

WASTEWATER TREATMENT, RECYCLING & DEMINERALIZATION PLANT IN CPCL'S MANALI REFINERY

By Dilip R Shukla



THE PLANT PRODUCES
HIGH PURITY DM WATER
FROM REFINERY WASTE
WATER REUSING OVER 75
PERCENT OF EFFLUENTS
GENERATED.

Fast Facts

- ▶ Project Assigned by: Chennai Petrochemical Corporation Limited (CPCL)
- ▶ Project: Water treatment package (DM Plant and ETP) of Resid Upgradation project of CPCL at Manali Refinery, Chennai
- ▶ Technologies Used: SBR/UF/RO/ Mixed Bed/VOC Control System
- ▶ One of the largest Effluent treatment facilities reusing 85 percent of the effluents of refinery for Demineralized water application

Chennai Petroleum Corporation Limited (CPCL), formerly – known as Madras Refineries Limited (MRL) was formed as a joint venture in 1965 between the Government of India (GOI), AMOCO and National Iranian Oil Company (NIOC). The CPCL–Manali Refinery is located in the state of Tamil Nadu. The Refinery has got a versatile design with high degree of automation. The present capacity of CPCL at Manali refinery is 10.5 MMTPA and it has set up Coker Block and Sulphur Block, two of the facilities under Resid Upgradation Project along with Effluent Treatment, Recycling & DM Plant from Paramount Limited.

All the effluent treatment plants since CPCL's inception have been designed and executed by Paramount Limited and this case study is on effluent treatment, recycling and generation of de-mineralized water for their Resid Upgradation Project. www.paramountlimited.com

- ▶ The Effluent treatment facility consists of:
 - ▶ Primary Treatment comprising of API – TPI– DAF
 - ▶ Secondary Treatment comprising SBR
 - ▶ Tertiary Treatment comprising UF – RO
 - ▶ De-mineralization plant comprising RO – MB

Project Highlights:

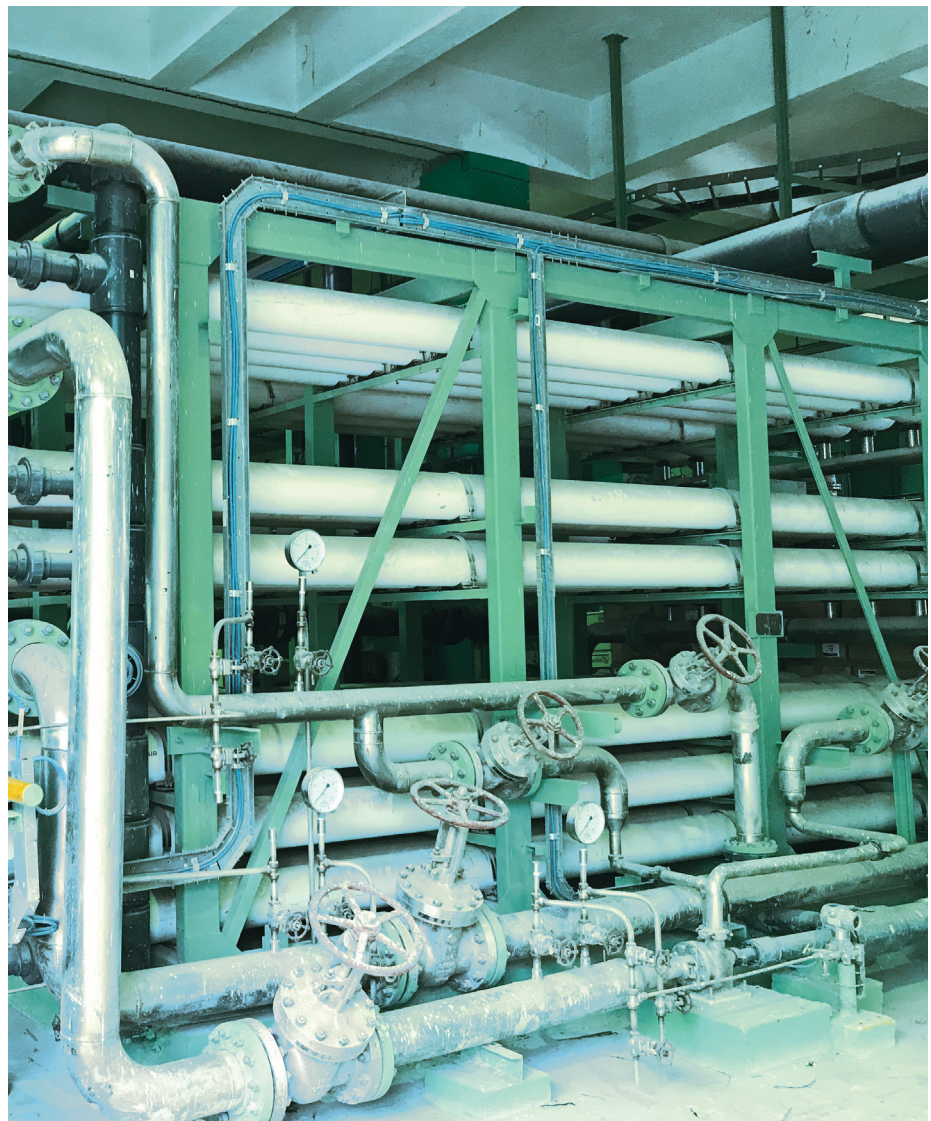
- ▶ Largest oily Effluent treatment and recycling

- ▶ plant reusing 85 percent of the treated effluent to generate Demineralized Water in India
- ▶ Design to accommodate production of DM Water from oily effluent waste as well as desalinated water.
- ▶ Combination of latest technologies for production of DM Water:
 - API – TPI – DAF – SBR – HRSCC – DMF – ACF – UF – RO for oily effluent treatment.
 - DMF – RO – MB for Desalinated Water
- ▶ Most eco friendly “VOC control technology”

- ▶ for adsorption of hydrocarbons being generated from oily effluent.
- ▶ Over 22000 m³ of RCC work.
- ▶ Whole plant constructed on 1232 nos piles of 500 mm dia* 25 meters depth
- ▶ Over 750 MT of Site fabricated 8 nos. storage tanks of capacities varying from 2000 m³ to 5800 m³
- ▶ Over 1,25,000 inch meter of piping
- ▶ Fully DCS controlled plant.

Feed Parameters

Feed capacity of plant is 322 m³/hr (7.72MLD)



which includes all the waste streams (resid area OWS, effluent from ETP-I and contaminated rain water).

Average feed parameters are:

- ▶▶ Total Oil: 31000mg/l (free oil –30500mg/l & emulsified oil 500 mg/l)
- ▶▶ TSS: 250 mg/l
- ▶▶ COD: 550 mg/l
- ▶▶ BOD: 270mg/l
- ▶▶ TDS: 2600 mg/l

Scheme

Two major types of effluents viz. process effluent and utilities effluent are treated in the plant. Process effluent comprises of waste from resid area and OWS, effluent from ETP-I and contaminated rainwater. Utilities effluent comprises of cooling water blow down and other utilities. The process effluents are subjected to free oil and emulsified oil removal. Free oil is removed in API separator and TPI separator installed in series. Over all free oil removal efficiency achieved is 95 percent in plant. The effluent treated for free oil in the API and TPI separators are further treated in DAF for removal of emulsified oil. Separated slop oil is collected and stored in the oil collection tank.

The slop oil is further transferred to the Refinery storage facility for further processing. The volatile organic compounds generated from oily effluent handling units API, TPI, DAF and sludge tank etc. are vented to activated carbon based adsorbers for adsorption of hydrocarbons in VOC system.

The sludge from the primary treatment units is collected in oily sludge tank and is de-watered in oily-centrifuge and sent for disposal.

Primary treated process effluent is fed to secondary treatment plant that consists of Sequential Bio-reactor (SBR). Bio-sludge wasted from SBR unit is de-watered in a bio-centrifuge and sent for disposal. Average outlet quality after SBR treatment is:

- ▶▶ TSS: 20 mg/l
- ▶▶ COD: 125 mg/l
- ▶▶ BOD: 15 mg/l
- ▶▶ TDS: 1400 mg/l

The secondary treated effluent is further subjected to High Rate Solid Contact Clarifier (HRSCC) and the clarified water is stored in filter feed tank.

The utilities effluent is treated in a separate High Rate Solid Contact Clarifier (HRSCC) and the clarified water are mixed with the treated process effluent in filter feed tank. Feed parameters of utilities effluent are:

- ▶▶ TSS: 114 mg/l
- ▶▶ COD: 62 mg/l
- ▶▶ BOD: 11 mg/l
- ▶▶ TDS: 4400 mg/l

The mix of process and utilities treated effluents are further fed to Dual Media Filter (DMF) followed by Activated Carbon Filter (ACF), which are provided in series and then the filtered effluent is further subjected to tertiary treatment. Average quality at ACF outlet is:

- ▶▶ TSS: 20 mg/l
- ▶▶ COD: 125 mg/l
- ▶▶ BOD: 15 mg/l
- ▶▶ TDS: 2600 mg/l

The filtered effluent is then treated in Ultrafiltration followed by a Reverse Osmosis system. Average achieved recovery of UF system is 90 percent. UF permeate is further passed through RO system. The recovery of RO system is 85 percent. The overall recovery of tertiary system is 76.5 percent.

The reject generated from RO system is collected in the RO reject tank and the permeate is stored in RO permeate tank which is further sent to DM plant for production of de-mineralized water. Desalinated water from desalination plant of CPCL Refinery is also sent to DM plant which is used as a substitute to ETP RO permeates for production of de-mineralized water. RO permeate quality generated from ETP is:

- ▶▶ TSS: NIL mg/l
- ▶▶ COD: BDL mg/l
- ▶▶ BOD: BDL mg/l
- ▶▶ TDS: 36 mg/l

RO permeate generated from ETP is first passed through the Dual Media Filter (DMF) and then

passed through RO membranes. The permeate generated from the RO membranes is then sent to Mixed bed exchangers for production of de-mineralized water. Final DM water quality is:

- ▶▶ TDS: <0.2 mg/l
- ▶▶ Reactive Silica: <0.02 mg/l
- ▶▶ Conductivity: <0.3 µmhos/cm

The DM water of such highest quality so produced from effluents is sent to Refinery for their use in captive power plant boilers thus enabling water starved CPCL refinery to reuse 76.5 percent of their effluents generated from refinery.

About the Author

Dilip R Shukla is the Managing Director of Paramount Limited, the market leader in India in Waste Water Treatment and Reuse in Oil and Gas sector and one of the largest manufacturer of Water and Waste Water equipments with a ASME U Code stamp certified shop. Prior to this assignment he held leadership position in several leading Water Infrastructure companies including as Chief Executive – Water & Special Projects SBU of KEC International Limited, 1.5 billion USD infrastructure company of RPG group, as Whole time Director & CEO of Doshion Veolia Water Solutions etc. He is a mechanical engineer and has done post graduate diploma in Industrial engineering. He has over 33 years of experience of which over 20 years is at the helm in serving Engineering, Process & Infrastructure Industries.

Paramount Limited is India's one of the leading EPC/ DBO players in water and wastewater infrastructure and emission control space with history of pioneering and innovative technologies and landmark projects. Paramount holds specific leadership position in wastewater treatment and recycling/reuse in oil & gas industry with its over 80 EPC executions in hydrocarbon industry. Based out Vadodara, it also has 2 manufacturing units with total plant area of 25000 m2 having ASME U & S Code stamp accreditation and manufactures all water and wastewater equipments in-house. Paramount is also recognized globally by refineries as Project Management Consultant for their water and wastewater projects for its Design and Engineering competence par excellence.

To know more about the author and contributor, you can write to us. Your feedback is welcome and should be sent at: shefali@eawater.com.

15th EverythingAboutWater

EXP

SOUTH ASIA'S LARGEST WATER EVENT

23-25 AUGUST, 2018

Hall 12A, Pragati Maidan, Delhi, India
www.eawater.com/expo

ORGANIZED BY



EVERYTHING ABOUT WATER

CO-ORGANIZED BY



SUPPORTED BY



WHERE THE WATER COMMUNITY COMES TOGETHER

EverythingAboutWater Expo is one of the most unique and comprehensive annual water event in India showcasing latest technologies in the water and wastewater management sector. Recognized as South Asia's largest water event offers unparalleled business opportunities to both national as well as international players from the water industry to learn explore the future trend and business opportunity in the Indian water market.

100,000

SQFT OF EXHIBITION SPACE

400

EXHIBITORS FROM 25 COUNTRIES

15000

Business Visitors

1000

CONFERENCE DELEGATES

EXCLUSIVE COUNTRY PAVILIONS

LIKE USA, GERMANY, CHINA, CANADA AND TAIWAN

3 DAY

INTERNATIONAL CONFERENCE & TRAINING WORKSHOPS

LEADING WATER COMPANIES PRESENCE

COUNTRY PARTNER



SILVER PARTNER



DELEGATE PARTNER



LANYARD & BADGE PARTNER



CONFERENCE ASSOCIATE



SUPPORTING ASSOCIATION



SUPPORTED BY



For Further Enquiry:

EA Water Pvt Ltd
Address – A1/152, Neb Sarai, IGNOU Road, New Delhi– 110068
T: +91 11 4310 0594, M: + 91 96500 59996, Email:
enquiry@eawater.com, www.eawater.com/expo

FREE VISITOR ENTRY

Join us at:   