



**RAIL WHEEL FACTORY
(INDIAN RAILWAYS)**

**NATIONAL ENERGY
CONSERVATION AWARD
2004**

A WRITE UP SUBMITTED

By

**RAIL WHEEL FACTORY
(INDIAN RAILWAYS)**

In partial fulfillment of the
requirements for the award of

National Energy Conservation

Award 2004

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RAIL WHEEL FACTORY

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OUTLINE OF RWF

Rail Wheel Factory is located at Yelahanka, a suburb of the Garden City of Bangalore, which is the political and industrial capital of the State of Karnataka. The Plant is situated at a distance of 16 Km from the city center.



Details of the land and plant area are as follows:

LAND AREA

The Rail Wheel Factory extends over an area of 117.77 hectares.

(In Hectares)

| | | |
|-------------|---------------------|---------------|
| Plant Area | Factory & Buildings | 77.30 |
| Colony area | East Colony | 13.36 |
| | West Colony | 27.11 |
| TOTAL | | 117.77 |

I. RWF ORGANIZATION

The General Manager heads the plant. He is assisted in discharging his functions by functional heads of Mechanical, Finance, Stores and Personnel departments.

Till early 1980s, Indian Railways were heavily dependent on imports for meeting their requirement of wheels and axles. Indigenous capacity was available only in Tata Iron & Steel Company (TISCO) and Durgapur Steel Plant (DSP). The TISCO plant was technically not capable of meeting the changing requirement of wheels and axles for the new designs of rolling stock. The performance of DSP was quite indifferent and this plant was only able to partially meet IR's needs.

The Planning Commission sanctioned the Rail Wheel Factory project in 1978 at a cost of Rs. 146 crores. Trial production commenced during 1983. Late Smt. Indira Gandhi, then Prime Minister of India, formally commissioned the plant on 15th September 1984.

This plant is very energy intensive. The electricity consumption is around 90 lakh units per month with contract demand of 31.7 MVA with a recorded maximum demand of about 23.75 MVA. Out of 90 lakh units, about 55 lakh units are consumed in Electric Arc Furnace and the rest of the energy is being consumed in other areas of the plant. The monthly electric bill is about 3.65 crores.

The plant started production with a single type of wheel & wheel set and six types of axles. Over a period, the plant widened its scope to produce products suitable for all gauges viz. Broad-gauge, Meter-gauge and Narrow gauge - 11 types of wheels, 9 types of axles and 5 types of wheel sets.

RWF has so far manufactured 13,79,484 Wheels, 7,51,280 Axles and 5,36,561 Wheel sets for Indian Railways, wagon building industry and export.

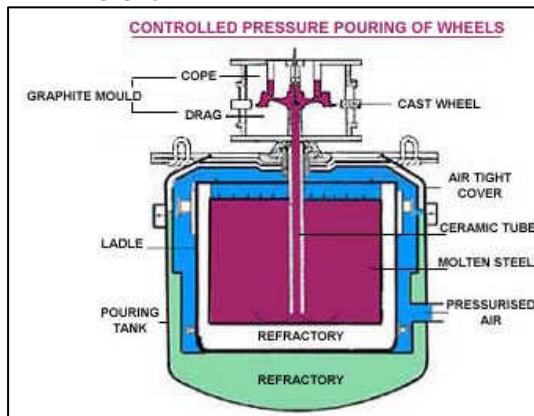
MANUFACTURING PROCESS AT A GLANCE

Rail Wheel Factory manufactures wheels, axles and wheel sets.

1. Wheel Manufacturing process

Wheel manufacturing facility was set up in RWF with complete technology transfer from M/s. Griffin Wheel Company, which is a subsidiary of Amsted Industries USA. The parabolic / deep-dish design of wheel developed by M/s Griffin is a low stress wheel with the advantage of a high strength to weight ratio.

M/s Griffin's patented process of **Controlled Pressure Pouring** is used for wheel casting. The technical support from M/s Griffin continued till 1991. Thereafter, RWF is independently pursuing manufacture and technological improvements, including development of new designs of wheels.



The Plant utilizes **Railway scrap** as raw material. The scrap is melted in three Electric Arc furnaces. The chemistry of the molten metal is precision controlled using Computerized Spectrometers. This enables precise control of steel composition during steel making for obtaining optimum metallurgical characteristics

needed for tough service and long life.

The casting is done in graphite moulds, which are precision-machined using forming tools. This ensures that all wheels are cast to the same dimensions and tolerances. The Controlled Pressure Pouring Process is employed for casting. The molten metal ladle is placed in a chamber and sealed with an airtight cover. A ceramic pouring tube is attached to the cover. Compressed air, forced into the chamber, pushes the steel up through the pouring tube and into the graphite mould positioned over the tube. The steel fills the mould from bottom to form the wheel. As the steel is forced into the mould at a controlled rate, the wheel is cast to extremely close tolerances.

The wheels as cast are normalized in a huge rotary hearth furnace to improve metallurgical structure and relieve internal stresses. Quenching of the rim and tread area is done to increase their hardness. The wheels are shot-peened to induce compressive stresses so that the cast wheels do not fail due to crack propagation in service. Each wheel is subjected to magnetic particle testing for surface flaws and ultrasonically tested for internal flaws to ensure maximum reliability.



2. Axle manufacturing process

Axles are manufactured from billets cut from blooms supplied by reputed indigenous Steel Plants. The billets are heated in a Rotary Hearth Furnace to forging temperatures. They are then forged on a Special Purpose Long Forging Machine having multiple hammers. The long forging machine was procured from M/s. GFM, Austria. The machine is capable of forging axle to



close tolerances in one-heat shaping in under 5 minutes. The forged axle is gas cut to required length, number stamped and then heat treated under controlled conditions to obtain axle forgings meeting the desired metallurgical and physical properties. Two years back, the Long Forging Machine was upgraded with Computerized Numerical Controls for better precision and quicker set up changes for forging a variety of axles of different designs.

The forged axles are machined on a battery of Farrell machines supplied by M/s. HMT Ltd, India. The operations include end machining, rough turning and finish turning which are carried out on hydraulic copying lathes, multiple operation axle machining centers and grinding / burnishing machines. A concept



of integrated engineering has been adopted for handling and transfer of axles from machine to machine, which facilitates the flow of axles.

All axles are subjected to ultrasonic testing and magnetic particle testing for ensuring zero defect products of the highest quality.

3. Wheel set Assembling Process

The assembly of wheel sets is done on a highly automated Wheel Assembly Complex. The wheel seat size of the axles is measured on an automated measuring unit and the dimensions are transferred to two wheel borers. Paired wheels are custom bored as per the wheel seat size to get correct interference



fit. The wheels are then pressed on the axle in a 300T Farrell Wheel Press. The Wheel Press Complex is capable of pressing 180 wheel sets per day. A new Wheel Assembly Complex, with a capacity to produce up to 300 wheel sets per day, has been procured from M/s. Simmons Machine Tools Corporation (SMTC), USA. The new complex is under pre-commissioning checks and trials.

AWARDS BESTOWED:

- Prestigious Golden Peacock National Award for Quality in the year 1997
- Best Quality Management Company award by IOD during 1998
- Best Environmental Management company award by IOD's during 2002
- Golden Peacock National Environmental Management Award in 2002
- Best Innovative Product award by IOD during 2003
- Greentech Environmental Award in the year 2003
- Laxman Rao Kirloskar Merit Certificate for Best Foundry in 2003

CERTIFICATES:

- ISO 9001 – 2001 for Quality Management System
- AAR for Quality Management System
- ISO 14001 – 1996 for Environmental Management System



Information on Total Energy Consumption

Electricity

RWF is an electric energy intensive Plant. RWF uses electricity for its electric arc furnaces, forging machines and other equipments of the process in manufacturing of wheels, axles and wheel sets. RWF uses 80,00,000 kwh of electricity per month and the monthly power bill is around Rs 2.8 crores.

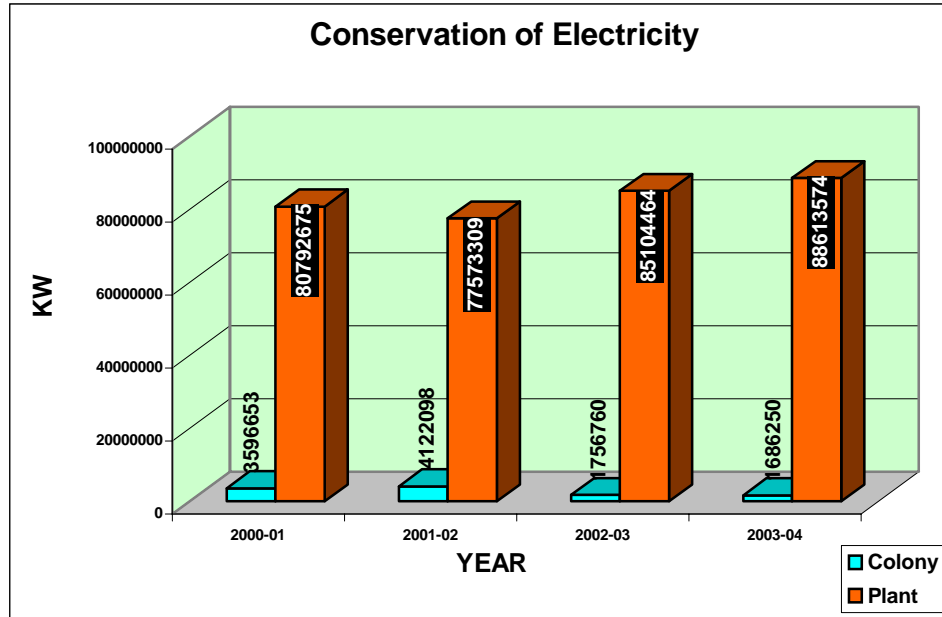
The total connected load is about 60 MVA and the contract demand is 31.7 MVA. The consumption trend for past 6 years is elucidated in the graph.

Karnataka Power Transmission Corporation Limited (KPTCL) makes the power available through 66 KV double feeders directly from KPTCL 220 KV Sharavathi Receiving Station, Peenya. Apart from this RWF operates its 2 Nos. of 2.19 MVA 11 KV diesel generators to feed essential loads of the Plant while KPTCL 66 KV power failures take place.

Steps taken to control Electricity:

- ◆ By continuous monitoring of various operations of the Arc Furnaces and other areas, the average energy (KWH) per wheel cast and axle forged was brought down to 580 and 121.87 in the financial year 2003-2004 in comparison to the figures of 653 and 147.49 in the financial year 2001-2002 respectively.
- ◆ By continuous monitoring and effecting economy in operation of circulating water pumps by both Mechanical and Electrical Department, Electrical energy has been conserved to the tune of about 2 lakhs during the year 2003-2004.
- ◆ Solar water heaters installed in Type IV and Type V quarters at East Colony. This has resulted in recurring savings of 36,000 units annually.
- ◆ HPSV fittings of 70w capacity have been replaced by 1 x 20w FL fittings and 4 x 20w FL fitting have been replaced by 2 x 11 compact fluorescent lamp fittings in Admin. Block corridors. This has resulted in recurring monthly energy savings of 540 units.

A write up on Energy Conservation is enclosed.

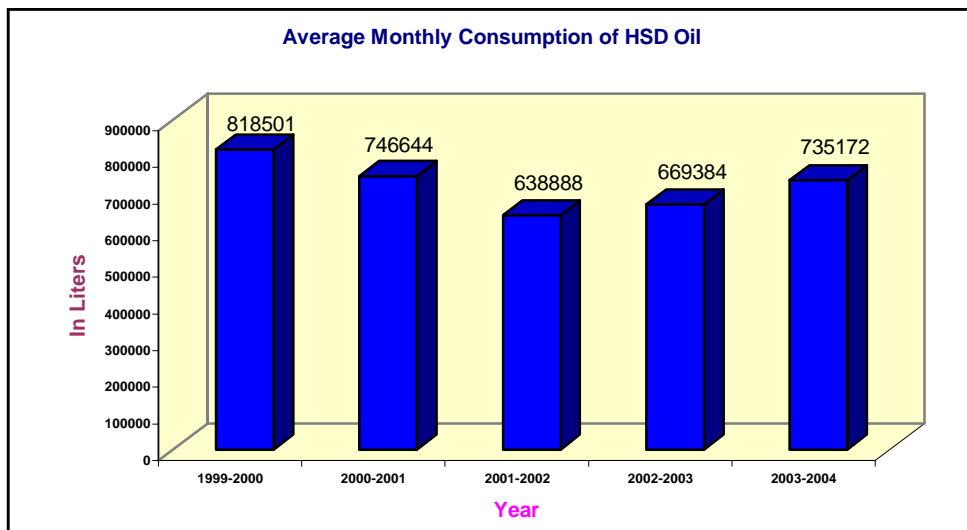


- ◆ Close monitoring and arresting of water and air leakages in plant premises has resulted in reduction of consumption of electricity.
- ◆ Provision of High efficiency Sodium Vapors Lamp.

With all the above control measures, the consumption of electricity is reduced by 10% in 5 years.

High Speed Diesel

RWF uses diesel oil for operating its furnaces and vehicles. RWF has 5 five treatment furnaces and 2 ladle pre heaters where this diesel oil is used. Apart from this, RWF has 22 Nos. of industrial vehicles & road vehicles that use diesel oil. RWF has taken conservative measure to reduce the consumption of fuel oil.



Other energy use:

RWF also uses:

LPG gas for heating ceramic tubes in wheel manufacturing and for staff canteen: Quantity consumed during 2003-2004 is 268274 Kgs.

Steps taken to control consumption of Diesel oil:

- * Revamping of draw furnaces of Wheel Shop.
- * Periodical attention to all furnaces and controls to eliminate hot air leakages.
- * Provision of fuel effluent oil burners.
- * Replacement of all Burners of Axle Forge Shop Furnaces

With the above control measures, the overall consumption of Diesel oil is reduced by 34% in 4 years.

Special features of Environment Management in the Organization.

The Plant has been designed, installed and provided with pollution control system right from the inception in 1984. The technology and methodology/systems used by RWF is by and large adequate to control pollution levels. However, as the technology for controlling pollution is improving, inputs are made from time to time to improve further the environmental standards and have aimed towards excellence in Environmental Standards.

- Maintaining clean environment to the satisfaction of stakeholders including KSPCB, CPCB though RWF has been classified by CPCB as 'RED Category' being a Steel making industry.
- Having ISO 14001:1996 certificate.
- Continual improvements in all fields of activities i.e. in controlling rejection, control of raw material, control of waste generation, efficient and quick disposal of waste. Conserved resources for benefiting environment and financial savings.
- Possessing pollution control equipments for all the critical management activities.
- Aforestation programme adopted by RWF.
- Better House Keeping practice through 5's (Kaizen).
- Adopting environment friendly/Eco-friendly technologies in RWF.
- Top management involvement in continual improvement of quality and environment.

Environmental Management Certification

RWF was first in Indian Railways to develop Environmental System Standards with ISO 14001:1996 by internationally acclaimed BVQI certification in the year 1999.

Environmental Policy of Rail Wheel Factory

We, as stake holders in this our Rail Wheel Factory and its environment, commit ourselves to maintain our **environmental friendliness and serenity** by complying with all applicable **legal and regulatory requirements** by exercise of control in manufacturing and servicing processes.

Environmental Objective of Rail Wheel Factory

We shall continually strive to improve the environment by pursuing:

- Prevention of the adverse and enhancement of the beneficial **environmental impacts** by using the right process / material / technology.
- Provision of **safe and healthy environment**.
- **Conservation of resources**.
- Proper **waste management** practices.
- Education and training to **create awareness and inculcate a spirit of responsibility** among ourselves and also all other stakeholders for maintaining environment friendliness.

Pollution Control Measures

Emissions To Air

Emissions to air by type (e.g. NH₃, HCl, HF, NO₂, SO₂ and sulphuric acid mists, VOCs and NOX, metals and persistent organic chemicals) and nature:

RWF is having 5 heat treatment furnaces in its production process. These are diesel-fired furnaces. The stacks for these furnaces are 30 meters height. Over and above, there



are 3 20 tons electric arc furnaces where the emissions are filled in Fume Extraction System before letting out to air. As per KSPCB's norms, the suspended particles and AAQ levels are being monitored. The pollution levels are being monitored by RWF and are being maintained within the prescribed levels by KSPCB. The test reports are enclosed.

Effluents To Water

Discharges to water, by type (e.g. oils/greases, TSS, COD, BOD, metal and persistent organic chemicals) and nature:

RWF is **not discharging any trade effluents to water**. It has its own **recirculating water system** for its production machinery and water saving system in the circuit.



Profile of water bodies into which discharges flow (e.g. ground water, river, lake, wetland, ocean):

RWF **discharges domestic effluent treated water to the ground for gardening purposes**. The BOD, COD, oils and suspended solid levels

SAFETY

i) SAFETY ORGANIZATION

The safety management system at Rail wheel Factory is aimed towards safety of an individual under any situation. Safety awareness and adoption of safe practices occupy vital role.

RWF's safety objective is to achieve 100% accident free working by better understanding and practice of safe working. Safety is everybody's concern; all individuals and departments have a special role to play towards accident free working.

A full-fledged safety officer is detailed to look after and coordinate all the activities related to safety. Safety officer reports to Factory Manager and Factory Manager reports 'Occupier' i.e., Chief Mechanical Engineer.

SAFETY POLICY OF RWF

Employees are our **important assets** and their safety is our **primary responsibility**.

Its our Policy –

To provide **protective equipments** for personal safety.

To provide proper **machine and hand tools** with which an employee can work safely.

To establish and insist on **safe methods and practice** at all times.

We expect from our employees –

To be **safety and cost conscious**.

To use **personal protective equipments**

To observe and establish **safe working/operating methods and practices** at all times.

Not to abuse **safety of equipments**.

We seek the **cooperation** of our employees in implementing the above **safety policy** in order to create and practice **accident free environment** and **improve productivity** in a serene atmosphere

Safety, Health & Environment (SHE) Committee

RWF has formed a Safety, Health, Environment Committee (SHE Committee) as stipulated in Factories Act under chapter IV-A section 41-G and Karnataka Factories Rules 88C. The SHE Committee is headed by Chief Mechanical Engineer and the occupier and composed of Factory Manager, Safety Officer, Security Commissioner, Inspector of Fire, Head of Departments of Mechanical, electrical, engineering departments, Members from Staff council and section in charge of critical staff and its staff. This meeting is conducted once in a quarter.

The functions and duties of SHE Committee includes:

- a. Assisting and cooperating with the management and achieving the aims and objectives outlined in the health and safety policy.
- b. Dealing with all matters concerning health, safety environment and to arrive at practicable solutions to problems encountered.
- c. Creating safety awareness amongst all workers,
- d. Undertaking educational training and promotional activities.
- e. Discussing reports on safety environment and occupational health survey, safety audits, risk assessment, emergency and disaster management plans and implementation of recommendation made in the reports.
- f. Carrying out health and safety surveys and identifying the causes of accidents,
- g. Looking into any complaint made on the likelihood of imminent danger to the safety, health of the workers and suggesting corrective measures and
- h. Reviewing the implementation of the recommendations made by it.

Safety Meetings

Monthly shop floor safety meetings are also conducted involving Officers, supervisors and staff. The points of discussions are:

- a) Discussion on Safety aspects raised by members.
- b) Discussion of trends of accidents and fire incidents taken during previous month.
- c) Evolving corrective and preventive action
- d) Sharing of experience by injured staff
- e) Presentation by member every month with regard to Factory Act as applicable to his work area.

Safety Awareness

RWF is conducting regular classes on Safety Training and Awareness programs by In-house and experts from National Safety Council.

SAFETY PROGRAMS

In order to achieve the objective of safe working, RWF has initiated various safety programs, which are indicated below:

- 1) Counseling on day to day basis at work areas
- 2) Ensuring supply of superior quality and usage of Personal Protective Equipments like -



1. Safety Helmets
2. Bata make Industrial Shoes
3. Leather Hand Gloves Leather, Cotton, Heat resistors
4. Goggles
5. Ear Plugs / Ear Muffs
6. Safety Belts



7. Respirators
8. Fire Resistant Aprons i.e., Aluminium coated Suits
9. Fire resistant uniform

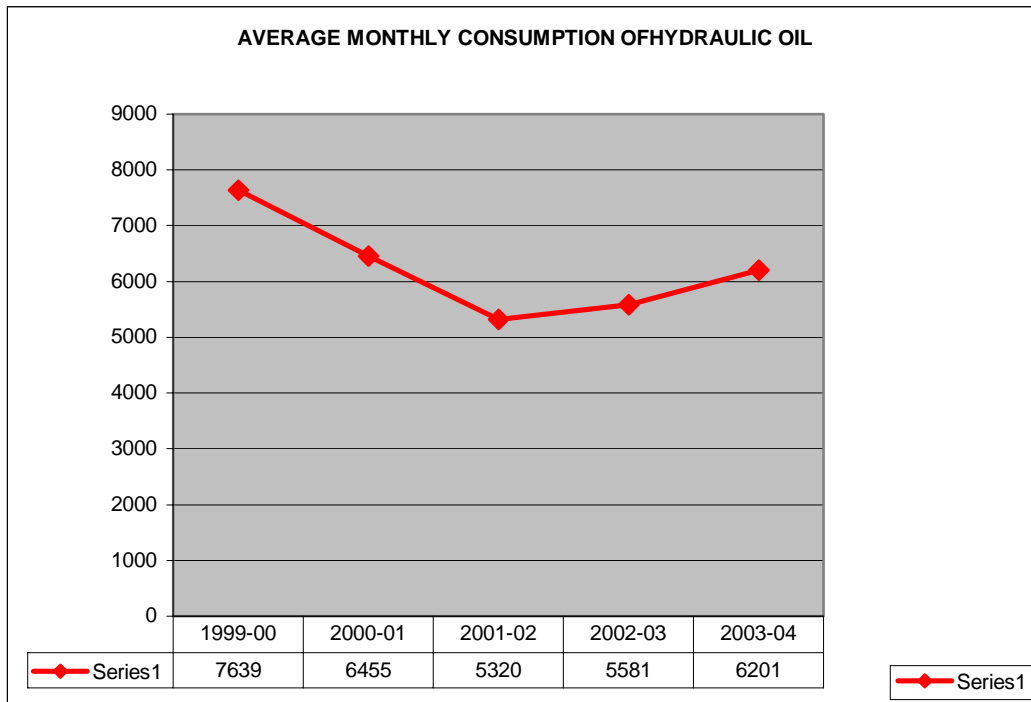


- 3) Conducting of Safety, Health & Environment (SHE) Committee Meeting
- 4) Conducting of Monthly safety meetings.
- 5) Mock Drills & Rehearsals conducted for ensuring of safety system all time to time.
- 6) Organizing trainings in Safety matters by Factory Inspector, experienced personnel from the safety fields on regular basis.
- 7) Deputing staff/supervisors for safety seminars, workshops etc.
- 8) Organizing Safety Audits through external auditors.

Steps taken to control consumption of Hydraulic oils:

- Periodical attention to all fittings and valves to eliminate leakage of oils.
- Proper maintenance of hydraulic oils.

With the above control measures, the consumption of hydraulic oil is reduced by 34% in 4 years.



Water

Total water use

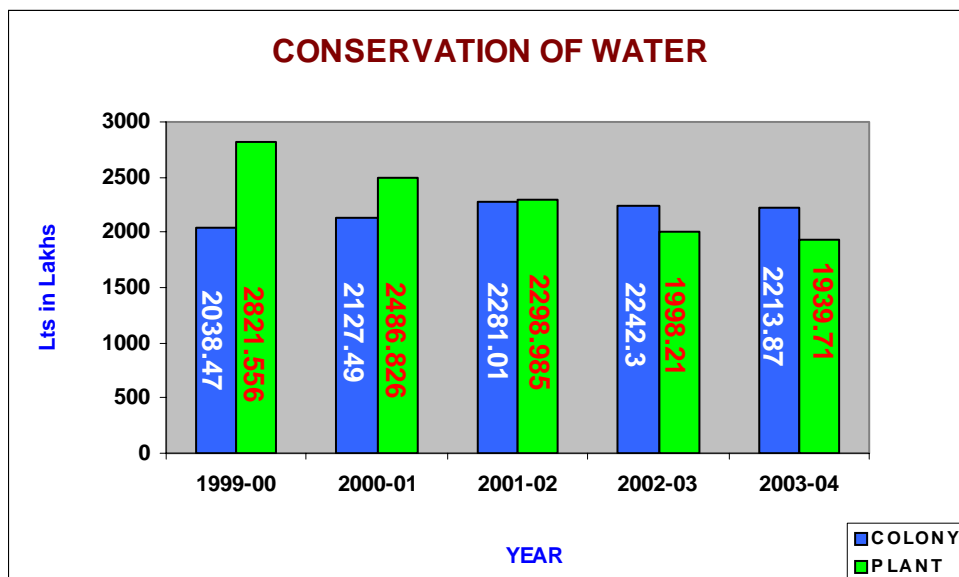
RWF requires about 15 lakh liters of water per day for its plant and colonies (Plant 6.68 lakhs + Colony 8.32 lakhs). The requirement is met through supply of BWSSB & RWF's own supply through bore wells. The source of water is as under:

From BWSSB - 8.5 lakh litres per day.

From RWF bore wells & ETP - 6.5 Lakh litres per day.

Steps taken to reduce consumption of water:

RWF was earlier using of water per day. Now, the consumption is 15 lakhs litres of water per day, despite the fact that there was increase in production levels and induction of additional staff and quarters in the recent years. The reduction is due to:



- o Installing of water flow meter has monitored the water consumption at various sources closely and critically.
- o Water leakage was identified and arrested.
- o Effluent treated water is now being used for gardening purposes instead of normal water.
- o Cooling water used for long forging machine has now been connected to water recycling circuit after separating oil traces from water. This has resulted in saving to a tune of 15,000 liters of water per day.
- o Auto cut off valves provided on hand wash taps at Staff Canteen.

All the above measures taken by RWF towards Energy Conservation makes RWF a stronger candidate for winning the

“National Energy Conservation Award”