and four sheds. In the remaining 12 workshops and 10 sheds, the noise level exceeded the limits in 387 locations.

[28] The noise limit for DG Sets up to 1000KVA is 75dB(A) as per Environment (Protection) Rules,1986
[29] in 17 out of 20 noise level tests
[30] SCR, SR, SWR and WCR
[31] DLS/KZJ(SCR),EWS/AJJ,DLS/ERS,C&W/PER,W&C/GOC(SR),ELS/Itarsi (WCR)
[32] CR, ER, NCR, NFR, NR, SCR, SER, SR, SWR, WCR and WR

III. SPCB did not specify the frequency of noise level checks in 17 workshops and 13 sheds. Consequently, while six workshops and six sheds carried out noise level checks, eleven workshops and seven sheds did not carry out the checks;

IV. Audit observed that there was no established system of monitoring compliance of instructions/stipulations of SPCBs either at the RB level or at the ZRs level; and

V. Audit scrutiny of records revealed that noise level was checked as per the frequency prescribed by the SPCBs and the noise level was observed within the permissible limit in all PUs. Eco- friendly noiseless generator was available in all PUs except RCF/Kapurtala.

RB stated (November 2013) that all diesel sheds were being regularly monitored by the concerned SPCBs/CPCB for quality level of noise. Contention of RB is not acceptable as there was not only shortfall with reference to prescribed frequency of checks, but noise quality checks were also not conducted in eleven workshops and seven sheds.

2.2.5 Water Pollution

Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without any treatment or removal of harmful compounds. Section 24 of the Water (Prevention and Control of Pollution) Act, 1974 provides that no person shall knowingly cause or permit flow of any poisonous, noxious or polluting matter into any stream. Section 25 provides that no person shall, without the previous consent of the SPCB establish any industry, operation or process which is likely to discharge sewage or trade effluent into a stream or well or sewer or on land.

As per special condition attached to CFO under Water (Prevention and Control of Pollution) Act, 1974, since the activities in workshops and sheds generate effluents such as waste oil, chemicals, sludge, waste grease etc., which pollute the environment, provision of Effluent Treatment Plant (ETP) is, therefore, necessary for treatment of effluents before discharging into sewers/water bodies. The sludge from the ETP should be dried in sludge drying bed and the drained liquid should be taken to equalisation tank. The dried sludge should be disposed off through agencies authorized by the Pollution Control Boards.

Review of the status of installation of Effluent Treatment Plants and disposal of ETP sludge in selected units revealed the following:

I. Though the instructions of RB (June 2009) exist for installation of ETP at all major stations of IR, the same does not exist specifically for workshops, sheds and PUs;

II. Out of selected workshops and sheds, ETP was not available in 83 workshops and sheds[33] (60 *per cent*). In two sheds[34] ETP was not required as no effluents were generated in these sheds;

III. In the remaining 20 workshops and 33 sheds where ETP was provided, the sources of effluents were not connected to the ETP in six workshops and two sheds[35]. During 2011-12, only seven workshops and eight sheds over nine ZRs[36] conducted analysis of sample of sewage or trade effluent before and after treatment;

IV. All the six PUs were provided with ETP. Analysis of the liquid waste discharged through ETP was being carried out in all PUs. However, at CLW/Chittaranjan only paint shop was connected to the ETP and the effluents generated in other shops[37] were being disposed off untreated.

V. In DLS/TNP (SR), oil skimmer was not in working condition. The effluent generated from the loco cleaning bay mixed with oil was being discharged into the pond located nearby without treatment. Effluent treatment facility sanctioned in 2005-06 at a cost of ₹ 23.34 lakh was not provided till September 2012. The delay was attributed to time taken in finalization of tender.

VI. While granting CFO to Bardhaman Diesel Shed (ER), West Bengal Pollution Control Board stipulated provision of alternate power source for running the ETP during power failure. Audit observed that the provision of alternate power source was not made in the shed for running ETP during power failure which would have resulted in discharge of untreated liquid effluents to the municipal drainage system during power failure.

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[33] 26 workshops and 57 sheds

[34] MEMU Car Shed/Ambala(NR) and Wagon Depot/Ambala(NR)

[35] Parel Workshop, Matunga Workshop, Bhusawal Wagon Depot (CR), CWS/LGD (SCR), Mechanical Workshop/KGP (SER), CRW/BPL (WCR), Loco, Carriage and Wagon Workshop, Dahod and Coaching Depot/ Bandra Terminus (WR).

[36] ER, NER, NR, NWR, SCR, SECR, SER, WR, NCR

[37] Heavy Machine Shop, Electric Loco Bogie, Traction Motor Manufacturing, Melting and Sand Plant Shop.

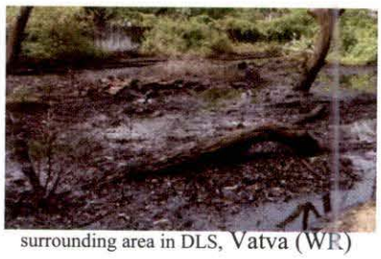
VII. In Diesel shed /Andal (ER), ETP was commissioned in March 2012 after a period of five years since issue of purchase order in March 2007.

VIII. Deficiencies were also observed in treatment and disposal of ETP sludge. Some instances are mentioned below:

a. In Matunga Workshop (CR), the sludge drying bed was not being used and sludge was disposed off along with the garbage directly;

b. In CW/PER, S&T/PTJ and WS/GOC, ETP sludge was not being tested through the agencies/laboratories authorised by SPCB and it was kept in covered sheds as hazardous waste;

c. At Jamalpur Workshop/ER, sludge was dumped in the ETP complex and not disposed off since 2006. Similarly, at DLS/ERS, sludge was accumulated in an open space within the workshop premises;


surrounding area in DLS, Vatva (WR)

d. In Loco Shed Vatva (WR) oil sludge from ETP was discharged in the open ground; and

e. At ICF/Perambur, ETP 2.57 MT of sludge was not disposed off within the prescribed period of ninety days (April 2014).

RB stated (November 2013) that no water pollution/hazardous effluents are generated in four signal workshops[38] and therefore, Water (Prevention and Control of Pollution) Act 1974 does not apply to these workshops. RB further stated that the S&T Workshops at CR, ER, NR and NER had been advised to take cognizance of statutory body recommendation and to take appropriate action on priority to comply with applicable statutory obligations. The reply of RB was only for some signal workshops which do not cause water pollution and generate hazardous effluents. The reply did not address the issues highlighted by audit in respect of other workshops and sheds.

In the absence of any specific instructions of the RB, ZRs did not initiate necessary measures to provide ETP in 60 *per cent* (26 workshops and 57 sheds out of selected units) of the workshops and sheds test checked. The performance of ETP to assess the quality of discharge was also not monitored in 13 workshops and 25 sheds. ETP sludge was improperly disposed off in an open area without proper treatment.

[38] S&T WS/Pandu (NEFR), Signal WS/Kharagpur(SER), Signal WS/Ajmer(NWR) and Signal WS/Sabarmati (WR)

2.3 ISO Certification

Workshops and sheds obtain ISO 14001 and ISO 18001 certification to demonstrate their commitment to environment, health and safety. While ISO 14001 establishes standards, guidelines, and policies governing environmental management by certified organizations, the ISO 18001 Occupational Health and Safety System (OHSAS) aim at providing a framework for a safe and healthy working environment. Obtaining ISO 14001 and 18001 certification is recognition of observance of due procedures relating to environment and OHSAS. In the Chief Mechanical Engineer's conferences (January/February 2000), ZRs were advised to seek help from appropriate consultants on the measures to be undertaken to meet the requirements of the SPCBs as well as the stipulations of ISO 14001. Surveillance Audit is conducted at the time of renewal of validity of ISO certification.

Scrutiny of records relating to issue of ISO certifications, renewal of certification and surveillance audit in selected units revealed the following issues:-

I. ISO 14001 accredition was obtained only by 12 workshops and 19 sheds (22 *per cent*) over 12 ZRs[39] and surveillance audit was conducted in ten workshops and 14 sheds (17 *per cent*). ISO surveillance audit team, however, suggested corrective actions for four workshops and eight sheds. Of them, two workshops and six sheds[40] have fully complied with the suggestions. Surveillance audit was not conducted in two workshops and five sheds[41]. Two workshops and seven sheds did not renew the validity of accreditation.

II. All PUs were accredited with ISO 14001 and the corrective action suggested by the surveillance audit teams was complied with.

III. Out of 12 workshops and 19 sheds that obtained ISO 14001 accredition, ISO 18001 accreditation was obtained by six workshops and nine sheds (11 *per cent*) across eight ZRs[42]. Diesel Shed/Abu Road (NWR) has obtained ISO 18001 accreditation only.

IV. Surveillance audit for ISO 18001 was conducted in six workshops and six sheds. In two workshops and three sheds, corrective action was suggested.

[39] CR, ECR, ER, NCR, NFR, NR, SCR, SER, SR, SWR, WCR and WR
[40] WS/Jagadhari, WD/Ambala (NR), DLS/Kharagpur (SER), CRW/Bhopal, DLS/Itarsi, DLS/New katni Jn. ELS/Itarsi (WCR), DLS/Ratlam (WR)
[41] Matunga workshop, DLS/Kalyan (CR) DLS/Ludhiana (NR) DLS/BNDM (SER), CWS/MYS (SWR) Electric loco shed/Vadodara (WR), RSK/STLI (NCR)
[42] CR, ECR, NCR, NFR, NR,SR, WCR and WR

Of them, one workshop and two sheds[43] had fully complied with the suggestions/instructions. Surveillance audit was not conducted by ISO accredited agencies in four sheds[44]. The validity of the accredition was renewed by six workshops and seven sheds and not renewed by DLS/Abu Road (NWR), DLS/ELS/Itarsi (WCR), ELS/Itarsi; and

V. All PUs were accredited[45] with ISO 18001 and surveillance audit was conducted periodically and corrective actions suggested by the ISO audit team were carried out.

The progress of obtaining ISO certification was not significant as only 31 and 16 workshops/sheds obtained ISO 14001 and ISO 18001 respectively. The implementation of corrective action suggested by surveillance audit team was partially complied by Pune DLS/CR in case of ISO 14001 and ISO 18001. In two workshops and one shed[46], implementation of ISO 14001 was partial and in respect of one workshop[47] ISO 18001 implementation was partial.

[43] WS/Jagadhari (NR), ELS/Itarsi (WCR) and DLS/Ratlam(WR)
[44] DLS/Abu Road (NWR), DLS/Itarsi (WCR), ELS/Vadodhara (WR), RSK/STLI (NCR)
[45] Renewal of accreditation was valid up to March 2013(ICF) and up to May 2013(RWF/Yelahanka)
[46] Mechanical WS Dibrugarh/NEFR, C&W Perumbur , ELS/ED (SR)
[47] Bridge WS/Jalandhar Cantt./NR

Chapter 3 ⟹ Conservation of Resources

Audit Objective 2

To verify whether the resources were effectively managed by optimizing the use of renewable sources of energy

Indian Railway (IR) is the single largest user of both energy and water in the country. Conservation of energy and water is essential to avoid wastage. Efforts should be made to reduce energy consumption through adoption of energy-efficient measures. Ground water being a scarce resource should be used optimally. Various measures are being adopted for conservation of water by recycling waste water, provision of water treatment plant, rain water harvesting and monitoring wastages of water. In IR, the expenditure on energy constitutes a major portion of their working expenditure. Majority of the workshops sheds and PUs utilize ground water for their activities. The measures adopted by IR for conservation of energy and water are discussed below.

3.1 Conservation of Energy

In May and August 2008, RB advised all the ZRs to fix targets for energy conservation through use of energy efficient devices and also to identify sources of energy wastage. Accordingly, 11 areas for conservation of electrical energy were identified by Audit for this review. Review of performance of the selected units in achieving target relating to various energy conservation measures revealed the following:

I. Targets fixed by the ZRs for implementing various energy conservation measures within a definite time frame were not uniform in all the ZRs. In some workshops and sheds etc. no targets were fixed.

II. Achievement of selected units test checked in respect of implementation of energy consumption measures is indicated in the table below:

Table 1: Achievement of target on various energy conservation measures

Sl. No.	Description of works	No. of Workshops and Sheds where target was fixed			Number of Workshops and Sheds where no target was fixed
		Total	Target Achieved	Target Not Achieved	
1.	Provision of CFL Lighting	75	48	27[48] (WS-14) (Sh - 12) (CD-1)	63 (WS-18) (Sh – 34) (CD-11)
2.	Provision of T5 FL lights	97	24	73[49] (WS-26) (Sh - 38) (CD-9)	41 (WS-16) (Sh - 18) (CD-7)
3.	Replacement of 90 watt Ceiling Fans with 60 watt fans	90	50	40[50] (WS-16) (Sh - 19) (CD-5)	48 (WS-32) (Sh - 8) (CD-8)
4.	Replacement of electronic fan regulators	90	38	52[51] (WS-15) (Sh - 32) (CD-5)	48 (WS-21) (Sh - 16) (CD-11)
5.	Provision of electronic ballast	82	32	50[52] (WS-15) (Sh - 28) (CD-7)	56 (WS-20) (Sh - 26) (CD-10)
6.	Replacement of HPMV lamps	69	29	40[53] (WS-14) (Sh - 21) (CD-5)	69 (WS-26) (Sh - 28) (CD-15)
7.	Automatic Power Factor Correction Panels	59	46	13[54] (WS-3) (Sh - 7) (CD-3)	79 (WS-32) (Sh - 35) (CD-12)
8.	Provision of Timer Switches	62	41	21[55] (WS-7) (Sh - 13) (CD-1)	76 (WS-30) (Sh - 34) (CD-12)
9.	Provision of energy savers[56]	35	18	17[57] (WS-6) (Sh - 8) (CD- 3)	103 (WS-33) (Sh - 52) (CD-18)
10.	Provision of occupancy sensors for light control	30	11	19[58] (WS-07) (Sh – 10) (CD- 2)	108 (WS-27) (Sh – 61) (CD-20)

[48] CR, ECOR, ER, NCR, NER, NR, NWR, SCR, SECR, SER, WCR and WR
[49] All ZRs except NEFR.
[50] All ZRs except SWR
[51] CR, ECOR, ECR, ER, NCR, NFR, NR, NWR, SCR, SECR, SER, WCR and WR
[52] CR, ECOR, ECR, ER, NCR, NER, NR, NWR, SCR, SECR, SER, WCR and WR
[53] CR, ECOR, ECR, ER, NCR, NER, NFR, NR, NWR, SCR, SER, WCR and WR
[54] ECOR, ECR, ER, NR, NWR, SCR, SER, SWR, WCR and WR
[55] CR, ECOR, ER, NCR, NFR, NR, NWR, SCR, SER, WCR and WR
[56] For pumps, lighting circuits, air conditioning circuits and machines in workshops and sheds
[57] CR, ECR, NCR, NWR, SCR, SECR, SER, SWR, WCR and WR
[58] CR, ECOR, ER, NCR, NER, NFR, NWR, SCR, SWR, WCR and WR

11.	Use of variable voltage variable frequency in cranes, lifts and escalators	23	8	15[59] (WS-08) (Sh – 07) (CD-nil)	115 (WS-36) (Sh – 58) (CD-21)

WS represents workshops, Sh represents Sheds. CD represents coaching depot.

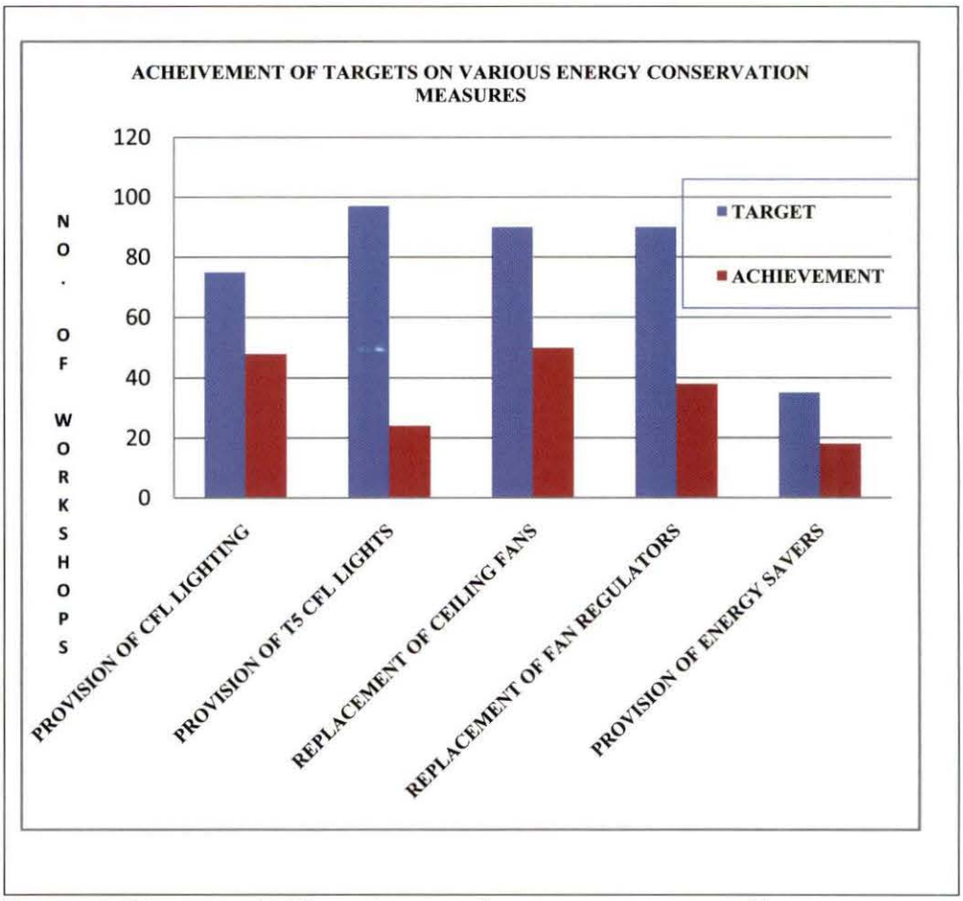


Figure: Achievement of targets on various energy conservation measures

The position tabulated above indicated that targets relating to provision of T5 FL lights, replacement of electronic fan regulators and provision of electronic ballast were not achieved by 58-75 *per cent* of workshop/sheds. The workshops and sheds where no target was fixed ranged between 30 *per cent* and 83 *per cent.* The reasons for not setting any target were not available on record.

III. Out of 22 Coaching Depot (CD) test checked, target for six energy conservation measures, as indicated against serial number 6 to 11 of the table 1, was not fixed by 12 to 21 workshop/sheds. In respect of remaining five areas of energy conservation measures mentioned against

[59] CR, NFR, NWR, SCR, WCR and WR

serial number 1 to 5 of the table above , target was not achieved by five to nine CDs[60] ;

IV. There was no system in place in RB to monitor reports received from ZRs regarding energy conservation measures and to initiate corrective actions; and

V. There is no system in place either at the field level or at RB level to quantify the financial impact of energy saving or opportunity cost of shortfall in achieving the targets.

Performance of the six production units in achieving the target for use of energy efficient fittings revealed that except RWF/Yelahanka (SWR), the implementation of various energy measures in the remaining five PUs were only partial. The areas where the PUs did not achieve the target are furnished below:

Table 2: **Achievement of target on various energy conservation measures by production units**

Sl No	Target in respect of	Target not achieved by
1	Use of automatic power factor correction panels in HT/LT substations	CLW, DMW
2	Replacement of old 90 watt ceiling fans by 60 watt ceiling fans	CLW, RCF,DMW
3	Use of electronic fan regulator in place of conventional fan regulators	CLW,DLW, DMW
4	Use of occupancy sensors in officers chambers and conference rooms	CLW, DMW
5	Provision of T5 FL light in place of T-12 FTL fittings	DLW, ICF, DMW
6	Timer Switches in mast towers	DLW, DMW
7	Replacement of CFL lighting in place of 60/40 Watt incandescent lamps	ICF, DMW
8	Replacement of electronic ballast in place of conventional ballast in FTL circuits	ICF, DMW
9	Provision of energy savers for pumps, lighting circuits,airconditioning circuits and machines.	ICF, DMW

[60] Except for provision of CFL lighting where only one coaching depot could not achieved the target

RB stated (December 2013) that they had been issuing policy guidelines to ZRs from time to time for implementing energy efficiency measures. RB also stated that IR achieved overall saving in energy consumption by one per cent despite increase in connected load by about 4-5 *percent.*

Audit, however, observed that in respect of four areas which involve high energy consumption viz. provision of electronic ballast, replacement of HPMV lamps, Automatic Power Factor Correction Panels and provision of Timer Switches, no target was fixed in respect of 41 *per cent* to 57 *per cent* of the workshop/sheds test checked. In PUs where substantial electrical energy is consumed, implementation of energy consumption measure was partial. The financial impact of non-implementation of energy conservation measures and shortfall in achieving the target was not evaluated either at the Zonal level or at the RB level. Though there is a system of awarding recognition for achieving target for conservation of energy, no punitive action was being taken against defaulters. There was also lack of adequate monitoring both at the Zonal and RB level of implementation of guidelines issued by the RB for energy conservation.

3.1.1 Renewable Energy

Solar energy is one of the growing sources of alternative renewable source of energy which converts sunlight directly into electricity. Similarly, power generation through wind is one of the most rapidly growing cost effective and environment friendly renewable energy technologies. "IR Vision 2020 statement" (December 2009) inter-alia envisaged use of at least 10 *per cent* of the required energy from renewable sources for reducing carbon foot print. In the budget proposal 2011-12, Minister for Railways announced setting up of 720 MW capacity Wind Mill Plants in five states[61]. However, there were no specific guidelines/instructions from the RB in this regard. Some ZRs, however, took initiatives for utilizing solar and wind power as an alternative source of energy as discussed in subsequent paragraphs.

Scrutiny of records relating to use of renewable sources of energy at selected units revealed the following:

I. Indian Railways had planned[62] to set up a total of 168 MW capacity wind mill plants across the country through capital funding and joint venture route. A new company, Railway Energy Management Company, was also set up (August 2013) to expedite harnessing green energy but the locations for

[61] Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and West Bengal

[62] Vide Pink Book item No.228 of 2010-11 (10.5 MW), 505 of 2010-11 (10.5 MW) 578 of 2012-13 (72MW), 640 of 2013-14(75MW)

installation of wind mill plants are, however, yet (June 2014) to be identified and no detailed action plan has so far been formulated in this regard;

II. At ICF/Perambur (Chennai) 10 MW capacity[63] wind mill plants were installed (March 2009) and 6.25 crore units of power was generated during the period 2009-12;


Wind Power Plant installed by ICF at Tirunelveli Dt., Tamil Nadu

III. Eighty three solar plants were installed in nine workshops and four sheds (nine *per cent*) over eight ZRs[64]. Audit observed that the saving in energy of 88075 kwh was assessed only in respect of six workshops and two sheds over five ZRs[65]. In respect of workshops and sheds in the remaining three ZRs, savings achieved as a result of use of solar plants could not be verified as the same was not assessed by the ZRs. RB stated (December 2013) that the centralized monitoring of energy saving due to solar energy plant of higher capacity had been planned through development of web based monitoring system as per Ministry of New and Renewable Energy (MNRE) guidelines. Audit, however, observed that the web based monitoring system has not been implemented till June 2014.

IV. Out of six PUs, nine solar plants were installed in three PUs[66].

Electrical Directorate of Ministry of Railways (RB) stated (December 2013) that the wind mills are provided at locations such as Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Maharashtra, Odisha, Gujarat and West Bengal having rich wind density and subject to availability of funds. Similar view was also expressed in respect of solar panel on the plea that the progress of solar panel depends upon feasibility/direction of sunlight on rooftop and other associate parameters. Scrutiny of records, however, revealed that though the states and the

[63] Windmill can generate power upto 10MW per hour depending upon the flow of wind and grid condition
[64] ER, NCR, NER, NR, SR, SWR, WCR, and WR
[65] ER, NCR, SR, SWR, and WCR
[66] ICF/Perambur/Chennai (Three), RWF/Yelahanka/SWR (Four) and DMW/Patiala (Two)

ZRs (NWR and SR) had been identified, no exercise was carried out to identify the exact locations of wind mill plants and solar panels.

Thus, the absence of any specific guidelines/instructions of the Electrical Directorate of Ministry of Railways (RB) led to inadequate initiative at the ZRs level for tapping wind and solar energy. Despite proposal in budget, the progress of installation of wind mill and solar plants was insignificant and was also not in commensurate with the policies envisaged in the Vision 2020 for use of 10 *per cent* of the energy requirement from renewable sources.

3.1.2 Energy Audit

Energy Conservation Act, 2001 classifies IR as an energy intensive industry. Ministry of Power in consultation with Bureau of Energy Efficiency (BEE)[67] notified (March 2007) workshops and PUs of Indian Railways as energy intensive establishment and specified Railways as 'Designated Consumer' (DC). Notification further specifies that every DC shall have to employ an Energy Manager who is to be certified by BEE and every DC has to get the energy audit done periodically as specified by regulation by an accredited energy auditor for which BEE conducts the certification examination.

Energy audit encompasses verification, monitoring and analysis of use of energy, including submission of recommendations for improving energy efficiency along with cost benefit analysis and action plan to reduce energy consumption.

Scrutiny of records relating to energy audit in selected units revealed the following:

I. Only 18 workshops and 10 sheds (20 *per cent*) over 13 ZRs[68] conducted energy audit during the review period and in eight workshops over eight ZRs [69] the recommendations of energy audit team were fully implemented. In the remaining 10 workshops and 10 sheds, recommendations were partially implemented. Though the energy audit report was being sent to RB, the monitoring of the progress of implementation of recommendations of energy audit was not being done at the RB level;

[67] The Government of India set up Bureau of Energy Efficiency (BEE) on 1st March 2002 under the provisions of the Energy Conservation Act, 2001. BEE co-ordinates with designated consumers, designated agencies and other organizations and recognize, identify and utilize the existing resources and infrastructure, in performing the functions assigned to it under the Energy Conservation Act.
[68] CR, ECR, ER, NCR, NER, NFR, NR, NWR, SCR, SECR, SR, WCR and WR
[69] CR, ECR, ER, NCR, NER, SCR, SR and WCR

II. Some instances are mentioned below where implementation of the recommendations would have resulted in financial savings as assessed by the ZRs:

a. In CWS/LGD/SCR, 13 recommendations of the energy auditor were not implemented though the expected savings was ₹0.14 crore per annum as against one time investment of ₹0.34 crore on the ground that the investment was more than the saving.

b. In the Manmad workshop/CR, 22 recommendations were not implemented since 2009 due to paucity of funds which could have saved energy worth ₹1.25 crore[70] during the period 2009-14 by investing ₹ 0.91 crore.

c. In the Mechanical workshop/Dibrugarh (NEFR), the recommendation of energy auditor regarding replacement of existing distilled water plant with solar distilled water plant with anticipated savings of ₹ 3.6 lakh per annum was not complied with due to paucity of funds. Similarly, in the Engineering workshop/Bongaigaon (NEFR), three recommendations of energy audit team with an annual anticipated savings of ₹2.78 lakh per annum were also not implemented during 2008-13;

d. In NWR, the recommendations of the energy audit team which projected an annual savings of ₹12.86 lakh were not implemented in five workshops and sheds[71] due to paucity of funds and non-availability of materials.

III. Out of six PUs, energy audit was conducted only in one PU (CLW/Chittaranjan).

ZRs opined that the energy audit recommendations, which were not economically feasible, were not implemented. Analysis of the economic feasibility in support of the actions of the ZRs for not implementing recommendations of the energy audit was not placed on record.

Electrical Directorate of RB stated (December 2013) that due to similar layout and pattern of energy consumption, the findings of one/two energy audit of

[70] ₹ 0.25 crore per annum

[71] DSL shed/BGKT, DSL shed/Abu road, CWS/Ajmer, Diesel Loco and wagon workshop/Ajmer, Signal workshop/Ajmer

similar type of asset is generally sufficient to make action plan for energy conservation efforts. It was also stated that the implementation of recommendations of energy audit depends upon its cost benefit analysis and the availability of funds. Scrutiny of records in the RB revealed that though the ZRs send energy audit reports to the RB, no action plan for energy conservation was framed for units based on the recommendations of Energy Audit of identical units. There exists no system at the RB level to monitor follow up action taken by the ZRs for implementation of recommendation of energy audit. The slow progress of implementation of recommendations of energy audit indicates lack of urgency of IR towards conservation of energy even though BEE classified IR as energy intensive industry.

3.2 Conservation of Water

Ground water is the primary source of water for the activities of workshops, sheds and PUs. Performance of selected units in implementation of water conservation measures revealed the following:

3.2.1 Water Recycling Plant

RB instructed (July/August 2006) the ZRs to provide Water Recycling Plant (WRP), especially at such locations (stations/sheds) where water is scarce in comparison to its demand.

Scrutiny of records relating to the implementation of RB's instruction on installation of WRP revealed the following:

i. No exercise was carried out either at the Zonal Railway level (except in WCR and SR) or at the RB level to identify requirement of WRP in workshops, sheds and PUs;

ii. There was no monitoring at the RB level to ensure compliance of its instructions on installation of WRP

iii. At coaching depot / Jabalpur (WCR), WRP with a recycling capacity of 600 kilo liters per day was provided.

iv. In view of the heavy consumption[72] of water for cleaning purposes, Southern Railway Administration proposed (2004-05) "Augmentation of water supply arrangement by installation of recycling plant and electronic monitoring system" at Coaching Depot/ Basin Bridge at an estimated cost of ₹ 3.50 crore. Though WRP was set up in December 2009, the

[72] Coaching Depot/ Basin Bridge requires 1800 KL of water for washing 500 coaches daily

same, remained idle as no over head tank for storage of recycled water was constructed. Fresh water was being used for washing coaches despite having incurred expenditure of ₹ 2.82 crore on installation of recycling plant.

Thus, there was lack of adequate efforts on the part of workshops, sheds and PUs to identify the requirement of WRP. Insignificant progress in making provision of WRP indicates the low priority attached to conservation of water despite clear instructions of RB. Moreover, RB did not monitor compliance of its own instructions.

Reply of RB was received only for S&T workshops from S&T directorate where the requirement of WRP is not necessary. No reply was given by other directorates of RB.

3.2.2 Rain Water Harvesting

Rain water harvesting (RWH) is the accumulation and storage of rainwater at surface or in sub-surface aquifers for reuse before it reaches the aquifer[73]. In February 2005, RB issued instructions to all zones to implement RWH in Railway establishments.

Scrutiny of records of selected units revealed the following:

I. RWH system was not available in 39 workshops and 73 sheds over 13 ZRs[74]; and

II. In three ZRs (SR,SWR and CR), out of ten selected workshops and 16 sheds, RWH was available only in five workshops and three sheds[75];and

III. Out of six PUs, RWH system was available at three units (RWF/Yelahanka, ICF/Chennai and RCF/Kapurthala).

Thus, the achievement in making provision of RWH in workshops and sheds was very insignificant. There was no monitoring at the RB of implementation of its instructions for making provision of RWH. This resulted in inadequate initiative on the part of ZRs towards conservation of water.

[73] An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, or silt) from which groundwater can be extracted using a water well.

[74] ECR, ECoR, ER, NCR, NEFR, NER, NR, SCR, SECR, WR, WCR, SER and NWR (information not available)

[75] SR(5),SWR(2) and CR(1)

Chapter 4 ⟹ Waste Management

Audit Objective 3

To verify whether waste generated at the workshops, sheds and PUs were managed in compliance with laws, rules and regulations

The waste generated in workshops, sheds, depots and PUs are generally hazardous wastes. Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008[76] issued by the Central Pollution Control Board (CPCB) defines Hazardous Waste as any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances. Hazardous wastes such as oil, chemical sludge, ETP sludge, paint flakes etc. generated by the workshops/sheds and PUs are required to be segregated from other wastes and stored properly before final disposal as per the procedures laid down by the SPCB/CPCB.

4.1 Management of Hazardous Waste

4.1.1 Authorisation for Handling Hazardous Waste

In terms of Rule 5 (1) of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, Workshops, sheds and PUs are required to obtain authorization from the SPCBs for handling hazardous wastes. Renewal of authorization for handling hazardous wastes is to be applied 60 days in advance of the expiry of authorization.

Scrutiny of records of selected units relating to authorization by SPCBs for handling hazardous wastes revealed the following:

I. Authorization for handling hazardous waste was obtained in 15 workshops and 17 sheds (23 *per cent)*. In two sheds[77] authorization for

[76] Government of India in the Ministry of Environment and Forest

[77] Bardhaman Diesel Shed/ER and Belur Scrap Yard/ER

handling hazardous wastes was not extended beyond June 2010 due to non-submission of Form 4[78] to SPCB by Bardhaman Diesel Shed/ER and in case of Belur Scrap Yard (ER), renewal of authorization from the WBPCB is still pending

II. In six workshops and twelve sheds authorization was not obtained as no hazardous waste was generated in these workshops and sheds.

III. Authorization for handling hazardous waste was not obtained by 28 workshops and 60 sheds ; and

IV. Out of six PUs, DLW/Varanasi had not obtained authorization for handling hazardous waste since July 2009. DLW/Varanasi has not initiated any action in this regard (June 2014).

4.1.2 Accumulation and Accounting

Hazardous Waste, if not disposed of periodically, may cause environmental pollution. In terms of Rule 7 of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, the occupiers may store the hazardous wastes for a period not exceeding ninety days.

As per Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, every organization authorized to handle hazardous wastes shall maintain record of hazardous wastes handled by them in Form 3[79]. Organization authorized to handle hazardous wastes are required to prepare and submit to the SPCB, an annual return containing the details specified in Form 4 on or before the 30th day of June following the financial year to which that return relates.

Instances of accumulation of hazardous wastes generated in Railway workshops, sheds and PUs during 2009-12 are detailed below:

Table 3: Accumulation of hazardous wastes

Workshop/Sheds/PUs	Quantity (MT)	Description of wastes
Integral Coach Factory, Perambur, Chennai	183.94	Paint flakes, Laser cutting dust, Chemical sludge, phosphate sludge, used oil etc.

[78] Form 4- Form for filing returns regarding handling of hazardous wastes. It indicates the categories of wastes generated, details of waste treatment, waste disposal operations etc.

[79] Form 3- Format for maintenance of records of hazardous wastes at the facility. It records the description, method of storage, treatment and disposal, mode of transportation in addition to the details of hazardous wastes reused and recycled.

Chittaranjan Locomotive Works, Chittaranjan	6.1	Hardening salt and sacrificing tape
Mechanical workshop/Izzatnagar (NER)	108.00	Scrap, Paint, Sludge from Phosphating plant and ETP
Loco shed/Gonda (NER),	54.00	Filters, gaskets and rubber
Carriage and Workshops/ Perambur (SR)	9.27	Sludge from ETP, phosphates and bosch tank, mud and muck mixed with oil and oil/paint soaked cotton waste.
Halisahar Stores Depot, Belur Scrap Yard and Jamalpur Stores Depot (ER)	Quantity not available as the records of hazardous wastes were not maintained in Form 3	Lead Acid Battery, Copper Arsenical Lamp, Brass, Bronze Gun Metal etc.
Signal Workshop/Howrah (ER)	3.1	Gun metal, empty paint drums, aluminum scrap, brass scrap, copper wire etc.

Thus, failure of the ZRs in obtaining authorization for handling hazardous wastes from the respective SPCBs and accumulation of huge quantities of hazardous wastes in workshops sheds and PUs indicate violation of provisions which prohibits storing of hazardous wastes for a period not exceeding ninety days.

4.1.3 Documentation

Rule 22 of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 provides that the occupier generating hazardous wastes and operator of the facility for disposal of hazardous waste shall maintain records of such operations in Form 3. Scrutiny of maintenance of records relating to hazardous wastes generated during 2009-12 in 15 workshops and 17 sheds and six PUs authorized to handle hazardous waste revealed the following:

I. Two workshops and five sheds[80] maintained complete records as prescribed in Form 3. Remaining 13 workshops and 12 sheds (78 *per cent)* did not maintain complete records during the review period. In absence of proper maintenance of records, accumulated quantity in respect of three Stores depot[81] could not be verified in audit.

[80] CRW/BBS, DLS/New Katni Junction, DLS/GY, DLS/KZJ, LS/Krishanrajapuram, RSK/STLI and WRS/Kota.

[81] Halisahar Stores Depot, Belur Scrap yard and Jamalpur Stores Depot

II. Out of 15 workshops and 17 sheds, only nine workshops and three sheds submitted annual return in Form 4;

III. All PUs maintained records in Form 3 and submitted annual return in Form 4 except DLW/Varanasi where neither records were maintained in Form 3 nor the annual return submitted in Form 4 during the period 2007-12; and

IV. Quantity of waste that could be disposed by the workshops, sheds and PUs is endorsed in the original registration certificate. Actual quantity of waste is noted in the pass book issued by the CPCB. However, the same was not done in Halisahar Stores Depot/ER despite this being pointed out by the WBPCB in June 2006. In NWR, none of the three workshops and five sheds were issued registration certificate by the SPCB. As a result it could not be verified whether the quantity disposed off was within the authorized limit.

Thus, the workshops and sheds failed to adhere to the statutory provisions regarding maintenance of records relating to hazardous wastes. The Zonal Railway Administration was not effective in enforcing statutory obligation though 78 *per cent* of the units failed to maintain records as per Form 3.

4.1.4 Handling and Disposal

The hazardous waste manifest system is a set of forms, reports, and procedures designed to track hazardous waste from the time it leaves the generator where it is produced, until it reaches the off-site waste management that will store, treat, or dispose of the hazardous waste.

In terms of Rule 4(2) of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, the hazardous waste generated should be sent or sold to a recycler or re-processor or re-user registered or authorized by the CPCB or should be disposed off in an authorized disposal facility.

In terms of the Hazardous wastes (Management and Handling) Rules 2008, the ZRs disposing hazardous waste shall prepare six copies of the manifest in six colour codes. The blue copy[82] of the manifest is required to be returned by the recycler/operator to the ZRs after treatment and disposal of waste. Rules also provide that the hazardous wastes generators and auctioneers are required to file

[82] As per Hazardous Wastes (Management, handling and transboundary movement) Rules, 2008, blue copy of the manifest to be returned by the operator of the facility to the occupier after treatment and disposal of hazardous materials/wastes.

annual returns of auction and sale in Form 13[83] latest by 31st day of January of every year to the respective SPCBs.

Review in Audit of the method of disposal of hazardous waste by selected units revealed the following:

I. The manifest system was followed only in six workshops and four sheds over five zones[84] (seven *per cent*). Of these, in one workshop and two sheds[85] the entries in the manifest were filled in partially. Receipt of blue copy from the recyclers was monitored only in two sheds[86] and as a result, proper treatment and disposal of wastes could not be ensured;

II. Waste oil generated at NCC/VSKP (ECoR) was released directly to the open ground. In two workshops and one shed[87], hazardous waste such as condemned rubber gasket, brake blocks, cotton waste soaked with grease and oil, oil filters etc. were not disposed of by burning in an incinerator..

III. In Engineering workshop /Sini (SER), the hazardous wastes such as glue, paint, oil soaked cotton waste generated to the tune of 1.5 MT each year was being disposed off outside the railway premises;

IV. In Wagon Repair Shop/RYP (SCR), the hazardous waste like cotton waste soaked with grease and oil was used in furnace of smithy shop instead of being burnt in an incinerator;

V. In Bardhaman and Andal Diesel Shed (ER), released battery electrolytes were being disposed off through drains instead of handing over the same to authorized agencies of SPCBs for proper disposal;

VI. In Diesel loco shed/Vatva (WR), EMU car shed/Kandivali (WR), Coaching depot/Bandra (WR), Electric loco shed/Vadodara (WR), Coaching depot/Ahmedabad (WR), oil contaminated cotton cloth (45.1MT) was disposed off along with municipal waste without segregation and disposal by burning in an incinerator; and

[83] Form 13 depicts total quantity of wastes auctioned or sold during a particular year. The wastes include Non-ferrous Metal Wastes, used oil and waste oil.

[84] SECR, SER, SWR, WCR and NCR

[85] CWS/Mysore (SWR), RSK/STLI (NCR) and DLS/Itarsi (WCR)

[86] DLS/Nagpur (SECR) and DLS/Itarsi (WCR)

[87] Mechanical workshop/New Bongaigon (NFR), EMU car shed/MLY (SCR) and Engineering workshop/Sabarmati (WR)

VII. All PUs except DLW (for waste oil) followed the procedure while selling hazardous waste and submitted the Annual Returns to SPCB in Form 3. However, ICF (Perambur /Chennai) did not monitor the receipt of blue copy from the recyclers to ensure proper treatment and disposal of hazardous wastes.

Thus, the procedures adopted by the Workshops and Sheds for disposal of wastes were not environment friendly. Out of the selected units, manifest system was not followed in 43 workshops and 89 sheds.

4.1.5 Environment Impact Assessment

Environment Impact Assessment (EIA) is an important management tool for ensuring optimal use of natural resources for sustainable development. EIA is mandatory under the Environmental (Protection) Act, 1986 for 29 categories of developmental activities. It provides that the operator of a facility, occupier or any association of occupiers shall undertake EIA of the selected site(s) and shall submit the EIA report to the SPCB. After approval of the site or sites, the State Government shall acquire the site(s) or inform the occupier or any operator of facility, or any association of occupiers to acquire the site(s) for setting up the facility for treatment, storage and disposal of hazardous wastes.

Examination of records of selected units revealed that out of 15 workshops and 17 sheds and six PUs authorized to handle hazardous waste, EIA was conducted in only two workshops and two sheds (13 *per cent*)[88] and in one PU (RWF/Yelahanka) only. RB did not enforce conducting of EIA.

4.1.6 Reuse and Re-cycling of Hazardous Waste

Reuse and recycling is important to minimize the strain on the environment. The protocol for Hazardous Waste Management issued by the CPCB states that the hierarchy in efficient management of hazardous waste is to reduce, reuse, recycle, re-process and finally dispose of wastes in an eco-friendly manner.

Scrutiny of records relating to reuse of the hazardous wastes in selected units revealed the following:

[88] C&W workshop/ Liluah (ER), Central workshop/Mysore (SWR), DLS/Itarsi (WCR) and RSK/STLI (NCR)

I. Only one workshop and 16 sheds (12 *per cent)* in 11 ZRs[89] tested samples in laboratory to explore the possibility of reuse of lubricating oil drained during maintenance schedule. The oil thus tested was reused in all these units except in RSK/STLI (NCR).

II. In Wagon Repair Workshop/Kota (WCR), waste grease (25.728 MT), waste oil (4.27 MT) generated during the period 2009-12 was used in furnace. In Electric loco shed/Itarsi (WCR), used grease (10.90 MT), TFP oil (47.0 MT), Suspension oil (25.50 MT) generated during the years 2009-11 was issued to engineering department for reuse. In both workshops, waste oil was not tested for its suitability before reuse.

III. In all the six PUs, the waste oil and lubricating oil drained during maintenance schedule was not reused.

Thus, the efforts of the workshops and sheds in reusing wastes were not very significant. While only one workshop and fifteen sheds could reuse wastes oil, none of the PUs reused waste oil which indicates low priority to the need of minimizing pollution.

4.2 Disposal of Used Batteries

As per the Batteries (Management and Handling) Rules 2001, used batteries are required to be sold only to registered recyclers. The Rules provide for submission of half-yearly returns in Form VIII[90] to SPCBs specifying the details pertaining to disposal of used batteries. It also provides that the responsibility of the consumer is to ensure that used batteries are not disposed of in any manner other than by depositing it with the dealer, manufacturer, registered recycler, reconditioner or at the designated collection centres.

Out of the selected units, 32 workshops and 70 sheds were using batteries. Examination of records relating to compliance with the extant provisions in above units revealed the following deficiencies:

I. Half yearly return was filed by five workshops and three sheds (eight *per cent*) over six ZRs[91] only;

[89] CR, ECoR, NCR, NFR, NR, NWR, SCR, SER, SWR, WCR and WR

[90] As per Batteries (Management and handling) Rules, 2001, it shall be the responsibility of the bulk consumer to file half-yearly return in Form VIII to the SPCB.

[91] ER, NWR, SR, SWR, WCR and WR

II. 14 workshops and 46 sheds (59 *per cent)* across all ZRs did not sell/auction the used batteries to the registered recyclers. Used batteries were kept in open areas pending disposal; and

III. Out of six PUs, returns were submitted by only two PUs (CLW/Chittaranjan and ICF/Chennai). All PUs, however, sold the used batteries only to the registered recyclers;

RB in their reply (December 2013) stated that the used lead acid batteries were being sold/auctioned only to those recyclers who are registered with MoEF. The contention of RB is not acceptable in view of the audit findings mentioned at II above. Further, the reply of RB is silent on the audit observation regarding open storage of used batteries. The storage of used battery in open areas exposed the environment to pollution from leakage of spent acid.

Chapter 5 ⟹ Health and Safety

Audit Objective 4

To verify whether health and safety of workers was as per the requirements of Indian Factories Act 1948 and in accordance with the provisions laid down in the manuals of Indian Railways.

Health and safety of the employees is an important aspect of an organisation for enhancing productivity, minimizing potential work-related injuries, illnesses and increasing the quality of products or services rendered. Occupational Health and Safety (ISO18001) demands adoption of structured approach for identification of hazards, their evaluation and control of risks in the organisation. In addition, the Factories Act 1948 also laid various provisions to ensure welfare of workers.

Audit examined compliance of workshops, sheds and PUs with health and safety requirements prescribed under Factories Act and Indian Railway Medical Manual. This chapter highlights the approach of IR in dealing with health and safety of employees of workshops, sheds and PUs.

5.1 Ventilation and Lighting

A carefully drafted layout plan of workshops, sheds and PUs ensures health and safety of workers and prepares an organisation for any disaster. This also ensures a clear demarcation of risk areas and facilitates access of emergency services to the workers. As per Section 13 of the Factories Act, effective and suitable provision shall be made in every factory for securing and maintaining adequate ventilation for circulation of fresh air in every workroom. Section 17 of the Act also provides that suitable lighting, natural or artificial, or both should be provided in work spots.

Scrutiny of records of the selected units revealed the following:

I. Adequate ventilation and lighting was available in all the workshops and sheds test checked. However, 23 workshops and 47 sheds in eight ZRs[92] did not get their layout plan of the workshops and sheds approved by the

[92] ECoR, ECR, ER, NCR, NER, NR, SER and SR

Director/Inspector of Factories. Initiative was not taken by the workshops to get their layout plan approved (June 2014);

II. In six PUs test checked, layout plan of the units was approved by the Director/Inspector of Factories. Adequate provision was made for ventilation and lighting.

Thus, though adequate care was taken for proper ventilation and lighting, there was lack of initiative on the part of the authorities of workshops and sheds in obtaining approval of the layout plan from the competent authority.

5.2 Healthcare facilities

Indian Railway Medical Manual provides that the Physician/ Medical Officer[93] should frequently visit the shop in order to acquaint himself / herself with the various aspects of the working environment[94], manufacturing processes and occupational physiology[95]. Recommendations should be made to the Works Manager concerned to prevent accidents and diseases likely to emerge from the physical and chemical hazards of the working environment and also to ensure that the recommended safety measures were in place.

Scrutiny of records of selected units relating to periodical inspections of Doctors or Medical Officers and the status of implementation of their recommendations revealed the following:

I. The periodical inspection by doctors was carried out only in nine workshops and nine sheds (13 *per cent*) over eight ZRs[96]. Periodic inspection by Doctors was not conducted in the remaining 40 workshops and 80 sheds;
II. Monitoring of implementation of the recommended safety measures was done in 10 workshops and 7 sheds (12 *per cent*) over seven ZRs[97] ;
III. Health Unit (HU) was attached to 46 workshops and 77 sheds across ZRs. In the remaining 3 workshops and 12 sheds over five ZRs[98] HU was not attached. HU was attached to three[99] PUs.

[93] Para 1522 (4 and 5) of Indian Railway Medical Manual
[94] temperature, lighting, ventilation, humidity, dust, fumes, gases, noise, vibration, air pollution and sanitation
[95] occurrence of fatigue, shift work, weight carried by the workers, etc
[96] ECR, ER, NER, NCR, NFR, NR, SCR and WCR
[97] ECR, ER, NCR, NER, NFR, NR and SCR
[98] ER, NCR, NR, SECR, SWR
[99] ICF, RWF and DLW. One First Aid Post attached to workshop of CLW unit.

IV. Out of six PUs, periodic inspection during 2011-12 was carried out only at RWF, Yelahanka. Monitoring of implementation of the recommended safety measures (including recommendations made during the previous years) was done in two PUs (DLW/Varanasi and RWF/Yelahanka.

Health Directorate of RB stated (December 2013) that the recommendations to prevent accidents and diseases likely to result from physical and chemical hazards of the work environment were being made to the Works Manager from time to time. RB further added that the extant instructions on the subject had been reiterated to the ZRs and PUs. However, the fact remained that the periodic inspection by doctors was not conducted in 40 workshops and 80 sheds (87 *per cent)*.

Thus, the instructions laid down in the IR Medical Manual with regard to periodic inspections by Medical Officers to ensure the health and safety of the employees of the workshops sheds and PUs were not complied with.

5.3 Maintenance of Medical Records

Indian Railway Medical Manual[100] provides for proper maintenance of workers health record and occupational disability record for future planning, development and efficient operation of occupational health services.

Scrutiny of maintenance of health records of workers in selected units revealed that out of 46 workshops and 77 sheds (89 *per* cent) where health units were attached, medical records of workers were maintained in the health units attached to 10 workshops and 15 sheds (20 *per cent*) over seven ZRs[101]. HUs attached to PUs, maintained medical records of employees.

Health Directorate of RB stated (December 2013) that the preventive medical examination of all the employees was being carried out as per the laid down frequency in Indian Railway as per Medical category. It was also stated that records were being maintained with the Assistant Medical Officer of the employee. Contention of the Health Directorate is not acceptable as only 20 *per cent* of the health units attached to the workshops and sheds maintained medical records of workers.

5.4 Occupational Safety

Working environment such as temperature, lighting, ventilation, humidity, dust, fumes, gases, noise, vibration, air pollution and sanitation in workshops, sheds

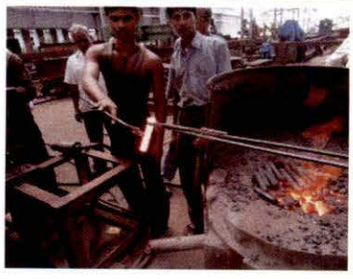
[100] Para 1522 (6) of Indian Railway Medical Manual
[101] CR, ECR, NCR, NER, NFR, NR and WCR

and PUs have an important bearing on the worker's health. The primary concern to the safety of the workmen should be addressed through use of appropriate personal protective equipment (PPE). Section 41 of the Factories Act stipulates that PPE are to be provided to workers to safeguard them from the hazards involved.

Audit conducted survey among workers of 30 workshops and 61 sheds over eleven ZRs[102] and six PUs. Survey revealed that while in three ZRs, the percentage of employees provided with PPE was less than 43 *per cent*, it ranged between 43 and 62 *per cent* in four ZRs. In the remaining four ZRs, the percentage of employees provided with PPE was between 78 and 97 *per cent.* Regarding use of PPE, more than 80 *per cent* of the employees of workshops and sheds across seven ZRs[103] stated that they were using PPE. During joint inspection with the Railway officials, following deficiencies were, observed in four ZRs:

I. None of the workers at Car shed/TBM (SR) were wearing PPE. In SR, most of the employees of EWS/AJJ, DLS/TNP and CD/BBQ were also not wearing safety gadgets.

II. In CRW/BBS (ECoR), some of the workers were not wearing any safety gadgets provided to them.



III. Though the workers of Signal Workshop/KGP/SER stated in the survey questionnaire that they use PPE, spot verification revealed that the workers were not using PPE.

IV. In NFR, workers at Diesel Shed/New Guwahati were not using the PPE.

Scrutiny of records relating to accidents during 2007-12 in selected units revealed that:

- There were 10,420 accidents occurred in 16 ZRs ***(Appendix VI)***. Of them, 5339 accidents (51 *per cent*) occurred in 12 workshops and 18 sheds over three ZRs (CR, ER and NR).

[102] ECOR, ER, ECR, NFR, SCR, SER, SWR, WCR, WR, SECR and NCR
[103] ER,NEFR,SCR,SER,SWR and WCR

- Workshops which registered high number of accidents were Kanchrapara/ER (1098 accidents), Jagadhari/NR (943 accidents) Jamalpur/ER (807 accidents) and Parel/CR (602 accidents).

- 9747 employees were injured across all ZRs. Of them, 4119 employees (42 *per cent*) were injured in eight workshops and 12 sheds over CR and ER.

- Out of 49 deaths, 11 occurred in WR. In PUs, 775 accidents occurred resulting in death of five workers[104] and injury to 773 workers.

Thus, the safety of workers was compromised due to non supply of PPE and monitoring its use by workers. Though the number of accidents during the review period showed a decreasing trend, instances of death and injuries were high particularly in four zones (CR, ER, NR and WR) which indicated deficiencies in workshops, sheds and PUs in complying with provisions related to the safety of workers.

[104] ICF (3), RCF (1) and CLW (1)

Chapter 6 ⟹ Conclusions and Recommendations

6.1 Conclusions

It was observed that RB had issued guidelines and instructions on pollution control, waste management and energy conservation. It was also noticed that some progress had been made by workshops, sheds and production units on these issues. The important deficiencies noticed in environment management are elaborated below.

Statutory obligation of obtaining Consent to Establish (CTE) and Consent for Operation (CFO) from the State Pollution Control Boards was not complied by 88 *per cent* (CTE) and 68 *per cent* (CFO) of the workshops and sheds test checked. Weakness in the existing system of monitoring by RB resulted in shortfall in compliance with the conditions specified while granting consent. Monitoring of air quality in workshops and sheds along with the provision of pollution control equipment was inadequate. Pollution control equipment were also not kept in working condition. Standards prescribed for controlling noise pollution for DG sets were not adhered to.

Adequate measures were not adopted to treat the effluents before discharging them into the environment. Effluent treatment plants were either not installed or wherever installed, quality of discharge was not monitored. ETP sludge was improperly accumulated in open area without proper treatment or by disposing them through agencies authorized by the SPCBs/CPCB.

ISO Certification was obtained by only 22 per cent of the units test checked. Despite a series of instructions/guidelines from the RB for conservation of resources- both energy and water, the progress of their implementation was slow.

Regarding use of renewable sources of energy, IR has not formulated a detailed action plan for identification of exact locations for installing wind mill and solar plants. Efforts of workshops and sheds to generate electricity from the solar energy and conservation of water by making provision of water recycling plant and rain water harvesting were insignificant. At the present rate of progress, IR will be unable to achieve its 2020 vision of meeting 10 *per cent* of its energy requirements from renewable sources. In absence of any concrete action plan,

efforts of IR to conduct energy audit and implement their recommendations were also not adequate.

Deficiencies were observed in disposal of wastes generated in the workshops, sheds and production units. Statutory guidelines on maintenance and submission of records/returns and handling of hazardous wastes were followed only partially. Reuse of waste oil was observed only in a few workshops and sheds. None of the PUs reused waste oil.

The instructions laid down in the Indian Railways Medical Manual with regard to periodic inspections of the workshops, sheds and PUs by Medical Officers were not complied with even though health units were attached to 89 *per cent* of the workshops and sheds. While the number of accidents showed a decreasing trend, instances of fatalities and injuries were high in four zones.

6.2 Recommendations

- ***Mechanical Directorate of RB needs to establish a system of effective monitoring to ensure compliance with the statutory obligations relating to air, water and noise pollution in workshops, sheds and production units. Provision of control equipment and keeping them in working condition needs to be given due importance;***

- ***Workshops, sheds and production units need to take effective steps for proper disposal of ETP sludge as per the guidelines issued by the SPCB/CPCB in order to prevent contamination of ground water;***

- ***All workshops, sheds and production units need to frame a well defined target for implementing energy conservation measures. Electrical Directorate of RB needs to closely monitor the achievement of target and analyse the impact of shortfall in achieving target.***

- ***A time bound action plan needs to be drawn for harnessing renewable energy such as wind and solar energy so as to achieve the 2020 vision of IR;***

- ***Mechanical Directorate of RB need to effectively ensure that its instructions on setting up of Water Recycling Plants and Rain Water Harvesting structures are complied in a time bound manner;***

- ***Mechanical Directorate and Stores Directorate of RB needs to establish a monitoring mechanism for strict observance of statutory provisions regarding proper accounting, handling and disposal of hazardous wastes;***

- ***Health Directorate of RB needs to ensure maintenance of medical records of the workers of all workshops, sheds and production units.***

(SUMAN SAXENA)
Deputy Comptroller and Auditor General

New Delhi
Dated: 19 August 2014

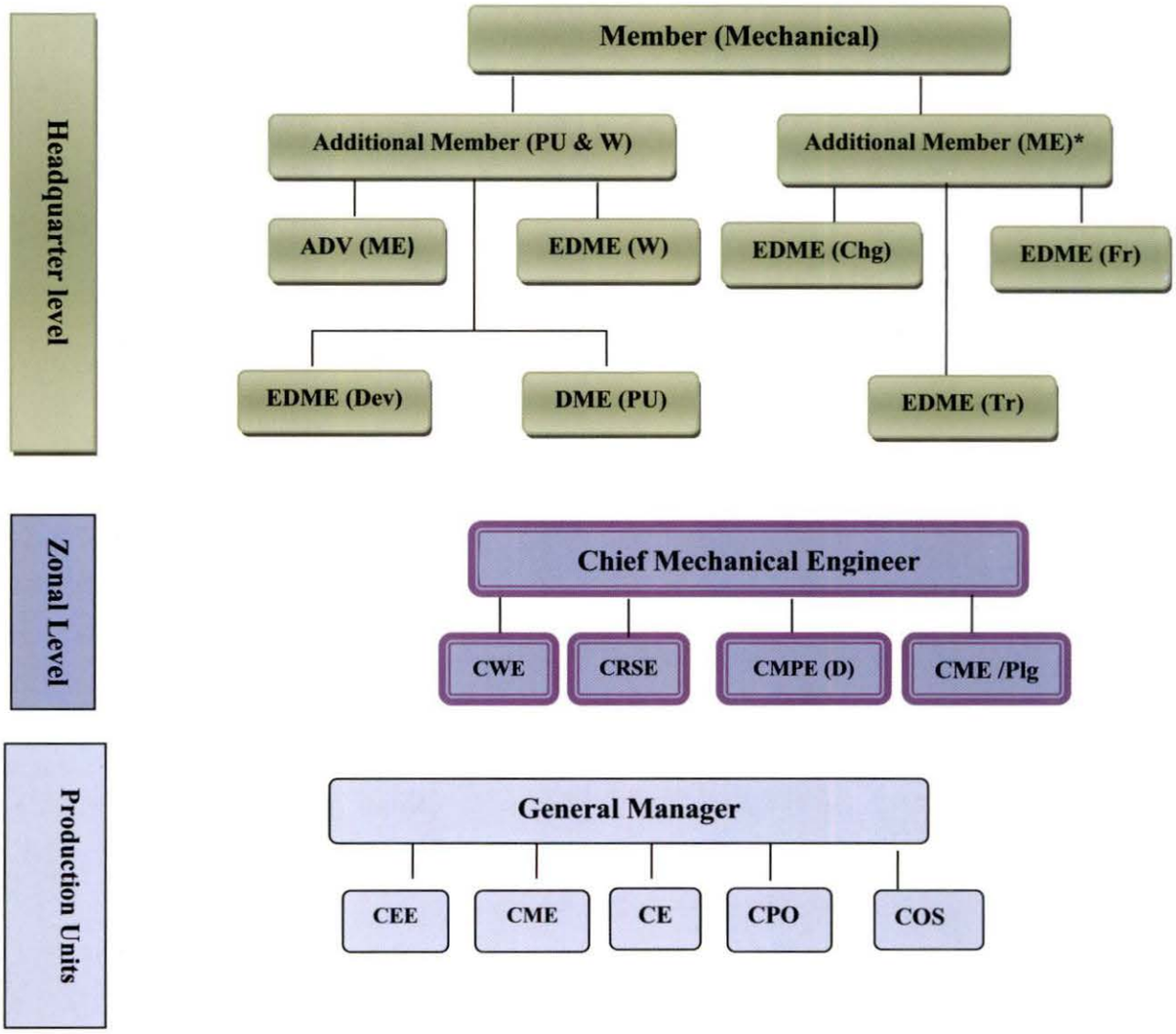
Countersigned

(SHASHI KANT SHARMA)
Comptroller and Auditor General of India

New Delhi
Dated: 19 August 2014

Appendix I **(Ref Para 1.1)**

Organization Chart



*Including Coaching Depots

Appendix II (Ref Para 1.4)

Statement showing details of workshops, sheds and PUs selected for sample study

Sl. No.	Description	Total No. of Units	Criteria for selection of units	No. of units selected
1	Workshops-Mechanical	41	50 *per cent* subject to a minimum of two workshops.	30
2	Signal and Telecommunication Workshop	10	One workshop in each Zone.	10
3	Engineering Workshops	15	One workshop in each Zone.	9
4	Sheds	94	Two Diesel Loco Sheds and one Electrical Loco Shed.	43
5	EMU/MEMU/ DEMU Car Sheds	30	One Car shed.	12
6	Coaching and Wagon Depots	242	Two Major Depots – one coaching depot and one wagon depot. If there is no wagon depot, two major coaching depot.	34
7	PUs	6	All the six PUs were selected. In each Production Unit, 25 *per cent* of the Manufacturing Shops subject to minimum five shops.	6
TOTAL		438		144

Appendix III **(Ref Para 1.4)**

Statement showing details of workshops, sheds and PUs selected from all ZRs

Mechanical Workshops		
Sl No.	Zone	Name of the Workshop
1	ECOR	Bhubneshwar
2	ECR	Samastipur
3	CR	Matunga
4		Parel
5	ER	Liluah
6		Kanchrapara
7		Jamalpur
8	NCR	Jhansi
9		Sithouli
10	NFR	New Bongaigaon
11		Dibrugarh
12	NER	Gorakhpur
13		Izzatnagar
14	NR	Charbagh, Lucknow
15		Jagadhari
16	NWR	Carriage Workshop, Ajmer
17		Diesel Loco & Wagon Workshop, Ajmer
18	SCR	Rayanapadu
19		Lallaguda
20	SECR	Motibagh at Nagpur
21		Raipur
22	SER	Kharagpur
23	SR	Perambur
24		PONMLAI GLD RCK
25	SWR	Hubli
26		Mysore
27	WCR	Kota
28		Bhopal
29	WR	Lower Parel
30		Dahod.

Diesel Loco Sheds		
Sl No.	Zone	Name of the Shed
1	ECOR	Vishakapatnam
2	ECR	Mugalsarai
3		Samastipur
4	CR	Kalyan
5		Pune
6	ER	Bardhaman
7		Andal
8	NCR	Jhansi
9		Gwalior
10	NFR	Siliguri
11		New Guwahati
12	NER	Gonda
13		Izzatnagar
14	NR	Alambagh, Lucknow
15		Ludhiana
16	NWR	Bhagat Ki Kothi
17		Abu Road
18	SCR	Gooty
19		Kazipet
20	SECR	Raipur
21		Motibagh at Nagpur
22	SER	Bondamunda
23		Kharagpur
24	SR	Tondiarpet
25		Ernakulam
26	SWR	Hubli
27		Krishnarajapuram
28	WCR	Itarsi
29		New Katni Junction.
30	WR	Ratlam
31		Vatva

Coaching Depots		
Sl No.	Zone	Name of the Depot
1	ECOR	Vishakapatnam
2	ECR	Rajendra Nagar
3	CR	Lokmanya Tilak Terminus
4	ER	Chitpur
5	NCR	Allahabad
6		Gwalior
7	NFR	New Jalpaiguri
8	NER	Lucknow
9	NER	Chhapra
10	NR	Moradabad
11	NWR	Jodhpur
12	NWR	Bikaner
13	NWR	Jaipur
14	SCR	Hyderabad
15	SECR	Bilaspur
16	SER	Tatanagar
17	SR	Basin Bridge Jn
18	SWR	Bangalore
19	WCR	Habibganj
20	WCR	Jabalpur
21	WR	Bandra Terminus
22	WR	Ahmedabad (BG)

Wagon Depots		
Sl No.	Zone	Name of the Depot
1	ECOR	Vishakapatnam
2	ECR	Mughal Sarai
3	CR	Bhusaval
4	ER	Andal
5	NFR	New Jalpaiguri
6	NR	Ambala Division
7	SCR	Ramgundam
8	SECR	Bhilai
9	SER	Bokaro Steel City
10	SR	Tiruchchirappal
11	SWR	Hospet
12	WCR	New Katni Junction
EMU car shed		
Sl No.	Zone	Name of the Workshop
1	ECR	Jhajha
2	CR	Kurla
3	ER	Bandel
4	NCR	Agra Cantt
5	NER	Chappra Kacheri
6	NFR	Siliguri
7	NR	Saharanpur
8	SCR	Maula Ali
9	SECR	Bhilai
10	SER	Tikiapara
11	SR	Tambaram
12	WR	Kandivali.

Engineering Workshop		
Sl No.	Zone	Name of the Workshop
1	CR	Manmad
2	NCR	Allahabad
3	NFR	Bongaigaon
4	NER	Gorakhpur Cantt
5	NR	Jalandhar Cantt.
6	SCR	Lallaguda
7	SER	Sini
8	SR	Arakkonam
9	WR	Sabarmati.
10	SWR	Bangalore

S&T Workshops		
Sl No.	Zone	Name of the Workshop
1	CR	Byculla
2	ER	Howrah
3	NER	Gorakhpur Cantt
4	NFR	Pandu
5	NR	Ghaziabad
6	NWR	Ajmer
7	SCR	Mettuguda
8	SER	Kharagpur
9	SR	Podanur
10	WR	Sabarmati.

Electric Loco Sheds		
Sl No.	Zone	Name of the Shed
1	ECOR	Vishakapatnam
2	ECR	Mugalsarai
3	CR	Ajni
4	ER	Howrah
5	NCR	Jhansi
6	NR	Ludhiana
7	SCR	Lallaguda
8	SECR	Bhilai
9	SER	Tatanagar
10	SR	Erode
11	WCR	Itarsi
12	WR	Vadodara

PUs		
Sl No.	Zone	Name of the Unit
1	NR	Diesel Modernization Works, Patiala
2		Rail Coach Factory, Kapurthala
3	SR	Integral Coach Factory , Perumbur, Chennai
4	SWR	Rail Wheel Factory, Yelahanka, Bangalore
5	RPU and Metro Railways	Diesel Locomotive Works, Varanasi
6		Chittaranjan Locomotive Works, Chittaranjan

***Appendix IV*(Ref Para 2.1.3)**

Conditions of SPCB for granting of renewal of CFO

Consent is valid for maintenance of wagons @ 400 FWU / month and coaches @ 212 VU / month
Daily discharge of mixed effluents should not exceed 2408 KL and should be discharged to North Tank through 4 outlets.
Any alteration in the existing system or place of discharge or introduction of new outlet should be informed to the Board and prior permission for the same to be obtained.
Railway should provide comprehensive facility for treatment of industrial liquid waste and domestic liquid waste and operate and maintain the same so that the quality of final effluent conforms to the prescribed standard: pH - 5.5 to 9.0; TSS - upto 100 mg/l; BOD - upto 30 mg/l; COD - upto 250 mg/l; Oil and grease - upto 10 mg/l. Analysis of discharged effluent to be done monthly.
Daily water consumption should not exceed 326 KL for domestic purpose and 2350 KL for processing whereby water gets polluted and the pollutants are easily bio degradable.
The Railway Administration should regularly submit to the SPCB the returns of water consumption in the prescribed form Form I on or before 5th of every calendar month and pay the cess.
The Railway Administration should install suitable device for measuring the volume of water consumed for different purposes giving correct result.
All the stacks connected to various sources of emissions must be designated by numbers and must be painted / displayed to facilitate identification.
The Railway Administration should install comprehensive control system consisting of pollution control equipment as is warranted with reference to generation of air emissions and operate and maintain the same continuously so as to achieve the level of pollutants to the Standard.
The Railway Administration should provide ports in the stacks and other necessary permanent facilities such as ladder, platform etc. for monitoring / sampling the air emissions.
The monthly fuel consumption should be limited to i) Hard Coke - 400 kg., Coal - 5 kgs.
The Railway Administration should take adequate measures for control of noise levels from its own sources within the premises within the standard limit of 75 dB (A) in day time and 70 dB (A) in night time.

The Railway Administration should provide for an alternate electric power source sufficient to operate all pollution control facilities installed by the Railway to maintain compliance with the terms and conditions of the consent. In absence of such an alternate electric power source, the Railway Administration should stop, reduce or otherwise control production to abide by the terms and conditions of the Consent regarding pollution level.
The Railway Administration should install a separate energy meter showing the consumption of energy for operation of pollution control devices.
The Railway Administration should ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the factory premises.
The Railway Administration should provide drainage system for conveying industrial and domestic liquid waste, storm-water drain should be kept separate from drainage system meant for industrial and domestic liquid waste.
The Railway Administration should analyze the samples of hazardous wastes/lactates from the laboratory recognised of the concerned Pollution Board and ensured that they should conform to the limits stipulated. The test report should be sent to the Board.
The Railway Administration should provide adequate and safe facility for collection of air, wastewater and solid waste samples by the State Board's staff as well as State Board's authorised agencies.
The Railway Administration should submit to the State Board by the 30th September every year the Environmental Statement Report for the financial year ending 31 March of the current year in the prescribed Form V.
The Railway Administration should furnish to the State Board all information in respect of quality, quantity, rate of discharge, place of discharge of liquid effluent and air emissions.
The Railway Administration should have to make registration for the use of groundwater with Central Ground water Authority.
The Railway Administration should make an application to the State Board in the prescribed form for renewal of the consent at least 60 days before the date of expiry of the previous consent.

The Railway Administration should not make any alteration, modification, expansion in the existing manufacturing process and equipment as well as the pollution control system without prior approval of the Board.
The Railway Administration should comply with the conditions as laid down in the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and Hazardous Wastes (Management & Handling) Rules, 1989.

Appendix V (Ref Para 2.2.1)

Statement showing workshops, sheds and PUs where air pollution control equipment were not provided

Zonal Railway	No. of shops/sheds provided with Air pollution control equipment	Name of the workshops/sheds provided with Air pollution control equipment	No. of shops/sheds not provided with Air pollution control equipment
CR	4	(WS/Parel & Matunga, DLS/Kalyan & Pune)	6
WR	5	CRW/Lower parel, DLS/Vatva, Ratlam, Loco carriage and wagon workshop/Dahod, EMU WS/Kandiveli),	5
SR	3	(EWS/AJJ, CW/PER, WS/GOC) 1 (WD/TPGY – Not required)	6
SER	3	(EWS/Sini, DLS/KGP, WS/KGP)	6
SWR	3	(CRS/Hubli, Loco shed/Hubli, KJM)	3
WCR	1	WRS/Kota	7
SECR	2	(WRS/Raipur, DLS/Raipur)	6
ECR	2	(DLS/Mugalsarai and Samastipur)	5
NWR	1	(DLS/Bhagat Ki Kothi)	7
ECoR, ER, NER, NR, SCR	Nil		44
14	24		95

Appendix VI (Ref Para 5.4)

Statement showing accidents and causalities in workshops, sheds amd PUs

A. ZRs

Zone	No. of units test checked	No. of Accidents	No. of casualties	No. of employees injured
CR	10	1635	4	1632
ECOR	5	186	0	186
ECR	7	18	1	17
ER	10	2489	7	2487
NCR	9	129	7	117
NER	9	566	2	564
NFR	9	48	0	48
NR	10	1215	1	614
NWR	8	577	2	577
SCR	10	561	2	560
SECR	8	612	3	611
SER	9	349	3	349
SR	10	587	5	582
SWR	6	244	1	243
WCR	8	798	0	784
WR	10	406	11	376
Total	138	10420	49	9747

B. PUs

Name of the PU	No. of accidents occurred during the review period	No. of employees injured during the review period
CLW	9	8
DLW	5	5
ICF	460	462
RWF	78	78
RCF	161	158
DMW	62	62

C. **Yearwise summary of accidents and causalities in workshops, sheds and PUs**

Year	No. of Accidents	No. of casualties	No. of employees injured
2007-08	2271	5	2052
2008-09	2284	4	2129
2009-10	2107	13	2038
2010-11	1955	8	1883
2011-12	1803	19	1645
	10420	49	9747