



**Indian Oil Corporation Limited**



## **Mathura Refinery**

*Green Refinery*

*Clean Refinery*

*Mathura Refinery*

i) **Company Profile:**

a) **Indian Oil Corporation Limited:**

Indian Oil Corporation Limited is India's largest commercial enterprise with a turnover of Rs. 247479 Crores and profit of Rs. 6963 Crores for the fiscal year 2007. ranking 116th on the Fortune Global 500 listing (2008).

Indian Oil and its subsidiaries account for a 47% share in the petroleum products market, 40% share in refining capacity and 67% downstream sector pipelines capacity in India.

The Indian Oil Group of Companies owns and operates 10 of India's 19 refineries with a combined refining capacity of 60.2 million metric tons per year.

Indian Oil operates the largest and the widest network of fuel stations in the country, numbering about 17606 (15557 regular ROs & 2049 Kissan Sewa Kendra). It has also started Auto LPG Dispensing Stations (ALDS). It reaches Indane cooking gas to over 47.5 million households through a network of 4,990 Indian distributors.

Indian Oil's product range covers petrol, diesel, LPG, auto LPG, aviation turbine fuel, lubricants, naphtha, bitumen, paraffin, kerosene etc. Xtra Premium branded petrol, Xtra Mile high speed diesel, Servo lubricants, Indane LPG, Autogas LPG, Indian Oil Aviation are some of its prominent brands. Recently Indian Oil has also introduced a new business line of supplying LNG(Liquefied natural gas) by the cryogenic transportation. The branding called "LNG at Doorstep". Lng headquarters are located in scope complex, Lodhi Road Delhi.

Besides the principal activities i.e. manufacturing and marketing petroleum products, Indian Oil Corporation Limited is also putting efforts to open a golden



window of opportunity for talented and deserving students in India. For that a total of 350 Scholarships, under select categories, are offered under the Indian Oil Scholarship Scheme this year to support and nurture talent from among deserving students so as to enable them to accomplish their academic goals.

With a countrywide network of infrastructure and services, Indian Oil is proud to be "in every part, and in every heart" of the nation, bringing energy to the lives of millions.

**b) UNIT profile:**

Mathura refinery was commissioned in 1982 as the sixth refinery in the fold of IndianOil and with an original capacity of 6.0 MMTPA. Located strategically between the historic cities of Delhi and Agra, the Refinery at Mathura is situated in the mythical and mystical land of Lord Krishna. Later the capacity of Mathura refinery was increased to 7.5 MMTPA by systematically debottlenecking and

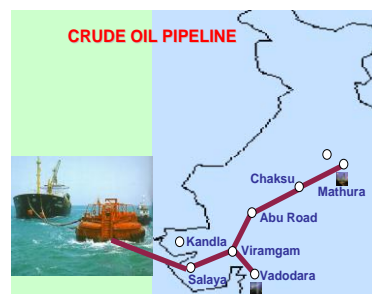


revamping. With its Fluid Catalytic Cracking Units (FCCU), the refinery mainly produces middle distillates for Northern India supplied through a 760km long product pipeline to Jalandhar in Punjab via Delhi (MJPL) and 100km long Mathura Tundla Pipeline (MTPL). A Vis-breaking unit was commissioned in 1982 and Soaker drum technology was implemented in VBU in the year 1993. The two-stage desalter was

commissioned in 1998 in order to improve the on-stream availability of the crude distillation unit. In the same year new Continuous Catalytic Reformer Unit

(CCRU) for production of unleaded gasoline was added.

The First hydrogen generation unit (HGU-I) commissioned in 1999 along with first Diesel Hydro-desulphurization unit (DHDS) for production of HSD with a low Sulfur content of 0.25% wt (max). A once through Hydro-cracker unit was commissioned in July' 2000 for increased middle distillates production. For supplying EURO-III grade auto fuels, viz, EURO-III HSD and EURO-III MS to National Capital Territory (NCT) and National Capital Region (NCR), a Diesel Hydro-treating unit (DHDT) and MS quality up gradation unit consists of NHDT and PENEX along with FCCU Gasoline splitter and 2nd Hydrogen generation unit (HGU-II) commissioned in 2005.



**The present capacity of the refinery is 8.0 MMTPA**

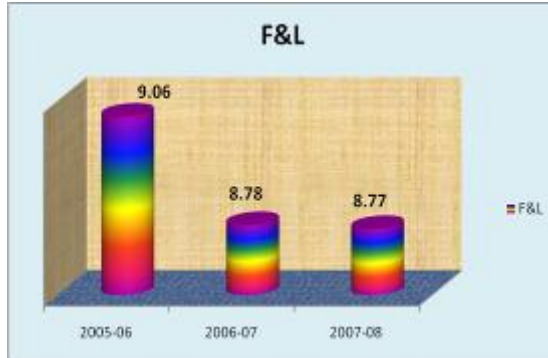
and regularly receives crude oil through the 1870 km long Salaya Mathura Pipeline (SMPL). Over the years Mathura Refinery has systematically synchronized technology with ecology with constant care for the surrounding environment. Its close proximity to the magnificent wonder Taj Mahal adds to the responsibility towards a cleaner Environment. **Since, April 2005, Mathura Refinery is the first refinery in India,** which is capable of producing 100% auto fuels meeting Euro – III norms.

## **ii) Energy Consumption**

Mathura Refinery consumes various types of fuels viz. Natural gas, R-LNG, refinery fuel gas and low Sulphur internal fuel oil (IFO) in furnaces / boilers. Natural gas, which is about 50% of total fuel consumed at MR is supplied by M/s GAIL whereas all others fuels are generated in the refinery itself. The IFO is fired as alternate fuel in old furnaces only.

The energy consumption in refinery is reported in terms of % Fuel & Loss on crude. Mathura Refinery has recorded substantial reduction in energy consumption over past three years. This has been achieved inspite of Refinery undertaking major revamp S/D for overhauling of equipments in process units and off-sites. During 2007-08, 11218 MT of

fuel savings equivalent to Rs 1795 Lacs has been achieved. The % fuel & loss for last three years is as given below:



iii) **Energy Conservation Commitment, Policy and Set-up (please include a photocopy of unit's Energy conservation policy, if decided)**

**IndianOil** is having strong Energy Conservation Commitment, which is also reflected in its Energy Management Policy. The policy consists of all points related to adopting & nurturing Energy Efficient and environment technologies. The policy is approved by the board of directors of the company and adopted by Mathura refinery. The **Energy Conservation Commitment, Policy and Set-up** are already elaborated at item No 13 above. Some of the major steps taken by Mathura Refinery for energy conservation are as given under:

- Installation of Air pre-heater (APH) in furnaces.
- Provision of high efficiency burners.
- Use of low-pressure gas in AVU /VBU furnaces which otherwise was being flared.
- Process optimization using advance process control.
- Use of LP steam in VDU for stripping purpose and for re-boiling in PRU etc.
- Change of service in crude pre-heat circuit from SR to LVGO for pre-heat improvement
- De-bottlenecking of main column 19-C-1 & Debutanizer 20-C-4 overhead circuits of FCC for recovery of gas and reduction of flare in summer months.
- Provision of secondary seal in tanks.
- Tank wagon gantry automation.
- Chemical treatment of CW system, thereby improving exchanger's fouling factor.
- VBU preheat exchanger-cleaning management.
- Comprehensive survey of burners' components and re-assembling during annual turn around in 2007-08 by external agency M/s Camvid, Bangalore.
- Additional condensate recovery at Propylene unit..

- Provision of New overhead Air coolers for crude distillation unit.
- Optimization of pre-heat train in AVU, FCCU & NSU with addition of new heat exchangers.
- Optimizing compressor loadings in DHDS and DHDT units
- Steam optimization in flare circuit
- Stepless control system in Reciprocating compressor
- Shell Global study
- Installation of Foggy Cooler in GT
- Replacement of 4 Nos bottom modules of CDU APH
- APH in VBU furnace
- Boiler optimization

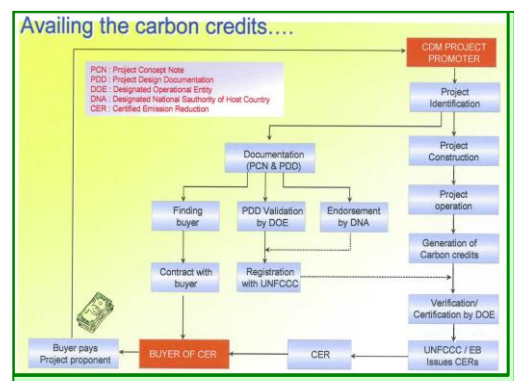
**iv) Energy Conservation Achievements - The portion should include one paragraph write-up on each major energy conservation project implemented during the year 2007-08 only.**

**Annual Energy savings to the tune of 14190 SRFT which is equivalent to Rs. 18 Crores** were achieved with the implementation of major energy conservation schemes. Brief description of the schemes implemented in 2007-08 is mentioned at page no 19, item no. 16 above.

In addition, the benefits of energy conservation measures implemented earlier were sustained during the year 2007-08 also. Refinery has used extensively Physical Acoustic Leak detector for detecting gas loss to flare by regular survey of safety valves and control valves connected to flare. Internal Energy Audit group has carried out Encon audit of furnaces, heat exchangers, crude oil receipt, Natural gas receipt, custody transfer operation, steam leaks survey, etc.

**Clean Development Mechanism (CDM):**

Climate change is one of the most significant sustainable developments facing the international community. The average global temperature is rising sharply due to emission of Green House Gases (GHGs) by both developed & developing countries. The consequences may lead to extreme weather events and adversely impact on human health. The Global initiatives on GHG mitigation lead to Kyoto Protocol. The Kyoto Protocol establishes three mechanisms viz. Clean Development Mechanism (CDM), International



Emission Trading (IET) and Joint Implementation (JI) to supplement actions to achieve real, long term, measurable and cost effective GHG reductions.

Under CDM, a project is identified for reduction in GHG emission and participating industry accrues Certified Emission Reduction (CER) credits. One CER is equivalent to 1 MT of CO<sub>2</sub> emission. The credits can be used to contribute to the emission reduction commitments of industrialized countries.

Host country approval for PRT in FCCU revamp has been obtained. The same is under validation.

**v) Energy Conservation Plans and Targets**

Mathura Refinery is committed to further reduce energy consumption by finding out new avenues on continuous basis. Refinery has planned for stepless control in DHDT compressor, implementing high pressure NG as HGU-I & HGU-II feed, adsorbent replacement in PSA-140 of HGU-I. Etc. The list of major proposals as a part of its future plans for energy conservation is mentioned as per item no. 18 and 19 at page no. 26 above.

**vi) Environment & Safety:**

Mathura Refinery, sensitive Taj (TTZ), is the first which an expert a scientific Assessment (EIA) of the the EIA study even of the refinery, laid a the Environmental Management System and it is an ever-Refinery has already Management System Environmental



being located in the Trapezium Zone industry in India for committee carried out Environmental Impact study. Implementation recommendations of before commissioning strong foundation of

right since inception continuing mission. adopted Quality Standard ISO 9001, Management System

Standard ISO 14001 and Occupational Health & Safety Management System Standard OHSAS 18001. The commitment to safety, health and environment protection has also been duly incorporated in the corporation Safety, Health & Environment (SHE) policy.

**Environment:**

A full-fledged Environment Protection (EP) Cell having qualified engineers exists to deal with all environmental issues. A well-equipped Pollution Control Lab has also been established to monitor environmental performance on day-to-day basis. The



lab is approved by the Ministry of Environment & Forests (MoE&F) and accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL). In addition, a full-fledged Occupational Health Center (OHC) is functional at the refinery for monitoring of work-related hazards namely toxic gas hazards, noise hazards, etc. and health monitoring of employees.

The process configuration of the refinery employs the state-of-the-art technologies with minimal impact on the environment. Besides this, a number of other steps like continuous quality improvement of the products have been taken up for preservation of the environment and maintain ecological balance.

The various Environment Protection measures taken are given below:

#### **i) Environment Protection-Air**

Mathura refinery is the only refinery in the country to set up four no of continuous air monitoring stations beyond the work area for the concern of community and archeological sites. Out of these, 3 nos. were set up at Farah, Keetham and Sikandara along the National Highway No.2 towards Agra in downwind direction. Bharatpur being a sensitive receptor because of Bird Sanctuary, one Ambient Air Monitoring Station was also set up at Bharatpur. These Ambient Air Monitoring Stations were commissioned before commissioning of the refinery in 1981 and being continuously operated thereafter. The data collected at these stations indicate that there is no adverse impact of refinery operations on the ambient air quality of the region. The concentrations of Sulphur Dioxide (SO<sub>2</sub>) at all four stations have been found all the time much below the limit of 15 µ gm/m<sup>3</sup> of air (on annual average basis) prescribed for sensitive areas.



In the field of Environment Protection, Mathura Refinery has acquired many 'firsts' to its credit. It is the first refinery in India to have started with 2 nos. Sulphur Recovery Units of which 1 no. as total stand-by. Besides this, various control measures have been taken over the years for air quality monitoring and to reduce emission of Sulphur Dioxide.

The chronology of such measures is as follows:

- ✚ Ambient Air Monitoring Stations at Farah, Keetham & Sikandra towards Agra and Birds Sanctuary at Bharatpur.



- ✦ Use of low Sulphur liquid fuel derived from low Sulphur crude oil like Bombay High and Nigerian.
- ✦ De-Sulphurisation of refinery fuel gases before burning in heaters.
- ✦ Tall stacks for better dispersion of pollutants.
- ✦ Sulphur Recovery Units
- ✦ Air quality monitoring van for Ambient Air Quality (AAQ) monitoring.
- ✦ Use of Natural Gas as Fuel in Refinery operations since 1996.
- ✦ New Sulphur Recovery Units with Super Clause Reactor since 1999.
- ✦ Continuous Sulphur Dioxide Analysers in all the stacks of the refinery.
- ✦ Procurement of portable Fugitive Emission monitoring instrument in June' 04.
- ✦ Tail Gas Treatment unit for recovery of Sulphur commissioned in Dec' 05.
- ✦ First IOCL refinery to install Flare Gas Recovery system in Oct'06.
- ✦ Modernization of mobile van for Ambient Air Quality Monitoring with wind monitor and SO<sub>2</sub>, NO<sub>x</sub> Analysers having data downloading facility in Feb'07. The van in static condition acts as a Monitoring Station & displays real time ambient air quality through an electronic display panel provided at the refinery main gate.
- ✦ Three Ambient Air Monitoring Stations in refinery premises for AAQ Monitoring.

## ii) Water Conservation

Mathura Refinery has a full-fledged Effluent Treatment Plant (ETP) consisting of physical, chemical and biological treatment facilities. This is a unique system, which not only removes hazardous pollutants, but also converts them into environmentally acceptable forms. The ETP was commissioned in 1982 along with the commissioning of the refinery. The plant was subsequently revamped in 2005 for minimization of VOC emissions, better sludge management and for increase in recycle & re use of treated effluent in refinery operations.



This includes covered surge reservoirs for storage of effluent, TPI Oil Separator, Belt Skimmers and Dissolved Air Flootation for recovery of free or emulsified oil, provision of Bio tower replacing the existing trickling filter for enhanced biological treatment and tertiary treatment for increase in re use of treated effluent in refinery operations.

The final treated effluent ex refinery fully meets the revised MINAS (Minimal National Standards) on effluent.

The chronology of events in various water protection measures is as follows:

- ✦ Full-fledged ETP consisting of physical, chemical & biological treatment facilities.
- ✦ Quality of treated effluent is well within Minimal National Standards (MINAS).
- ✦ Recycle & reuse of treated effluent in the refinery for firewater, construction water, horticulture purpose and green belt development.

- ✚ Ground water level Monitoring system in new tank area Ground water quality monitoring within and outside the refinery premises. Installation of flow meter at effluent leaving refinery channel commissioned in May' 05. Modernization of existing ETP for minimization of VOC emissions, better sludge management, better recycle & reuse of treated effluent etc by Mar' 07.
- ✚ A new RO unit of capacity 150 M3/Hr was added in ETP for utilizing treated effluent for generation of DM water.

### iii) Land Protection

For protection of this component of the environment, Mathura Refinery has adopted environmentally sound solid waste management practices based on the philosophy of minimization of generation of solid waste and safe disposal of residual waste.



Oily sludge is the main solid waste generated in refinery operations. Generation of sludge is minimized by hot gas oil circulation before cleaning of crude oil tanks. Subsequently, melting pit and centrifuge has been provided for recovery of oil from oily sludge, PVC lined secured landfill site having proper leachate collection facility has been constructed for storage of oily sludge and its subsequent disposal through bioremediation in a safe manner.



H<sub>2</sub>O<sub>2</sub> based enhanced oxidation process implemented in ETP for treatment of Sulphide bearing streams for elimination of chemical sludge generation and its handling, which was otherwise being generated in conventional treatment based on Ferrous Sulphate and Lime.

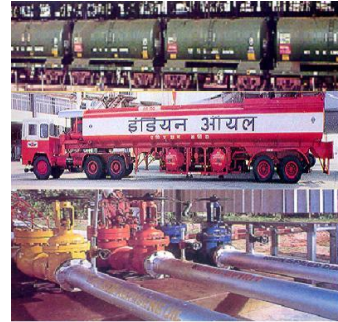
Sludge thickener has been provided for dewatering/ stabilizing of biological sludge generated during biological treatment in ETP. The biological sludge is further treated in centrifuge to reduce the volume. It is then used as manure in the green area of the refinery thereby avoiding the use of chemical fertilizers.

The chronology of events in various land protection measures is as follows:

- ✚ Oily sludge is the main solid waste generated in refinery operations. Generation of sludge is minimized by hot gas oil circulation before cleaning of crude oil tanks and operation of melting pit.
- ✚ PVC lined pit for storage & disposal of oily sludge in 2000-01.
- ✚ Bioremediation of oily sludge through indigenously developed 'Oilivorous-S' technology by IOC (R&D) and TERI in 2001-02.
- ✚ H<sub>2</sub>O<sub>2</sub> based enhanced oxidation process in ETP for treatment of Sulphide bearing streams for elimination of chemical sludge generation and its handling in Jan' 01.
- ✚ Crude tank cleaning thru Blabo Technology for minimization of oily sludge generation.

#### iv) Eco- Friendly Products:

Keeping in view the fact that vehicular emission is one of the big sources of air pollution, Mathura Refinery has taken many initiatives to produce more and more clean fuels in stages in the interest of environment, public health and preservation of national monuments around. Its noteworthy efforts are stage-wise implementation of various projects like Catalytic Reforming Unit, Diesel Hydro-de-Sulphurization Unit and Hydro cracker for quality up-gradation of automobile fuels. Subsequently, in line with auto fuel policy of Govt of India for Euro-III quality for MS & Diesel, Refinery set up MS quality up-gradation and Diesel hydro treating unit. Mathura Refinery has already taken the required steps for implementation of Euro IV grade auto fuels by April'2010 as per the honorable Supreme Court directive.



The chronology of Eco-friendly products produced by Mathura Refinery is as follows:

- ✚ Unleaded Petrol (ULP) to Delhi since Mar' 95.
- ✚ Low Sulphur Diesel (S < 0.25 %) to TTZ since July' 96.
- ✚ Entire Unleaded Petrol (ULP) with S - 0.05 % max since July' 98.
- ✚ Entire Low Sulphur Diesel (S < 0.25 %) since Aug' 99
- ✚ Petrol with 1% vol. max Benzene to NCT since Nov' 2K and to NCR since Mar' 01.
- ✚ Ultra Low Sulphur Diesel ('S' 0.05%) to NCT since Mar' 2K, to NCR since June' 01 and to Agra since Apr' 03.
- ✚ BS III Diesel (S < 350 ppm) since Jan' 05.
- ✚ BS III Petrol (S < 120 ppm) since Feb' 05.

#### v) Cleaning through Greening

In the vicinity of the Effluent Treatment Plant, thriving on treated effluent, a beautiful **ecological park** with lush green cover has been developed in an area of 4.45 acre. Water bodies in the park are receiving water from ETP. Thousands of migratory birds visit this park every year between Octobers to February. The park is a testimony to Eco-friendly operations at Mathura Refinery.



Mathura Refinery has done extensive tree plantation in and around the refinery as tree plantation provides long-term far-reaching benefits, besides serving as a pollution sink, this green cover also enhances the aesthetic look. The refinery



has planted about 1, 55,000 trees/shrubs in the refinery premises, township, surrounding villages and Mathura Region. The refinery has taken extra-ordinary initiatives to provide green cover to the archeological heritage sites especially the Taj Mahal by planting 1, 15,000 trees in Agra region including Taj Reserve Forest. Mathura Refinery also provided 6000 trees to Social Forestry Department for UP government initiative to plant One Crore trees in One Day.

## vi) Environmental Awareness

Environmental awareness amongst employees is created through articles published in in-house bulletins, structured training programme and observance of the World Forestry Day, Earth Day & World Environment Day. Employees are imparted training, induction as well as refresher, on responsible practices to be followed for protection of the environment. Contractors' personnel are educated on environmental safety on a continual basis.

Environmental awareness amongst the local population is created by involving them in the activities like observance of the World Environment Day. In addition, awareness about safety from fire, disaster, etc. is also created amongst the nearby habitats. Apart from this, as a part of on-going awareness programme in the refinery, tank truck drivers are educated on safe transportation of petroleum products and to deal with emergency situations on road.

In our efforts to preserve the ecology, a campaign has been launched in the township on 'Non-use of Polythene Bags' for our common benefit and well-being. An annual flower show is organized in the refinery township premises to inculcate the culture of keeping the environment clean and green. The environment protection measures under taken by Refinery have always been well appreciated by the visiting dignitaries.

## v) Concern for Community

Mathura Refinery has initiated various community development activities viz. clean drinking water, health & medical care, welfare of women etc. to improve the quality of life of the community. Refinery has contributed in development of children education by providing infra structure to schools. Refinery has also established a 50-bedded hospital known as 'Swarna Jayanti Samudayik Hospital' on NH-2 near



township for the benefit of the neighbouring community and spent nearly ~ Rs 2 crores last year towards running expenses of the hospital. Near about 58, 000 patients (including both indoor & out door) had been treated in the Swarna Jayanti Hospital. The refinery is also operating two mobile dispensaries and serving the community.

## **b) SAFETY:**

### **SAFETY IS JOB NO- 1 IN MANAGEMENT PRIORITY**

Safety being an integral part of refinery operation, best practices on safety is in place at Mathura Refinery. Safety is accorded the highest priority. To make the refinery a safe place for its employees, environment and nearby community, high standard of safety is maintained. Management strongly believes and keeps Safety as Job No 1.

Mathura Refinery with its enviable safety record and achievements continuously demonstrate its safety performance through following:

#### **1. Safety Awards & accolades**

Mathura Refinery is accredited with International Safety Rating System (ISRS) on 20 Elements scale and awarded Level-8. The system is followed on sustained basis for improvement involving all sections of employees.

#### **2. National Safety Awards:**

Two National Safety Awards for performance year 2006 were won under National Safety Award Schemes of DGFASLI, Mumbai.

The NSA is given to outstanding safety performance of industrial establishments, construction sites and ports to stimulate and maintain the interest of both the managements and the workers in accident prevention programmes.



*Shri JP Guharay, Executive Director, Mathura Refinery receiving Award from honorable minister on 17.9.2008 at Vigyan Bhawan, Delhi*

#### **3. Safety Innovation Award-2008**

MR received Safety Innovation Award-2008 under oil and gas category from the Institution of Engineers (India).

#### **4. OISD Safety Award for the year 2006-07 was received by MR under category –I**

(Refineries) from Petroleum Secretary in Sept'2007. It also received OISD Award for 2004-05 – Second best in refineries sector



#### **5. Shri A.V.Ogale**



Shri A.V.Ogale Shield for zero fire and zero fatality was received by MR for the performance year 2006-07. It was also awarded for 2004-05 as joint winner with other refineries

## **6. Certification of Integrated Safety, Health, Environment & Quality Management system (ISO- 9001, ISO- 14001 & OSHAS-18001**

Director(R ) Shri BN Bankapur ,  
presenting shield to GM(TS) , MR

Truly committed to Occupational Safety, Health & Environmental Management System, the refinery was accredited with OHSMS (as per BS 8800 guidelines) in 1998 and later with OHSAS: 18001. Mathura Refinery was the first refinery in world to be certified with OHSMS. It is also certified to ISO-9001(QMS) : Certified in 1995 & ISO-14001(EMS): certified in 1996

## **7. Safety Audit & compliance:**

To check with compliance & corrective measures, safety audit is conducted as follows and recommendations are complied on time bound schedule with regular review by top management

- Internal Safety Audit as per OISD Std-145 by Multidisciplinary Group
- External Audit by OISD:
- ESA every Three Years.
- SSC Every Year
- OHSMS (Safety Audits) are carried out once in every Six months by
  - a. Qualified Internal Auditors &
  - b. DNV Auditors.

## **8. Innovations for safety improvements**

### **Smart Safety Cubicles**

In a bid to evolve high impact safety thru visuals, smart safety cubicles with various safety subjects were made and provided at vantage points in shutdown units. They are configured with features of revolving faces of safety displays with pictures taken from Mathura Refinery work sites. They demonstrate on use of PPE, ELCB. Tool Box talk; work at height, scaffolding etc.

These cubicles are rotated every two days at different locations and on the job trainings given thru these posters. Features of safety display cubicles:

- ❑ Rotating on pivot (double ball bearing)
- ❑ Illustrations of concurrent & critical safety subject
- ❑ Photographs of actual job site of workers, equipment
- ❑ Portable in nature
- ❑ Pictures /display can be changed on new subjects

## **9. Safety Culture foundation building:**

Mathura Refinery management has taken number of steps during 2007 to build a strong safety culture within company. The significant few are:

- a) Top Management Group ( ED, GMs & DGMs) carries out walk through safety audit of refinery area
  - b) Structure Safety Audit tours conducted by SR Managers & HODs are submitted to ED who reviews the status and directs compliance
  - c) ED chairs managements safety committee meeting every month to review safety, health & environment issues
  - d) GMs & DGMs attend Group Loss control Meetings in plant area to overview status and support employees' involvement in safety management process.
  - e) ED, GMs & DGMs address Monthly Safety Safety Day function in different areas every month and present award to units and persons to motivate them for the good jobs
  - f) In recognition of good jobs done by an individual or group or by contractors, felicitation ceremonies are held to encourage others.
  - g) For person reporting maximum near miss and departments reporting targeted figures of near miss reporting, prizes and trophies are presented by ED during Management safety committee meeting
  - h) ED himself delivered safety talk on safety culture foundation building in meetings.
  - i) Safety perception survey and awareness :
- Following were done for safety perception

### **I. Safety perception survey by M/s Dupont:**

Mathura Refinery took the initiative in assessing and evaluating its prevailing 'Safety culture' by engaging renowned consultant M/s Dupont (who has the record of no accident for last 100 years) in the field of 'Safety', who had conducted a detail 'Employee Perception Survey' followed by 'Safety culture Foundation Building Exercises' during the period from October to Dec 2006. Path forward for IOCL leadership towards reaching 'World Class Safety Standard' has been identified for adoption and implementation.

### **II. Indian Oil Safety Management System standards:**

14 New safety Standards Known as Indian Oil Safety Management System standard as follows have been developed in 2007 for implementation

- 1001 ISMS-Working at Height
- 1002 ISMS-Confined Space Entry
- 1003 ISMS-Safety during Excavation work
- 1004 ISMS -Hot work
- 1005 ISMS-Energy Isolation - Electrical & Process
- 1006 ISMS -Work Permit System
- 1007 ISMS-Scaffold Safety
- 1008 ISMS-Incident Reporting & Investigation
- 1009 ISMS-Behaviour Based Safety
- 1010 ISMS- Contractor Safety Management
- 1011 ISMS-Management of Change
- 1012 ISMS-Start Up Clearance

### III. Safety Awareness was survey by National Safety Council, Mumbai:

Safety Awareness Survey conducted during the period 18th - 20th March, 2008. The Safety Committees regularly seek the suggestions and generate knowledge of the problems of the employees regarding safety. On the face of it, it appears that the efforts have borne fruit. This is evident through reduction in the number of accidents during past years and prevalence of a risk free attitude of the employees. However, the management wanted to assess scientifically the perceptions of employees regarding various aspects of safety awareness and knowledge based on comprehensive International Safety Rating System. The Survey was conducted with the following objectives.

a) To assess

- Attitudes of employees towards Safety
- The perceptions of employees towards Safety,
- The perceptions of the Employees regarding the management's commitment and attitude to safety at various levels.
- The perceptions of Employees towards the physical environment and other plant safety practices including safety gadgets and equipments provided by the management –
- The perceptions of Employees towards things like Safety Committees, Mock Trials, as well as with regard to actions taken on any deviations from normal functioning.

The perception of employees at the work place regarding unsafe practices, the perception of Employees towards Safety Communications and other motivational activities,

b) To review the following

- i) The status of safety education and training of workers,
- ii) Corrective actions/ inputs required to inculcate positive attitudes and safety consciousness among Employees.

c) To check the following

- i) Overall management control on Occupation Health and Safety Management of Mathura Refinery.

### Community Safety & Fire Prevention Education propaganda

An awareness camp was organized in April 2008 for villagers and school children in village "Dhangaon". Officers from Fire & Safety Department and Corporate Communication gave briefings to the villagers and school children regarding fire prevention measures in case of any emergency. Such programs are conducted on regular basis.

### 10. New system Implemented during 2007-08

- a. A powerful system of communication is provided in Sept'2007 in Mathura Refinery known as "Disaster paging system" for



emergency communication at Evacuation Assembly points connected to plant paging system. The system is operated in case of emergencies and disasters apart from giving routine safety messages in plant area from Crisis Control Room and Fire Station.

- b. Smoke detectors were provided** in all unmanned electrical sub stations as per OISD Stsd-116
- c. A new fire training ground was upgraded** and provided with various models of real plant equipment for fire fighting training. The facility was inaugurated by Dy Chief Inspector of Factories , Govt Of Uttar Pradesh in April'2008
- d. A dedicated Training hall for Contractor Personnel** was set up and inaugurated in June'2007 for daily safety awareness & skill development training for contract personnel. various types of display for skill training in safety
- e. A system of On Line reporting of near miss incidents** have been implemented in July'2007 and at average more than 200 near miss incidents are reported every month. Till 27.9.2008: 2723 near miss incidents have been reported. Also the same is reported to RHQ to be shared with other refinery.The data base is used for accident prevention through analysis and corrective measures.
- f. A safety film of Mathura Refinery** has been made in Nov'2007 and is shown through TV at Gate No 1 to visitors and contract workers
- g. All meetings start with Safety Talk** on a subject and lessons learnt are shared with people.
- h. Employees Involvement in Safety:**
  - Fourteen Group loss control meetings were planned and conducted every month at floor level in the year 2007 with active participation for safety improvements. Management Safety Committee meetings were conducted on monthly basis
  - Participation in Safety Day Programs
  - Participation in suggestion schemes
  - Reporting of near miss incidents /unsafe condition and practices
  - Participation in TPM activities with ownership of equipment for its operation and maintenance.
- i. Training Programs Refinery:**
- j. Observation of Monthly Safety Day:**

An unique way towards building a safety culture started in Mathura Refinery involving all cross sections of employees, contract workers, workers union , Officers Association representatives and every month on 1st working day, monthly safety day is observed on a specific topic . At 7 places, such programs



are conducted, each location headed by one of the DGM. At One place ED himself head the event at shop floor. Prizes for best area of the month, safety man of the month from employees and contract personnel is given away. Posters, booklets, bulletins and flyers are released on that day for mass awareness.

### **11. Fire fighting & Safety Projects implemented in 2007:**

- Procurement of High Capacity Foam Tender made on VOLVO chassis for the first time in IOCL refineries. The unique features of appliance are :
- Installation of double seals with left over floating roofs for light and storage tanks.
- Installation of additional Fire water Pumps of 450 M3/Hr (One Diesel Engine & one Electrical) as part of augmentation of Fire Water system.
- Provision of two numbers high capacity ( 250 M3/Hr)jockey pumps in Water Block for maintaining pressure in fire water network
- Reliability Improvement: Back power supply for Fire Alarm Panel in Fire Station provided in Oct'2007 to take care of power failure and reliability.
- Change in Disaster Siren Timing as per revised OISD- Std 116(Aug'2007): Siren timing changed from total 10 minutes to 8 minutes from Nov'2007
- Modifications in Monkey ladders and staircase with safety cage and stop bars
- Replacement of Asbestos roof of three BG gantries with Kirby sheets taking full safety precautions, use of safety net, fall arrest system, The replacement job was done in operating gantries without any incident.
- Replacement of left out single mechanical seal with double mechanical seal in all the pumps handling light ends / hazardous substances to reduce VOC / fugitive emission
- Up-gradation of fire fighting facilities for tank number 007 & 008 for catastrophic fire conditions as per OISD-116:  
Provision of 2 Numbers of 2000 GPM UL listed HVLR ((High Volume Long Range) Foam Water monitors made for large capacity Crude tank 007 & 008 made in Oct'2007 . 4 Number of such monitors provided for Diesel & MS storage tanks ( 507 & 509).
- A New approach provided for access of fire tenders for 51 Series storage tanks of light product.
- Integrated HAZOP study of units and off site facilities
- Applicability of OISD standards study by M/s PDIL

### **12. Fire fighting & Safety Projects in the advance stage of implementation:**

- Installation of 4th Sulphur Recovery Unit to reduce sulphur content in fuel gas thereby reducing SO2 emission from refinery stacks.
- Fall Protection System with over head railing with chain arrangement in Rail Wagon Gantry area for use of Fall Arrest Full body safety harness.

- Installation of additional Fire water Pumps of 450 M3/Hr (One Diesel Engine & one Electrical) as part of augmentation of Fire Water system.
- Provision of two numbers high capacity ( 250 M3/Hr)jockey pumps in Water Block for maintaining pressure in fire water network
- Modifications in Monkey ladders and staircase with safety cage and stop bars
- High capacity Foam Nurser: Procurement of Two high capacity ( 12000 Liters of AFFF) Foam Nurser with 500 LPM pumps @ 12.5 Kg/Cm2 pumps . This will enhance fire fighting capability for large hydrocarbon fires . Foam replenishment and continuity of AFFF supply will be greatly achieved without disrupting fire fighting operation.
- BG gantry Fire Protection: To built up fire fighting capability in Rail wagon gantries, provision of 22 Numbers UL listed HVLR of 750 GMP (High Volume Long Range) monitors . Under procurement.
- Crude tank, HPS & Diesel Tanks Fire Protection: Provision of 2000 GPM UL listed HVLR ((High Volume Long Range) Foam Water monitors with variable flow for large capacity Crude Tanks and product tanks

### 13. Safety Incentive Scheme:

For Accident free refinery operation, company has a well-laid Safety Award Scheme approved by IOCL Board of Directors. For completing one full year of accident free operation & completion of ESA recommendations on target dates, every employee of the company becomes eligible to receive an award of is Rs. 2500/-

### Implementation of Total Productivity Maintenance (TPM)

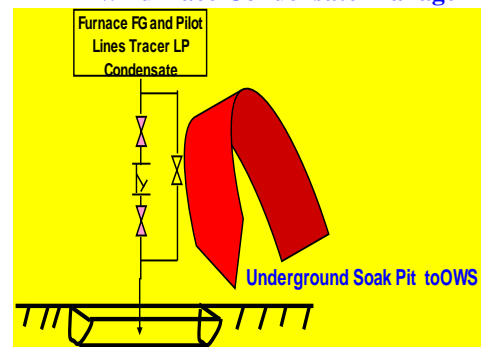
MR has adopted TPM work philosophy and implementing in phase manners. TPM, which promises total elimination of all unnecessary cost leads to additional material, operations, maintenance time and minimization of all types of losses with total involvement of every employees.

Developed in 1970's, by Japan Institute of Plant Maintenance (JIPM), Tokyo, the concept of TPM was launched at MR in Dec'03 and is followed by every section of the refinery. Implementation of TPM in the process units has helped to improve the productivity, quality, cost reduction, and delay in delivery, safety & morale/motivation.

In addition to TPM, employees are encouraged to suggest improvements in operational design, energy conservation, and total safety or any other related matters. The viable kaizen (suggestion) are implemented and duly recognized which are categorized to eliminate major losses affecting equipment efficiency in a process plant, man power efficiency and utilization of material & energy. TPM has brought changes in the approach and attitude of every employee and it is helping to achieve greater heights in every field of productivity. It has also helped in generation of kaizen data bank in the refinery.

### TPM concept:

#### KAIZEN: Furnace Condensate Management



- Essential ingredient for operational excellence in industries across the globe.
- Proven indispensable strategy for achieving excellence in operation through complete cultural change
- New life style of doing business, incorporating new paradigm of reliability, quality and safety.
- Aims at forming a corporate culture, which assures optimal efficiency of overall production & related systems.
- New corporate concept, which can be better experienced than defined, when sustained with practice.
- Well thought off maintenance program, harping on maintaining plants and equipments.
- Proactive maintenance strategy designed to improve the Overall Equipment Effectiveness (OEE).
- Industrial philosophy inculcating ownership for plant.
- Change agent for mindsets for owing responsibility.
- Motivating program for enhanced work output.
- Culture that arrives to stay.
- New approach for bringing machines up to their optimal condition and maintain them.
- Practice that makes our job easier, more comfortable, more efficient and safer.



#### **TPM helps:**

- + Improve the state of maintenance,
- + Improve product quality,
- + Reduce waste,
- + Reduce manufacturing costs,
- + Reduces breakdowns,
- + Reduces accidents

#### **TPM involves zero loss concepts:**

- + Zero breakdowns
- + Zero accidents
- + Zero defects
- + Zero wastage
- + Zero customer complaint

### **Implementation of Six Sigma**

Mathura Refinery has taken Six Sigma business process improvement initiative in a big way and has already acquired certifications for 4 Black Belt and 2 Green Belt projects from Motorola University USA. Benefit / savings of Rs. 326 Lacs per year have been accomplished in the certified Projects. Precisely with the aim of reduction in energy consumption level a six-sigma Black Belt project titled **‘Reduction of energy consumption in Mathura Refinery’** was undertaken. Energy consumption data of various units of the refinery was collected, compared & gathered that energy consumption in AVU is highest. Further, it was noted that direct fuel consumption was the highest energy being consumed within the AVU. The goal was set to reduce the direct fuel consumption by 1000 SRFT/year.

The process leading to the consumption of direct fuel was mapped in detail and it was found that the energy consumption could be reduced by increasing the preheat recovery. Necessary process

modifications were carried out during the M&I shut down to re-route the Vacuum Slop through RCO heat exchangers and exchange the heat from the Slop for heating the Crude Oil to increase the preheat.

The improved process is in operation now and this has resulted in a saving of direct fuel consumption estimated at **3000 SRFT/year**. The monetary savings are estimated to be Rs. 250 Lacs per year.