भारत पेट्रोलियम कॉर्पोरेशन लिमिटेड
भारत सरकार का उपक्रम
कोच्चि रिफ़ाइनरी

BHARAT PETROLEUM CORPORATION LIMITED
A Govt. of India Enterprise
Kochi Refinery

KR.HSE.ENV.05.HSSE.EA/2023 - 24
27.09.2024

To
The Member Secretary
Kerala State Pollution Control Board,
Plamoodu Junction,
Pattom Palace,
Trivandrum 695 004.

Sir / Madam,

Sub: Environmental Statement (Form - V) for the financial year 2023 - 24

Ref: -
Circular No. PCB/T4/232/86 dated 18/06/92 (PCB/HO/EE3/Envt.St./19/2021; dated 18.06.2021) regarding the Environmental Audit Report.

Please find the enclosed annual Environmental statement (Form-V) of Bharat Petroleum Corporation Ltd – Kochi Refinery for the year 2023 - 24

Thanking You,

Very truly yours
For **BPCL-Kochi Refinery**

Sainath. C
General Manager (HSE)

Encl.: as above

Cc: The Chief Environmental Engineer
Kerala State Pollution Control Board
Gandhi Nagar
Kochi - 20

FORM - V

(See Rule 14)

Environmental Statement for the financial year ending the 31st March 2024

PART - A

1. Name and address of the owner / occupier of the industry, operation process : Sankar. M
   Executive Director
   BPCL - Kochi Refinery.
   Post Bag No - 2
   Ambalamugal - 682 302
   Kerala State.

2. Industry category Primary - (STC Code)
   Secondary - (STC Code). : Petroleum Refining.

3. Production capacity- Units : **15.5 MMTPA** (Crude Oil Refining Capacity)

4. Year of establishment. :1966

5. Date of the last environmental statement Submitted. :25.09.2023

PART - B

Water and Raw Material Consumption

i) **Water consumption in m^3/day**

Process	:	**3488.15**
Cooling +Boiler feed water	:	**40848.00**
Domestic	:	**2987.70**

	Process Water consumption per unit of product Output	
Name of Products	**During the previous Fin. year 2022-2023**	**During the last Fin. year 2023 -2024**
Light Distillates		
1. Hydrogen	1.207m^3 /MT of crude processed. (This excludes domestic water consumption)	1.03 m^3 /MT of crude processed. (This excludes domestic water consumption)
2. LPG		
3. Propylene		
4. Propylene-Polymer Grade		
5. Motor Spirit – Euro VI		
6. Reformate		
7. Naphtha		
8. Benzene		
9. Toluene		
10. Special Boiling Point Spirit		
11. Food Grade Hexane		
Middle Distillates		
12. Superior Kerosene Oil		
13. ATF		
14. MTO		
15. HSD - Euro VI		
16. HF HSD - Euro VI		
17. LS HFD		
18. LDO		
Heavy distillates		
19. VLSFO		
20. Bitumen		
21. Sulphur		
22. Pet-coke		

PETCHEM 23. Acrylic Acid 24. N - Butanol 25. 2 - Ethyl Hexanol 26. i – Butanol 27. Butyl Acrylate 28. 2- Ethyl Hexyl acrylate		

Note: - Domestic water consumption is excluded for calculating the unit water consumption.

ii) Raw material consumption

Name of Raw Material: **PETROLEUM CRUDE OIL**	**Consumption of raw material per unit of output**	
Name of Products	**During the previous year 2022 - 23**	**During the current year 2023 -24**
Light Distillates 1. Hydrogen 2. LPG 3. Propylene 4. Propylene-Polymer Grade 5. Motor Spirit – Euro VI 6. Reformate 7. Naphtha 8. Benzene 9. Toluene 10. Special Boiling Point Spirit 11. Food Grade Hexane ***Middle Distillates*** 12. Superior Kerosene Oil 13. ATF 14. MTO 15. HSD - Euro VI 16. HF HSD - Euro VI 17. LS HFD 18. LDO ***Heavy distillates***	**1.125 M.T.** of crude processed / MT of product	**1.067 M.T.** of crude processed / MT of product

Heavy distillates		
19. VLSFO		
20. Bitumen		
21. Sulphur		
22. Pet-coke		
PETCHEM		
23. Acrylic Acid		
24. N - Butanol		
25. 2 - Ethyl Hexanol		
26. i – Butanol		
27. Butyl Acrylate		
28. 2- Ethyl Hexyl acrylate		

PART - C

Pollution Generated

(Parameter as specified in the consent issued)

A. Water

Pollutants	**Quantity of pollution generated Kg/1000 T of crude processed**	**Limit as per STD (in kg)**	**% of Variation with Std.**
Oil & Grease	**0.37**	**2.0**	Below limit
Phenols	**0.02**	**0.14**	Below limit
Sulphides	**0.048**	**0.2**	Below limit
BOD	**1.63**	**6.0**	Below limit
TSS	**1.90**	**8.0**	Below limit

B. Air

Parameter	**Average Values (µg/Nm³)**			**Std. Limit (µg/Nm³)**	
	max.	**min.**	**avg.**	**Annual**	**Daily**
SO_2 (µg/Nm³)	25.4	5.9	13.57	50	80
NO_X (µg/Nm³)	23.1	9.3	14.16	40	80
PM 2.5 (µg/Nm³)	42.5	34.2	39.07	40	60

PART - D

Hazardous Wastes

(As specified under Hazardous Wastes (Management, Handling & Trans boundary Movement) Rules 2016)

	Total Quantity (MT)	
	During the previous Fin. Year **(2022 -23)**	**During the Current Fin. Year (2023 -24)**
A) From Process	**3469.7**	**2754.94**
B) From Pollution Control facilities	**6820.67 m3 (Internally re-processed in DCU)**	**13214.5 (Internally re-processed in DCU)**

PART - E

Solid Wastes

Solid Waste	**Total Quantity (MT)**	
	During the Current Fin. Year (2022-23)	During the Current Fin. Year (2023-24)
A. From Process	**69**	**0**
B. From Pollution Control facilities	**34**	**0**
C. Qty. recy. or re-utilized within the unit	**25**	**32**
D. Sold	**0**	**0**
E. Disposed	**0**	**0**

PART - F

(Characterization (Concentration & Quantum) of Solid Wastes / Hazardous Wastes and Disposal Practice adopted.)

Quantity of Solid wastes disposed/Reprocessed, and disposal practice adopted for Solid wastes/Hazardous waste is given below table.

Sl. No:	Type of waste	Characteristics of wastes	Quantity (MT) 2023 - 24 disposed	Disposal method
1	PFCCU & FCCU Catalyst Fines	Silica/Alumina	388.58	Land filling / TSDF
2	Oily Sludge: (Tank sludge) / S/D sludge / RODM Clarifier sludge	Oily Sludge	78.16	TSDF
3	Bio-remediated sludge	Sand without oil	63.94	TSDF
4	Insulation Waste (Glass wool)	Glass fibrous material	1118.42	TSDF
5	Spent Clay	Aluminates and Silicates	357.04	TSDF
6	Cooling Tower CCA Treated Timber, fills & FRP	CCA treated wood /Polymer/ Resin	8.12	TSDF
7	RO DM / NHT CCR Poly Propylene filter material	Synthetic Polymer	30.76	TSDF
8	RO DM Poly Amide Membrane material	Polymer	19.92	TSDF
9	Spent Catalyst / Adsorbent (Alumina - Silica)	Silica/Alumina	359.89	TSDF
10	Alumina Balls / Alumina Desiccant	Silica/Alumina	20.41	TSDF
11	Spent Charcoal	Carbonaceous	46.43	TSDF / Re- use
12	Haz. Chemical Drums / Tins / Bags	Paper material	56.12	TSDF
13	Non spec. Acrylic Acid Polymer waste	Polymer	75.52	TSDF
14	Polymer waste (SAP)	Polymer	21.96	TSDF
15	Soiled Sulphur / TGTU Column sludge	Sulphur	109.67	TSDF
16	ETP Oily / Chemical sludge	Chemical & Oily Sludge	13214.5	Re-process in DCU

A. Oily Sludge from tank bottom:

Formation of oily sludge in the tank bottom is a normal phenomenon in all refinery operations. The oily sludge is processed for maximum recovery of oil before final disposal. This process involves dewatering of sludge and centrifuging and the recovered oil is then re-processed. The final residue disposed-off after bio-remediation process.

B Spent PFCCU / FCCU Catalyst:

The catalyst fines (Silica and Alumina) from Fluidized Catalytic Cracking Units are collected by ESP and periodically disposed-off thru TSDF.

C. Secondary / Tertiary Process Units (NHT-CCR / VGO HDS / DHDS / NHDS / KHDS / VGO HDT / DHDT / PENEX) spent catalysts.

Different catalysts are used in these units. These catalysts will become exhausted in due course of operation. We are authorized by KSPCB to dispose of these spent catalysts either by sale to registered recycler or disposed-off in to a TSDF depends on the characteristics of the material.

D. Chemical sludge from the Effluent treatment plant:

Kochi Refinery has established four effluent treatment plants to treat the process wastewater generated in the Refinery. Treated water meets the Minimal National Standards (MINAS) and meets all the stipulations laid by KSPCB. The treatment for sulphide removal from the wastewater includes use of hydrogen peroxide as this minimizes formation of chemical sludge. The oily and chemical sludge formed from the wastewater treatment plants are processed in Delayed Coker Unit (DCU).

E. Spent Charcoal

Charcoal is used in many refinery processes as an adsorbent; and it will become exhausted in due course of process. It can be either disposed-off through Pet- coke or TSDF based on its physical and chemical qualities.

F. Acrylic acid polymer waste:

BPCL - Kochi Refinery commissioned Petro Chemical Complex (PDPC) in 2021 April. The hazardous waste generated (mainly Acrylic acid polymer and empty chemical bags / drums) from the PDPP is disposed-off to TSDF as per their lab analysis and stabilization methods.

G. Polypropylene filter Material:

Polypropylene filter Material is used in many refineries processes, and it will become exhausted in due course of process, and we are disposing these materials thru TSDF as secured land fill method.

PART - G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

- BPCL Kochi Refinery has installed many facilities for environment protection. The major features include

- Sulfur Recovery Unit with TGTU (Tail Gas Treating Unit) of 99.9 % efficiency to minimizing the SO_2 emissions.
- DHDT, VGOHDT, CCR & PENEX units were commissioned to meet Euro-VI norms for HSD and MS
- Petro Fluidized Catalytic Cracker unit is provided with 3 stage cyclones and ESP for minimizing the particulate matter emission.
- Delayed Cocker Units (DCU) can handle the entire oily / Chemical sludge and used transformer oil generated in the Refinery.
- Sulfur content in Fuel oil is maintained well below 0.5wt. % to minimize SO_2 in the stack emissions.
- A state-of-the-art ETP-V with minimum sludge generation and chemical consumption also is installed.
- The RO (Reverse Osmosis) based DM plant erected and it could recycle 90% of the treated effluent, cooling tower blow downs and Boiler blow downs.
- The condensate polishing unit helps to recover or recycle major quantity of generated condensate.
- LDAR survey (VOC emission survey) is conducted every quarter in all Refinery units and the identified leaks are attending within a time frame of 7 days. It is helpful to control / arrest atmospheric pollution.
- 45 nos. of bore-wells are maintained inside Refinery and conducting water analysis on monthly basis to confirm there is no leakage from storage facility and under-ground pipeline services.
- Continuous Sound monitoring system has been installed at two locations inside Refinery premises to ensure the noises are within the limit. And we are also doing the regular monitoring of boundary noise level.

Rainwater harvesting:

- BPCL - KR maintaining total 134315 m^2 of rainwater harvesting system as roofs and catchment area of ponds and water storage quarries.
- BPCL - KR is maintain a large rainwater harvesting pond of 76220 m^2 reservoir area and many roof drains are routed to this pond. Currently, during monsoon season we are consuming this harvested water.

Several measures have been taken by BPCL - Kochi Refinery to reduce Water / Soil pollution and some of these are:

- Water consumption at the refinery is controlled through close monitoring and Automation and discharge only 75% of the allowable limit.
- Sour water (Process Effluent water) strippers installed, and it enables the reuse of water in many process units.
- Four number of Effluent treatment plants are operated in the Refinery, enables it to proper treatment and reuse of the water. The well-engineered networks for process effluents, Floor washing, and Storm water ensures the effectiveness and recovery of effluents.
- An RO (Reverse Osmosis) technology-based DM plant was commissioned in the year 2017 and treated effluent from ETPs is taken to RO based DM plant for making of DM water and then steam, for further utilization. Cooling towers blow down and Boiler blow down are directly taken to RO

plant. Part of treated effluent taken to fire pond for firefighting activities and watering the Ecopark, Fruit Park, and other plants and gardens inside refinery. Water collected in the Rainwater harvesting pond is also utilized as a water conservation measure. Total water recycled during 2023 -24 period was **54043538 m^3** which equals around **15078 m3/day.**

- The closed blow-down systems installed in the Units enable proper recovery of slop oil generated and it will be re-processed.
- The condensate recovery systems installed in the units along with Condensate polishing unit maximizes the condensate recovery and thus reducing the raw water consumption.
- Coke cutting water is reused in the unit after coke separation in Delayed Coker Unit
- Treated water is discharged to Chitrapuzha Backwater with quality parameters which is well maintained within the stipulated MINAS limits.
- Storage tanks are made-up with MS plates at bottom to avoid leaching of oil to land. Moreover LDPE lining is also provided on the tank pad of new tanks as an additional precaution to prevent oil seepage to underground water.

Solid waste management:

For effective solid waste management BPCL KR is following the best practices as given below.

- Oily sludge is being reprocessed and the oil is recovered. The process involves dewatering the sludge, screening, centrifuging and thermal desorption. Impervious storage tank is used for oily sludge storage. The solids are bio remediated prior to disposal. The oil recovered from the sludge is reprocessed.
- Oily & Chemical sludge formed in the Effluent treatment plant is processed along with feed in the Delayed Coker Unit.
- Food waste generated is utilized for bio-gas production. For this a bio-gas plant of capacity one ton per day is in operation and the biogas so obtained is utilized in the canteen for cooking. The solid waste from the bio-gas plant is used as manure in the Green belt area.
- Separate storage facilities maintained for handling different categories of hazardous wastes and e - wastes.
- Spent Catalyst is either sold to recyclers, wherever the opportunity exists or disposed to the TSDF (Treatment, Storage and Disposal Facility) of KEIL (Kerala Enviro Infrastructure Limited) if no recoverable precious metals are available.
- 45 Bore-wells have been provided, spread across the refinery, to check for any oil seepage in the ground water.
- Two secured landfills are in operation for storing hazardous waste generated within the refinery if needed. One section is of 590m^3 capacity whereas the second section is of 390m^3.
- Integrated Management System (IMS) certification for better Quality, Environment, Health and Safety management.

Energy Conservation:

The following energy conservation and loss control measures were adopted during the year 2023 -24, resulting in significant fuel savings/ reduction in CO_2, SO_2, NOx and all other emissions:

(i) Steps taken for impact on conservation of energy

Energy conservation and Transition towards Net Zero was a major business goal during the year for BPCL-KR. Major Studies were taken up for Furnace efficiency improvements, Process Heat integration, Fuel Substitution and Electrification for decarbonization of operations. Energy management system was recertified in line with ISO 50001:2018 and fully integrated. Specific energy consumption (MBN) has reduced up to 62.7 against a business plan target of 63. BPCL-KR implemented 22 nos. of Major Energy Conservation Schemes, having the potential savings of 31345 MTOE/hr Year and reduction of CO2 emission by 97169 MT/Year. The following were the areas of major improvement.

- Integration of refinery fuel gas system
- Hot feed maximization and catalyst replacement in Hydrotreating units
- Delayed Coker Unit (DCU) Heater pass modifications
- Implementation of Advanced Process control
- Use of nitrogen as stripping medium instead of steam in Kerosene Hydrodesulphurization Unit (KHDS)
- Conversion of Air fin Cooler fan blades from metallic to E Glass Fiberglass Reinforced Plastic (e-FRP)
- Impeller modifications and Motor replacement for pumps to avoid 2 pumps running in parallel.

(ii) Steps taken for utilizing alternate sources of energy

Following Solar Power plants were installed.

- 3.37 MWp Solar plant at Rainwater Harvesting Pond Commissioned
- 6.0 MWp Solar plant commissioned at CISF Colony
- 3.83 MWp solar plant at Shore Tank Farm under construction

(iii) The capital investment on energy conservation and estimated savings

Sl. No	Energy Schemes	Investment in Crs	Energy Savings	
			Fuel Savings MT/Year	Power Savings MWh/Year
1	Preheat Improvement in CDU3 by passing LK and HK re-boiling medium	Nil	3256	
2	Routing of CDU3 Hot VGO to VGO HDS unit thereby reducing steam heating in VGO HDS unit	Nil	2116	
3	DCU heater A & heater B pass headers modification	0.25	1901	
4	Various APC initiatives implementation in FY'23-24: 1. PDO LP Oxo section, BuOH and 2EH section 2. UB10 & HRSG for steam reduction 3. KHDS for steam and FG optimization 4. DHDT and VGO HDT Preheat Improvement 5. APC revamp of CDU2 and FCC units 6. Dynamic SOx limit in DCU and CDU3 thereby increasing heater efficiencies	Nil	6324	
5	Installation of sour water coalescer on sour water line in DCU for oil recovery.	6.00	999	
6	Cold Flash drum off-gas from VGO HDS routed to NHT 1 – reducing H2 intake and reducing excess Fuel Gas in CEMP2	NIL	950	
7	Fuel gas connectivity to old Refinery from IREP thereby reducing flaring and reducing fuel oil consumption in refinery	0.28	950	
8	Routing KHDS off gases to Biturox incinerator to avoid flaring - Approximate reduction of 2 TPD of HC gas.	0.09	770	
9	Use of Nitrogen as stripping stream instead of steam in KHDS	Nil	729	
10	Routing of excess FG from IREP to CEMP-II to reduce flare loss	0.45	500	

11	Use of New / improved Catalyst in place of old catalyst in VGO HDS	Nil	3906	
12	Use of New / improved Catalyst in place of old catalyst in DHDS	Nil	2604	
13	In DHDT Unit, 55 AFC metallic blades have been replaced with e-FRP type blades	0.47	0	1704
14	Stopping Fuel Oil circulation in MSBP after fuel gas rationalization scheme implementation	Nil	274	639
15	In PDA unit, replacing small rating motors (P-13A/B and P-17A/B) with higher rating which has helped in running only one pump instead of two parallel pumps	0.35	0	511
16	In CDU2 unit, replacing small rating motors (Pumps CP232A&B - RCO Pump) with higher rating and change in impeller diameter has helped in running only one pump instead of two parallel pumps.	0.4	0	1278
17	**Energy conservation initiatives in PDPP:** 1. AFC Power optimization in PDO unit 2. Diversion of PDO Recycle compressor purge to FG system	Nil	388	213
18	Energy conservation initiatives in CDU2 - stopping FO firing in furnaces, direct routing of Raffinate for SBP production, feed pump impeller trimming etc	0.05	577	2113
19	**Energy Improvement Schemes in CDU3**: Replacing small rating motors (Heavy Naphtha and HVGO pumps) with higher rating which has helped in running only one pump instead of two parallel pumps, bringing CDU3 heater ID fan in VFD mode.	1.53	0	2982
20	**Reduction of steam size systems initiatives**: Stoppage of SCAPH in DHDT, Steam optimization in NHTCCR SCAPH, Removal of redundant lines in SRU3 and utilities	0.05	1405	
21	**Operational improvements:** VGO HDS recycle gas Anti-surge opening reduction, MSBP RGC (MNC01) loading reduction to 50% from 75%, Taken VGO HDS PRT inline, routing of hot lean amine from SRU3 to VGO HDT thereby stoppage of amine preheater in VGO HDT.	Nil	984	2190
22	**Energy conservation initiatives in MSBP:** installation of FRIC insulation on Hot oil system valves, Routing of condensate to DHDS Utility boiler De-aerators	0.30	665	
	Total		**29298**	**11630**

PART - H

Additional Investment Proposal

- Polypropylene project as part of petrochemical expansion with an investment of 5500 crores is under progress.
- Compressed Bio Gas Plant: Bio-degradable Municipal Solid waste treatment plant, which produces Bio gas is under construction with an investment of 73 Cr.

PART - I

Other Details in respect of Environment protection

In addition to the measures taken for resource conservation and environment protection the following programmes were conducted for awareness building in these areas.

- Commissioned 13.7 MW solar power projects during the 2023 – 24.
- BPCL Kochi Refinery celebrated World Environment Day (June 05) with the following programs:
- On world Environment Day, 5th June 2023 we have planted 580 tree saplings in various parts of the Refinery and total 580 nos. of tree saplings planted during the year 2023 – 24.
- Arrangements have been done for the disposal of obsolete CFL / Mercury vapour lamps from homes to propagate the message of environment protection as well as hazardous nature of these items.
- Kochi Refinery stacks are connected to CPCB/KSPCB servers updating continuous online SO2, CO, NOx & PM emission values.
- BPCL Kochi refinery has been explored the possibility of Oxygen enrichment technology for enhancing the efficiency of SRU and the same commissioned.
- Following provisions exists for VOC control

a. Provision of mechanical seals on pumps for leak free operation.
b. Use of submerged filling in product loading gantries.
c. Closed blow down system for process plants.
d. Floating roof tanks for volatile product storage.
e. Conversion of floating roof tanks to double seal arrangement.
f. Closed loop sampling system in process plants.
g. Covered facility for oily effluent storage

- VOC control system in ETPs: Carbon adsorption technology for the removal of VOCs generated during in the effluent treatment area.
- Benzene monitoring is carried out using "dragger" chip technique in the Aromatic recovery unit daily.
- New vapor recovery system is implemented for Benzene & Toluene truck loading area.
- Spent catalyst containing recoverable heavy metals, which are having recycle value, disposed /sold to authorized recyclers.
- Flare losses are monitored continuously through flare meters installed in the process units and Flare Gas recovery system has been installed to recycle the maximum.
- An electrostatic precipitator has been installed downstream of CO boiler for minimizing particulate matter emission from FCCU regenerator flue gases
- Low pressure amine treatment of vacuum column vent gas. This is a unique environmental protection technology developed by BPCL KR for removing toxic hydrogen sulphide gas produced during vacuum distillation process.
- State of the art Biturox Technology has been adopted for production of Bitumen without any harmful emission. Unlike the traditional bitumen blowing technology, this technology helps for no odor or pollutants emissions. The off gases generated is subjected to incineration and caustic scrubbing in this technique. The wastewater stream generated is also oxidized, thereby resulting in zero BOD for effluent. The freshwater consumption is also significantly reduced by the adoption of this technique.
- Based on the lab reports, spent charcoal disposed-off in a more environment friendly approach by blended with Pet coke which yielding better value also.

- Closed loop sampling system in process plants which benefits zero spillage to outside and clean environment.

Major environmental protection measures implemented in Kochi Refinery are

1. Water is used in the industry, which includes cooling of process streams, steam production and in many other process applications. It is managed judiciously through various measures to conserve, recover, and reuse.

Major quantity of treated effluent is routed to RO-DM plant for recycling and rest is used for

(i) Firefighting purposes,
(ii) Process area cleaning,
(iii) Gardening / green belt development within the refinery & colony.

2. Six ambient air quality monitoring stations (AAQMS) at Kochi Refinery and three ambient air quality monitoring stations at Shore Tank Farm area are installed to monitor the ambient air quality on continuous basis. Those provide eleven air quality parameters, including hydrocarbons and the live data is transferring to CPCB/KSPCB portals. The ambient air quality information is also communicated to public through an electronic display board at main gate area.
3. Advanced process control (APC) system has implemented in Hydrogen network for decreasing hydrogen flaring.
4. To control emission of NOx, we have provided low NOx burners in all high-capacity heaters and boilers.
5. Most of the firing systems have been transformed into more Enviro-friendly fuel LNG.
6. Electrostatic precipitators are installed for FCCU / PFCCU Regenerator off gas treatment for minimizing particulate emission within the limits.
7. BPCL - KR: A new green drive and developed a new green park named as ECO PARK with many varieties of trees and medicinal plants.

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