



## इंडियन ऑयल कॉर्पोरेशन लिमिटेड

गुजरात रिफ़ाइनरीज़, डाकघर : जवाहरनगर

जिला : वडोदरा, गुजरात - 391 320

### Indian Oil Corporation Limited

Gujarat Refineries, P.O. Jawaharnagar,

Dist. : Vadodara, Gujarat - 391 320

Phone : +91-265-2237106

E-mail : gujaratrefinery@indianoil.in

Website : www.iocl.com



रिफ़ाइनरीज़ प्रभाग  
Refineries Division

Ref: JR/HSE/GPCB/form V/2022-23

Date: 27.09.2023

The Unit Head, Vadodara,  
Gujarat Pollution Control Board,  
Paryavaran Bhavan,  
Sector 10-A,  
Gandhinagar – 382 010.

Sub: Environment Statement for the year 2022-23(PCB ID 21967)

Dear Sir,

Pleased find enclosed, the Environment Statement of Gujarat Refinery for the financial year ending 31<sup>st</sup> March 2023. The report has been compiled as per Form-V of Central Pollution Control Board.

Thanking you,

Yours faithfully,

(B B Makwana)

Deputy General Manager (HSE)

Gujarat Refinery

Encl: As above.

CC: The Regional Officer

Gujarat Pollution Control Board

GERI Compound, Race Course

Baroda-390007.

**B.B. MAKWANA**  
Dy. General Manager (H, S & E)  
Gujarat Refinery, IOCL,  
Vadodara

पंजीकृत कार्यालय : जी-9, अली यावर जंग मार्ग, बान्द्रा (पूर्व) मुम्बई - 400 051 महाराष्ट्र (भारत)  
Regd. Office : G-9, Ali Yavar Jung Marg, Bandra (East) Mumbai - 400 051 Maharashtra (India)  
CIN-L 23201 MH1959 GOI 011388

**FORM – V**  
**(See Rule 14)**

**From:**

Gujarat Refinery  
Indian Oil Corporation Limited  
PO : Jawaharnagar  
Vadodara – 391 320  
Gujarat

**To,**

**Gujarat Pollution Control Board**  
**Paryavaran Bhavan**  
**Sector 10-A**  
**Gandhinagar – 382 010.**

**Environmental statement for the financial year ending on 31<sup>st</sup> Mar'23.**

**PART – A**

i.	Name & address of the owner/ Occupation of the industry, Operation or process.	Shri Rahul Prashant Executive Director & Refinery Head Gujarat Refinery PO: Jawaharnagar Vadodara – 391 320
ii.	Industry category	Primary
iii.	Production capacity	13.7 Million Metric tons of crude oil per annum.
iv.	Year of establishment	1965
v.	Date of the last Environmental Statement submitted.	28 <sup>th</sup> Sep'22

**PART – B**

<b>(1)Water and Raw Material Consumption</b>				
		<b>2020-21</b>	<b>2021-22</b>	<b>2022-23</b>
<b>Sl No.</b>	<b>Description</b>	<b>Water consumption, m3/day</b>	<b>Water consumption, m3/day</b>	<b>Water consumption, m3/day</b>
1	Process/Service	5781	5796	4640
2	Cooling	8216	8216	9132
3	Domestic (Refineries area only)	5761	5016	5042
4	DM Plant	6681	8056	15000
5	Fire water from freshwater	3481	4942	5871
	<b>TOTAL</b>	<b>29920</b>	<b>32026</b>	<b>39685</b>

<b>Process water consumption per unit of crude processed</b>		
<b>2020-21</b>	<b>2021-22</b>	<b>2022-23</b>
0.753 m3 per MT of crude processed	0.88 m3 per MT of crude processed	0.81 m3 per MT of crude processed

<b>(2) Raw Material Consumption</b>				
<b>SN</b>	<b>Name of Raw material</b>	<b>2020-21, MT</b>	<b>2021-22, MT</b>	<b>2022-23, MT</b>
1	Crude Oil	11602994	13474106	15566894
2	Methanol	8442	10537	9808
3	Benzene	48501	47987	37457
4	Ethanol	0	0	14633

List of products are enclosed below:

<b>Name of the products</b>	<b>Yield (MT) , (20-21)</b>	<b>Yield (MT) , (21-22)</b>	<b>Yield (MT) , (22-23)</b>
Liquefied Petroleum Gas	414319	434682.65	452421.2
Butene-I/Butene-II	0	0	0
Benzene	0	0	0
Toluene	0	0	0
Naphtha	584413	803091.284	964732
MTBE	0	0	0
Motor Spirit (MS)	2001740	2118056.71	2057020
Food Grade Hexane (FGH)	0	0	0
Motor Turpentine Oil (MTO)	0	84.185	0
Aviation Turbine Fuel (ATF)/ Superior Kerosene	228324	551795	608942
LABFS	426675	72654.034	58212.16

LAB	134011	131197.074	97441.29
HAB	0	0	4502
Light Aluminum Rolling Oil (LARO)	0	0	0
PD Oil	0	0	0
IOC Residue 96	0	0	0
ISO-SOI-90	0	0	0
HSD	5370564	6137625.3	7520269
LDO	91716	124665.974	71968.94
LSHS	0	0	0
Furnace Oil	234033	1291528.13	1331965
Bitumen	451318	489619.98	483260
Sulphur	82449	115540.135	146401.1
Pet Coke	5195237	566421.29	803702.5
Poly medium	0	0	0
EBMS	0	0	123845
DEF	0	0	1822.24
Aviation Gasoline(Av-Gas)	0	0	551

**PART – C**

Pollutants discharged to environment / unit of output  
(Parameters as specified in the consent issued)

**(1) Quantity of Treated water discharged to VECL in 2022-23: 1228104 M3**

**(2) Concentration of the Effluent discharged :**

Effluent Discharge-Quality				
Parameters	Unit	VECL Norms	Concentration of pollutants in discharge	Percentage of variation from prescribed standards with Reasons
pH	---	6.5-8.5	7.14	Always remained within prescribed limits for discharging in VECL.
Temp.	°C	40	28.33	
Colour (Pt. CO.)	Pt. co.unit	100	29.33	
T.S.S.	mg/l	100	16.67	
TDS	mg/l	5000	1366.67	
COD	mg/l	250	44.34	
BOD	mg/l	100	12.77	
O & G	mg/l	10	6.50	
Phenolic Comp	mg/l	1	Nil	
Cyanide	mg/l	0.2	Nil	
Fluoride	mg/l	1.5	0.64	
Sulfide	mg/l	2	0.002	

NH <sub>3</sub> - N	mg/l	50	Nil
Total Chromium	mg/l	2	0.53
Hexavalent Chromium-Cr <sup>+6</sup>	mg/l	0.1	0.04
Copper	mg/l	3	Nil
Lead	mg/l	0.1	Nil
Nickel	mg/l	3	Nil
Zinc	mg/l	5	Nil
Mercury	mg/l	0.01	Nil
Cadmium	mg/l	2	Nil
Arsenic	mg/l	0.2	Nil
Chloride	mg/l	2000	471.13
Sulphate	mg/l	1000	89.67
Insecticide / pesticide	mg/l	Absent	Absent
Bio-Assay Test	%	90.0% Survival of Fish after 96.0 hours	Pass

#### Quantity of Air emission

Air emissions from various furnace stacks for FY-2022-23 is as given below-

Sl.No.	Point Source (Furnace Stacks)	Emission rate (Kg/ Day)			
		SO <sub>2</sub>	Nox	PM	CO
1	Furnace No.AU-1,F-1	133.285	29.689	2.285	7.644
2	Furnace No. AU-1,F-2	30.436	6.780	0.513	1.760
3	Furnace No.AU-1,F-3	19.547	4.362	0.368	1.097
4	Furnace No.AU-1,F-4	20.607	4.591	0.388	1.164
5	Furnace No.AU-1,F-5	37.471	8.344	0.645	2.151
6	Furnace No.AU-2,F-1	113.465	138.720	12.022	13.931
7	Furnace No.AU-2,F-2	20.939	25.594	2.214	2.585
8	Furnace No.AU-2,F-3	14.060	17.181	1.500	1.727
9	Furnace No.AU-2,F-4	13.752	16.812	1.464	1.684
10	Furnace No.AU-2,F-5	25.330	30.962	2.686	3.118
11	CRU, 21 F01	1.405	3.114	0.565	0.993
12	CRU, 21 F02	2.807	5.984	1.099	1.955
13	CRU, 22 F01	3.539	7.673	1.411	2.442
14	CRU, F-1	10.592	22.702	4.142	7.336
15	AU-V,05-FF-001	216.353	143.250	16.162	17.864
16	DHDS-1010-F01	2.275	17.783	1.750	4.697
17	DHDS (1010 F-02)	11.647	10.337	4.049	5.745
18	HGU-II-,1011-F-01	---	---	---	---
19	HGU-II-,1011-F-02	---	---	---	---
20	Furnace No.AU-3,F-1	24.223	73.221	5.500	6.367

21	Furnace No.AU-3,F-2	24.223	73.221	5.500	6.367
22	Furnace No.AU-3,F-3	2.715	0.426	1.335	7.964
23	UDEX	---	---	---	---
24	AU-4, 712 F-02	88.974	21.692	2.988	3.858
25	AU-4, 712-F01	62.377	58.012	2.834	2.793
26	AU-4, 712 F-01 (W)	78.998	73.466	3.608	3.548
27	VDU, 721 F01	332.576	107.798	2.482	16.282
28	VBU, 731 F01	14.798	12.008	4.129	7.400
29	BBU, F-1	7.680	27.360	18.720	4.320
30	BBU, F-2	12.960	23.040	11.520	4.080
31	FCC-CHARGE HEATER	5.005	2.219	4.067	2.584
32	FCC-CO BOILER	20.936	50.419	66.268	13.774
33	FPU, 812 F01	155.882	54.716	5.975	5.584
34	HCU-06-FF-01/02	5.037	8.698	1.862	5.377
35	HCU-06-FF-03/04	59.019	38.745	4.385	6.433
36	FPU-03FF001	55.273	20.050	12.318	4.796
37	HGU-I, -FF-701	10.774	34.595	2.337	6.655
38	LAB, 2061-F-01	2.288	4.688	0.296	0.898
39	LAB, 2063 F-01/2071 F-01	11.218	5.931	7.341	8.319
40	MSQ-15-FF-01/15-FF-02/15-FF-03/15-FF-04	4.928	44.143	2.467	5.017
41	MSQ-14 FF 01	3.764	36.152	0.423	3.402
42	MSQ-15 FF05	7.888	33.034	0.506	1.827
43	MSQ-16 FF01	8.063	21.119	0.159	1.030
44	HGU-III-2041-F-101	1.343	14.528	0.389	3.918
45	HGU-III-2092-F-01	41.320	60.990	2.766	16.726
46	DHDT	9.969	0.715	1.774	5.724
47	ISOM	12.486	21.955	2.190	3.389
48	SRU-II	---	---	---	---
49	SRU-III	169.942	38.751	1.976	10.539
50	DCU-F-01	17.124	62.064	1.768	6.224
51	DCU-F-02	38.482	95.498	1.113	4.394
52	VGO-HDT	1.904	25.622	0.399	0.758
53	TPS-STACK	415.149	738.440	152.177	42.669
54	HRGS-1	10.655	7.334	3.054	6.131
55	HRGS-2	9.048	195.662	3.018	23.021
56	HRGS-3	13.143	110.367	5.417	12.067
57	HRGS-4	2.922	7.709	4.084	15.037
58	HRGS-5	63.713	84.011	5.082	47.666
59	6th GT / HRGS-6	33.633	74.021	2.525	106.817
60	New DHDT(Combined Feed heater) (0601 F-01)	3.867	3.920	0.587	0.720
61	New DHDT(Fractionator reboiler) (0601 F-02)	3.270	8.460	0.450	1.050
62	HGU-4(PDS) (0602 F-01)	10.267	6.400	1.920	9.627
63	HGU-4(Tubular Reformer) (0602 F-101)	0.880	8.107	1.787	3.733
64	FCC- GDS (Splitter reboiler) (0603 F-01)	---	---	---	---
65	FCC- GDS (HDS Heater) (0603 F-02)	---	---	---	---

**PART – D**

**HAZARDOUS WASTES**

As specified under hazardous wastes (management and handling) Rules, 1989

1. Total quantity of waste generated category wise			2020-21	2021-22	2022-23
SI No.	Description of the waste	Type of waste with category as per Schedules I, II and III of these rules	Total quantity of Generation	Total quantity of Generation	Total quantity of Generation
1	Residual oily Sludge	4.1	2871.85	8008.31	1407.61
2	Spent catalyst	4.2	580	323.97	666.4
3	Slop Oil	4.3	56935	67727	67628
4	Spent Resin	35.2	0	40.18	5.3
5	Spent carbon	36.2	7.06	25	189.47
6	Old and used drums	33.1	10711	14602	22725
7	Used oil	5.1	0	35.72	12.012
8	Insulation ( other waste)	----	200	50	250

**PART – E**

Sl.No.	Solid wastes generation/Disposal	2020-21	2021-22	2022-23
		(MT)	(MT)	(MT)
<b>a</b>	From Process	Nil	Nil	Nil
<b>b</b>	From Pollution Control Facility (Bio-Sludge)	4800	5256	4743
<b>c1</b>	Quantity recycled or reutilized within unit	Nil	Nil	Nil
<b>c2</b>	Sold (bio-sludge)	Nil	Nil	Nil
<b>c3</b>	Solid (bio-sludge) Disposed (in green belts as manure)	4800	5256	4743

## PART – F

Please specify the characterizations (in terms of composition and quantum) of hazardous as well as solid wastes and indicate disposal practice for both these categories of wastes.

### 1. Oily Wastes:

Characteristics of residual oily sludge are tabulated below:

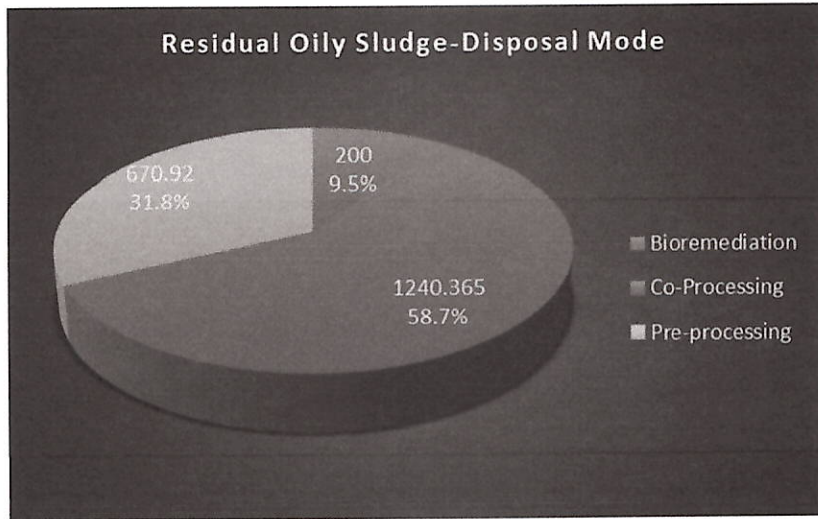
Parameters	ETP Residual Oily sludge
pH	7.01
Oil & Grease	66.09
% Total Solids	54.99
% Total Volatile Solids	82.40
Amm. Nitrogen	Nil
Iron	Nil
Zinc	Nil
Copper	Nil
Cadmium	Nil
Cyanide	Nil
Nickel	Nil
Lead	0.02
Mercury	Nil
Arsenic	Nil
T Chromium	0.21
<b>Note:</b>	
1. All results are expressed in gm/kg except pH, % Total Solids, % Total Volatile Solids, %Total Fixed solids & % Moisture Contain	
2. All samples analyzed by making distilled water leachate.	

Presently M/s Arham Oil-Gas Products and Services Pvt. Ltd. has been engaged for processing of oily sludge for recovery of oil. A sludge processing Unit (SPU) is installed by the Vendor which process oily sludge on continuous basis. SPU basically uses decanter which separates Oil, Water and sludge. Oily sludge after heating with steam is fed to unit and some solvent like slop oil is added for better mixing. Gujarat Refinery has residual Oily waste which is treated in the refinery premises by bioremediation. It is bacteriological treatment with bacteria developed by IOCL, R&D. In this process, oily waste is converted into harmless components like CO<sub>2</sub>, Water and fatty acid. Presently confined space fast bioremediation is taking place in bioreactor.

This residual sludge after oil recovery is bio remediated in confined space bio reactor. Apart from confined space bio-remediation, Gujarat refinery have been carrying out the disposal of residual oily sludge through SPCB authorized co-processors and pre-processors for processing the waste in an eco-friendly way. Currently residual oily sludge is being disposed to M/s Ambuja Cements Limited & M/s Recycling Solutions Private Limited.



Following is the disposal of the residual oily sludge through various disposal methods for the year 2022-23.

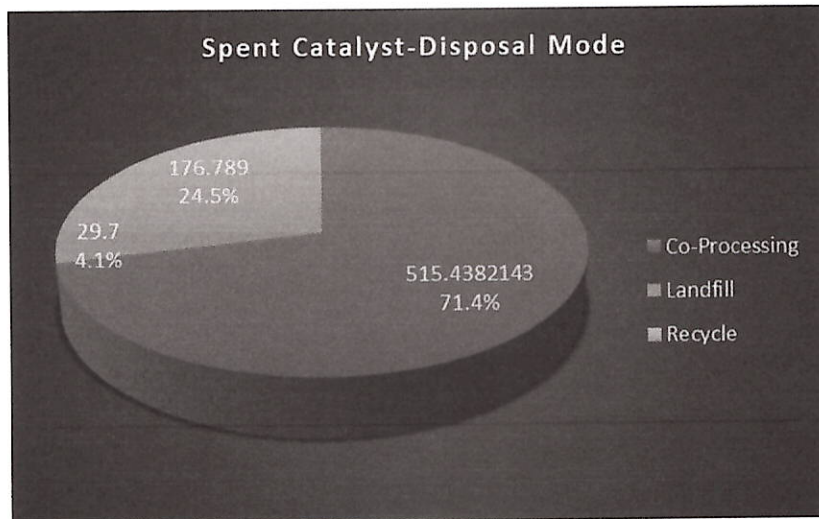


**2. Spent catalyst:**

Spent catalyst is generated from various refinery processes due to its deactivation. Authorization is obtained from Gujarat Pollution Control Board to dispose the spent catalysts to the secured landfill approved by GPCB, through auction to registered Re-cyclers, through incineration facilities approved by GPCB and through SPCB approved Co-processors/Pre-processors.

Gujarat refinery has started the disposal through Co-processors from April 2022 onwards.

Following is the disposal of the spent catalyst through various disposal methods for the year 2022-23-



### 3. Bio-sludge:

At present, bio-sludge is dried in sludge drying beds after centrifuging. This dried bio-sludge is used as manure in green belt. Characteristics of bio-sludge are tabulated below:

Parameters	Biological Sludge
pH	6.84
Oil & Grease	5.84
% Total Solids	50.145
% Total Volatile Solids	54.61
Amm. Nitrogen	0.6395
Iron	0.025
Zinc	0.0255
Copper	0.041
Cadmium	Nil
Cyanide	Nil
Nickel	Nil
Lead	Nil
Mercury	Nil
Arsenic	Nil

#### PART – G

(Impact of the pollution control measures on conservation of natural resources and consequently on the cost of production)

1. Treated effluent from CETP is mostly recycled in Cooling Towers and in RO plant. After commissioning of RO Plant, CETP treated water is totally diverted to RO Plant. Permeate from RO is used in DM plants and the remaining in cooling towers and fire-water network. RO Reject is discharged via VECL maintaining the VECL inlet norms. . The reuse from RO Plant is around 88% and the remaining 12 % ( 120-150 m<sup>3</sup>/hr) is discharged via VECL maintaining the VECL inlet norms.
2. Replacement of Ultra-Filtration (UF) membranes was carried out in Reverse Osmosis (RO) plant involving a cost of INR .6.65 Crores. The replacement has improved the quality of permeate water in RO plant due to which DM plant regenerations and Cooling Towers Blowdowns has been reduced and subsequently waste effluent generation has also gone down.
3. Bioremediation of oily sludge by cultured bacteria developed by IOCL (R&D) is being done continuously. This eco-friendly disposal of oily waste solved the long pending disposal problem. Bioreactor for fast confined space bioremediation is presently being used for bioremediation of oily sludge.
4. Residual Oily sludge (oil < 10%) of 1755.49 MT has been disposed through the Co-processor M/s Ambuja Cements Limited and Pre-processor-M/s Recycling Solutions Pvt. Ltd. during Nov-2022-Mar-2023 costing Rs. 1.77 crores. With this initiative, Gujarat refinery ensures the Conservation of natural resources along with environment safe disposal of the hazardous waste.

5. A work-order has been awarded to M/s Ambuja cements Limited at a cost of INR 2.92 Crores for a period of two years (Feb-2022 – Jan-2024) for co-processing of various hazardous wastes like Spent catalyst, Spent resin, Spent carbon etc. for co-processing , which can be used as an alternate fuel by the cement industry. By this, Gujarat refinery ensures the Conservation of natural resources along with environment safe disposal of the hazardous waste.
  6. Spent Caustic Treatment Plant with state-of-the-art technology was set up in Gujarat Refinery CETP, where reactive sulfide is converted into less harmful soluble sulfate by wet-air-oxidation process. This facility has reduced the generation of chemical waste in the Gujarat Refinery.
  7. For removal of H<sub>2</sub>S from the fuel source itself, Refinery has set up amine treating units for fuel gas. MDEA is being used for absorbing H<sub>2</sub>S from the fuel gas. H<sub>2</sub>S from the rich amine is being stripped off in amine regenerator. A sulfur recovery unit uses off gas from amine regeneration unit as feed and converts gaseous H<sub>2</sub>S into liquid elemental sulfur, thereby reducing SO<sub>2</sub> emission from the refinery.
  8. Side entry mixers and also jet mixers have been installed in crude oil tanks for reduction of tank bottom sludge in the crude oil. The oily sludge of crude oil tanks is now treated in Sludge Processing Unit (SPU) installed by M/s Plant Tech Mid continental Pvt. Ltd. and M/s Balmer Lawrie where the oil extracted from bottom sludge is reused & processed in Refinery and the solid waste after oil recovery is disposed through co-processors/pre-processors.
9. Loss prevention and energy conservation measures:
- Installation of combustion control system in furnaces for reduction of excess air in order to increase the efficiency of furnaces which in turn reduces fuel consumption.
  - All lighter product tanks are provided with floating roofs to minimize the evaporation loss. Lighter product tanks have also been provided with Secondary seals.
  - By optimum utilization of Hydrogen generation capacity and consumption, one Hydrogen unit was stopped.
  - By optimum utilization of HRSG steam generation capacity and consumption of HP/MP steam, one Boiler was stopped.

#### PART – H

(Additional investment proposal for environmental protection including abatement of pollution) scheme approved / job in progress:

- 1) Water foot Print Reduction –Tie up with Vadodara Municipal Corporation(VMC) for STP treated water reuse facility(40 MGD) in Gujarat Refinery for industrial water use replacing of fresh water. Project is under pre-commissioning stage with 21 MLD capacity under phase-I and further 19 MLD addition with upcoming Gujarat Refinery Projects.
- 2) To improve the efficiency of water treatment, Bio-Tower media replacement undertaken with estimated cost INR 15.96 Crores and plastic recycled with authorized plastic recycler M/s ARS.

- 3) In order to minimize the effluent discharge through VECL, RO Reject is utilized in Pet Coke yard for Dust Suppression System (DSS). Approximately 200-250 m<sup>3</sup>/day in the non-monsoon period is being to be utilized through this scheme.
- 4) VOC LDAR programme is in practice to reduce VOC emissions from the refinery processes.
- 5) Agencies (M/s Ambuja Cements Limited & M/s Recycling Solutions Private Limited) Ltd has been lined up for co-processing/pre-processing of oily/residual sludge.
- 6) Co processing of other hazardous waste except residual oily sludge has been started from Mar'22. M/s Ambuja Cement. Ltd has been lined up for this purpose.
- 7) To control and minimize the fugitive emissions, VOC system of around 20 crores is proposed for all primary units in CETP and the GR/GRE influent Sump. The fugitive emissions shall be routed to Activated Carbon Filter and the clean air from filter shall be vented out in atmosphere.
- 8) For the year 2022-23, 3285 trees were planted in and around Gujarat Refinery to sequester the carbon dioxide generated from refinery processes along with existing green canopy of 2,15,000 trees.
- 9) Environment Protection measures for existing Refinery and upcoming projects
  - a. Hydrogen Dispensing Facility at Koyali
  - b. ZLD facility for upcoming LuPech(Lubes & Petrochemical) at Refinery/Oxo-alcohol(Dumad) plants.
  - c. New flare having a height of 176 meter
  - d. Multi-cyclone separator/bag filter for upcoming boiler
  - e. Low NOx burners for all furnaces
  - f. 2 new CAAQMS under upcoming LuPech(Lubes & Petrochemical) plants
  - g. Rain water harvesting from roof tops of buildings.
  - h. Green Belt development with miyawaki technique.
  - i. Existing ETP modernization with additional state of art technology adding various analyzers, improved bio treatment etc.
  - j. Additional SRU plant
  - k. ETP tertiary treatment media replacement

Total expected expenditure on environment protection measured: 1172 crores

#### **PART – I**

(Any other particulars for improving the quality of the environment)

- 1) Environment Management System at Gujarat Refinery is at par with International standard. For effective environment management system, refinery declared an environment policy, which aims to comply & excel the statutory limit and norms of pollution control & prevention.  
  
The efforts of the refinery towards environment management system is recognized by reputed third party M/s VEXIL Business Process Services Pvt. Ltd. In every one year, surveillance audit is

conducted to verify whether the system meets the standard. Gujarat Refinery has been recertified for ISO 45001: 2018, ISO-14001:2015 & ISO-9001:2015. It is valid up to 30<sup>th</sup> Jan-2026 which will be further revalidated.

- 2) Gujarat Refinery recognizes the importance of a structured and comprehensive mechanism to ensure that the refinery activities and products do not cause adverse effects on the environment. Thus, yearly environment audit is being conducted by GPCB approved schedule –I auditors. The Environment Audit for 2022-23 was carried out by DharmSinh Desai University, Nadiad, Gujarat.
- 3) World Environment Day, Energy conservation fortnight were celebrated with involving employees, contract labors and nearby villagers to inculcate awareness towards Environment and energy conservation.
- 4) Gujarat Refinery has whole heartedly supported "**Mission LiFE**"- a mass movement of Environmental Conscious Lifestyle through various evbents/competitions/training programmes as per MoPNG directions. Various events were organized under the campaign such as Display of LiFE logos at various prominent locations for mass awareness, Nukkad Natak event organized in Township, drawing /poster making competitions for school students, Training programmes on energy management, environment management, stress management etc.
- 5) Swachhta Pakhwada under Swachh Bharat Mission is being observed at Gujarat Refinery every year for awareness among employees, contract workers, nearby schools and nearby areas. Various events are organized for awareness and participation at various levels.

Name: B B Makwana  
Designation: DGM (HSE)  
Address: Indian Oil Corporation Limited  
Gujarat Refinery  
PO: Jawaharnagar  
Vadodara -391320