



इंडियन ऑयल कॉर्पोरेशन लिमिटेड

हल्दिया रिफाइनरी, डाकघर : हल्दिया ऑयल रिफाइनरी -721606

जिला : पूर्व मेदिनीपुर, पश्चिम बंगाल

Indian Oil Corporation Limited

Haldia Refinery, P.O. : Haldia Oil Refinery-721606

District : Purba Medinipur, West Bengal

Website : www.iocl.com, E-mail : haldiarefinery@indianoil.in

Phone : 91-3224-223270



रिफाइनरीज प्रभाग
Refineries Division

Ref No.: HR/HSE/8D/2025-26/01

08.12.2025

To

The Deputy Director General of Forests (Central),
Integrated Regional Office, Bhubaneswar
Ministry of Environment, Forest and Climate Change,
Sub-office: Regional Office, Kolkata,
IB – 198, Sector-III, Salt Lake City,
Kolkata – 700106

Sub: Submission of Half-Yearly Environmental Clearance Compliance Report for the period
April 2025 –September 2025– IOCL, Haldia Refinery

Respected Sir,

With reference to the above, please find enclosed the Half-Yearly Compliance Report detailing the status of compliance with the stipulated conditions of the Environmental Clearances granted to various ongoing and existing projects at IOCL, Haldia Refinery. This report pertains to the period from 1st April 2025 – 30th September 2025.

The compliance report has been prepared in line with the guidelines and format prescribed by the Ministry and is submitted for your kind perusal and necessary action.
Thank you for your continued guidance and support.

Yours sincerely,

for Indian Oil Corporation Limited, Haldia Refinery

Santanu Sen

Dy. General Manager (HSE)

शान्तनु सेन, उप महाप्रबंधक (एचएस एण्ड ई)
Santanu Sen, DGM (H S & E)

इंडियन ऑयल कॉर्पोरेशन लिमिटेड, हल्दिया रिफाइनरी
Indian Oil Corporation Limited, Haldia Refinery

Enclosure: Half-Yearly Environmental Clearance Compliance Report with an Annexure

Copy to: The Regional Officer, West Bengal Pollution Control Board (WBPCB), Haldia



IndianOil

**INDIANOIL CORPORATION LIMITED
HALDIA REFINERY**

**HALF YEARLY COMPLIANCE REPORT
OF ENVIRONMENTAL CLEARANCE**

(Status for the Period 1st April 2025 – 30th September 2025)



Index on Status of Compliance of Past Environmental Clearances
(Haldia Refinery – Indian Oil Corporation Ltd.)

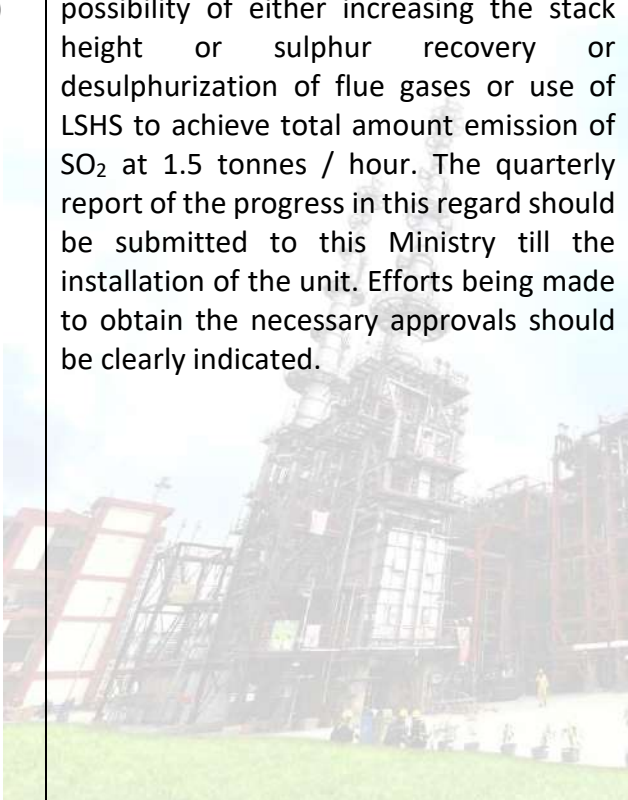
Sl. No.	EC Reference Number & Date	Description of Environmental Clearance	Page No.
1	J-11011/34/88-IA, 16-Mar-1989	Environmental Clearance for Lube Oil Block	1-7
2	J.11011/39/96-IA II (I), 18-Dec-1996	Installation of Diesel Hydro Desulphurisation Unit (4.6 MTPA) at Haldia Refinery	8-10
3	J.11011/99/96-IA II (I), 01-Oct-1997	Fluidized Catalytic Cracking Unit (FCCU) at Haldia Refinery	11-12
4	J-11011/28/2000-IA II, 21-Aug-2000	2nd VDU (2 MMTPA) & Catalytic Iso-Dewaxing Unit (0.2 MMTPA) at 7.5 MTPA Crude Processing Level	13-18
5	J-11011/5/2002-IA II(I), 01-May-2002	HSD Quality & Distillate Yield (OHCU) and MS Quality Improvement (MSQI) Facilities	19-23
6	J-13011/14/2006-IA II (T), 05-Jan-2007	3rd Gas Turbine (GT-3) with HRSG at Haldia Refinery	24-28
7	J-11011/422/2006-IA II(I), 06-Mar-2007	RFCCU Revamp from 0.7 to 1.0 MMTPA – Not pursued	29-37
8	J-11011/904/2007-IA II(I), 17-Mar-2009	Installation of Delayed Coking Unit (DCU) – Clubbed under DYIP	38
9	J-11011/299/2013-IA II(I), 04-Mar-2016	Capacity Expansion (7.5 to 8.0 MTPA), DYIP & Feed Processing Unit	39-52
10	J-11011/175/2016-IA II(I), 28-Nov-2017	BS-VI Fuel Quality Upgradation (Phase-I)	53-66
11	J-11011/299/2013-IA II(I), 11-Dec-2019	Amendment to EC (VDU-II 2.4 to 2.6 MTPA in place of VDU-I)	67
12	J-11011/175/2016-IA II(I), 05-Jan-2021	2nd Catalytic Iso-Dewaxing Unit (270 TMTPA)	68-78
13	F. No. 11/23/2023-IA.III, 21-Jul-2023	Sulphuric Acid Pipeline to Finger Jetty – CRZ Proposal	79-83

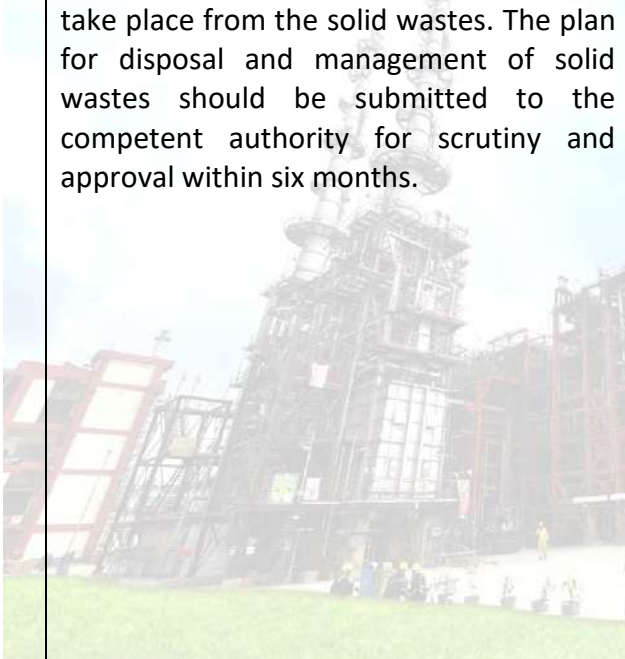
List of Annexures

Annexure	Description
Annexure-1	Month-wise average data of Manual Ambient Air Quality Monitoring Stations (Apr'25 to Sep'25)
Annexure-2	Monthly average data of Final Treated Effluent discharge to River Hooghly (Apr'25 to Sep'25)
Annexure-3	Groundwater sampling results by WBPCB recognized lab
Annexure-4	Expenditure incurred by Haldia Refinery for implementing MoEF&CC conditions (FY 2024–25)
Annexure-5	Noise level measurements at the boundary area of Haldia Refinery
Annexure-6	SO ₂ Stack Emission Monitoring data (Apr'25 to Sep'25)
Annexure-7	Month-wise average data from Continuous Ambient Air Quality Monitoring Stations (CAAQMS)- Apr'25 to Sep'25
Annexure-8	Year-wise tree plantation details
Annexure-9	Effect Assessment & ZLD Feasibility Report by M/s EIL
Annexure-10	NABL Certificate of Quality Control Laboratory, Haldia Refinery
Annexure-11	Emergency Response and Disaster Management Plan (ERDMP) Certificate
Annexure-12	Third-party Safety Audits 2025 as per MSIHC Rules
Annexure-13	Fugitive emissions (LDAR) Report

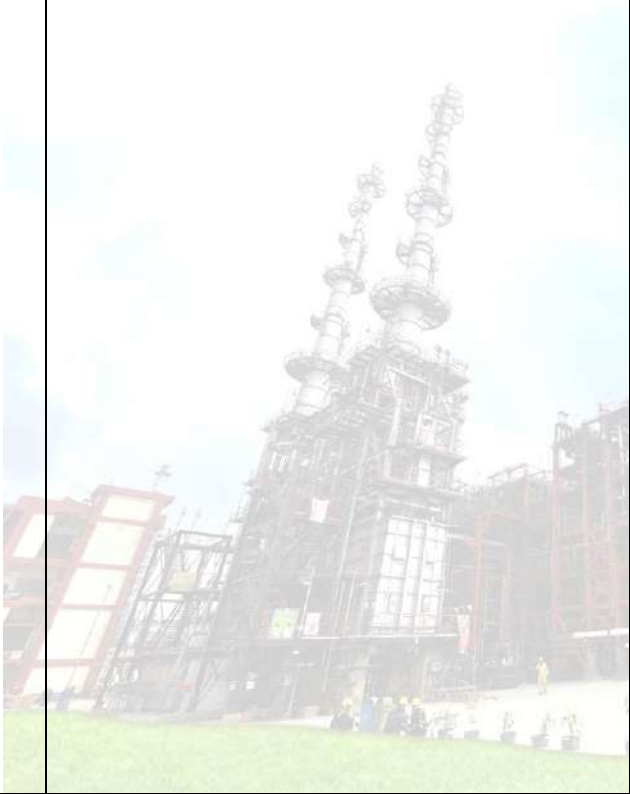
1.0 EC Reference No. & Issue date: J11011/34/88-IA; 16th MARCH 1989

Status of Conditions Imposed with Respect to Environmental Clearance: For Lube Oil Block at Haldia Refinery

Sl. No.	STIPULATION BY MoEF & CC	STATUS
i)	The project proponent must strictly adhere to the stipulations made by West Bengal Pollution Control Board.	Haldia Refinery has been adhering to the stipulations made by the West Bengal Pollution Control Board and submitting necessary compliance reports as per schedule.
ii)	The project authority will explore the possibility of either increasing the stack height or sulphur recovery or desulphurization of flue gases or use of LSHS to achieve total amount emission of SO ₂ at 1.5 tonnes / hour. The quarterly report of the progress in this regard should be submitted to this Ministry till the installation of the unit. Efforts being made to obtain the necessary approvals should be clearly indicated.	 • Only low sulphur fuel gas and oil are fired in the heaters. • Old Sulphur Recovery Units (SRUs) were commissioned in April/May 1994. • New SRUs were commissioned in 2010, and SRU-V was commissioned in 2020. • Additionally, the Wet Sulfuric Acid (WSA) Plant—first of its kind in IOCL with a capacity of 375 MTPD—was successfully commissioned at Haldia Refinery on 30th September 2022, converting H₂S-rich gas to H₂SO₄. • Stack emissions are well within prescribed limits. Continuous online stack monitoring systems are in place, and real-time data is linked to the CPCB server. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
iii)	Air quality monitoring network design should be made on the basis of model exercise and submitted to this Department within three months for review. A minimum of three air quality monitoring stations should be set up.	• Ambient air quality is monitored twice weekly at five locations inside the refinery and two locations in the township. • The last six-monthly air quality monitoring report is submitted to the MoEF&CC Regional Office (refer Annexure-1). • Three Continuous Ambient Air Quality Monitoring Stations

		(CAAQMS) are installed inside the refinery and are integrated with the CPCB server (refer Annexure-7).
iv)	All the stacks should be provided with continuous stack monitoring facilities. The data should be furnished quarterly to State Pollution Control Board and half yearly to this Ministry.	- Continuous stack monitoring systems with SO₂, PM₁₀, NO_x, and CO analyzers are installed on all furnaces with heat duty >10 MM Kcal/hr, and the data is linked to the CPCB server. - WBPCB also carries out quarterly sampling for stack emissions verification.
v)	The project authority should prepare a plan for implementation of disposal of solid waste generated during various process operations or in the treatment plant provided. They should ensure that no leaching of pollutants like sulphides take place from the solid wastes. The plan for disposal and management of solid wastes should be submitted to the competent authority for scrutiny and approval within six months. 	Haldia Refinery has implemented an integrated and environmentally responsible solid waste management system, with a strong emphasis on waste minimization, resource recovery, and safe disposal. Oily Sludge Management: - In-situ oily sludge centrifuge used to recover oil and minimize residuals. - De-oiled sludge is either bioremediated or stored in PVC-lined pits. - Thermo-mechanical sludge treatment unit commissioned for enhanced oil recovery. Oil Recovery: - Melting pits commissioned for tank bottom sludge oil recovery. - Combined system significantly reduces hazardous waste. Bio-Sludge Management: - Bio-Tower technology reduces biomass generation. - Sludge is dewatered using thickener and centrifuge for easier handling. Spent Catalyst: - Stored in sealed drums; metal-value catalysts auctioned via MSTC to authorized recyclers. - Zero-value catalysts sent to authorized TSDF. Other Solid Waste: - Spent resins, carbon, and mineral wool securely stored and disposed through WBPCB-authorized TSDF. Authorization & Compliance:

		• Hazardous waste authorization obtained from WBPCB. • Annual returns submitted; WBPCB conducts regular site verifications.
vi)	No change in design of stack should be made without the prior approval of State Pollution Control Board. Alternate pollution control system and/or proper design (steam injection system) of the stack should be made to minimize hydrocarbon emission due to failure in the flare system in the plant.	• No changes have been made to the stack design. • Since 2010, Flare Gas Recovery and Utilization (FGRU) has been operational, helping to recover and reuse flare gas as fuel and reducing flaring emissions
vii)	Additional area under the control of project which is not being used for the plant utilities should be afforested and funds for this purpose should be suitably provided.	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total 610 acres plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy: 1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: • Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. • Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts.

		2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: • Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar Island (247 Ha) was completed to enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township. • Massive Plantation Drives: Targetted afforestation at Balughata and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024-25: 1739 trees
viii)	Tree plantation program in the plant premises and in the periphery of the plant should be undertaken in consultation with State Forest Department. Plant species which are sensitive as well as resistant to Sulphur-dioxide emissions should be chosen for plantation purposes.	Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: • Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air

		quality. • Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts.
ix)	Project authority must set up laboratory facilities in the existing premises for testing air emissions and water quality.	• The refinery operates an in-house, first-party Quality Control Laboratory with a permanent facility inside the refinery premises. • This lab is NABL accredited (TC10599, valid till 01.05.2026) and WBPCB-approved lab for daily water testing (Refer Annexure-10).
x)	The clearance of Chief Inspector of Explosives must be taken before starting construction of the proposed plant and a copy of consent letter should be made available to this Ministry.	PESO approvals are obtained prior to construction for all projects and Consent is taken from PESO before commissioning of respective process units.
xi)	Project authority will establish five water quality monitoring stations in consultation with State Pollution Control Board to monitor the quality of stream water and to study the impact of treated effluent discharge and will submit its report quarterly to state Pollution Control Board and half yearly to this Ministry. Ground water quality also should be monitored.	• Effluent quality is monitored daily at NABL-accredited lab. Online analyzers installed at ETP-1, ETP-2, and TTP/RO outlets to monitor pH, TSS, COD, and BOD. • Additional monitoring stations are installed in the stormwater channel. • Refer Annexure-2 for six-month average data of treated effluent (Oct–Mar 2024). • Groundwater is monitored quarterly via WBPCB and external agencies. Report attached as Annexure-3.
xii)	The project authority will explore the possibility of water recycling to the maximum possible extent. A plan in this regard should be prepared within the next one year and furnished to this Ministry.	Haldia Refinery has adopted multiple sustainable practices to ensure effective reuse, of treated effluents thereby reducing its water footprint. • The refinery operates a comprehensive and robust Effluent Treatment Plant (ETP) equipped with physical, chemical, biological, and tertiary treatment facilities to meet

		and maintain the statutory discharge norms. • Haldia Refinery is undertaking a major modernization and capacity augmentation of ETP-1 with a capital investment of Rs. 87 crores • In line with its commitment to maximizing treated water reuse, the refinery has installed a Reverse Osmosis (RO) plant that enables further polishing of treated effluent for reuse in cooling tower make-up and as feed water to the Demineralization (DM) plant. • Further Treated effluents are reused in fire water systems, cooling towers make up.
xiii)	The liquid effluent coming out of the plant premises should strictly conform to MINAS.	Treated effluent meets MINAS standards and is continuously monitored through online systems.
xiv)	The project authority will submit a Disaster Management Plan duly approved by nodal agency.	Emergency Response & Disaster Management Plan certified by PNGRB-authorized agency (M/s EHS Integrated Solution); valid till 31.08.2025
xv)	A separate environmental management cell with suitably qualified people to carry out various functions related to environmental management should be set up under the control of a Senior Technical personnel who will report direct to the head of organization.	A dedicated Health, Safety & Environment (HS&E) department, headed by a Chief General Manager (CGM) reporting directly to the Head of the organization, is in place. The team comprises experienced personnel from refinery and petrochemical operations across various levels. Environmental activities are also periodically reviewed by the Refinery HQ HSE team to ensure compliance and continuous improvement
xvi)	The fund provision of Rs.10 Crores which has been made should be utilized for implementation of all conditions stipulated herein and the budget so provided will not be delivered for any other purpose. The conditions stipulated above needs additional funds it should be so provided either from non-recurring or recurring budget of the unit.	• Haldia Refinery has consistently earmarked and allocated substantial funds every financial year towards environmental protection and management activities. • This fund is not diverted for any other purposes and is utilized solely for environmental compliance. • The funds are utilized for comprehensive activities including the operation and maintenance of pollution control systems (ETP, TTP-

		RO), greenbelt development, environmental monitoring, hazardous waste management, sludge oil recovery, consent/authorization fees, awareness programs, and EIA/RA studies. These allocations are made from both recurring and non-recurring budgets as required, ensuring that all environmental obligations are fully met without any shortfall. A summary of environmental expenditure over the last nine financial years is provided below: <table><tr><th>Year</th><th>Expenditure (₹ Crore)</th></tr><tr><td>2024–25</td><td>19.17</td></tr><tr><td>2023–24</td><td>17.84</td></tr><tr><td>2022–23</td><td>20.61</td></tr><tr><td>2021–22</td><td>23.86</td></tr><tr><td>2020–21</td><td>20.79</td></tr><tr><td>2019–20</td><td>20.58</td></tr><tr><td>2018–19</td><td>20.59</td></tr><tr><td>2017–18</td><td>15.07</td></tr><tr><td>2016–17</td><td>21.19</td></tr></table>	Year	Expenditure (₹ Crore)	2024–25	19.17	2023–24	17.84	2022–23	20.61	2021–22	23.86	2020–21	20.79	2019–20	20.58	2018–19	20.59	2017–18	15.07	2016–17	21.19
Year	Expenditure (₹ Crore)																					
2024–25	19.17																					
2023–24	17.84																					
2022–23	20.61																					
2021–22	23.86																					
2020–21	20.79																					
2019–20	20.58																					
2018–19	20.59																					
2017–18	15.07																					
2016–17	21.19																					

2.0 EC Reference No. & Issue date: 11011/39/96-IA II (I); 18/12/1996

Status of Conditions Imposed With respect To Environmental Clearance: For DHDS unit at Crude Processing level for 4.6 MMTPA at Haldia Refinery, IOC

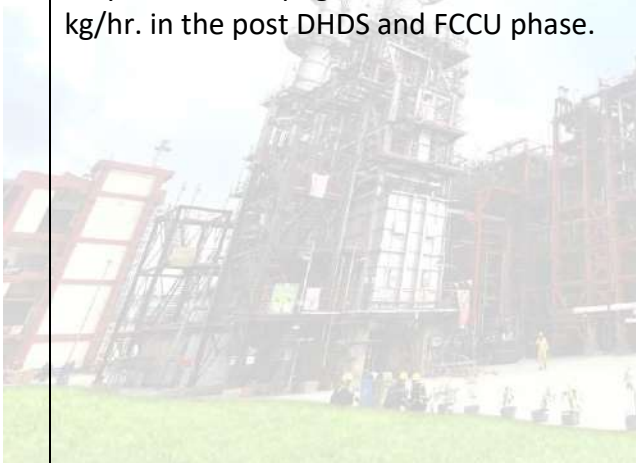
Sl. No.	STIPULATION BY MoEF & CC	STATUS
i)	The project authority must strictly adhere to the stipulations laid down by the West Bengal State Pollution Control Board and the State Govt.	Haldia Refinery complies with all WBPCB and State Government stipulations and submits regular compliance reports as per schedule.
ii)	No expansion or modernization of the plant should be carried out without approval of the Ministry of Environment and Forest.	Environmental Clearance from MoEF&CC is obtained for all new projects, expansions, and modernization activities.
iii)	The total SO ₂ emission from Haldia Refinery including DHDS project should not exceed norms of 850 Kg/hr. after installing the new Crude Distillation unit (CDU).	 • Only low sulphur fuel gas and oil are fired in the heaters. • Old Sulphur Recovery Units (SRUs) were commissioned in April/May 1994. • New SRUs were commissioned in 2010, and SRU-V was commissioned in 2020. • Additionally, the Wet Sulfuric Acid (WSA) Plant—first of its kind in IOCL with a capacity of 375 MTPD—was successfully commissioned at Haldia Refinery on 30th September 2022, converting H₂S-rich gas to H₂SO₄. • Stack emissions are well within prescribed limits. Continuous online stack monitoring systems are in place, and real-time data is linked to the CPCB server. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
iv)	The existing ETP should be adequately augmented (if required) to accommodate the additional effluent from the DHDS project before commissioning the project so as ensure that the treated effluent meets the MINAS.	• The refinery operates a comprehensive and robust Effluent Treatment Plant (ETP) equipped with physical, chemical, biological, and tertiary treatment facilities to meet and maintain the statutory discharge norms.

		- The refinery has progressively enhanced its Effluent Treatment Plant (ETP) capacity from the initial 320 m³/hr (at commissioning) to the current 1,250 m³/hr, consisting of ETP-1: 650 m³/hr which was revamped during 2003–04 and ETP-2: 600 m³/hr commissioned in 2010. - Further, jobs are underway for ETP-1 upgradation to increase capacity from 650 to 850 m³/hr. - The combined capacity of the two ETPs caters to the effluent load of the refinery.
v)	Time bound Action Plan for disposal of oily sludge / recovery of oil & design details of the solid waste disposal pit should be furnished to the Ministry within a period of three months. Hazardous waste should be handled as per Hazardous Waste (Management & Handling) rules, 1989 and necessary approval from SPCB must be obtained for its safe collection, treatment, storage and disposal.	HW authorization valid till 31.12.2025. Annual HW returns submitted to WBPCB. Solid waste and oily sludge are handled per HW Rules, 1989.
vi)	SRU having an efficiency of more than 99% should be installed.	New SRUs having efficiency >99.5% installed and operational.
vii)	Location of riverine outfall point showing the alignment of pipeline and outfall point with reference to the HTL and LTL should be submitted to this Ministry. IOC should also obtain the expert opinion of NIO or any other expert body on the best possible location of the outfall point and IOC should abide by the changes if any recommended by the expert body.	- The job was carried out by National Institute of Oceanography (NIO), Goa. As per the study, the existing location of outfall point of treated effluent to river Hooghly is suitable and does not require change. - The copy of final report sent to Joint Director (S), MOE&F, Bhubaneswar in Aug-99. The sketch on location of riverine outfall point has already been included in that report.
viii)	The IOC should commission a study by a competent technical expert to evaluate the effects of the existing effluents on aquatic life and on mangrove and submit to the Ministry the results of the study within one year.	Previous Study (NIO): A comprehensive study was earlier carried out by the National Institute of Oceanography (NIO), Goa, to evaluate the effects of effluents on aquatic life and on mangroves. As per the study report, the effect of treated effluent was found to be insignificant. The copy of the final report was

		submitted to the Joint Director (S), MoEF&CC, Eastern Regional Office, Bhubaneswar in August 1999. • New Study Initiated (EIL): To re-evaluate the impact in the current scenario and ensure continued environmental stewardship, IOCL has recently engaged M/s Engineers India Limited (EIL) to conduct a fresh "Effluent Effect Assessment Study." This study will scientifically assess the present impact of treated effluent on the aquatic ecosystem and mangroves. Based on the study there is no appreciable increase in the pollutant concentration due to disposal of treated effluent from Haldia refinery and no impact to the aquatic life and hence there is no food chain contamination. Since there is no impact to either quality of river or to the aquatic life, there shall be no Livelihood impacts. The detailed findings of this study are submitted to the Ministry and attached as Annexure-9.
ix)	A detailed risk analysis study board on maximum credible accident analysis (MCA) and HAZOP study should be done to the Refinery including DHDS project facilities and submitted to this Ministry Board. On this, a Disaster Management Plan and off site plan be prepared and submitted after approval has been obtained from nodal agency.	• Risk Analysis Report submitted to Ministry for every project during obtaining EC. • Quantitative Risk Assessment study is done every 5 years of interval. • HAZOP study being done at 5 years interval. • Emergency Response and Disaster Management Plan (ERDMP) recertified every 3 years; valid till 05.08.2028.(Refer Annexure-11)
x)	The project authority must strictly comply with the provisions made in MSIHC Rules, 1989 as amended in October, 1994 for handling of hazardous chemicals etc. Necessary approvals from Chief Controller of Explosives must be obtained before commission the project.	• Third-party Safety Audits conducted as per MSIHC Rules every year. (Refer Annexure-12) • PESO approvals obtained prior to commissioning.

3.0 EC Reference No. & Issue Date: J.11011/99/96-IA II (I); 01/10/1997

Status of Conditions Imposed With Respect To Environmental Clearance of “Fluidized Catalytic Cracking Unit (FCCU) At Haldia Refinery of IOC”

Sl. No.	CONDITIONS	STATUS
i)	The project authority must strictly adhere to the stipulations laid down by the West Bengal State Pollution Control Board and the State Govt.	Haldia Refinery strictly adheres to the stipulations of West Bengal Pollution Control Board and State Government, with timely submission of compliance reports.
ii)	No expansion or modernization of the plant should be carried out without approval of the Ministry of Environment and Forest	Environmental Clearance from MoEF&CC is obtained before undertaking any plant expansion or modernization.
iii)	The total SO ₂ emission from the FCCU project should not exceed 390 kg/hr. Maximum SO ₂ emission from the Refinery complex should be below 1500 kg/hr. (letter dated 16.03.89). However, efforts may be made to peg the SO ₂ values at 1240 kg/hr. in the post DHDS and FCCU phase.	 • Only low sulphur fuel gas and oil are fired in the heaters. • Old Sulphur Recovery Units (SRUs) were commissioned in April/May 1994. • New SRUs were commissioned in 2010, and SRU-V was commissioned in 2020. • Additionally, the Wet Sulfuric Acid (WSA) Plant—first of its kind in IOCL with a capacity of 375 MTPD—was successfully commissioned at Haldia Refinery on 30th September 2022, converting H₂S-rich gas to H₂SO₄. • Stack emissions are well within prescribed limits. Continuous online stack monitoring systems are in place, and real-time data is linked to the CPCB server. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
iv)	The studies on aquatic life and marine outfall for discharge of treated effluent into the river should be expedited. A time bound action plan to implement the	• Previous Study (NIO): A comprehensive study was earlier carried out by the National Institute of Oceanography

conditions stipulated by the Ministry while according approval for the DHDS unit vide letter dated 18/12/96 should be submitted to the Ministry for review within a period of one month. 	(NIO), Goa, to evaluate the effects of effluents on aquatic life and on mangroves. As per the study report, the effect of treated effluent was found to be insignificant. The copy of the final report was submitted to the Joint Director (S), MoEF&CC, Eastern Regional Office, Bhubaneswar in August 1999. • New Study Initiated (EIL): To re-evaluate the impact in the current scenario and ensure continued environmental stewardship, IOCL has recently engaged M/s Engineers India Limited (EIL) to conduct a fresh "Effluent Effect Assessment Study." This study will scientifically assess the present impact of treated effluent on the aquatic ecosystem and mangroves. Based on the study there is no appreciable increase in the pollutant concentration due to disposal of treated effluent from Haldia refinery and no impact to the aquatic life and hence there is no food chain contamination. Since there is no impact to either quality of river or to the aquatic life, there shall be no Livelihood impacts. The detailed findings of this study are submitted to the Ministry and attached as Annexure-9.

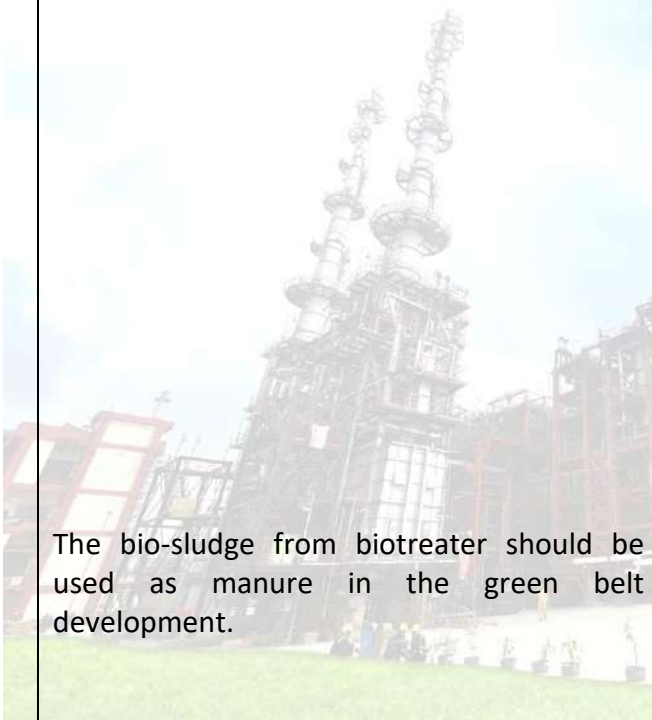
4.0 EC Reference No. & Issue date: J.11011/28/2000-IA II ; 21/08/2000

Status of Conditions Imposed with Respect to Environmental Clearance Of “2nd Vacuum Distillation Unit (Capacity 2 MMTPA) and Catalytic ISO-Dewaxing Unit (Capacity 0.2 MMTPA) At 7.5 MMTPA Crude Processing Level at Haldia Refinery of IOC”

SPECIFIC CONDITIONS:

Sl. No	STIPULATION BY MoE&F & CC	STATUS
1	The SO ₂ emission from the refinery unit including the proposed 2nd VDU and CIDW should not exceed 1340 kg/hr. 	• Only low sulphur fuel gas and oil are fired in the heaters. • Old Sulphur Recovery Units (SRUs) were commissioned in April/May 1994. • New SRUs were commissioned in 2010, and SRU-V was commissioned in 2020. • Additionally, the Wet Sulfuric Acid (WSA) Plant—first of its kind in IOCL with a capacity of 375 MTPD—was successfully commissioned at Haldia Refinery on 30th September 2022, converting H₂S-rich gas to H₂SO₄. • Stack emissions are well within prescribed limits. Continuous online stack monitoring systems are in place, and real-time data is linked to the CPCB server. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
2	The ETP load should be within the design capacity of 540 m ³ /hr. The total quantity of effluent generation should not exceed 414 m ³ /hr as indicated in the EMP of which 150 m ³ /hr treated effluent should be recycled and rest 264 m ³ /hr should be discharged after proper treatment. The treated effluent should comply with the prescribed standards.	• The refinery operates two ETPs with a combined treatment capacity of 1,250 m³/hr (ETP-1: 650 m³/hr; ETP-2: 600 m³/hr). • The actual ETP load remains within 900–1100 m³/hr. • Treated effluent is reused for TTP-RO feed, fire water, and cooling tower make-up. • Only TTP-RO reject is discharged into the Hooghly River after meeting prescribed standards.

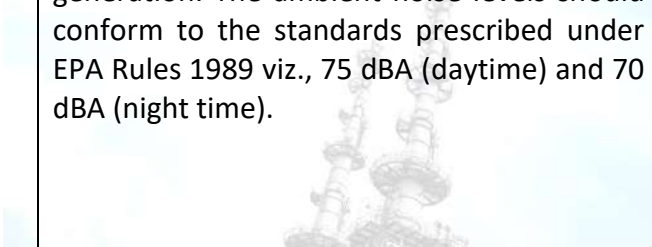
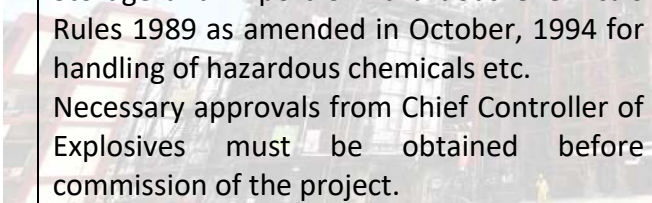
		The monthly average data of final treated effluent (last six months) is enclosed as Annexure-2.
3	The oily sludge generated from the refinery operation should be subjected to melting pit treatment for recovery of oil. The recovered oil should be recycled. The residual oily sludge should be disposed off in the HDPE lined pits. The spent catalyst from CIDW unit should be sent to supplier for metal recovery. 	<u>Oily Sludge Management:</u> - Mechanized recovery of slop oil from tank bottom sludge is carried out in melting pits; the recovered oil is recycled back into the system. - A thermo-mechanical sludge treatment unit has been commissioned to enhance oil recovery efficiency. - In-situ centrifuge systems are deployed for oily sludge generated from ETP to recover oil and minimize residual waste. - De-oiled residual sludge is stored in jumbo bags at a designated area prior to disposal. - Residual oily sludge is disposed of through WBPCB-approved authorized agencies as per regulatory norms. - The integrated system significantly reduces oily sludge generation. <u>Spent Catalyst Management:</u> - Spent catalysts from the CIDW unit are securely stored in sealed drums. - They are sent to authorized metal recyclers through MSTC for metal recovery, as and when required.
4	Oil spill response facilities should be in place, in accordance with OISD guidelines with regard to the likely risks associated with transportation of finished products by Hooghly-Sea route.	<u>Oil Spill Response (Tier-I readiness):</u> - Tier-I oil spill response facilities in place as per OISD & Indian Coast Guard guidelines. - Oil dispersants, containment booms available with Fire & Safety. 2 Super Suckers and 3 Mobile Oil Spill Recovery Units (MOSRU) deployed for monsoon readiness. - Floating oil skimmer in open channel and drum skimmers in ETP and guard ponds recover spilled oil. - Regular mock drills conducted to ensure readiness. - Green Belt Canal can be isolated using oil booms for oil recovery.

		Well-defined SOP in place for emergency oil spill response.
5	Green belt of adequate width and density should be provided to mitigate the effects of fugitive emission all around the plant in consultation with the local DFO.  The bio-sludge from biotreater should be used as manure in the green belt development.	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total 610 acres plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy: 1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts. 2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar

		Island (247 Ha) was completed to enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township. • Massive Plantation Drives: Targetted afforestation at Balughata and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024-25: 1739 trees
6.	Occupational Health Surveillance of the workers should be done on a regular basis and records maintained as per the Factories Act and the West Bengal Factories Rules.	Haldia Refinery has its own Occupational Health center with all facilities. Periodical health checkup schedule is being followed for target employees as per Factories Act and WB Factory Rules and records are being maintained.

GENERAL CONDITIONS:

Sl. No	STIPULATION BY MOE&F & CC	STATUS
1	The project authorities must strictly adhere to the stipulations made by the West Bengal State Pollution Control Board and the State Government.	Haldia Refinery has been adhering to the stipulations made by the WBPCB and submitting necessary compliance Reports as per schedule.
2	No further expansion or modernization in the plant should be carried out without prior approval of the Ministry of Environment and Forests.	Environmental clearance from MoEF & CC is taken before any expansion or modernization in the plant.
3	At no time, the emissions should go beyond the prescribed standards. In the event of failure of any pollution control system adopted by the units, the respective unit should be immediately put out of operation and should not be restarted until the desired efficiency has been achieved.	• Emissions from all stacks are continuously monitored and maintained well within the prescribed standards. • Online Continuous Emission Monitoring Systems (OCEMS) have been installed and are integrated with the CPCB server for real-time data transmission.

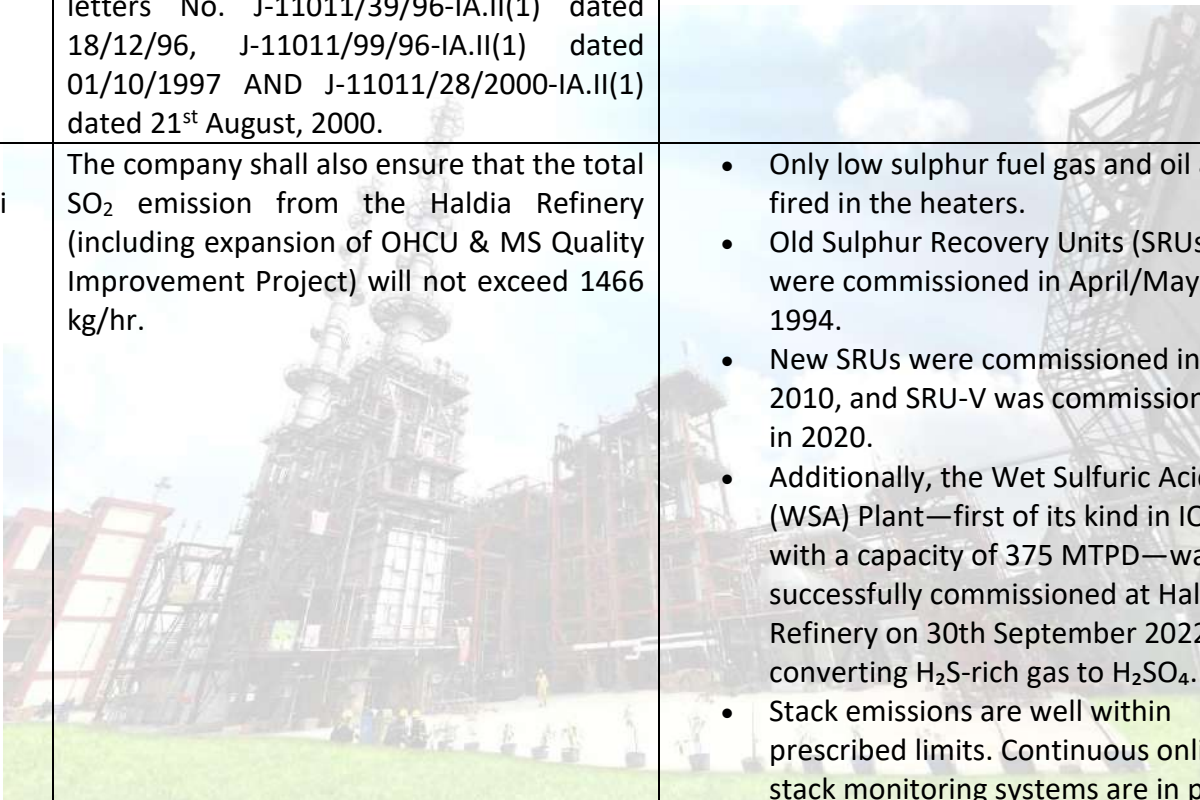
		- The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6 - In the event of any malfunction in pollution control systems, affected units are immediately shut down and restarted only after restoration of required efficiency.
4	The overall noise levels in and around the plant area should be kept well within the standards (85 dBA) by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels should conform to the standards prescribed under EPA Rules 1989 viz., 75 dBA (daytime) and 70 dBA (night time). 	- Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989. Noise monitoring is regularly conducted both inside the plant and at boundary locations. Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.
5	The project authorities must strictly comply with the provisions made in Manufacture, Storage and Import of Hazardous Chemicals Rules 1989 as amended in October, 1994 for handling of hazardous chemicals etc. Necessary approvals from Chief Controller of Explosives must be obtained before commission of the project. 	- Third-party Safety Audits under MSIHC Rules are conducted every year. (Refer Annexure-12) - PESO approval was obtained prior to commissioning.
6	The project authorities will provide adequate funds both recurring and non-recurring to implement the conditions stipulated by the Ministry of Environment and Forests as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so provided should not be diverted for any other purposes	- Haldia Refinery has consistently earmarked and allocated substantial funds every financial year towards environmental protection and management activities. - This fund is not diverted for any other purposes and is utilized solely for environmental compliance. - The funds are utilized for comprehensive activities including the operation and maintenance of pollution control systems (ETP, TTP-RO), greenbelt development, environmental monitoring, hazardous waste management, sludge oil recovery, consent/authorization fees,

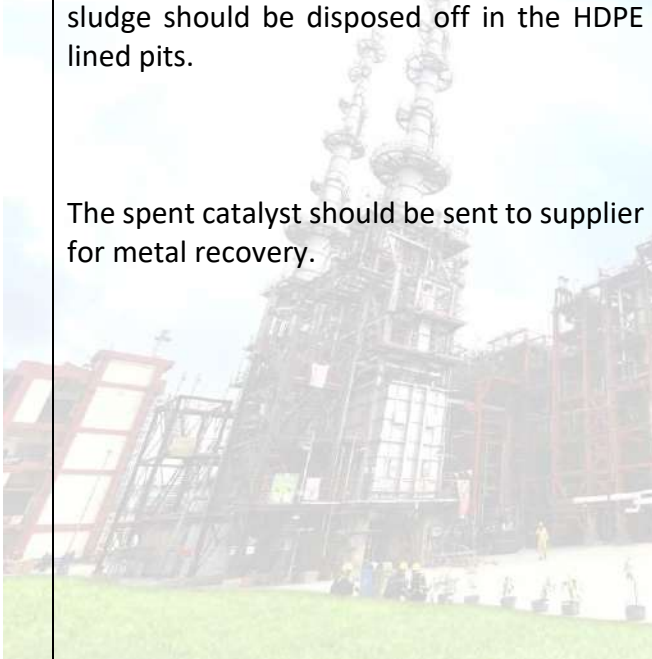
		awareness programs, and EIA/RA studies. These allocations are made from both recurring and non-recurring budgets as required, ensuring that all environmental obligations are fully met without any shortfall. A summary of environmental expenditure over the last nine financial years is provided below: <table><tr><th>Year</th><th>Expenditure (₹ Crore)</th></tr><tr><td>2024-25</td><td>19.17</td></tr><tr><td>2023-24</td><td>17.84</td></tr><tr><td>2022-23</td><td>20.61</td></tr><tr><td>2021-22</td><td>23.86</td></tr><tr><td>2020-21</td><td>20.79</td></tr><tr><td>2019-20</td><td>20.58</td></tr><tr><td>2018-19</td><td>20.59</td></tr><tr><td>2017-18</td><td>15.07</td></tr><tr><td>2016-17</td><td>21.19</td></tr></table>	Year	Expenditure (₹ Crore)	2024-25	19.17	2023-24	17.84	2022-23	20.61	2021-22	23.86	2020-21	20.79	2019-20	20.58	2018-19	20.59	2017-18	15.07	2016-17	21.19
Year	Expenditure (₹ Crore)																					
2024-25	19.17																					
2023-24	17.84																					
2022-23	20.61																					
2021-22	23.86																					
2020-21	20.79																					
2019-20	20.58																					
2018-19	20.59																					
2017-18	15.07																					
2016-17	21.19																					
7	The stipulated conditions will be monitored by the Regional of this Ministry at Bhubaneswar/ Central Pollution Control Board / State Pollution Control Board. A six monthly compliance report and the monitored data should be submitted to them regularly.	Six-monthly compliance reports are regularly submitted to MoEF&CC Regional Office (Bhubaneswar) and WBPCB.																				
8	The Project Proponent should inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the State Pollution Control Board / Committee and may also be seen at Website of the Ministry and Forests at http:// WWW.envfor.nic.in . This should be advertised in at least two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned.	Post-EC, the project details were advertised in two local newspapers (one in vernacular), and consent to establish was obtained from WBPCB.																				
9.	The Project Authorities should inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of commencing the land development work.	Commissioning dates of 2nd VDU (15.03.2002) and CIDW Unit (25.03.2003) were timely communicated to the authorities.																				

5.0 EC Reference No. & Issue Date: J11011/5/2002 IA II(I) ; 1st May 2002

Status of conditions imposed with respect to environmental clearance of installation of facilities for improvement of HSD quality and distillate yield (OHCU) and MS quality improvement (MSQI) at Haldia refinery of M/S. IOCL in district Midnapore (E), West Bengal.

A. SPECIFIC CONDITIONS:

Sl. No	STIPULATION BY MOE&F & CC	STATUS
I	The company shall ensure strict implementations / compliance of the terms and conditions mentioned vide Ministry's letters No. J-11011/39/96-IA.II(1) dated 18/12/96, J-11011/99/96-IA.II(1) dated 01/10/1997 AND J-11011/28/2000-IA.II(1) dated 21 st August, 2000.	All terms and conditions stipulated in the earlier EC have been strictly implemented and are being duly complied with.
ii	The company shall also ensure that the total SO ₂ emission from the Haldia Refinery (including expansion of OHCU & MS Quality Improvement Project) will not exceed 1466 kg/hr.	 • Only low sulphur fuel gas and oil are fired in the heaters. • Old Sulphur Recovery Units (SRUs) were commissioned in April/May 1994. • New SRUs were commissioned in 2010, and SRU-V was commissioned in 2020. • Additionally, the Wet Sulfuric Acid (WSA) Plant—first of its kind in IOCL with a capacity of 375 MTPD—was successfully commissioned at Haldia Refinery on 30th September 2022, converting H₂S-rich gas to H₂SO₄. • Stack emissions are well within prescribed limits. Continuous online stack monitoring systems are in place, and real-time data is linked to the CPCB server. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
iii	Additional water requirement should be met from the Geonkhali Water Supply Scheme. There should be no further drawl from ground.	Additional water requirement is sourced from Geonkhali Water Supply Scheme.

iv	The ETP load should be within the design capacity of 540m³/hr. The total quantity of effluent generation should not exceed 446 m³/hr as indicated in the EMP of which 150m³/hr treated effluent should be recycled and rest 296 m³/hr should be discharged after proper treatment. The treated effluent should comply with the prescribed standards.	- Two ETPs in operation with total capacity of 1,250 m³/hr (ETP-1: 650, ETP-2: 600). - Current load ranges between 900–1100 m³/hr. - Treated water reused for TTP-RO, fire water, and cooling tower make-up. - Only TTP-RO reject discharged to Hooghly River after treatment as per norms. - Monthly average discharge data enclosed as Annexure-2.
v	The oily Sludge generated from the refinery operation should be subjected to melting pit treatment for recovery of oil. The recovered oil should be recycled. The residual oily sludge should be disposed off in the HDPE lined pits. The spent catalyst should be sent to supplier for metal recovery. 	<u>Oily Sludge & Spent Catalyst Management:</u> - Mechanized recovery of slop oil from tank bottom sludge is carried out in melting pits; the recovered oil is recycled back into the system. - A thermo-mechanical sludge treatment unit has been commissioned to enhance oil recovery efficiency. - In-situ centrifuge systems are deployed for oily sludge generated from ETP to recover oil and minimize residual waste - Residual sludge is disposed through authorized co-processing cement plant and TSDF (M/s WBWML). - Spent catalysts with metals are e-auctioned via M/s MSTC. - Noble metal catalysts are sent to authorized recyclers for metal recovery.
vi	Oil spill response facilities should be in place, in accordance with OISD guidelines with regard to the likely risks associated with transportation of finished products by Hooghly-Sea route.	- No changes have been made to the stack design. - Since 2010, Flare Gas Recovery and Utilization (FGRU) has been operational, helping to recover and reuse flare gas as fuel and reducing flaring emissions
vii	Green belt of adequate width and density should be provided to mitigate the effects of fugitive emission all around the plant in consultation with the local DFO.	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total

The bio-sludge should be used as manure in the green belt development. 	610 acres plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy: 1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: • Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. • Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts. 2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: • Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar Island (247 Ha) was completed to enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township.

		• Massive Plantation Drives: Targetted afforestation at Balughata and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024-25: 1739 trees Bio-Sludge Management: • Bio-Tower technology reduces biomass generation. • Sludge is dewatered using thickener and centrifuge for easier handling. Utilized as manure in greenbelt development.
viii	Occupational Health Surveillance of the workers should be done on a regular basis and records maintained as per the Factories Act and the West Bengal Factories Rules.	Haldia Refinery has an Occupational Health center with all facilities. Periodical health checkup schedule is being followed for target employees as per Factories Act and WB Factory Rules and records are being maintained.

B. GENERAL CONDITIONS:

Sl. No	STIPULATION BY MOE&F & CC	STATUS
i	The project authorities must strictly adhere to the stipulations made by the West Bengal State Pollution Control Board and the State Government.	Haldia Refinery has been adhering to the stipulations made by the West Bengal Pollution Control Board and State Govt. and submitting necessary compliance Reports as per schedule.
ii	No further expansion or modernization in the plant should be carried out without prior approval of the Ministry of Environment and Forests.	Environmental clearance from MoEF & CC is always taken before any expansion or modernization in the plant.
iii	The company shall implement all recommendations made in the EMP and risk Analysis reports.	Recommendations from the EMP and Risk analysis reports are implemented at Haldia Refinery.
iv.	At no time, the emissions should go beyond the prescribed standards. In the event of	• Emissions from all stacks are continuously monitored and

	failure of any pollution control system adopted by the Units, the respective unit should be immediately put out of operation and should not be restarted until the desired efficiency has been achieved.	maintained well within the prescribed standards. • Online Continuous Emission Monitoring Systems (OCEMS) have been installed and are integrated with the CPCB server for real-time data transmission. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6 • In the event of any malfunction in pollution control systems, affected units are immediately shut down and restarted only after restoration of required efficiency
v.	The overall noise levels in and around the plant area should be kept well within the standards (85 dBA) by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels should conform to the standards prescribed under EPA Rules, 1989 vis. 75 dBA (day time) and 70 dBA (night time).	• Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989. • Noise monitoring is regularly conducted both inside the plant and at boundary locations. • Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.
vi	The project authorities must strictly comply with the rules and regulations under Manufacture, Storage and Import of Hazardous chemicals Rules, 1989 as amended in 1994 and 2000. Prior approvals from Chief Inspectorate of Factories, Chief Controller of Explosives, Fire Safety Inspectorate etc. must be obtained.	• Third-party Safety Audits under MSIHC Rules are conducted every year. (Refer Annexure-12) • PESO approval was obtained prior to commissioning.

6.0 EC Reference No. & Issue Date: J13011/14/2006 IA. II (T); 5TH JAN 2007

Status Of Conditions Imposed With Respect To Environmental Clearance Of Installation Of 3rd Gas Turbine (GT-3) With Heat Recovery Steam Generation (HRSG) At Haldia Refinery By M/S Indian Oil Corporation Ltd.

A. SPECIFIC CONDITIONS

Sl. No.	STIPULATION BY MOE&F &CC	STATUS
i	All the conditions stipulated by West Bengal Pollution Control Board vide their letter no. 334-2N-295/2005 dated 28 th June 2006 shall be strictly implemented.	All conditions stipulated by West Bengal Pollution Control Board vide letter no. 334-2N-295/2005 dated 28.06.2006 have been duly complied with during implementation of GT-3.
ii	No additional land shall be acquired for any activity/facility of the power project.	No additional land has been acquired. GT-3 has been installed within the existing Refinery premises.
iii	Water requirement will be met from existing water supply system. No additional facilities will be created as part of this project.	Water requirements are being met from the existing water supply system.
iv	Sulphur content in the Naphtha to be used in the project shall not exceed 0.025%.	Sulphur content in Naphtha used is maintained below 0.025% as stipulated
v	A single stack of 60 m with exit velocity of 20 m/sec shall be provided with continuous online monitoring equipment's.	A 60 m stack with exit velocity of 20 m/sec has been provided, equipped with continuous online monitoring for SO ₂ , NO _x , PM ₁₀ , and CO.
vi	NO _x emission shall not exceed 100 ppm.	NO _x emissions from GTs/HRSGs stacks are maintained within 25–40 ppm.
vii	The treated effluents conforming to the prescribed standards shall only be discharged in the river Hoogly.	Treated effluents conforming to MINAS are discharged to the river Hoogly. Quality is monitored daily at NABL-accredited and WBPCB-approved IOCL laboratory.
viii	Adequate measures shall be taken to avoid fire and explosion hazard.	Adequate safety measures have been taken to prevent fire and explosion hazards, adhering to OISD, PESO, and other applicable statutory norms

ix	A greenbelt shall be developed all along the plant. 	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total 610 acres plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy: 1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: • Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. • Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts. 2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: • Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar Island (247 Ha) was completed to

		enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township. • Massive Plantation Drives: Targetted afforestation at Balughata and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024-25: 1739 trees
x	First aid and sanitation arrangements shall be made for the drivers and other contract workers during construction phase.	First aid and sanitation facilities were provided at the worksite during construction.
xi	Leq of Noise level should be limited to 75 dBA and regular maintenance of equipment be undertaken. For people working in the high noise areas, personal protection devices should be provided.	• Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989. • Noise monitoring is regularly conducted both inside the plant and at boundary locations. • Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.
xii	Regular monitoring of the ambient air quality shall be carried out in and around the power plant and records maintained. The location of the monitoring stations and frequency of monitoring shall be decided in consultation with SPCB. Periodic reports shall be submitted to the Regional Office of this Ministry.	• Ambient air quality is monitored twice weekly at five locations inside the refinery and two locations in the township. • The last six-monthly air quality monitoring report is submitted to the MoEF&CC Regional Office (refer Annexure-1). • Three Continuous Ambient Air Quality Monitoring Stations (CAAQMS) are installed inside the

		refinery and are integrated with the CPCB server (refer Annexure-7).
xiii	Half yearly report on the status of implementation of the stipulated conditions and environmental safeguards should be submitted to this Ministry/ Regional Office/CPCB/SPCB.	Half-yearly reports on the implementation of stipulated conditions and environmental safeguards are submitted in June and December each year.
xiv	Regional Office of the Ministry of Environment & Forests located at Bhubaneswar will monitor the implementation of the stipulated conditions. Complete set of Environmental Impact Assessment Report and Environment Management Plan along with the additional information submitted from time to time shall be forwarded to the Regional Office for their use during monitoring.	The Regional Office of MoEF&CC visits Haldia Refinery to monitor the implementation of stipulated conditions. Additional information is submitted as required during their visits.
xv	Separate funds should be allocated for implementation of environmental protection measures along with item-wise break-up. This cost should be included as part of the project cost. The funds earmarked for the environment protection measures should not be diverted for other purposes and year-wise expenditure should be reported to the Ministry.	• Haldia Refinery has consistently earmarked and allocated substantial funds every financial year towards environmental protection and management activities. • This fund is not diverted for any other purposes and is utilized solely for environmental compliance. • The funds are utilized for comprehensive activities including the operation and maintenance of pollution control systems (ETP, TTP-RO), greenbelt development, environmental monitoring, hazardous waste management, sludge oil recovery, consent/authorization fees, awareness programs, and EIA/RA studies. These allocations are made from both recurring and non-recurring budgets as required, ensuring that all environmental obligations are fully met without any shortfall. A summary of environmental expenditure over the last nine financial years is provided below:

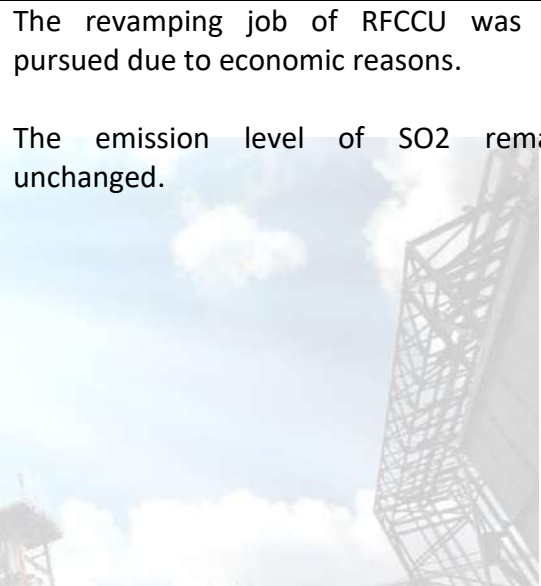
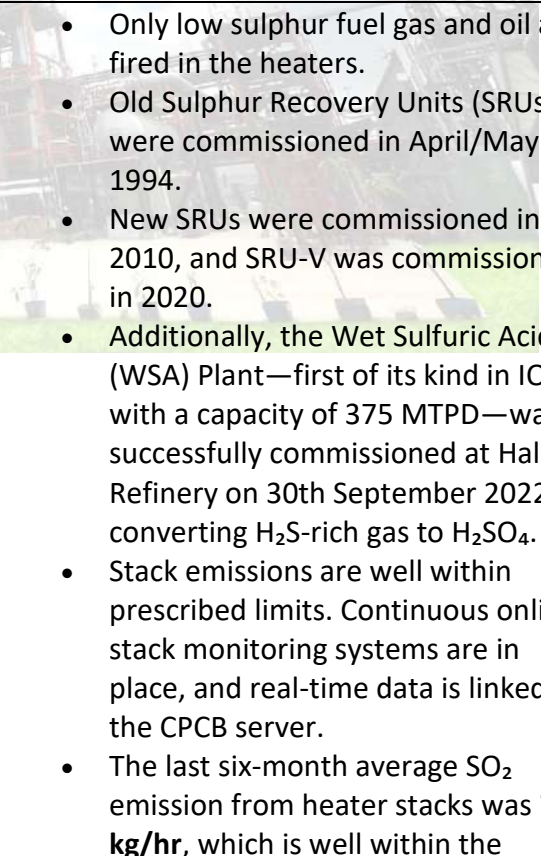
		<table><tr><th>Year</th><th>Expenditure (₹ Crore)</th></tr><tr><td>2024–25</td><td>19.17</td></tr><tr><td>2023–24</td><td>17.84</td></tr><tr><td>2022–23</td><td>20.61</td></tr><tr><td>2021–22</td><td>23.86</td></tr><tr><td>2020–21</td><td>20.79</td></tr><tr><td>2019–20</td><td>20.58</td></tr><tr><td>2018–19</td><td>20.59</td></tr><tr><td>2017–18</td><td>15.07</td></tr><tr><td>2016–17</td><td>21.19</td></tr></table>	Year	Expenditure (₹ Crore)	2024–25	19.17	2023–24	17.84	2022–23	20.61	2021–22	23.86	2020–21	20.79	2019–20	20.58	2018–19	20.59	2017–18	15.07	2016–17	21.19
Year	Expenditure (₹ Crore)																					
2024–25	19.17																					
2023–24	17.84																					
2022–23	20.61																					
2021–22	23.86																					
2020–21	20.79																					
2019–20	20.58																					
2018–19	20.59																					
2017–18	15.07																					
2016–17	21.19																					
xvi	Full cooperation should be extended to the Scientists/Officers from the Ministry/ Regional Office of the Ministry at Bhubaneswar/the CPCB/the SPCB who would be monitoring the compliance of environmental status.	Haldia Refinery is always extending full co-operation to the Scientists / Officers visiting the Refinery from the statutory bodies.																				



7.0 EC Reference No & Issue date; J11011/422/200 IA II(I): 6th March 2007

Status of conditions imposed with respect to environmental clearance for Crude Oil Refining Capacity by Revamping of RFCCU from 0.7 MMTPA to 1.0 MMTPA and installing a Gas Turbine of 20 MW capacity at Haldia refinery of M/S. IOCL in district Purba Medinipure (E), West Bengal.

A. SPECIFIC CONDITIONS:

Sl. No	STIPULATION BY MOE&F & CC	STATUS
I	The gaseous emissions (SO ₂ , NO _x , HC, VOC and Benzene) from various process units shall be kept within limit as per standard prescribed by the concerned SPCB. All the measures detailed in the EMP shall be taken to control the point/stack and fugitive gaseous emissions from the proposed facilities, RFCCU, process and storage units etc. for ensuring that the ambient air quality around the Refinery due to the expansion is maintained at the predicted 24 hourly average maximum concentration levels and shall not exceed for the worst scenario predicted for SO ₂ (15.7 Micro gram/m ³).	The revamping job of RFCCU was not pursued due to economic reasons. The emission level of SO₂ remains unchanged. 
II	There will be no increase in the pollution load of SO ₂ emission as augmentation of Flue Gas Scrubbing section will be undertaken to keep the SO ₂ emission levels within the existing levels. A new Sulphur Recovery Unit (SRU) with more than 99% of efficiency shall be installed under once through hydro-Cracker Unit to keep SO ₂ emission levels within the existing levels.	• Only low sulphur fuel gas and oil are fired in the heaters. • Old Sulphur Recovery Units (SRUs) were commissioned in April/May 1994. • New SRUs were commissioned in 2010, and SRU-V was commissioned in 2020. • Additionally, the Wet Sulfuric Acid (WSA) Plant—first of its kind in IOCL with a capacity of 375 MTPD—was successfully commissioned at Haldia Refinery on 30th September 2022, converting H₂S-rich gas to H₂SO₄. • Stack emissions are well within prescribed limits. Continuous online stack monitoring systems are in place, and real-time data is linked to the CPCB server. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the 

		specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
III	No additional stack is envisaged for the revamp of RFCCU. There will be no increase in emission levels of SO ₂ from the existing two stacks in the RFCCU of 100 and 60M attached to the regenerator and the heater.	There is no change in emission levels of SO ₂ from existing RFCCU as revamping job was not done.
IV	The emission levels of the other pollutants shall also remain within the existing levels.	Emission level remains within limit and stack emission parameters is being monitored online.
V	Low Sulphur internal fuel oil will be fired in process heaters and boilers.	Low Sulphur fuel gas and Low Sulphur fuel oil are used in heaters and boilers. Sulphur content in Naphtha is maintained below 0.025%
VI	Regular Ambient Air Quality Monitoring shall be carried out. The location and results of existing monitoring stations will be reviewed in consultation with the concerned State Pollution Control Board based on the occurrence of maximum ground level concentration and downwind direction of wind. Additional Stations shall be set up, if required. It will be ensured that at least one monitoring station is set up in up-wind and in down-wind direction along with those in other directions.	• Ambient air quality is monitored twice weekly at five locations inside the refinery and two locations in the township. • The last six-monthly air quality monitoring report is submitted to the MoEF&CC Regional Office (refer Annexure-1). • Three Continuous Ambient Air Quality Monitoring Stations (CAAQMS) are installed inside the refinery and are integrated with the CPCB server (refer Annexure-7).
VII	On-line data for air emissions shall be transferred to the CPCB and SPCB regularly. The instruments used for ambient air quality monitoring shall be calibrated regularly. The monitoring protocol shall ensure continuous monitoring of all the parameters.	• Three Continuous Ambient Air Quality Monitoring Stations (CAAQMS) are installed inside the refinery and are integrated with the CPCB server. • Analyzers are calibrated regularly. Typical CAAQMS readings are provided in Annexure-7.
VIII	The practice of acoustic plant design shall be adapted to limit noise exposure for personnel to an 8 hr time weighted average of 90 db(A).	• Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989.

		• Noise monitoring is regularly conducted both inside the plant and at boundary locations. • Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.
IX	For control of fugitive emissions, all unsaturated hydrocarbons will be routed to the flare system. The flare system shall be designed for smokeless burning.	• Gaseous hydrocarbons are recovered through the flare gas recovery system and recycled to the fuel gas system. • The flare is designed for smokeless burning. • Storage tanks have floating roofs with secondary seals, and high-risk pumps are equipped with double mechanical seals to control fugitive emissions.
X	All the pumps and other equipment's where there is a likelihood of HC leakages shall be provided with LEL indicators. Provision for immediate isolation of such equipment, in case of a leakage will also be made. The company shall adopt Leak Detection and Repair (LDAR) program for quantification and control of fugitive emissions.	• HC detectors with LEL indicators are installed at key locations and integrated with DCS for immediate alerts. Regular calibration is ensured. • LDAR program is implemented through certified agencies to monitor and control fugitive emissions. (Refer Annexure-13).
XI	The product loading gantry shall be connected to the product sphere in closed circuit through the vapour arm connected to the tanker. Data on fugitive emissions shall be regularly monitored and records will be maintained.	• During LPG loading, vapors from tank trucks are collected via a closed-loop vapor line connected to the product storage system. • Fugitive emissions (LDAR program) are regularly monitored and recorded by an authorized agency. (Refer Annexure-13).
XII	The company shall ensure that no halogenated organic is sent to the flares. If any of the halogenated organic are present than the respective streams may be incinerated, if there are no technically feasible or economically viable reduction/recovery options. Any stream containing organic carbon, other than halogenated shall be connected to proper flaring system, if not to a recovery device or an incinerator.	Flare gas recovery system is in operation to recover and reuse gases as fuel. A separate flare system is provided to incinerate any acid gas generated. No halogenated organics are sent to the flare.

XIII	All new standards/ norms that are being proposed by the CPCB for petrochemical plants shall be applicable for the proposed expansion unit. The company shall conform to the process vent standards for organic chemicals including non-VOCs and all possible VOCs i.e. TOCs standard and process vent standards for top priority chemicals. The company shall install online monitors for VOC measurements. Regular monitoring will be carried out for VOC and HC.	All new CPCB standards for petrochemical units are being complied with. VOC and HC monitoring is conducted quarterly by a WBPCB-recognized lab.
XIV	No additional fresh water will be used for the expansion project. The requirement of 40 m3/hr of additional fresh water will be met from the existing facilities.	The revamping of RFCCU job was not done and freshwater consumption remains unchanged.
XV	Additional waste water generation from the expansion project will be around 5 m3/hr which will be treated in the existing ETP. Part of the treated effluent shall be recycled and remaining shall be disposed into the river Hoogly through closed pipeline.	The revamping of RFCCU job was not done and effluent generation rate remain unchanged.
XVI	An additional generation of 1.5 T/day of Spent Catalyst (including filter cake), will be disposed off through the common hazardous waste disposal site of WBIDC at Haldia. Oily sludge shall be sent to melting pit treatment for recovery of oil. The recovered oil shall be recycled into the refinery system. The residual sludge will be stored in HDPE line pit for disposal through bioremediation inside the 'refinery premises. Bio sludge will be stored in drying pit for natural weathering and then used as manure inside refinery premises. Remaining sludge will be incinerated in their own incinerator.	• The spent catalyst generated from existing RFCCU is being disposed to authorized CHWTSDF agency approved by WBPCB. • Oily sludge is processed through centrifuge to recover slop oil and the recovered slop oil is reprocessed in process units. • The residual sludge with low oil content (less than 10 vol%) is being disposed through SPCB authorized CHWTSDF agency & also disposed through authorized Co-processing Cement plant.
XVII	Green belt shall be provided to mitigate the effects of fugitive emissions all around the plant in a minimum of 33% of the plant area in consultation with DFO as per CPCB guidelines.	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total 610 acres plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy:

		1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: • Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. • Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts. 2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: • Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar Island (247 Ha) was completed to enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township. • Massive Plantation Drives: Targetted afforestation at Balughata

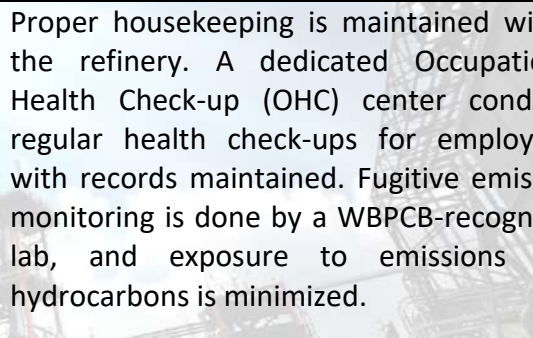
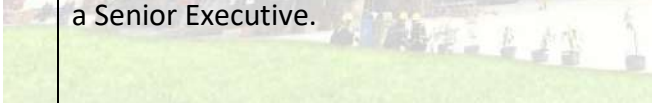
		and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024–25: 1739 trees
XVIII	The company shall strictly follow all the recommendations mentioned in the Charter on Corporate Responsibility for Environmental Protection (CREP).	All recommendations under the Charter on Corporate Responsibility for Environmental Protection (CREP) are being strictly followed by Haldia Refinery.
XIX	The Company must harvest surface as well as rainwater from the rooftops of the buildings proposed in the expansion project and storm water drains to recharge the ground water and use the same water for the various activities of the project to conserve fresh water.	• Haldia Refinery has implemented 9 rainwater harvesting projects since 2011–12 for storage and groundwater recharge. • Key initiatives during FY 2024-25 include a newly constructed stormwater reservoir named 'Neer Kund', with oil catchpits (capacity: 3800 m³), enabling recycling of up to 200 m³/hr of runoff for use in fire systems or ETP, conserving freshwater.
XX	Occupational Health surveillance of the workers should be done on a regular basis and records maintained as per the Factories Act.	Haldia Refinery has its own Occupational Health center with all facilities. A periodical health checkup schedule is being followed for target employees as per the Factories Act and WB Factory Rules and records are being maintained.
XXI	The company shall implement all the recommendations made in the EIA / EMP report and risk assessment report.	All recommendations from the EIA, EMP, and risk assessment report have been implemented.

GENERAL CONDITIONS:

Sl.No	STIPULATION BY MOE&F & CC	STATUS
I	The project authorities must strictly adhere to the stipulations made by the concerned State Pollution Control Board (SPCB) and the State Government.	Haldia Refinery has been adhering to the stipulations made by the West Bengal Pollution Control board and submitting necessary compliance Reports as per schedule.
II	No further expansion or modifications in the plant shall be carried out without prior	Environmental clearance from MoEF & CC shall be taken before any expansion or modernization in the plant.

	approval of the Ministry of Environment and Forests.	
III	At no time, the emissions should go beyond the prescribed standards. In the event of failure of any pollution control system adopted by the units, the respective unit should be immediately put out of operation and should not be restarted until the desired efficiency has been achieved.	- Emissions from all stacks are continuously monitored and maintained well within the prescribed standards. - Online Continuous Emission Monitoring Systems (OCEMS) have been installed and are integrated with the CPCB server for real-time data transmission. - The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6 - In the event of any malfunction in pollution control systems, affected units are immediately shut down and restarted only after restoration of required efficiency.
IV	Adequate number of influent and effluent quality monitoring stations shall be set up in consultation with the SPCB. Regular monitoring shall be carried out for relevant parameters.	- Water quality is monitored at ETP-1, ETP-2, and ELR outlet. Online analyzers continuously track pH, TSS, COD, and BOD, with real-time data sent to the CPCB server. - Daily MINAS parameters are tested at the in-house QC lab, and monthly analysis is conducted by WBPCB-approved third-party laboratories.
V	Industrial wastewater shall be properly collected and treated so as to conform to the standards prescribed under GSR 422(E) dated 19 th May 1993 and 31 st December, 1993 or as amended from time to time. The treated wastewater shall be utilized for plantation purpose.	Waste effluent water generated from process units are collected into Influent sump through Oily Water Sewer (OWS) closed pipelines. This waste effluent water is treated in ETP-1 & ETP-2. The treated water from ETP-1 & ETP-2 is being re-used in Tertiary Treatment-RO plant, Cooling water and Fire water service.

VI	The overall noise levels in and around the plant area shall be limited within the prescribed standards (85 dBA) by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels should conform to the standards prescribed under EPA Rules, 1989 viz. 75 dBA (day time) and 70 dBA (night time).	- Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989. Noise monitoring is regularly conducted both inside the plant and at boundary locations. Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.
VII	The project authorities must strictly comply with the provisions made in Manufacture, Storage and Import of Hazardous chemicals Rules 1989 as amended in 2000 for handling of hazardous chemicals etc. Necessary approvals from Chief Controller of Explosives must be obtained before commission of the expansion project.	- Third-party Safety Audits under MSIHC Rules are conducted every year. (Refer Annexure-12) - PESO approval was obtained prior to commissioning.
VIII	Authorization from the SPCB must be obtained for collections/ treatment/ storage /disposal of hazardous wastes.	Hazardous Waste authorization for generation, handling, and disposal has been obtained from WBPCB and is valid up to 31.12.2025
IX	The project authorities will provide adequate funds both recurring and non-recurring to implement the conditions stipulated by the Ministry of Environment and Forests as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so provided should not be diverted for any other purposes.	Adequate recurring and non-recurring funds are allocated annually for implementing all stipulated environmental conditions, without any diversion for other purposes.
X	Half yearly report on the status of implementation of the stipulated conditions and environmental safeguards should be submitted to this Ministry/ Regional Office/CPCB/SPCB.	- Six-monthly reports on the implementation of stipulated conditions and environmental safeguards are submitted to MoEF&CC Regional Office and WBPCB every June and December. - The last report was submitted in Dec 2024
XI	The Project Proponent should inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the SPCB/ Committee and may also be	After receipt of Environmental clearance, application is placed before State pollution control board to obtain Consent to Establish (NOC). Also, the news of EC published in two local newspapers.

	seen at Website of the Ministry of Environment and Forests at http://www.envfor.nic.in This should be advertised within seven days from the date of issue of the clearance letter at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same should be forwarded to the concerned Regional office of this Ministry.	
XII	The date of Financial Closure and final approval of the project by the concerned authorities and the date of commencing the land development work as well as the commissioning of the project will be informed to the Ministry and its Regional Office.	The revamping job of RFCCU was not pursued due to economic reasons. 
XIII	Proper Housekeeping and adequate occupational health programs shall be taken up. Regular Occupational Health Surveillance Program for the relevant diseases shall be carried out and the records shall be maintained properly for at least 30-40 years. Sufficient preventive measures shall be adopted to avoid direct exposure to emission and other Hydrocarbons etc.	Proper housekeeping is maintained within the refinery. A dedicated Occupational Health Check-up (OHC) center conducts regular health check-ups for employees, with records maintained. Fugitive emission monitoring is done by a WBPCB-recognized lab, and exposure to emissions and hydrocarbons is minimized. 
XIV	A separate environment management cell with full fledged laboratory facilities to carry out various management and monitoring functions shall be set up under the control of a Senior Executive. 	A dedicated Health, Safety & Environment (HS&E) department, headed by a Chief General Manager (CGM) reporting directly to the Head of the organization, is in place. The team comprises experienced personnel from refinery and petrochemical operations across various levels. Environmental activities are also periodically reviewed by the Refinery HQ HSE team to ensure compliance and continuous improvement.

8.0 EC Reference No & Issue date J-11011/904/2007-IA II (I) Dated 17TH MARCH 2009

SI No	EC Reference No and Date	Project name	Status
8.0	J-11011/904/2007-IA II (I) Dated 17 TH MARCH,2009	Installation of Delayed Coking unit (DCU) at Haldia refinery Haldia WB by IOCL.	The Delayed Coking Unit (DCU) project at Haldia Refinery was incorporated into the Feed Processing Unit (FPU) and Capacity Expansion projects, with a fresh Environmental Clearance granted. The DCU project is now named the Distillate Yield Improvement Project (DYIP).



9.0 EC Reference No & Issue date; J-11011/299/2013-IA II (I) DATED 4TH MARCH 2016

Status of conditions imposed with respect to environmental clearance for “Capacity expansion from 7.5 MTPA to 8 MTPA along with Distillate Yield Improvement Project (DYIP) and Feed processing unit (FPU) at IOCL Haldia refinery, Purba Medinipur, WB.

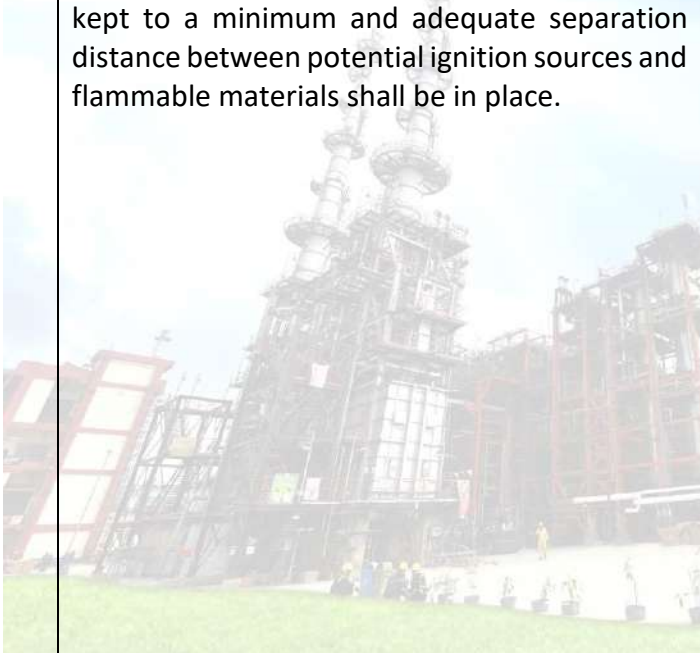
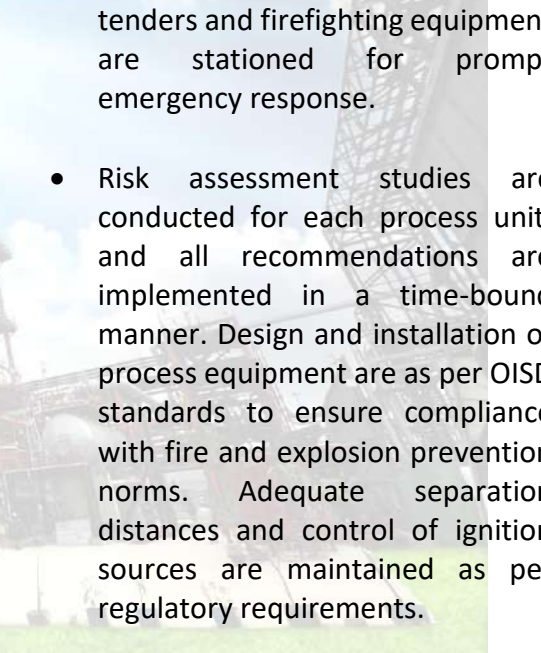
Sl. No.	SPECIFIC CONDITIONS	STATUS
i)	Compliance to all the environmental conditions stipulated in the environmental clearance letter No. J-11011/39/96-IA II (I) dated 18 th December, 1992, F. No. J-11011/99/96-IA II (I) dated 1 st October, 1997 and J-11011/28/2000-IA (I) dated 21 st August, 2000 shall be satisfactorily implemented and compliance reports submitted to the Ministry's Regional Office at Bhubaneswar.	Environmental conditions stipulated in the Environmental Clearance are compiled and half yearly compliance status report is being submitted in the month of June & December every year to the MoEF & CC Regional Office.
ii	M/s. IOCL shall comply with new standards/norms for Oil Refinery Industry notified under the Environment (Protection) Rules, 1986 vide G.S.R. 186(E) dated 18 th March, 2008	New standards/ norms for Oil Refinery are being followed as per notification under the Environment (Protection) Rules, 1986 vide G.S.R. 186 (E) dated 18 th March, 2008.
iii	Continuous on-line stack monitoring for SO ₂ , NO _x and CO of all the stacks shall be carried out. Low NO _x burners shall be installed.	• New analyzers for stack emission monitoring (SO₂, NO_x, CO, and PM) are installed, with online data linked to the CPCB server. • Low NO_x burners are installed in new heaters, and older systems are being retrofitted. All new furnaces feature staged combustion and low-NO_x burners to ensure compliance with evolving NO_x norms.
iv	The process emissions [SO ₂ , NO _x , HC (Methane & Non-methane)], VOCs and Benzene from various units shall conform to the standards prescribed under the Environment (Protection) Act. At no time, the emission levels shall go beyond the stipulated standards. In the event of failure of pollution control system (S) adopted by the unit, the unit shall be immediately put out of operation and shall not be restarted until the desired efficiency of the pollution control device has been achieved.	The process emissions (SO ₂ , NO _x , HC - Methane & Non-methane), VOCs, and Benzene will comply with the standards under the Environment (Protection) Act. Emission levels will not exceed prescribed limits. In case of failure of pollution control systems, the unit will be shut down immediately and restarted only after restoring the system's efficiency. Emissions are regularly monitored by a WBPCB-approved laboratory. SOPs are in place for safe shutdown during process-

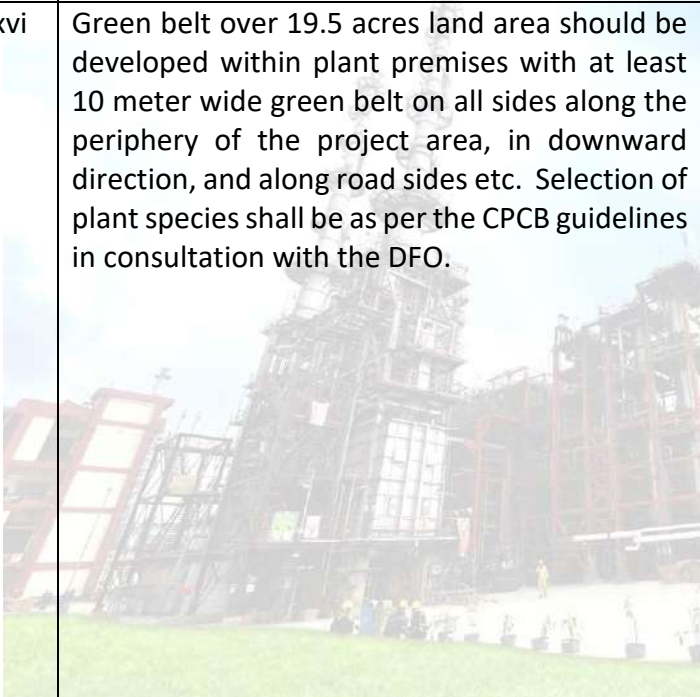
		related emergencies, ensuring continuous monitoring of pollution control devices.
v	Leak Detection and Repair program shall be prepared and implemented to control HC/VOC emissions. Focus shall be given to prevent fugitive emissions for which preventive maintenance of pumps, valves, pipelines are required. Proper maintenance of mechanical seals of pumps and valves shall be given. A preventive maintenance schedule for each unit shall be prepared and adhered to. Fugitive emissions of HC from product storage tank yards etc. must be regularly monitored. Sensors for detecting HC leakage shall be provided at strategic locations.	The Leak Detection and Repair (LDAR) program is implemented to control HC/VOC emissions (Refer Annexure-13). Preventive maintenance is conducted for pumps, valves, and pipelines, with emphasis on mechanical seals to avoid fugitive emissions. 1. LDAR program is followed, and VOC monitoring is done at critical locations. 2. Double mechanical seals are used on pumps handling hydrocarbons. 3. Floating roof storage tanks store volatile hydrocarbons. 4. Preventive maintenance is carried out for pumps, valves, and pipelines. 5. HC gas detectors are installed in process units and tank farms, with alarms routed to the control room. Calibration of detectors is done as per schedule.
vi	SO ₂ emissions after expansion from the refinery shall not exceed 941 Kg/hr. Sulphur recovery units shall be installed for control of H ₂ S emissions. The overall sulphur recovery efficiency of Sulphur recovery unit with tail gas treating shall not be less than 99.9%.	SO₂ emissions are maintained within permissible limits. • Monthly manual sampling for all heater stacks and data submitted biannually to MoEF&CC. • Stack emissions are within prescribed limits with continuous online monitoring linked to the CPCB server. • A new SRU with tail gas treating ensures >99.9% sulfur recovery efficiency was added under this project. • The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
vii	As proposed, record of sulphur balance shall be maintained at the Refinery as part of the environmental data on regular basis. The basic component of sulphur balance include sulphur	Sulphur balance is maintained monthly at Haldia Refinery, tracking sulfur input from crude oil, output through products, byproducts, and emissions.

	input through feed (sulphur content in crude oil), sulphur output from Refinery through products, byproduct (elemental sulphur), atmospheric emissions etc.	- Monthly sulfur balance is calculated based on crude intake, sulfur output, SRU production, and SO₂ emissions from process heaters and boilers. - A data-driven SO₂ Emission Dashboard has been created using AI and Robotic Process Automation captures and reports sulfur emissions and trend analysis.
viii	Ambient air quality monitoring stations, [PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , H ₂ S, mercaptan, non-methane-HC and Benzene] shall be set up in complex in consultation with West Bengal Pollution Control Board, based on occurrence of maximum ground level concentration and down-wind direction of wind. The monitoring network must be decided based on modeling exercise to represent short term GLCs and trend analysis w.r.t. past monitoring results shall also be carried out. Adequate measures based on the trend analysis shall be taken to improve the ambient air quality in the project area.	- Ambient air quality is monitored twice weekly at five locations inside the refinery and two locations in the township. - The last six-monthly air quality monitoring report is submitted to the MoEF&CC Regional Office (refer Annexure-1). - Three Continuous Ambient Air Quality Monitoring Stations (CAAQMS) are installed inside the refinery and are integrated with the CPCB server (refer Annexure-7).
ix	The gaseous emissions from DG set shall be dispersed through adequate stack height as per CPCB standards. Acoustic enclosure shall be provided to the DG sets to mitigate the noise pollution. Besides, acoustic enclosure / silencer shall be installed wherever noise levels exceed the limit.	No DG set installed in the subject DYIP project.
x	Fresh water requirement from Geonkhali Water Supply System and ground water sources (16 deep tube wells) will be 1270 m ³ /hr.	Fresh water consumption is maintained within the limits as per EC directives.
xi	Industrial effluent generation shall not exceed 1150 m ³ /hr. after expansions. Industrial effluent shall be treated in effluent treatment plant. Treated effluent shall be recycled / reused as make up for the raw water cooling tower and remaining treated effluent (262.5 m ³ /hr) shall be discharged into surface water bodies.	- The refinery operates two ETPs with a combined treatment capacity of 1,250 m³/hr (ETP-1: 650 m³/hr; ETP-2: 600 m³/hr). - The actual ETP load remains within 900–1100 m³/hr. - Treated effluent is reused for TTP-RO feed, fire water, and cooling tower make-up. - Only TTP-RO reject is discharged into the Hooghly River after meeting prescribed standards.

		The monthly average data of final treated effluent (last six months) is enclosed as Annexure-2.
xii	All the effluents after treatment shall be routed to a properly lined guard pond for equalization and final control. In the guard pond, automatic monitoring system for flow rate, pH and TOC shall be provided.	- Effluents are treated in existing ETPs, with online analyzers installed to monitor the quality of treated water and final river discharge. - Online analyzers continuously track pH, TSS, COD, and BOD, with real-time data sent to the CPCB server
xiii	Comprehensive water audit to be conducted on annual basis and report to the concerned Regional Office of MoEF&CC. Outcome from the report to be implemented for conservation scheme.	- Periodic water audits are carried out at Haldia Refinery. Several water conservation schemes have been implemented, with others in progress. - The latest water consumption study by M/s EIL was conducted in Feb'20. - With the implementation of recommendations and in-house water-saving schemes, Haldia Refinery has successfully reduced its water footprint over the years.
xiv	Automatic / online monitoring system (24 x 7) monitoring devices) for flow measurement and relevant pollutants in the treatment system to be installed. The data to be made available to the respective SPCB, Regional Office of MoEF&CC and in the Company's website.	OCEMS data is transmitted to CPCB servers for continuous monitoring and compliance reporting.
xv	Oil catchers / oil traps shall be provided at all possible locations in rain / storm water drainage system inside the factory premises.	- Oil catchers are installed at all key locations in the storm water drainage system. - Haldia Refinery has five storm water storage ponds with oil catch pits to recover oil. - All surface drains are connected to guard ponds equipped with oil catch systems. - Oil-free water is transferred to ETP feed tanks (2 x 35,000 KL) for further treatment. If oil is detected, water is routed through the Storm Water Management System (SWMS) with API & TPI units (1000 m³/hr capacity).

xvi	As proposed, spent catalyst shall be sent to the authorize recycler/re-processors. Oily sludge shall be treated in the sludge Centrifuge provided in the ETP and the cake generated from the centrifuge is further sent to bioremediation for disposal.	- The spent catalyst generated is being disposed to authorized CHWTSDf agency approved by WBPCB. - Oily sludge is processed through centrifuge to recover slop oil and the recovered slop oil is reprocessed in process units. - The residual sludge with low oil content (less than 10 vol%) is being disposed through SPCB authorized CHWTSDf agency & also disposed through authorized Co-processing Cement plant
xvii	The Company should strictly comply with the rules and guidelines under Manufacture, Storage and Import of Hazardous Chemicals rules, 1989 as amended in October, 1994 and January, 2000. Hazardous waste should be disposed of as per Hazardous Waste (management, Handling and Trans-boundary Movement) rules, 2008 and amended time to time.	- Haldia Refinery complies with MSIHC Rules. - Hazardous waste is disposed of through WBPCB-authorized CHWTSDf. - Hydro-processing catalyst is handled via SPCB-authorized recyclers.
xviii	The membership of common TSDF should be obtained for the disposal of hazardous waste. Copy of authorization or membership of TSDF should be submitted to Ministry's Regional Office at Bhubaneswar. Chemical/inorganic sludge shall be sent to treatment storage disposal facility (TSDF) for hazardous waste. Spent catalyst shall be sent to authorize recyclers/re-processors.	- Haldia Refinery holds valid authorization for hazardous waste generation and disposal from WBPCB, valid up to 31.12.2025. - Haldia Refinery holds Membership of CHW-TSDF (WBWML) at Haldia vide No. WBWML-HzZ/HLDA/I-001.
xix	Proper oil spillage prevention management plan shall be prepared to avoid spillage/ leakage of oil/ petroleum products and ensure regular monitoring.	Oil spillage inside units is routed to the oily water sewer (OWS) and collected at the ETP inlet sump. Slop oil is skimmed from holding tanks and processed in units. Haldia Refinery maintains Tier-I Oil Spill Response readiness for external spills, as per OISD and Indian Coast Guard guidelines. - Oil dispersants and containment booms are available with Fire & Safety. 2 Super Suckers and 3 MOSRUs deployed during monsoon. - Skimmers installed in open channels, ETP, and guard ponds.

		• Green Belt Canal isolatable using booms for oil recovery. • Regular mock drills and SOPs ensure emergency preparedness.
xx	Acoustic enclosure/ silencer shall be installed wherever it is possible.	Acoustic enclosures/silencers are installed primarily at steam pressure reducing and de-superheater systems (PRDS) to control noise levels.
xxi	Occupational health Surveillance of the workers should be done on a regular basis and records maintained as per the Factories Act.	Occupational Health checkup for the employees is being carried out at periodic intervals and records are maintained at Occupational health centre.
xxii	The company should make the arrangement for protection of possible fire and explosion hazards during construction and operation phase. To prevent fire and explosion at oil and gas facility, potential ignition sources shall be kept to a minimum and adequate separation distance between potential ignition sources and flammable materials shall be in place. 	• Haldia Refinery has a dedicated Fire & Safety department in place. A comprehensive fire water network covers all process units and tank farms. Multiple fire tenders and firefighting equipment are stationed for prompt emergency response. • Risk assessment studies are conducted for each process unit, and all recommendations are implemented in a time-bound manner. Design and installation of process equipment are as per OISD standards to ensure compliance with fire and explosion prevention norms. Adequate separation distances and control of ignition sources are maintained as per regulatory requirements. 
xxiii	The company shall strictly follow all the recommendation mentioned in the Charter on Corporate Responsibility for Environmental Protection (CREP).	All recommendations mentioned in Charter on CREP are being followed by Haldia Refinery.
xxiv	All the recommendations mentioned in the rapid risk assessment report, disaster management plan and safety guidelines shall be implemented.	• All recommendations from the Rapid Risk Assessment and Disaster Management Plan (ERDMP) have been implemented. • The ERDMP is reviewed and updated every three years and is certified by a PNGRB-approved agency.

		The current ERDMP is valid up to 05.08.2028. (Refer Annexure-11)
xxv	As proposed, spent catalyst shall be sent to the authorized recycler/re-processors. Oily sludge shall be treated in the sludge Centrifuge provided in the ETP and the cake generated from centrifuge is further sent for bioremediation for disposal.	- The spent catalyst generated is being disposed to authorized CHWTSDf agency approved by WBPCB. - Oily sludge is processed through centrifuge to recover slop oil and the recovered slop oil is reprocessed in process units. - The residual sludge with low oil content (less than 10 vol%) is being disposed through SPCB authorized CHWTSDf agency & also disposed through authorized Co-processing Cement plant.
xxvi	 Green belt over 19.5 acres land area should be developed within plant premises with at least 10 meter wide green belt on all sides along the periphery of the project area, in downward direction, and along road sides etc. Selection of plant species shall be as per the CPCB guidelines in consultation with the DFO.	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total 610 acres plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy: 1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in

		consultation with experts. 2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: • Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar Island (247 Ha) was completed to enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township. • Massive Plantation Drives: Targetted afforestation at Balughata and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024-25: 1739 trees
xxvii	All the commitments made to the public during public hearing/public consultation meeting held on 12 th September, 2014 shall be satisfactorily implemented and adequate budget provision shall be made accordingly.	All commitments made to the public during public hearing meeting held for subject project on 12.09.2014 are implemented.

xxviii	At least 2.5% of the total cost of the project should be earmarked towards the corporate social responsibility and item-wise details along with time bound action plan should be prepared and submitted to the Ministry's Regional Office at Bhubaneswar. Implementation of such program should be ensured accordingly in a time bound manner. 	Haldia Refinery has earmarked and allocated the stipulated 2.5% of the project cost towards Corporate Environment Responsibility (CER) for DYIP Haldia Refinery Project. The EC approved cost of the project stands at ₹3217 Cr, and accordingly, ₹80.43 Cr has been allocated as CER fund (2.5% of the project cost), as per the EC Certificate. As on date, ₹31.79 Cr has been utilized for various CER activities, and the balance ₹48.64 Cr remains earmarked for ongoing and planned initiatives. The activities undertaken under CER include healthcare, sanitation, skill development, urban infrastructure, and environmental conservation. Key projects include: Healthcare & Sanitation: Mobile Road Sweeping Machine for Haldia Municipality to address dust pollution – <i>Completed.</i> 4 MLD Sewage Treatment Plant at Haldia – <i>Work order issued; execution i/p</i> Modern Toilet at Mohana Market, Haldia Township – <i>Completed.</i> Skill Development & Livelihood: Water Hyacinth Handicraft Program for underprivileged women – <i>Completed.</i> Urban Infrastructure Development: Central Bus Stand at Haldia – <i>Completed.</i> Development of area adjacent to "Haldia Bhawan" – <i>Completed.</i>

		• Community Relief Centres at Nayachar Island – <i>In Progress.</i> 4. Environmental Conservation: • Tiger Conservation at Sundarbans Tiger Reserve through patrol system upgrades – <i>In Progress.</i> • Mangrove Plantation over 150 ha (Dakshinchara & Beliarychar) with 6-year maintenance – <i>Under process; ₹8.17 Cr earmarked.</i> 5. Public Safety & Surveillance: • Installation of CCTV Cameras in Haldia Industrial Region – <i>Completed.</i> All activities have been finalized by the CER Committee and are either completed or in various stages of implementation.
xxix	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, Safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	No temporary labour housing was developed as the construction workforce is sourced from nearby villages and commutes daily. However, necessary facilities such as safe drinking water, mobile toilets, and first-aid medical support were provided at the project site during construction activities.
Sl. No.	GENERAL CONTITIONS	STATUS
i)	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board (SPCB), State Government and any other statutory authority.	Haldia Refinery has been adhering to the stipulations made by the WBPCB and submitting necessary compliance Reports as per schedule.
ii	No further expansion or modification in the project shall be carried out without prior approval of the Ministry of Environment & forests. In case of deviations or alternations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry to assess the adequacy of conditions imposed and to add	Environmental clearance from MoEF & CC is always taken before expansion or modernization of the existing plants.

	additional environmental protection measures required, if any.	
iii	The project authorities must strictly comply with the rules and regulations under manufacture, Storage and Import of Hazardous chemicals rules, 2000 as amended subsequently. Prior approvals from Chief Inspectorate of Factories, Chief Controller of Explosives, Fire Safety inspectorate etc. must be obtained, wherever applicable.	- MSIHC rules- 2000 (amended) is being followed by Haldia Refinery. - Third-party Safety Audits conducted as per MSIHC Rules every year. (Refer Annexure-12) - PESO approvals obtained prior to commissioning.
iv	The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels shall conform to the standards prescribed under EPA Rules, 1989 viz. 75 dBA (daytime) and 70 dBA (night time).	- Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989. Noise monitoring is regularly conducted both inside the plant and at boundary locations. Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.
v	A separate Environmental management Cell equipped with full-fledged laboratory facilities must be set up to carry out the environmental management and monitoring functions.	- A dedicated Health, Safety & Environment (HS&E) department comprising experienced personnel across all grades, headed by a Chief General Manager reporting to the Refinery Head, oversees environmental management at Haldia Refinery. - An in-house Quality Control Laboratory, NABL-accredited (TC10599, valid till 01.05.2026) and WBPCB-approved, is available for routine environmental monitoring, including water quality analysis. (Refer Annexure-10).
vi	Adequate funds shall be earmarked towards capital cost and recurring cost/annum for environment pollution control measures and shall be used to implement the conditions stipulated by the Ministry of Environment and forests as well as the State government along with the implementation schedule for all the	Haldia Refinery has consistently earmarked and allocated substantial funds every financial year towards environmental protection and management activities.

	conditions stipulated herein. The funds so provided shall not be diverted for any other purposes. 	• This fund is not diverted for any other purposes and is utilized solely for environmental compliance. • The funds are utilized for comprehensive activities including the operation and maintenance of pollution control systems (ETP TTP-RO), greenbelt development, environmental monitoring, hazardous waste management, sludge oil recovery, consent/authorization fees, awareness programs, and EIA/RA studies. These allocations are made from both recurring and non-recurring budgets as required, ensuring that all environmental obligations are fully met without any shortfall. A summary of environmental expenditure over the last nine financial years is provided below: <table><tr><th>Year</th><th>Expenditure (₹ Crore)</th></tr><tr><td>2024-25</td><td>19.17</td></tr><tr><td>2023-24</td><td>17.84</td></tr><tr><td>2022-23</td><td>20.61</td></tr><tr><td>2021-22</td><td>23.86</td></tr><tr><td>2020-21</td><td>20.79</td></tr><tr><td>2019-20</td><td>20.58</td></tr><tr><td>2018-19</td><td>20.59</td></tr><tr><td>2017-18</td><td>15.07</td></tr><tr><td>2016-17</td><td>21.19</td></tr></table>	Year	Expenditure (₹ Crore)	2024-25	19.17	2023-24	17.84	2022-23	20.61	2021-22	23.86	2020-21	20.79	2019-20	20.58	2018-19	20.59	2017-18	15.07	2016-17	21.19
Year	Expenditure (₹ Crore)																					
2024-25	19.17																					
2023-24	17.84																					
2022-23	20.61																					
2021-22	23.86																					
2020-21	20.79																					
2019-20	20.58																					
2018-19	20.59																					
2017-18	15.07																					
2016-17	21.19																					
vii	The Regional Office of this Ministry/Central Pollution control Board / State Pollution Control Board will monitor the stipulated conditions. A six monthly compliance report and the monitored data along with statistical interpretation shall be submitted to them regularly.	• Six-monthly compliance reports are regularly submitted to MoEF&CC Regional Office, CPCB, and WBPCB. • The last report was submitted in Dec 2024.																				
viii	A copy of clearance letter shall be sent by the proponent to concerned Panchayat, Zila	The EC intimation is published in local two newspapers & also intimated to MoEF &																				

	Parishad / Municipal Corporation, Urban local Body and the local NGO, if any, from whom suggestions / representations, if any, were received while processing the proposal. The clearance letter shall also be put on the web site of the company by the proponent.	CC regional office, SPCB, Factories Inspector & local Administration.
ix	The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional office of the MOEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; PM ₁₀ , PM _{2.5} , SO ₂ , NOX, HC (Methane & Non-methane) VOCs (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the projects shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.	- Compliance status and monitored data are regularly uploaded on the IOCL website and shared with MoEF&CC Regional Office, CPCB, and WBPCB. - Criteria pollutant levels (ambient and stack) are continuously monitored and displayed publicly near the Refinery's main gate.
x	The project proponent shall also submit six monthly reports on the status of the compliance of the stipulated environmental conditions including results of monitored data (both in hard copies as well as by e-mail) to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB. The Regional office of this Ministry / CPCB / SPCB shall monitor the stipulated conditions.	Six-monthly compliance reports are regularly submitted to MoEF&CC Regional Office, Bhubaneswar, CPCB, and WBPCB.
xi	The environmental statement for each financial year ending 31 st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) rules, 1986, as amended subsequently, shall also be put on the web side of the company along with the status of compliance of environmental conditions and shall also be sent to the respective Regional Offices of the MOEF by e-mail.	- Annual Environmental Statements in Form-V are submitted to WBPCB. - The last submission was made in September 2024. - The statement is also uploaded on the IOCL website.
xii	The Project Proponent shall inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the SPCB and may also be seen at Website of the Ministry of Environment and forests at	After receipt of Environmental clearance, application is being placed before State pollution control board and consent to establish is obtained. Also, the news of EC was published in two local newspapers.

	http://envfor.nic.in . This shall be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same shall be forwarded to the Regional Office.	Consent to operate taken from WBPCB before commissioning of the project.
xiii	Project authorities shall inform the Regional as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of commencing the land development work.	The subject project was approved on 20 th Apr-2014.



10.0 EC Reference No. & Issue date: J11011/175/2016-IA -II (I) dated 28th November 2017

Status of conditions imposed with respect to environmental clearance for “BS-VI Fuel Quality Upgradation Project (Phase-I) at Haldia Refinery, Haldia (West Bengal) by M/S Indian Oil Corporation Limited –Environmental Clearance-reg”.

Sl. No.	SPECIFIC CONDITIONS	STATUS
(i)	Consent to Establish/Operate for the project shall be obtained from the State Pollution Control Board as required under the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974.	Consent to Establish and Consent to Operate have been obtained from WBPCB. CTO No.: WBPCB/4890720/2024, valid till: 27.05.2029.
(ii)	As already committed by the project proponent, Zero Liquid Discharge shall be ensured and no waste/treated water shall be discharged outside the premises. 	• Operational Efficiency: Haldia Refinery operates an advanced Effluent Treatment Plant (ETP) with integrated physical, chemical, biological, and tertiary treatment units. • High Reuse Rate: The treated effluent is extensively reused in the Tertiary Treatment-RO plant, cooling water systems, and fire water networks, achieving 91% reuse in FY 2024–25, up from 90.5% in FY 2023–24. • Discharge Compliance: Currently, only the RO reject—meeting MINAS standards—is discharged to the Hooghly River, strictly in accordance with the Consent to Operate (CTO) from WBPCB, which permits discharge up to 240 m³/hr. • ZLD Amendment Request: Regarding the ZLD commitment, IOCL–Haldia Refinery initially submitted a proposal to MoEF&CC requesting an amendment to the EC conditions, citing constraints such as land availability, salt management,

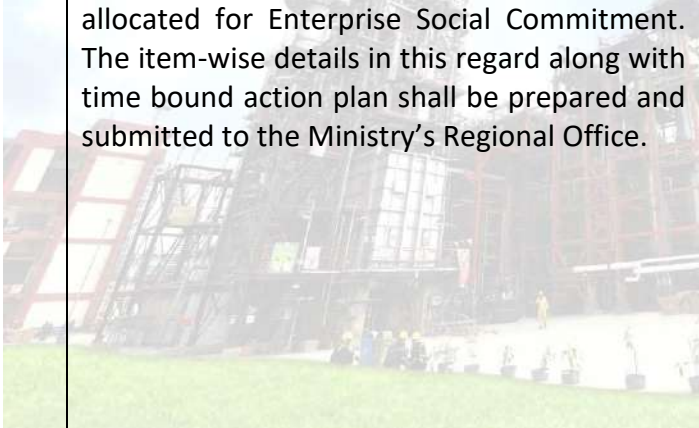
		and techno-economic challenges. • EAC Deliberation (Jan 2025): The matter was deliberated in the EAC meeting held on 10.01.2025. As per the Minutes of Meeting (MoM), the EAC suggested the submission of a detailed Techno-Economic Feasibility Study and an impact assessment of treated effluent on the Hooghly River. • Feasibility Study & Revised Proposal: Pursuant to the Committee's directions, Engineers India Limited (EIL) was engaged to conduct a "Techno-Economic Feasibility Study." The study validated the physical constraints. Consequently, in 2025, IOCL approached the Ministry with the report, proposing a realistic alternative: a 60% reduction in effluent discharge by FY 2028 through high-recovery technologies. • Current Status (Nov 2025): The matter was again deliberated in the EAC meeting held on 14.11.2025. As per the MoM, the Hon'ble EAC has directed IOCL to submit a definite ZLD Implementation Project Timeline. IOCL is proceeding with the necessary actions to comply with this direction.
(iii)	Necessary authorization required under the Hazardous and Other Wastes (Management and Trans-Boundary Movement) Rules, 2016 Solid Waste Management Rules, 2016 shall be obtained and the provisions contained in the Rules shall be strictly adhered to.	Hazardous Waste (HW) Authorization is accorded by WBPCB & it is valid till 31.12.2025. Yearly Hazardous Waste return is being submitted to WBPCB every year before 30th June.
(iv)	National Emission Standards for Organic Chemicals Manufacturing Industry issued by the Ministry vide G.S.R. 608(E) dated 21 st July,	National Emission Standards for Organic Chemicals Manufacturing Industry issued by the Ministry vide

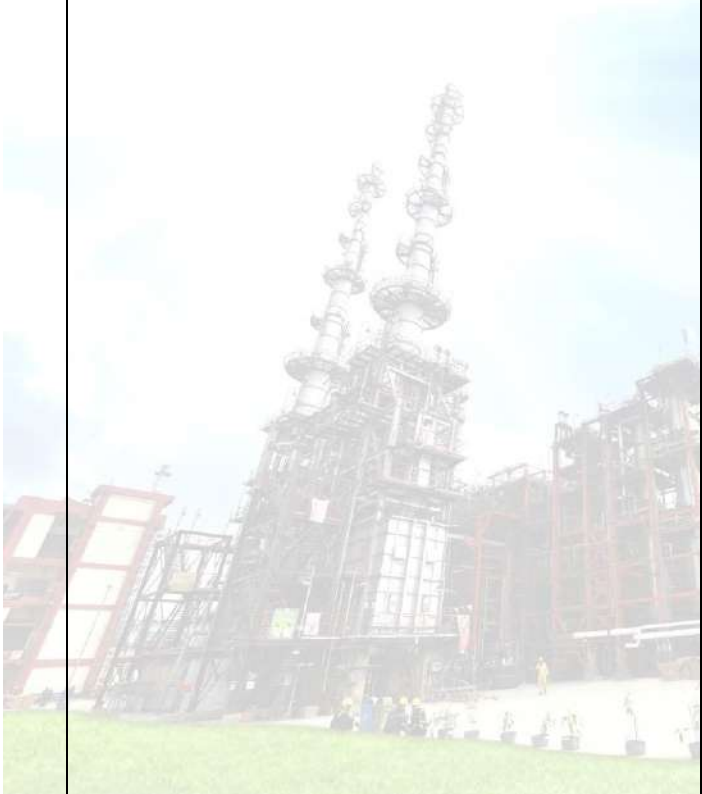
	2010 and amended from time to time shall be followed.	G.S.R. 608(E) dated 21 st July, 2010 is not applicable.
(v)	To control source and the fugitive emissions, suitable pollution control devices shall be installed with different stacks (attached to DHDT, HGU-II-Revamp, Prime G-Revamp and Sulphuric Acid Plant) to minimize the incremental concentrations (for PM₁₀ & PM_{2.5}) in order to meet the prescribed norms/NAAQS. Sulphur content should not exceed 0.5% in the coal for use in coal fired boilers to control particulate emissions within permissible limits. The gaseous emissions shall be dispersed through of adequate height as per CPCB/SPCB guidelines. 	1. Online Continuous Emission Monitoring Systems (OCEMS) for SO₂, NO_x, CO, and PM have been installed on stacks associated with process units such as DHDT, HGU-II Revamp, Prime-G Revamp, and Sulphuric Acid Plant. The data is transmitted in real-time to CPCB servers to ensure regulatory compliance and transparency. 2. Adequate stack heights have been provided for new heaters as per CPCB/SPCB guidelines to ensure proper dispersion of pollutants. 3. Only low sulphur fuel gas and oil are used for combustion across the refinery; there are no coal-fired boilers in operation. 4. Low NO_x burners and staged combustion systems have been installed in all new furnaces to comply with the latest NO_x emission norms. Existing furnaces are being progressively retrofitted with similar systems. 5. In addition to OCEMS, manual stack emission testing for critical parameters is conducted monthly to validate compliance.
(vi)	Total fresh water requirement shall not exceed 1395 cum/hr to be supplied by Haldia Development Authority. Necessary permission in this regard shall be obtained from the concerned regulatory authority. No ground water shall be used without prior permission from the CGWA.	Fresh water consumption remains well within the stipulated limit of 1395 m³/hr. Actual freshwater consumption: • FY 2021–22: ~900 m³/hr • FY 2022–23: ~800 m³/hr • FY 2023–24: ~870 m³/hr • FY 2024–25: ~800 m³/hr
(vii)	Industrial/ trade effluent shall be segregated into High COD/TDS and Low COD/TDS effluent	• All effluent generated inside the refinery are treated in existing

	streams, if any. High TDS/COD shall be passed through stripper followed by MEE and ATFD (agitated thin film drier). Low TDS effluent stream shall be treated in ETP and then passed through RO system.	ETPs, with online analyzers installed to monitor the quality of treated water and final river discharge. Treated water from ETP is used in TTP-RO Plant to produce Permeate Water.
(viii)	Process effluent/any wastewater shall not be allowed to mix with storm water. Storm water drain shall be passed through guard pond.	Process effluent is routed through dedicated closed OWS pipelines to ETP inlet—no mixing with storm water. Storm water is collected in guard ponds connected via open surface drains. - Guard ponds are equipped with oil catch pits to arrest hydrocarbon traces. Storm water is reprocessed through ETP or treated in SWMS (1000 m³/hr capacity) during heavy rainfall. - Complete segregation of process and storm water is maintained.
(ix)	Hazardous chemicals shall be stored in tanks, tank farms, drums, carboys etc. Flame arresters shall be provided on tank farm, and solvent transfer to be done through pumps.	Hazardous chemicals and hydrocarbons are stored in floating and fixed roof tanks within designated tank farms. Flame arrestors are installed on all fixed roof tanks as per safety standards. Solvent and chemical transfers are carried out using mechanized pump systems—no manual handling. - Storage and transfer systems are designed in compliance with OISD and MSIHC norms.
(x)	Process organic residue and spent carbon, if any, shall be sent to cement industries. ETP sludge, process inorganic & evaporation salt shall be disposed off to the TSDF. The ash from boiler shall be sold to brick manufacturers/ cement industry.	- The spent catalyst generated is being disposed to authorized CHWTSDF agency approved by WBPCB. - Oily sludge is processed through centrifuge to recover slop oil

		and the recovered slop oil is reprocessed in process units. The residual sludge with low oil content (less than 10 vol%) is being disposed through SPCB authorized CHWTSDf agency & also disposed through authorized Co-processing Cement plant.
(xi)	The Company shall strictly comply with the rules and guidelines under Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 as amended the time to time. All transportation of Hazardous Chemicals shall be as per the Motor Vehicle Act (MVA), 1989.	- MSIHC Rules, 1989 is being followed. - Safety audit as per MSIHC Rules being done annually. (Refer Annexure-12)
(xii)	Fly ash should be stored separately as per CPCB guidelines so that it should not adversely affect the air quality, becoming air borne by wind or water regime during rainy season by flowing along with the storm water. Direct exposure of workers to fly ash & dust should be avoided.	No fly ash generation in Haldia refinery. Heaters are oil and gas fired.
(xiii)	The company shall undertake waste minimization measures as below:-	
	(a) Metering and control of quantities of active ingredients to minimize waste.	Flow meters are installed across process streams for precise metering and control.
	(b) Reuse of by-products from the process as raw materials or as raw material substitutes in other processes.	No by-products generated. Oily sludge generated is reprocessed to recover slop oil for reuse.
	(c) Use of automated filling to minimize spillage.	Automated filling systems are in place to minimize spillage.
	(d) Use of Close Feed system into batch reactors.	Close feed systems are adopted in operations.
	(e) Venting equipment through vapor recovery system.	- No venting to open atmosphere. - Flared gases routed to flare routed through Flare Gas Recovery System (FGRS).
	(f) Use of high pressure hoses for equipment cleaning to reduce wastewater generation.	High-pressure hoses are used for equipment cleaning to reduce wastewater generation.
(xiv)	The green belt of at least 10 m width shall be developed in more than 33% of the total project area, mainly along the plant periphery, in downwards wind direction, and along roadsides etc. Selection of plant species shall	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total 610 acres)

	be as per the CPCB guidelines in consultation with the State Forest Department.	plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy: 1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: • Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. • Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts. 2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: • Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar Island (247 Ha) was completed to

		enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township. • Massive Plantation Drives: Targetted afforestation at Balughata and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024–25: 1739 trees
(xv)	At least 5% of the total project cost shall be allocated for Enterprise Social Commitment. The item-wise details in this regard along with time bound action plan shall be prepared and submitted to the Ministry's Regional Office. 	Haldia Refinery has earmarked and allocated the stipulated 5% of the project cost towards Corporate Environment Responsibility (CER) for BS-VI Project. The board-approved cost for the BS-VI Project (RH-0757) is ₹2934 Cr, against which a CER allocation of ₹129.86 Cr (5%) has been made. Activities under CER have been finalized in consultation with District Authorities and the local community to address priority needs in education, healthcare, sanitation, green development, and skill building. A total of 29 projects have been taken up, of which 23 have been completed and 6 are in progress. The cumulative utilization till date is ₹35.93 Cr, and the balance is committed and under execution in a time-bound manner. Key Completed Projects: • Education:

		• Construction and renovation at multiple government schools across villages (e.g., Raj Nagar Ram Chandra Adarsh Vidyapeeth, Gopalpur Vivekananda Mission, Hariharpur Primary School). • Establishment of e-Classroom and desk bench facilities at BMT High Secondary School. • Skill development project with CIPET for 150 students (residential course). • Providing school computers, student desks (980 Nos), and infrastructure at Kendriya Vidyalaya and IndianOil Gyanodaya. • Shishu Aloy centers under ICDS in Purba Medinipur district (5 units). • Healthcare: • Distribution of assistive kits to Divyangjans through ALIMCO. • Ambulance support to Trauma Care Center. • Supply of Covid management materials to IOCL Haldia Refinery. • Sanitation: • Toilet construction at multiple schools and public places. • Installation of dustbins across Haldia and schools. • Green Belt & Plantation: • Tree plantations (including 35,200 trees at Balughata,

		community plantations, and school campuses). • Creation of a Bio-Diversity Park at Digha and Miyawaki Forest at Mahisadal. • Mangrove plantation at Beliary Char (ongoing). Key Ongoing Projects: • Dedicated healthcare infrastructure such as: • 20-bed isolation ward and 10-bed Caesarean ward at district hospitals. • Burn ward at Haldia Subdivision Hospital. • Providing infrastructure to ITI Haldia under education sector. • Deployment of portable USG machines. All projects have been duly approved by the CER Committee and relevant competent authorities. The implementation follows the stipulated action plan, with periodic reviews and updates submitted to the Ministry's Regional Office.
(xvi)	For the DG sets, emission limits and the stack height shall be in conformity with the extant regulations and the CPCB guidelines. Acoustic enclosure shall be provided to DG set for controlling the noise pollution.	No DG sets are installed under the project. Power requirements are met through in-house Gas Turbines (GTs), Steam Turbines (TGs), and import from WBSEDCL.
(xvii)	The unit shall make the arrangement for protection of possible fire hazards during manufacturing process in material handling. Firefighting system shall be as per the norms.	• Haldia Refinery has a dedicated Fire & Safety department in place. • A comprehensive fire water network covers all process units and tank farms. • Multiple fire tenders and firefighting equipment are stationed for prompt emergency response.
(xviii)	Continuous online (24x7) monitoring system for stack emissions shall be installed for	• Online Continuous Emission Monitoring Systems (OCEMS)

	measurement of flue gas discharge and the pollutants concentration, and the data to be transmitted to the CPCB and SPCB server. For online continuous monitoring of effluent, the unit shall install web camera with night vision capability and flow meters in the channel/drain carrying effluent within the premises. In case of the treated effluent to be utilized for irrigation/ gardening, real time monitoring system shall be installed at the ETP outlet.	for SO₂, NO_x, CO, and PM are installed on relevant stacks and are integrated with CPCB and WBPCB servers. • OCEMS for BOD, COD, TSS, and pH are operational at the ETP outlet and ELR discharge point to monitor treated effluent quality. • Web cameras with night vision and flow meters are installed at both the effluent inlet and outlet channels. • Also, periphery boundary cameras are installed to monitor the green belt channel around the refinery premises. • Treated water is reused in TTP-RO, cooling towers, and fire water systems.
(xix)	Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act.	• Haldia Refinery has its own fully equipped Occupational Health Centre. • Periodic health check-ups are conducted for all employees as per the Factories Act and WB Factory Rules. • Records of surveillance and medical assessments are systematically maintained in our database and available from medical portal.
(xx)	Wetland habitat shall be provided for migratory birds, at the reservoir and green belt areas.	Haldia Refinery, under its commitment to ecological stewardship, has undertaken key ecological initiatives to support migratory birds and biodiversity: • Biodiversity Park at Digha-A key initiative developed over a large area with native flora, water bodies, and open green spaces to attract and support migratory birds and coastal wildlife. • Ecological Butterfly Park: Located within refinery premises, it hosts diverse

		nectar plants and shelter zones to sustain butterfly species and other pollinators, enhancing local biodiversity.
(xxi)	Natural surface water bodies within 10 km study area shall be rejuvenated and developed as complete eco-system with the tree plantation development and growth using satellite imageries. 	Haldia Refinery has implemented a comprehensive ecological rejuvenation strategy, focusing on the restoration and development of wetlands, canals, and water bodies within and also outside the 10 km radius. The refinery's sustained afforestation and wetland enhancement initiatives have led to a significant increase in green cover from 11% in 2019 to over 60% by FY 2024–25. <u>Key Initiatives(within 10 km):</u> • Tree Plantation at Water Reservoir – Durgachak Green development around key freshwater assets to improve local hydrology and habitat. • Maintenance of Saplings for Six Months Locations include: • Satish Samanta Trade Center • Trauma Care Center • Water Reservoir – Durgachak • Green Belt Canal • Tree Plantation in and around Haldia (Schools & Colleges) Focused on building green awareness and enhancing campus ecosystems across educational institutions. • Tree Plantation with 4-Year Maintenance: • Green Belt Channel (in front of refinery) • Extension of HPL Link Road (City Centre to Balughata)

		• Tree Plantation using Miyawaki Technique at Land of Southeastern Railways. <u>Key Initiatives (outside 10 km):</u> • Coastal Mangrove Plantation – Phase 1 (2021) Planted 20 lakh mangroves over 50 hectares at Beliary Char, restoring coastal wetlands, improving biodiversity, and enhancing soil stability. • Mangrove Plantation Drive 2.0 (2025-ongoing) Launched as a flagship initiative, targeting 30 lakh mangroves across 150 hectares (Beliary Char & Dakshinchara Shankarara), making it India's largest mangrove restoration project by any refinery. <u>Monitoring and Impact Assessment:</u> • All plantation and rejuvenation areas are being tracked through satellite imagery and GIS tools, in line with EC requirements. • Over 8 native and endangered mangrove species included to build climate resilience and support a thriving wetland ecosystem • Biodiversity enhancement, carbon sequestration, and soil quality improvements are being periodically reported. • Community engagement and awareness drives are included as part of project sustainability.
12.1	The grant of environmental clearance is subject to compliance of other general conditions, as under:-	

(i)	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board, Central Pollution Control Board, State Government and any other statutory authority.	Statutory stipulations are being complied.
(ii)	No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forest and Climate Change. In case of deviations or alterations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry to assess the adequacy of conditions imposed and to add additional environmental protection measures required, if any.	Permission always taken from MoEF & CC and State pollution control board for every projects.
(iii)	The locations of ambient air quality monitoring stations shall be decided in consultation with the State Pollution Control Board (SPCB) and it shall be ensured that at least one station each is installed in the upwind and downwind direction as well as where maximum ground level concentrations are anticipated.	• Three Continuous Ambient Air Quality Monitoring Stations (CAAQMS) have been installed within Haldia Refinery premises, including new stations under the DYIP and BS-VI projects. These are located in consultation with SPCB, covering upwind, downwind, and maximum ground-level concentration zones. • All stations are integrated with the CPCB server for real-time data transmission and regulatory compliance.
(iv)	The National Ambient Air Quality Emission Standards issued by the Ministry vide G.S.R. No. 826(E) dated 16 th November, 2009 shall be followed.	• As per NAAQMS standard 2009, Ambient Air Quality (AAQ) is monitored twice a week at five locations within the refinery and two locations in the township. • Monitoring is conducted by a WBPCB-recognized laboratory, and results are regularly submitted as part of the six-monthly compliance reports to MoEF&CC.
(v)	The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient	• Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989.

	noise levels shall be conform to the standards prescribed under Environment (Protection) Act, 1986 Rules, 1989 viz. 75 dBA(day time) and 70 dBA (night time).	• Noise monitoring is regularly conducted both inside the plant and at boundary locations. • Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.



11.0 EC Reference No. & Issue date: J11011/299/2013-IA -II (I) dated 11th December 2019

Status of conditions imposed with respect to environmental clearance for “Capacity expansion from 7.5 MTPA to 8 MTPA along with Distillate Yield Improvement Project (DYIP) and Feed processing unit (FPU) at IOCL Haldia refinery- **Amendment in Environmental Clearance-reg.**

Sl. No.	EC detail	Existing EC conditions	Amendment in EC
11	J-11011/299/2013-IA II(I) Date 11-Dec-2019	Capacity expansion from 7.5 MTPA to 8.0 MTPA along with Distillate Yield Improvement Project (DYIP) and installation of Feed Processing Unit (FPU) at IOCL Haldia Refinery, Purba Medinipur, WB – EC- Amendment in EC dated 04-March-2016	Augmentation of VDU-II (2.4 to 2.6 MTPA) in place of VDU-I (1.5 to 1.7 MTPA) – As per Ministries notification dated 23 rd Nov 2016, para 7 (ii) (b), no requirement for amendment in the EC dated 4th-March-2016

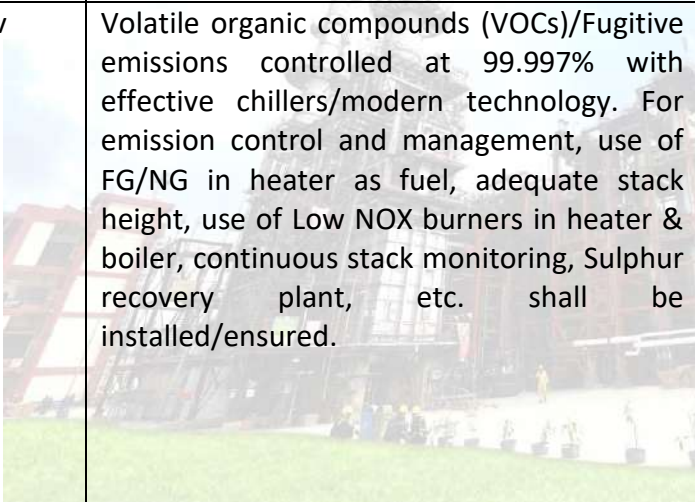


12.0 EC Reference No. & Issue date: J11011/175/2016-IA -II (I) dated 05th January 2021

Status of conditions imposed with respect to environmental clearance for “Installation of 2nd Catalytic Iso-Dewaxing unit of capacity 270.0 TMTA by M/s Haldia Refinery of IOCL located at East Medinipur, West Bengal- EC regarding”.

Sl. No.	Specific Condition	Status
I	The company shall comply with all the environmental protection measures and safeguards proposed in the documents submitted to the Ministry. All the recommendations made in the earlier EIA/EMP report and updated in respect of environmental management, and risk mitigation measures relating to the project shall be implemented.	All environmental protection measures and safeguards proposed have been implemented.
II	As already committed by the project proponent, Zero Liquid Discharge shall be ensured and no waste/treated water shall be discharged outside the premises. Treated effluent shall be reused in the process/utilities. Treated industrial effluent shall not be used for gardening/greenbelt development/horticulture	• Operational Efficiency: Haldia Refinery operates an advanced Effluent Treatment Plant (ETP) with integrated physical, chemical, biological, and tertiary treatment units. • High Reuse Rate: The treated effluent is extensively reused in the Tertiary Treatment-RO plant, cooling water systems, and fire water networks, achieving 91% reuse in FY 2024–25, up from 90.5% in FY 2023–24. • Discharge Compliance: Currently, only the RO reject—meeting MINAS standards—is discharged to the Hooghly River, strictly in accordance with the Consent to Operate (CTO) from WBPCB, which permits discharge up to 240 m³/hr. • ZLD Amendment Request: Regarding the ZLD commitment, IOCL–Haldia Refinery initially submitted a proposal to MoEF&CC requesting an amendment to the EC conditions, citing constraints such as land availability, salt

		management, and techno-economic challenges. • EAC Deliberation (Jan 2025): The matter was deliberated in the EAC meeting held on 10.01.2025. As per the Minutes of Meeting (MoM), the EAC suggested the submission of a detailed Techno-Economic Feasibility Study and an impact assessment of treated effluent on the Hooghly River. • Feasibility Study & Revised Proposal: Pursuant to the Committee's directions, Engineers India Limited (EIL) was engaged to conduct a "Techno-Economic Feasibility Study." The study validated the physical constraints. Consequently, in 2025, IOCL approached the Ministry with the report, proposing a realistic alternative: a 60% reduction in effluent discharge by FY 2028 through high-recovery technologies. • Current Status (Nov 2025): The matter was again deliberated in the EAC meeting held on 14.11.2025. As per the MoM, the Hon'ble EAC has directed IOCL to submit a definite ZLD Implementation Project Timeline. IOCL is proceeding with the necessary actions to comply with this direction.
III	Continuous online (24x7) monitoring system for stack emissions shall be installed for measurement of flue gas discharge and the pollutants concentration, and the data to be transmitted to the CPCB and SPCB server. For online continuous monitoring of effluent, the unit shall install web camera with night vision capability and flow meters in the channel/drain carrying effluent within the premises.	• Online Continuous Emission Monitoring Systems (OCEMS) for SO₂, NO_x, CO, and PM are installed on relevant stacks and are integrated with CPCB and WBPCB servers. • OCEMS for BOD, COD, TSS, and pH are operational at the ETP outlet and ELR discharge point

		to monitor treated effluent quality. • Web cameras with night vision and flow meters are installed at both the effluent inlet and outlet channels. • Also, periphery boundary cameras are installed to monitor the green belt channel around the refinery premises.
IV	The National Emission Standards for Petroleum Oil Refinery issued by the Ministry vide G.S.R. 186(E) dated 18th March, 2008 and G.S.R. 595(E) dated 21st August, 2009 as amended from time to time, shall be followed. 	• As per NAAQMS standard 2009, Ambient Air Quality (AAQ) is monitored twice a week at five locations within the refinery and two locations in the township. • Monitoring is conducted by a WBPCB-recognized laboratory, and results are regularly submitted as part of the six-monthly compliance reports to MoEF&CC.
v	Volatile organic compounds (VOCs)/Fugitive emissions controlled at 99.997% with effective chillers/modern technology. For emission control and management, use of FG/NG in heater as fuel, adequate stack height, use of Low NOX burners in heater & boiler, continuous stack monitoring, Sulphur recovery plant, etc. shall be installed/ensured. 	• Adequate stack height for new heaters will be provided. • Only low sulphur fuel gas and oil are fired in the heaters. • Low NO_x burners are installed in new heaters, and older systems are being retrofitted. • All new furnaces feature staged combustion and low-NO_x burners to ensure compliance with evolving NO_x norms, Same has been implemented for CIDW-II. • Four nos. of Sulphur Recovery units with design capacity of 360 TPD are already installed at Haldia Refinery. • Additionally, the Wet Sulfuric Acid (WSA) Plant—first of its kind in IOCL with a capacity of 375 MTPD—was successfully commissioned at Haldia Refinery on 30th September 2022, converting H₂S-rich gas to H₂SO₄.

		- Stack emissions are well within prescribed limits. Continuous online stack monitoring systems are in place, and real-time data is linked to the CPCB server. - The last six-month average SO₂ emission from heater stacks was 753 kg/hr, which is well within the specified limit of 980 kg/hr as per latest EC condition. Refer Annexure-6
vi	Occupational health center for surveillance of the worker's health shall be set up. The health data shall be used in deploying the duties of the workers. All workers & employees shall be provided with required safety kits/mask for personal protection.	- Haldia Refinery has its own fully equipped Occupational Health Centre. - Periodic health check-ups are conducted for all employees as per the Factories Act and WB Factory Rules. - Records of surveillance and medical assessments are systematically maintained in our database and available from medical portal.
Vii	Process safety and risk assessment studies shall be carried out using advanced models in repeated intervals, and the mitigating measures shall be undertaken/ implemented accordingly.	Risk Analysis Reports are submitted to the Ministry during EC processes. QRA, HAZOP, and SIL Studies are conducted at 5-year intervals using the latest PHAST and AR technologies for advanced risk modeling. Mitigation measures recommended by these studies are implemented and externally audited by OISD. Quarterly compliance status of implementation is regularly submitted to OISD for review.
viii	The storage of toxic/hazardous raw material/products shall follow all the safety norms and best practices to avoid any leakage/explosion/emissions. The unit shall make the arrangement for protection of possible fire hazards during manufacturing process in material handling. Fire-fighting system shall be as per the norms.	- Lighter hydrocarbons are stored in internal floating roof tanks equipped with rim seal fire protection systems. - All storage and handling practices comply with OISD, PESO, and other statutory safety norms.

		Adequate fire and explosion prevention systems are in place, with firefighting systems designed as per prescribed standards to mitigate any potential hazards.
ix	Training shall be imparted to all employees on safety and health aspects of chemicals handling. Safety and visual reality training shall be provided to employees	- Regular training sessions are conducted on chemical handling and health safety, covering 69 topics last year with 2,249 officer participations. Safety and process incident training is scheduled year-round. Safety videos and VR-based content are also made available on the company's internal web portal for continuous learning.
X	Total additional fresh water requirement shall not exceed 408 KLD proposed to be met from Haldia Development Authority. Necessary permission in this regard shall be obtained from the concerned regulatory authorities, and renewed from time to time.	Fresh water consumption of the refinery remains well within the stipulated limit of 1395 m³/hr. Actual freshwater consumption: - FY 2021–22: ~900 m³/hr - FY 2022–23: ~800 m³/hr - FY 2023–24: ~870 m³/hr - FY 2024–25: ~800 m³/hr
xi	Storm water from the roof top shall be channelized through pipes to the storage tank constructed for harvesting of rain water in the premises and harvested water shall be used for various industrial processes in the unit. No recharge shall be permitted within the premises. Process effluent/any wastewater shall not be allowed to mix with storm water.	- Haldia Refinery has implemented 9 rainwater harvesting projects since 2011–12 for storage and groundwater recharge. - Key initiatives during FY 2024-25 include a newly constructed stormwater reservoir named 'Neer Kund', with oil catchpits (capacity: 3800 m³), enabling recycling of up to 200 m³/hr of runoff for use in fire systems or ETP, conserving freshwater.
xii	The company shall undertake waste minimization measures as below (a) Metering and control of quantities of active ingredients to minimize waste. (b) Reuse of by products from the process as raw materials or as raw material substitutes in	(a) Flow meters are installed across process streams for precise metering and control. (b) No by-products generated. Oily sludge generated is reprocessed to recover slop oil for reuse.

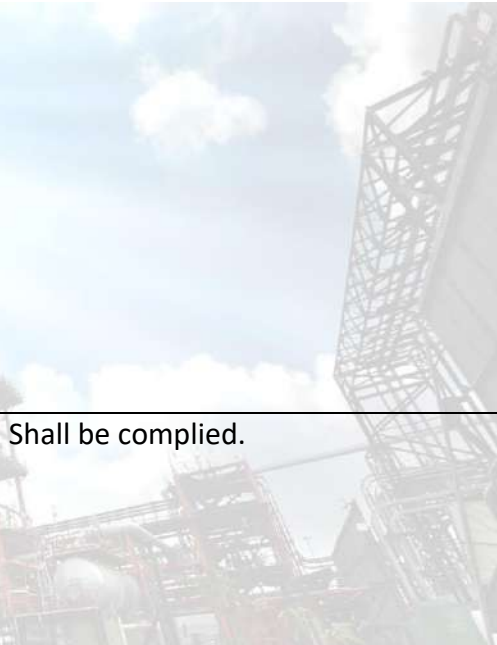
	other processes. (c) Use of automated filling to minimize spillage. (d) Use of close Feed system into batch reactors. (e) Venting equipment through vapour recovery system. (f) Use of high pressure hoses for equipment clearing to reduce wastewater generation.	(c) Automated filling systems are in place to minimize spillage. (d) Close feed systems are adopted in operations. (e) No venting to open atmosphere. Flared gases routed to flare routed through Flare Gas Recovery System (FGRS). (f) High-pressure hoses are used for equipment cleaning to reduce wastewater generation.
xiii	The green belt of at least 5-10 m width shall be developed in nearly 33% of the total project area, mainly along the plant periphery. Selection of plant species shall be as per the CPCB guidelines in consultation with the State Forest Department. Records of tree canopy shall be monitored through remote sensing map. The greenbelt shall be developed/planted within in 6 months and a compliance report needs to be submitted to RO MoEFCC. 	Haldia Refinery is fully committed to maintaining a robust greenbelt and enhancing local biodiversity. As of 2025, the refinery has achieved an impressive 68.49% green coverage (417.82 acres out of a total 610 acres plant area). To ensure technical compliance and ecological balance, the refinery follows a dual strategy: 1. Internal Greenbelt & Biodiversity Initiatives Due to limited land availability within the industrial battery limit, the refinery maximizes every available square meter: • Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) has been developed within the refinery premises. This park is specifically designed to support pollinators and indigenous flora, serving as a biological indicator of air quality. • Species Selection: In line with the EC mandate, plantation includes species known for their tolerance to industrial environments and those that act as bio-indicators. This includes a mix of SO₂ resistant and sensitive species selected in consultation with experts.

		2. External Greenbelt Development (Off-site Mitigation) To meet and exceed the statutory requirement of 33% green cover despite land constraints inside the plant, Haldia Refinery has entered into several MoUs with the State Forest Department (GoWB) and the Haldia Development Authority (HDA) for massive afforestation in the periphery: • Coastal Resilience: A landmark initiative involving the plantation of 20 lakh mangroves at Beliarychar Island (247 Ha) was completed to enhance climate resilience and prevent soil erosion. • Miyawaki Plantation (Mahishadal): Implementation of the Miyawaki method to create dense, fast-growing native forests at Mahishadal Rajbari and within the refinery township. • Massive Plantation Drives: Targetted afforestation at Balughata and other degraded patches using native timber and fruit-bearing species. Trees planted in last few years: • FY 2021–22: ~20 lakh mangroves planted at Beliarychar Island (247 Ha) • FY 2022–23: 20,800 trees • FY 2023–24: 661 trees • FY 2024-25: 1739 trees
xiv	The activities and the action plan proposed by the project proponent to address the public hearing and socio-economic issues in the study area, shall be completed as per the schedule presented before the committee and as described in the EMP report in letter and spirit. All the commitments made during public hearing shall be satisfactorily	• All public hearing commitments and socio-economic action plans are being implemented as per the timeline submitted to the EAC and detailed in the EMP report. • Preference is given to local villagers for employment, including in office,

	implemented. Preference shall be given to local villagers for employment in the unit.	maintenance, and project-related roles, ensuring inclusive development.
xv	A separate Environmental Management Cell (having qualified person with Environmental Science/Environmental Engineering/specialization in the project area) equipped with full-fledge laboratory facilities shall be set up to carry out the Environmental Management and Monitoring functions.	• A dedicated Health, Safety & Environment (HS&E) department comprising experienced personnel across all grades, headed by a Chief General Manager reporting to the Refinery Head, oversees environmental management at Haldia Refinery. • An in-house Quality Control Laboratory, NABL-accredited (TC10599, valid till 01.05.2026) and WBPCB-approved, is available for routine environmental monitoring, including water quality analysis. (Refer Annexure-10).
B	General Conditions	Status
i	No further expansion or modifications in the plant, other than mentioned in the EIA Notification, 2006 and its amendments, shall be carried out without prior approval of the Ministry of Environment, Forest and Climate change/SEIAA, as applicable. In case of deviations or alterations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry/ SEIAA, as applicable, to assess the adequacy of conditions imposed and to add additional environmental protection measures required, if any.	Noted. All expansions or modifications at Haldia Refinery are undertaken only after obtaining prior Environmental Clearance from MoEF&CC, in full adherence to the EIA Notification, 2006 and shall also be ensured in future.
(ii)	The energy source for lighting purpose shall be preferable LED based, or advanced having preference in energy conservation and environment betterment.	Haldia Refinery has already converted all conventional lights in refinery and township into LED.
iii)	The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels shall conform to the standards prescribed under	• Haldia Refinery ensures that noise levels remain within the prescribed limits of <75 dBA (day) and <70 dBA (night) as per EPA Rules, 1989.

	the environment (Protection) Act, 1986 Rules, 1989 viz. 75 DBA (day time) and 70 DBA (night time).	• Noise monitoring is regularly conducted both inside the plant and at boundary locations. • Noise control measures such as acoustic enclosures and silencers are in place, and PPEs such as earplugs are mandated in high-noise zones. Monitoring data is attached as Annexure-5.
(iv)	The company shall undertake all relevant measures for improving the socio-economic conditions of the surrounding area. CER activities shall be undertaken by involving local villages and administration and shall be implemented. The company shall undertake eco-developmental measures including community welfare measures in the project area for the overall improvement of the environment.	Haldia Refinery has effectively implemented its CER/ESC commitments with a strong focus on education, healthcare, environment, and community welfare. Key initiatives include construction and upgradation of school infrastructure, establishment of isolation and burn wards in local hospitals, extensive mangrove and Miyawaki forest plantations for ecological restoration, and support for disaster relief and basic amenities in nearby villages. These activities have been executed in consultation with local administration, with budgets duly allocated and booked, ensuring affirmative and time-bound fulfillment of obligations as per project and regulatory requirements
(v)	The company shall earmark sufficient funds towards capital cost and recurring cost per annum to implement the conditions stipulated by the Ministry of Environment, Forest and Climate Change as well as the state Government along with the implementation schedule for all the conditions stipulated herein. The funds so earmarked for environment management/pollution control measures shall not be diverted for any other purpose.	• Haldia Refinery has consistently earmarked and allocated substantial funds every financial year towards environmental protection and management activities. • This fund is not diverted for any other purposes and is utilized solely for environmental compliance. • The funds are utilized for comprehensive activities including the operation and maintenance of pollution control systems (ETP, TTP-RO), greenbelt development, environmental monitoring, hazardous waste management,

		sludge oil recovery, consent/authorization fees, awareness programs, and EIA/RA studies. These allocations are made from both recurring and non-recurring budgets as required, ensuring that all environmental obligations are fully met without any shortfall. A summary of environmental expenditure over the last nine financial years is provided below: <table><tr><th>Year</th><th>Expenditure (₹ Crore)</th></tr><tr><td>2024-25</td><td>19.17</td></tr><tr><td>2023-24</td><td>17.84</td></tr><tr><td>2022-23</td><td>20.61</td></tr><tr><td>2021-22</td><td>23.86</td></tr><tr><td>2020-21</td><td>20.79</td></tr><tr><td>2019-20</td><td>20.58</td></tr><tr><td>2018-19</td><td>20.59</td></tr><tr><td>2017-18</td><td>15.07</td></tr><tr><td>2016-17</td><td>21.19</td></tr></table>	Year	Expenditure (₹ Crore)	2024-25	19.17	2023-24	17.84	2022-23	20.61	2021-22	23.86	2020-21	20.79	2019-20	20.58	2018-19	20.59	2017-18	15.07	2016-17	21.19
Year	Expenditure (₹ Crore)																					
2024-25	19.17																					
2023-24	17.84																					
2022-23	20.61																					
2021-22	23.86																					
2020-21	20.79																					
2019-20	20.58																					
2018-19	20.59																					
2017-18	15.07																					
2016-17	21.19																					
(vi)	A copy of the clearance letter shall be sent by the project proponent to concerned Panchayet, Zilla Parishad/Municipal Corporation, Urban local Body and the local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal.	No suggestions or representations were received from any Panchayat, Zilla Parishad, Municipal Corporation, Urban Local Body, or NGO during the processing of the project; hence, no clearance letter dispatch was required.																				
(vii)	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated Environmental Clearance conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional office of MoEF&CC, the respective Zonal Office of CPCB and SPCB. A copy of Environmental clearance and six monthly compliance status reports shall be posted on the website of the company.	Six-monthly reports on the implementation of stipulated conditions and environmental safeguards are submitted to MoEF&CC Regional Office and WBPCB before 1st June & 1st Dec.																				
(viii)	The environmental statement of each financial year ending 31st March in Form-V as is mandated shall be submitted to the	- Complied. - Annual Environmental Statement (Form-V) is																				

	concerned state Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective Regional Officers of MoEF&CC by e-mail.	submitted to WBPCB (last in Sept 2024) and uploaded on IOCL website. Six-monthly EC compliance reports are submitted to MoEF&CC Regional Office (last in June 2025), fulfilling all regulatory requirements.
(ix)	The project proponent shall inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the SPCB/Committee and may also be seen at website of the Ministry and at https://parivesh,nic.in/ . This shall be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same shall be forwarded to the concerned Regional Office of the Ministry.	After receipt of Environmental clearance, the news of EC receipt is published in two local newspapers. 
(x)	The project authorities shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of the project.	Shall be complied. 
(xi)	This Environmental clearance is granted subject to final outcome of Hon'ble supreme Court of India, Hon'ble High Court, Hon'ble NGT and any other Court of law, if any, as may be applicable to this project.	Accepted. 

13.0. EC Reference No. & Issue date: F.No.11/23/2023-IA.III dated 21.07.2023

Status of CRZ recommendation for the Proposal 'Sulphuric Acid Pipeline From IOCL, Haldia Refinery to Finger Jetty of Haldia Dock Complex, Shyama Prasad Mukherjee Port, Kolkata' at Haldia, Purba Medinipur District, West Bengal.

PART-A -SPECIFIC CONDITIONS:

S.I No.	Recommendations	Compliance
1	All construction shall be strictly in accordance with the provisions of the CRZ Notification, 2011, as amended from time to time	Noted for compliance. All construction activities are and shall be undertaken strictly in accordance with the provisions of the CRZ Notification, 2011, and subsequent amendments.
2	The pipeline where crossing of water body/ river/ creek areas should be laid through Horizontal Directional Drilling (HDD) method.	Horizontal Directional Drilling (HDD) method has been adopted.
3	Any temporary physical infrastructure setup and excavated material during laying of pipelines shall not be dumped in water bodies or adjacent areas and the site shall be restored to its original condition after completion of construction of work.	Shall be complied
4	No storage reservoir for sea water shall be permitted and only pipelines conveyance system shall be installed.	Noted for Compliance
5	No groundwater shall be extracted within the CRZ area to meet the water requirements during the construction and / or operation phase of the project.	Shall be complied
6	Permanent labour camp, machinery and material storage shall not be set up in the CRZ area.	Shall be complied
7	The project proponents will certify that there is no legal restriction on the proposed project activities at the proposed site	Noted for Compliance
8	The Project Proponent shall comply order/direction, if any, issued by Hon"b1e Court/tribunal on the project	Shall be complied
9	There will be no construction activity during the turtle nesting season, if any from 1st January to 30th April of every year	Shall be complied

S.I No.	Recommendations	Compliance
10	All the conditions stipulated by the West Bengal State Coastal Zone Management Authority for CRZ clearance under CRZ Notification, 2011 vide letter no. 103 EN/T-II-4/ 17/ 2022 dated 08/ 02/ 2023 and commitments made by the PP before the WBSCMA and EAC shall be followed in letter and spirit.	Shall be complied
11	As a part of EMP, Indian Institute of Science Education and Research (IISER) — Kolkata or Zoological Survey of India any such nationally and internationally reputed government or academic institute will be provided with state of art laboratory equipment that can be used for high quality academic and research purpose.	-
12	All necessary clearance from the concerns authority, as may be applicable should be obtained prior to commencement of project or activity	Shall be complied

PART-B-GENERAL CONDITIONS:

S.I No.	Recommendations	Compliance
1	Management of solid waste in accordance with the Solid Waste Management Rules, 2016 shall be strictly implemented.	Noted for Compliance
2	'Consent to Establish' and/ or 'Consent to Operate' shall be obtained from State Pollution Control Board under the provisions of Air (Prevention and Control of Pollution) Act, 1981 and /or the Water (Prevention and Control of Pollution) Act, 1974, as may be applicable.	Consent to Establish Application has been obtained from WBPCB office. CTE No.: WBPCB/5369661/2024 dated 02.12.2024
3	Disposal of muck during construction phase should not create any adverse effect on the neighboring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of Competent Authority.	Shall be complied

S.I No.	Recommendations	Compliance
4	All liquid waste arising from the proposed development will be disposed of as per the norms prescribed by Central/ State Pollution Control Board. There shall not be any disposal of untreated effluent into the sea/ coastal water bodies. It shall be ensured that the waste water generated is treated in the STP as committed by the project proponent. The treated waste water shall be reused for landscaping, flushing and 'or HVAC cooling purposes etc. within the development. The project proponent should also make alternate arrangement for situation arising due to malfunctioning of STP. There shall be regular monitoring of standard parameters of the effluent discharge from STP under intimation to the SPCB.	Not applicable as the proposed project is only pipe laying job.
5	Any hazardous waste generated during construction phase, shall be disposed off as per applicable rules and norms with necessary approvals of the State Pollution Control Board	Shall be complied
6	A copy of the clearance letter shall be uploaded on the website of the concerned State Coastal Zone Management Authority/ State Pollution Control Board. The Clearance letter shall also be displayed at the Regional Office, District Industries Centre and Collector's Office/Tehsildar's office for 30 days.	Copy of the CRZ letter is available with the mentioned authorities.
7	A six-monthly monitoring report shall need to be submitted by the project proponent to the concerned Regional Office of this Ministry regarding the implementation of the stipulated conditions	Being be complied
8	The Ministry of Environment, Forest & Climate Change or any other Competent Authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.	Noted for Compliance

S.I No.	Recommendations	Compliance
9	Full co-operation shall be extended to the officials from the Regional Office of MoEF&CC, during monitoring of implementation of environmental safeguards stipulated. It shall be ensured that documents / data sought pertinent is made available to the monitoring team. A complete set of all the documents submitted to MoEF&CC shall be forwarded to the concerned Regional Office of MoEF&CC.	Haldia Refinery is always extending full co-operation to the Scientists / Officers visiting the Refinery from the statutory bodies.
10	In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by this Ministry	Noted for Compliance
11	The Ministry reserves the right to add additional safeguard measures subsequently, if considered necessary, and to take action to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner, including revoking of the environment clearance under the provisions of the Environmental (Protection) Act, 1986, for non-compliance	Agreed
12	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponent from the respective Competent Authorities	Shall be Complied
13	The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded CRZ Clearance and copies of clearance letters are available with the State Pollution Control Board (SPCB) and may also be seen on the website of the Ministry of Environment, Forest and Climate Change at https://parivesh.nic.in/ . The advertisement	Complied

S.I No.	Recommendations	Compliance
	should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the concerned Regional Office of this Ministry.	
14	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad / Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions / representations, if any, were received while processing the proposal	No suggestions or representations were received from any Panchayat, Zilla Parishad, Municipal Corporation, Urban Local Body, or NGO during the processing of the project; hence, no clearance letter dispatch was required.
15	The proponent shall upload the status of compliance of the stipulated conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF&CC, the respective Zonal Office of CPCB and the SPCB.	Six-monthly EC compliance reports including monitoring data are uploaded on IOCL website.
16	The environmental statement for each financial year ending 31 st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the project proponent along with the status of compliance of clearance conditions and shall also be sent to the respective Regional Office of the Ministry by e-mail.	• Complied. • Annual Environmental Statement (Form-V) is submitted to WBPCB (last in Sept 2024) and uploaded on IOCL website. • Six-monthly EC compliance reports are submitted to MoEF&CC Regional Office (last in Dec 2024), fulfilling all regulatory requirements.



Chairman & Director (Refinery) flagged off Mangrove Plantation Drive 2.0 during Haldia Refinery's Golden Jubilee celebration





Inauguration of Neerkund – A stormwater Storage facility



Neerkund - Constructed on a 46m x 23m footprint with an average depth of 6 meters, Neer Kund offers a net holding capacity of 3800 m³.



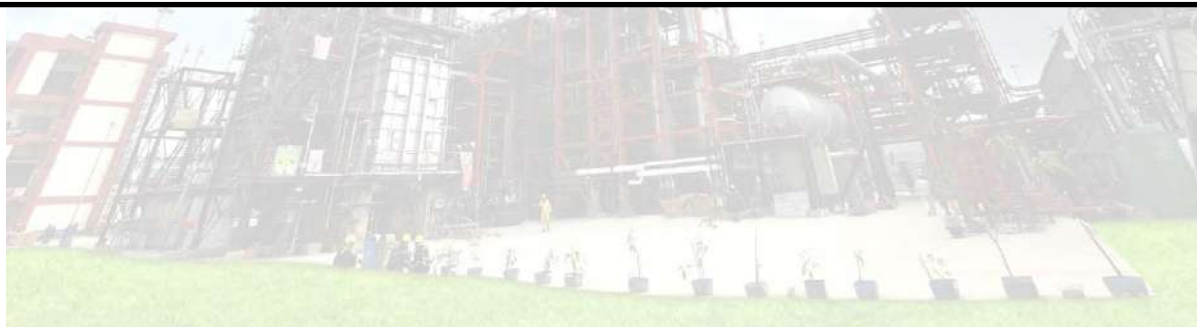
Flagging off Ambient Air Quality Monitoring Van in presence of WBPCB

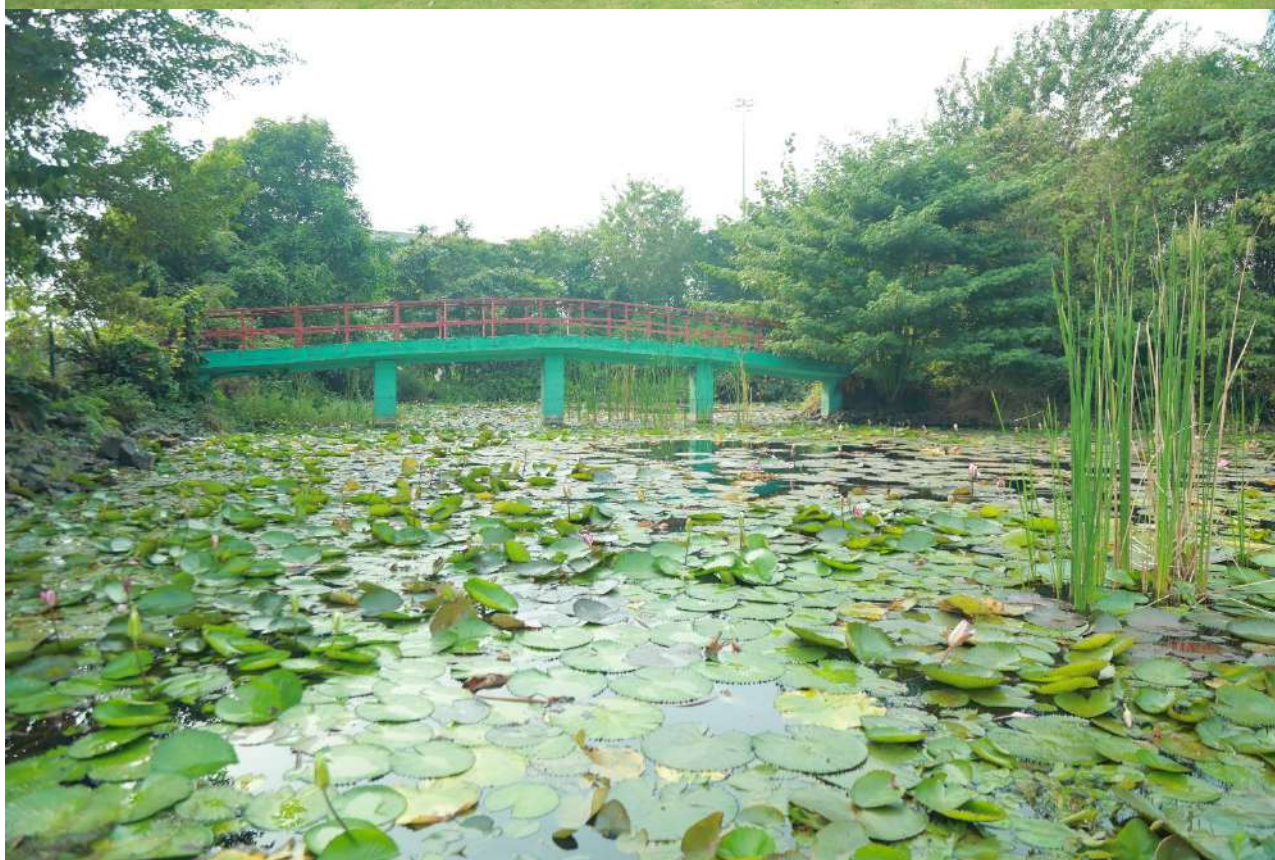


Ambient Air Quality Monitoring Van



Continuous Ambient Air Quality Monitoring Stations (CAAQMS) installed inside the refinery





Ecological Butterfly Park: A dedicated biodiversity zone encompassing 3,728 sq. m (0.921 acre) developed inside Refinery

IOCL HALDIA	Monthly Report of Ambient Air Quality at Haldia Refinery for APRIL 2025	Page 1 of 7

TABLE - 1 A : Ambient Air Quality Results

MONITORING LOCATION : IOCL MAIN GATE

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.04.25	04.04.25	07.04.25	10.04.25	15.04.25	17.04.25	21.04.25	24.04.25	29.04.25	Max	Min	Avg.
IOCL MAIN GATE	PM ₁₀	µg/m ³	9	100	62	57	63	68	56	52	61	55	51	68	51	58.33
	PM _{2.5}	µg/m ³	9	60	32	26	30	35	27	28	31	26	24	35	24	28.78
	SO ₂	µg/m ³	9	80	19	17	20	22	17	15	20	18	16	22	15	18.22
	NO ₂	µg/m ³	9	80	40	38	44	41	36	41	45	39	35	45	35	39.89
	Ozone	µg/m ³	9	100 (8 hrs)	27	26	28	25	27	24	28	24	25	28	24	26.00
	Lead (Pb)	µg/m ³	9	1	0.09	0.07	0.08	0.09	0.07	0.07	0.08	0.09	0.07	0.09	0.07	0.08
	CO	mg/m ³	9	2 (8 hrs)	1.1	0.8	1.1	1.2	0.9	0.8	1.2	1.1	1.0	1.2	0.8	1.02
	Ammonia(NH ₃)	µg/m ³	9	400	23	21	27	24	22	20	24	26	22	27	20	23.22
	Benzene	µg/m ³	9	5 (Annual)	2.2	2.4	1.9	2.0	2.5	1.8	2.9	2.3	2.2	2.9	1.8	2.24
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



TABLE - 1 B : Ambient Air Quality Results

MONITORING LOCATION : QUALITY CONTROL LAB

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.04.25	04.04.25	07.04.25	10.04.25	15.04.25	17.04.25	21.04.25	24.04.25	29.04.25	Max	Min	Avg.
QUALITY CONTROL LAB	PM ₁₀	µg/m ³	9	100	51	44	50	56	46	42	48	46	43	56	42	47.33
	PM _{2.5}	µg/m ³	9	60	24	23	23	29	26	21	26	23	22	29	21	24.11
	SO ₂	µg/m ³	9	80	16	13	14	17	14	12	16	15	13	17	12	14.44
	NO ₂	µg/m ³	9	80	32	30	35	33	30	33	35	32	30	35	30	32.22
	Ozone	µg/m ³	9	100 (8 hrs)	20	21	23	20	21	20	22	20	21	23	20	20.89
	Lead (Pb)	µg/m ³	9	1	0.05	BDL	0.06	0.05	0.06	BDL	0.06	0.05	BDL	0.06	0.05	0.06
	CO	mg/m ³	9	2 (8 hrs)	0.8	0.6	0.9	0.9	0.7	0.6	0.9	0.9	0.8	0.9	0.6	0.79
	Ammonia(NH ₃)	µg/m ³	9	400	21	20	22	20	21	BDL	22	21	BDL	22	20	21.00
	Benzene	µg/m ³	9	5 (Annual)	1.4	1.1	1.3	1.4	1.2	1.1	1.4	1.1	1.3	1.40	1.10	1.26
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 C : Ambient Air Quality Results

MONITORING LOCATION : OM & S BLOCK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.04.25	04.04.25	07.04.25	10.04.25	15.04.25	17.04.25	21.04.25	24.04.25	29.04.25	Max	Min	Avg.
OM & S BLOCK	PM ₁₀	µg/m ³	9	100	57	51	58	63	52	47	59	52	48	63	47	54.11
	PM _{2.5}	µg/m ³	9	60	32	27	30	29	28	26	29	25	23	32	23	27.67
	SO ₂	µg/m ³	9	80	18	15	16	19	16	14	20	15	17	20	14	16.67
	NO ₂	µg/m ³	9	80	38	35	41	37	35	39	43	41	36	43	35	38.33
	Ozone	µg/m ³	9	100 (8 hrs)	20	23	26	24	21	22	27	23	21	27	20	23.00
	Lead (Pb)	µg/m ³	9	1	0.07	0.06	0.08	0.05	0.07	0.07	0.08	0.06	0.06	0.08	0.05	0.07
	CO	mg/m ³	9	2 (8 hrs)	0.9	0.7	0.9	1.1	0.9	0.8	0.9	0.9	0.8	1.10	0.70	0.88
	Ammonia(NH ₃)	µg/m ³	9	400	24	22	25	21	20	23	24	25	22	25	20	22.89
	Benzene	µg/m ³	9	5 (Annual)	1.5	1.2	1.6	1.7	1.6	1.2	1.9	1.7	1.5	1.90	1.20	1.54
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 D : Ambient Air Quality Results

MONITORING LOCATION : BITUMEN FILLING STATION

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.04.25	04.04.25	07.04.25	10.04.25	15.04.25	17.04.25	21.04.25	24.04.25	29.04.25	Max	Min	Avg.
BITUMEN FILLING STATION	PM ₁₀	µg/m ³	9	100	46	44	49	54	45	41	47	42	39	54	39	45.22
	PM _{2.5}	µg/m ³	9	60	22	21	22	28	23	20	24	21	20	28	20	22.33
	SO ₂	µg/m ³	9	80	14	12	13	17	13	11	16	13	12	17	11	13.44
	NO ₂	µg/m ³	9	80	33	30	34	31	29	32	34	28	27	34	27	30.89
	Ozone	µg/m ³	9	100 (8 hrs)	20	20	22	20	21	20	21	22	21	22	20	20.78
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	0.06	BDL	0.05	BDL	0.05	0.05	BDL	0.06	0.05	0.05
	CO	mg/m ³	9	2 (8 hrs)	0.8	0.6	0.8	0.9	0.9	0.7	0.8	0.8	0.7	0.90	0.60	0.78
	Ammonia(NH ₃)	µg/m ³	9	400	20	BDL	22	23	20	BDL	21	BDL	BDL	23	20	21.20
	Benzene	µg/m ³	9	5 (Annual)	1.2	1.5	1.1	1.2	1.1	0.8	1.2	0.8	0.9	1.50	0.80	1.09
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 E : Ambient Air Quality Results

MONITORING LOCATION : TUBE WELL 4A, NEAR MCO TANK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.04.25	04.04.25	07.04.25	10.04.25	15.04.25	17.04.25	21.04.25	24.04.25	29.04.25	Max	Min	Avg.
TUBE WELL 4A, NEAR MCO TANK	PM ₁₀	µg/m ³	9	100	54	46	51	57	46	43	53	45	43	57	43	48.67
	PM _{2.5}	µg/m ³	9	60	28	24	25	29	24	21	25	23	24	29	21	24.78
	SO ₂	µg/m ³	9	80	17	14	15	18	14	12	18	13	13	18	12	14.89
	NO ₂	µg/m ³	9	80	33	32	36	34	29	35	39	31	30	39	29	33.22
	Ozone	µg/m ³	9	100 (8 hrs)	20	21	23	21	20	21	24	20	21	24	20	21.22
	Lead (Pb)	µg/m ³	9	1	0.06	0.05	0.06	0.06	0.05	0.05	0.06	0.05	0.05	0.06	0.05	0.05
	CO	mg/m ³	9	2 (8 hrs)	0.8	0.7	0.8	1.1	0.9	0.8	1.1	0.8	0.9	1.10	0.70	0.88
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	22	BDL	BDL	BDL	BDL	21	BDL	22	21	21.50
	Benzene	µg/m ³	9	5 (Annual)	1.6	1.4	1.2	1.5	1.6	1.2	1.5	1.4	1.1	1.60	1.10	1.39
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 F : Ambient Air Quality Results

MONITORING LOCATION : SECTOR – 21

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.04.25	04.04.25	07.04.25	10.04.25	15.04.25	17.04.25	21.04.25	24.04.25	29.04.25	Max	Min	Avg.
SECTOR - 21	PM ₁₀	µg/m ³	9	100	44	38	45	42	55	39	45	40	36	55	36	42.67
	PM _{2.5}	µg/m ³	9	60	22	21	22	19	28	20	25	21	19	28	19	21.89
	SO ₂	µg/m ³	9	80	5	5	4	4	7	4	6	4	4	7	4	4.78
	NO ₂	µg/m ³	9	80	24	23	27	24	27	27	28	24	22	28	22	25.11
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	22	BDL	20	BDL	BDL	22	20	21.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.7	0.5	0.8	0.8	0.7	0.6	0.9	0.6	0.6	0.90	0.50	0.69
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	0.8	BDL	0.9	BDL	BDL	BDL	BDL	0.90	0.80	0.85
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 G : Ambient Air Quality Results

MONITORING LOCATION : REFINERY HOSPITAL

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.04.25	04.04.25	07.04.25	10.04.25	15.04.25	17.04.25	21.04.25	24.04.25	29.04.25	Max	Min	Avg.
REFINERY HOSPITAL	PM ₁₀	µg/m ³	9	100	36	32	39	31	47	29	38	32	30	47	29	34.89
	PM _{2.5}	µg/m ³	9	60	19	15	19	16	24	14	19	15	17	24	14	17.56
	SO ₂	µg/m ³	9	80	4	BDL	4	BDL	5	BDL	5	BDL	BDL	5	4	4.50
	NO ₂	µg/m ³	9	80	21	22	27	21	25	23	27	23	21	27	21	23.33
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	20	BDL	21	BDL	22	BDL	BDL	22	20	21.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.6	0.5	0.7	0.5	0.6	0.4	0.7	0.6	0.6	0.70	0.40	0.58
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 A : Ambient Air Quality Results

MONITORING LOCATION : IOCL MAIN GATE

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					02.05.25	05.05.25	08.05.25	12.05.25	15.05.25	19.05.25	22.05.25	26.05.25	29.05.25	Max	Min	Avg.
IOCL MAIN GATE	PM ₁₀	µg/m ³	9	100	53	61	56	54	49	55	58	49	54	61	49	54.33
	PM _{2.5}	µg/m ³	9	60	25	32	30	29	24	26	28	25	27	32	24	27.33
	SO ₂	µg/m ³	9	80	16	19	18	17	15	18	19	15	17	19	15	17.11
	NO ₂	µg/m ³	9	80	34	39	37	32	30	36	39	32	34	39	30	34.78
	Ozone	µg/m ³	9	100 (8 hrs)	23	28	25	20	23	25	27	21	27	28	20	24.33
	Lead (Pb)	µg/m ³	9	1	0.06	0.09	0.07	0.06	0.05	0.07	0.07	0.06	0.07	0.09	0.05	0.07
	CO	mg/m ³	9	2 (8 hrs)	0.9	1.1	1.0	0.9	0.8	0.9	1.1	0.8	0.9	1.1	0.8	0.93
	Ammonia(NH ₃)	µg/m ³	9	400	20	22	24	22	BDL	21	23	BDL	21	24	20	21.86
	Benzene	µg/m ³	9	5 (Annual)	1.2	1.6	1.1	0.9	1.1	1.2	1.7	BDL	1.5	1.7	0.9	1.29
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Am Banerjee

TABLE - 1 B : Ambient Air Quality Results

MONITORING LOCATION : QUALITY CONTROL LAB

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					02.05.25	05.05.25	08.05.25	12.05.25	15.05.25	19.05.25	22.05.25	26.05.25	29.05.25	Max	Min	Avg.
QUALITY CONTROL LAB	PM ₁₀	µg/m ³	9	100	45	53	49	46	42	48	50	43	47	53	42	47.00
	PM _{2.5}	µg/m ³	9	60	24	25	23	22	19	24	26	23	22	26	19	23.11
	SO ₂	µg/m ³	9	80	13	16	14	13	12	15	16	13	14	16	12	14.00
	NO ₂	µg/m ³	9	80	28	33	30	27	25	30	32	27	28	33	25	28.89
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	24	20	BDL	BDL	21	22	BDL	22	24	20	21.80
	Lead (Pb)	µg/m ³	9	1	BDL	0.06	BDL	BDL	BDL	BDL	0.06	BDL	0.05	0.06	0.05	0.06
	CO	mg/m ³	9	2 (8 hrs)	0.7	0.9	0.8	0.7	0.6	0.7	0.8	0.7	0.7	0.9	0.6	0.73
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	0.9	1.2	0.8	BDL	BDL	0.9	1.3	BDL	BDL	1.30	0.80	1.02
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 C : Ambient Air Quality Results

MONITORING LOCATION : OM & S BLOCK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					02.05.25	05.05.25	08.05.25	12.05.25	15.05.25	19.05.25	22.05.25	26.05.25	29.05.25	Max	Min	Avg.
OM & S BLOCK	PM ₁₀	µg/m ³	9	100	50	57	54	51	47	52	56	47	51	57	47	51.67
	PM _{2.5}	µg/m ³	9	60	26	32	29	24	22	27	30	23	24	32	22	26.33
	SO ₂	µg/m ³	9	80	15	18	17	16	14	17	18	14	16	18	14	16.11
	NO ₂	µg/m ³	9	80	32	37	36	31	29	34	37	30	32	37	29	33.11
	Ozone	µg/m ³	9	100 (8 hrs)	22	26	24	21	22	24	26	BDL	26	26	21	23.88
	Lead (Pb)	µg/m ³	9	1	0.06	0.08	0.07	0.05	BDL	0.08	0.08	BDL	0.07	0.08	0.05	0.07
	CO	mg/m ³	9	2 (8 hrs)	0.8	1.1	0.9	0.8	0.7	0.9	1.1	0.7	0.9	1.10	0.70	0.88
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	21	23	BDL	BDL	20	22	21	20	23	20	21.17
	Benzene	µg/m ³	9	5 (Annual)	0.9	1.2	0.8	0.8	BDL	0.9	1.3	BDL	0.9	1.30	0.80	0.97
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Am Banerjee

TABLE - 1 D : Ambient Air Quality Results

MONITORING LOCATION : BITUMEN FILLING STATION

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					02.05.25	05.05.25	08.05.25	12.05.25	15.05.25	19.05.25	22.05.25	26.05.25	29.05.25	Max	Min	Avg.
BITUMEN FILLING STATION	PM ₁₀	µg/m ³	9	100	43	49	46	43	38	48	45	39	43	49	38	43.78
	PM _{2.5}	µg/m ³	9	60	21	24	26	24	19	23	24	20	20	26	19	22.33
	SO ₂	µg/m ³	9	80	12	15	14	12	9	14	11	10	12	15	9	12.11
	NO ₂	µg/m ³	9	80	26	30	28	24	22	29	28	24	26	30	22	26.33
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	22	20	BDL	BDL	21	20	BDL	20	22	20	20.60
	Lead (Pb)	µg/m ³	9	1	BDL	0.06	0.05	BDL	BDL	0.05	BDL	BDL	BDL	0.06	0.05	0.05
	CO	mg/m ³	9	2 (8 hrs)	0.7	0.8	0.8	0.6	0.6	0.8	0.9	0.6	0.6	0.90	0.60	0.71
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	0.9	BDL	BDL	BDL	BDL	0.8	BDL	0.8	0.90	0.80	0.83
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 E : Ambient Air Quality Results

MONITORING LOCATION : TUBE WELL 4A, NEAR MCO TANK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					02.05.25	05.05.25	08.05.25	12.05.25	15.05.25	19.05.25	22.05.25	26.05.25	29.05.25	Max	Min	Avg.
TUBE WELL 4A, NEAR MCO TANK	PM ₁₀	µg/m ³	9	100	47	54	50	46	43	48	52	44	48	54	43	48.00
	PM _{2.5}	µg/m ³	9	60	24	26	24	22	20	23	27	20	24	27	20	23.33
	SO ₂	µg/m ³	9	80	13	16	15	14	12	16	17	12	14	17	12	14.33
	NO ₂	µg/m ³	9	80	29	31	32	28	26	29	34	26	28	34	26	29.22
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	22	21	BDL	BDL	20	22	BDL	22	22	20	21.40
	Lead (Pb)	µg/m ³	9	1	BDL	0.06	0.05	BDL	BDL	0.05	0.07	BDL	BDL	0.07	0.05	0.06
	CO	mg/m ³	9	2 (8 hrs)	0.7	0.9	0.8	0.8	0.7	0.9	1.1	0.7	0.6	1.10	0.60	0.80
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	23	21	BDL	BDL	BDL	24	BDL	BDL	24	21	22.67
	Benzene	µg/m ³	9	5 (Annual)	BDL	1.0	0.8	BDL	0.8	BDL	1.2	BDL	1.0	1.20	0.80	0.96
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Am Banerjee

TABLE - 1 F : Ambient Air Quality Results

MONITORING LOCATION : SECTOR - 21

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					02.05.25	05.05.25	08.05.25	12.05.25	15.05.25	19.05.25	22.05.25	26.05.25	29.05.25	Max	Min	Avg.
SECTOR - 21	PM ₁₀	µg/m ³	9	100	42	45	41	44	38	42	45	39	44	45	38	42.22
	PM _{2.5}	µg/m ³	9	60	20	22	19	21	18	20	21	19	21	22	18	20.11
	SO ₂	µg/m ³	9	80	8	6	4	5	4	4	5	BDL	5	8	4	5.13
	NO ₂	µg/m ³	9	80	24	27	25	22	21	24	27	23	25	27	21	24.22
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	22	BDL	BDL	BDL	BDL	21	BDL	21	22	21	21.33
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.5	0.7	0.6	0.5	0.6	0.7	0.9	0.6	0.7	0.90	0.50	0.64
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Am Banerjee

TABLE - 1 G : Ambient Air Quality Results

MONITORING LOCATION : REFINERY HOSPITAL

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					02.05.25	05.05.25	08.05.25	12.05.25	15.05.25	19.05.25	22.05.25	26.05.25	29.05.25	Max	Min	Avg.
REFINERY HOSPITAL	PM ₁₀	µg/m ³	9	100	35	39	35	37	32	36	38	31	35	39	31	35.33
	PM _{2.5}	µg/m ³	9	60	18	20	18	17	16	18	19	15	16	20	15	17.44
	SO ₂	µg/m ³	9	80	4	5	BDL	4	BDL	5	BDL	BDL	BDL	5	4	4.50
	NO ₂	µg/m ³	9	80	19	24	22	20	19	22	23	19	21	24	19	21.00
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	21	BDL	BDL	BDL	BDL	BDL	BDL	BDL	21	21	21.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.6	0.60	0.50	0.56
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Am Banerjee

TABLE - 1 A : Ambient Air Quality Results

MONITORING LOCATION : IOCL MAIN GATE

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring								Monitored Value		
					02.06.25	05.06.25	09.06.25	12.06.25	16.06.25	19.06.25	23.06.25	26.06.25	Max	Min	Avg.
IOCL MAIN GATE	PM ₁₀	µg/m ³	8	100	48	54	58	51	46	43	52	41	58	41	49.13
	PM _{2.5}	µg/m ³	8	60	23	26	30	24	22	20	25	21	30	20	23.88
	SO ₂	µg/m ³	8	80	15	17	19	16	13	11	15	10	19	10	14.50
	NO ₂	µg/m ³	8	80	31	35	38	33	31	28	33	27	38	27	32.00
	Ozone	µg/m ³	8	100 (8 hrs)	21	25	26	22	BDL	BDL	23	BDL	26	21	23.40
	Lead (Pb)	µg/m ³	8	1	0.06	0.06	0.08	0.06	BDL	BDL	0.06	BDL	0.08	0.06	0.06
	CO	mg/m ³	8	2 (8 hrs)	0.8	1.1	1.2	0.9	0.8	0.7	1.0	0.7	1.2	0.7	0.90
	Ammonia(NH ₃)	µg/m ³	8	400	BDL	20	25	21	BDL	BDL	22	BDL	25	20	22.00
	Benzene	µg/m ³	8	5 (Annual)	BDL	0.9	0.8	BDL	BDL	BDL	0.7	BDL	0.9	0.7	0.80
	Benzo(a)Pyrene (BaP)	ng/m ³	8	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	8	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	8	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 B : Ambient Air Quality Results

MONITORING LOCATION : QUALITY CONTROL LAB

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring								Monitored Value		
					02.06.25	05.06.25	09.06.25	12.06.25	16.06.25	19.06.25	23.06.25	26.06.25	Max	Min	Avg.
QUALITY CONTROL LAB	PM ₁₀	µg/m ³	8	100	39	47	49	45	40	36	43	34	49	34	41.63
	PM _{2.5}	µg/m ³	8	60	20	23	25	21	19	17	22	16	25	16	20.38
	SO ₂	µg/m ³	8	80	12	14	15	13	10	9	11	7	15	7	11.38
	NO ₂	µg/m ³	8	80	24	29	30	25	23	22	27	21	30	21	25.13
	Ozone	µg/m ³	8	100 (8 hrs)	BDL	20	21	BDL	BDL	BDL	BDL	BDL	21	20	20.50
	Lead (Pb)	µg/m ³	8	1	BDL	0.05	0.06	BDL	BDL	BDL	BDL	BDL	0.06	0.05	0.06
	CO	mg/m ³	8	2 (8 hrs)	0.6	0.8	0.9	0.8	0.6	0.6	0.8	0.5	0.9	0.5	0.70
	Ammonia(NH ₃)	µg/m ³	8	400	BDL	BDL	20	BDL	BDL	BDL	BDL	BDL	20	20	20.00
	Benzene	µg/m ³	8	5 (Annual)	BDL	BDL	0.4	BDL	BDL	BDL	BDL	BDL	0.40	0.40	0.40
	Benzo(a)Pyrene (BaP)	ng/m ³	8	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	8	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	8	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Ant Banerjee

TABLE - 1 C : Ambient Air Quality Results

MONITORING LOCATION : OM & S BLOCK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring								Monitored Value		
					02.06.25	05.06.25	09.06.25	12.06.25	16.06.25	19.06.25	23.06.25	26.06.25	Max	Min	Avg.
OM & S BLOCK	PM ₁₀	µg/m ³	8	100	46	51	54	49	44	41	48	39	54	39	46.50
	PM _{2.5}	µg/m ³	8	60	22	25	28	25	23	21	25	20	28	20	23.63
	SO ₂	µg/m ³	8	80	13	16	17	15	12	11	13	10	17	10	13.38
	NO ₂	µg/m ³	8	80	29	33	35	29	27	25	32	26	35	25	29.50
	Ozone	µg/m ³	8	100 (8 hrs)	20	21	24	BDL	BDL	BDL	22	BDL	24	20	21.75
	Lead (Pb)	µg/m ³	8	1	BDL	0.06	0.07	0.06	0.05	BDL	0.06	BDL	0.07	0.05	0.06
	CO	mg/m ³	8	2 (8 hrs)	0.8	0.9	1.1	0.8	0.7	0.7	0.8	0.7	1.10	0.70	0.81
	Ammonia(NH ₃)	µg/m ³	8	400	BDL	BDL	23	20	BDL	BDL	20	BDL	23	20	21.00
	Benzene	µg/m ³	8	5 (Annual)	BDL	0.8	0.9	BDL	BDL	BDL	0.5	BDL	0.90	0.50	0.73
	Benzo(a)Pyrene (BaP)	ng/m ³	8	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	8	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	8	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 D : Ambient Air Quality Results

MONITORING LOCATION : BITUMEN FILLING STATION

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring								Monitored Value		
					02.06.25	05.06.25	09.06.25	12.06.25	16.06.25	19.06.25	23.06.25	26.06.25	Max	Min	Avg.
BITUMEN FILLING STATION	PM ₁₀	µg/m ³	8	100	39	44	46	40	37	34	41	32	46	32	39.13
	PM _{2.5}	µg/m ³	8	60	19	21	22	20	18	16	19	15	22	15	18.75
	SO ₂	µg/m ³	8	80	11	13	14	12	9	8	11	6	14	6	10.50
	NO ₂	µg/m ³	8	80	24	27	31	28	23	21	26	20	31	20	25.00
	Ozone	µg/m ³	8	100 (8 hrs)	BDL	20	21	BDL	BDL	BDL	20	BDL	21	20	20.33
	Lead (Pb)	µg/m ³	8	1	BDL	0.05	0.05	BDL	BDL	BDL	BDL	BDL	0.05	0.05	0.05
	CO	mg/m ³	8	2 (8 hrs)	0.6	0.7	0.9	0.8	0.6	0.6	0.8	0.5	0.90	0.50	0.69
	Ammonia(NH ₃)	µg/m ³	8	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzene	µg/m ³	8	5 (Annual)	BDL	BDL	0.5	BDL	BDL	BDL	BDL	BDL	0.50	0.50	0.50
	Benzo(a)Pyrene (BaP)	ng/m ³	8	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	8	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	8	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 E : Ambient Air Quality Results

MONITORING LOCATION : TUBE WELL 4A, NEAR MCO TANK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring								Monitored Value		
					02.06.25	05.06.25	09.06.25	12.06.25	16.06.25	19.06.25	23.06.25	26.06.25	Max	Min	Avg.
TUBE WELL 4A, NEAR MCO TANK	PM ₁₀	µg/m ³	8	100	43	48	52	45	41	37	45	34	52	34	43.13
	PM _{2.5}	µg/m ³	8	60	20	22	25	23	21	18	21	16	25	16	20.75
	SO ₂	µg/m ³	8	80	12	14	16	13	10	9	13	7	16	7	11.75
	NO ₂	µg/m ³	8	80	27	31	33	29	25	23	29	21	33	21	27.25
	Ozone	µg/m ³	8	100 (8 hrs)	BDL	21	23	BDL	BDL	BDL	20	BDL	23	20	21.33
	Lead (Pb)	µg/m ³	8	1	BDL	0.05	0.06	BDL	BDL	BDL	BDL	BDL	0.06	0.05	0.06
	CO	mg/m ³	8	2 (8 hrs)	0.7	0.9	0.9	0.8	0.6	0.7	0.9	0.7	0.90	0.60	0.78
	Ammonia(NH ₃)	µg/m ³	8	400	BDL	BDL	21	20	BDL	BDL	BDL	BDL	21	20	20.50
	Benzene	µg/m ³	8	5 (Annual)	BDL	0.5	0.6	BDL	BDL	BDL	0.5	BDL	0.60	0.50	0.53
	Benzo(a)Pyrene (BaP)	ng/m ³	8	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	8	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	8	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 F : Ambient Air Quality Results

MONITORING LOCATION : SECTOR - 21

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring								Monitored Value		
					02.06.25	05.06.25	09.06.25	12.06.25	16.06.25	19.06.25	23.06.25	26.06.25	Max	Min	Avg.
SECTOR - 21	PM ₁₀	µg/m ³	8	100	40	43	46	38	34	36	40	33	46	33	38.75
	PM _{2.5}	µg/m ³	8	60	18	21	24	17	15	17	19	15	24	15	18.25
	SO ₂	µg/m ³	8	80	6	7	7	5	BDL	BDL	5	BDL	7	5	6.00
	NO ₂	µg/m ³	8	80	22	27	25	23	18	21	25	20	27	18	22.63
	Ozone	µg/m ³	8	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Lead (Pb)	µg/m ³	8	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	8	2 (8 hrs)	0.5	0.7	0.6	0.6	0.5	0.5	0.7	0.5	0.70	0.50	0.58
	Ammonia(NH ₃)	µg/m ³	8	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzene	µg/m ³	8	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	8	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	8	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	8	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 G : Ambient Air Quality Results

MONITORING LOCATION : REFINERY HOSPITAL

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring								Monitored Value		
					02.06.25	05.06.25	09.06.25	12.06.25	16.06.25	19.06.25	23.06.25	26.06.25	Max	Min	Avg.
REFINERY HOSPITAL	PM ₁₀	µg/m ³	8	100	31	34	38	32	30	27	33	28	38	27	31.63
	PM _{2.5}	µg/m ³	8	60	15	16	18	15	14	12	16	13	18	12	14.88
	SO ₂	µg/m ³	8	80	BDL	BDL	4	BDL	BDL	BDL	BDL	BDL	4	4	4.00
	NO ₂	µg/m ³	8	80	19	23	26	22	17	18	21	17	26	17	20.38
	Ozone	µg/m ³	8	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	#DIV/0!
	Lead (Pb)	µg/m ³	8	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	#DIV/0!
	CO	mg/m ³	8	2 (8 hrs)	0.5	0.6	0.7	0.6	0.4	0.5	0.6	0.5	0.70	0.40	0.55
	Ammonia(NH ₃)	µg/m ³	8	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	#DIV/0!
	Benzene	µg/m ³	8	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	#DIV/0!
	Benzo(a)Pyrene (BaP)	ng/m ³	8	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	#DIV/0!
	Arsenic(As)	ng/m ³	8	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	#DIV/0!
	Nickel (Ni)	ng/m ³	8	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	#DIV/0!

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 A : Ambient Air Quality Results

MONITORING LOCATION : IOCL MAIN GATE

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.07.25	04.07.25	07.07.25	10.07.25	14.07.25	17.07.25	21.07.25	24.07.25	28.07.25	Max	Min	Avg.
IOCL MAIN GATE	PM ₁₀	µg/m ³	9	100	44	51	49	53	42	40	49	44	39	53	39	45.67
	PM _{2.5}	µg/m ³	9	60	23	26	24	27	23	21	25	23	19	27	19	23.44
	SO ₂	µg/m ³	9	80	14	16	16	17	12	10	14	11	12	17	10	13.56
	NO ₂	µg/m ³	9	80	28	33	32	34	28	26	31	29	24	34	24	29.44
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	24	22	23	BDL	BDL	22	21	BDL	24	21	22.40
	Lead (Pb)	µg/m ³	9	1	0.05	0.06	0.05	0.07	0.05	BDL	0.06	0.06	BDL	0.07	0.05	0.06
	CO	mg/m ³	9	2 (8 hrs)	0.8	1.1	0.8	1.1	0.9	0.8	0.9	0.9	0.6	1.1	0.6	0.88
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	21	20	23	BDL	20	22	22	BDL	23	20	21.33
	Benzene	µg/m ³	9	5 (Annual)	0.7	0.9	0.6	0.9	0.6	BDL	0.9	0.5	BDL	0.9	0.5	0.73
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature of Anirban Banerjee

TABLE - 1 B : Ambient Air Quality Results

MONITORING LOCATION : QUALITY CONTROL LAB

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.07.25	04.07.25	07.07.25	10.07.25	14.07.25	17.07.25	21.07.25	24.07.25	28.07.25	Max	Min	Avg.
QUALITY CONTROL LAB	PM ₁₀	µg/m ³	9	100	36	39	37	45	39	32	38	34	30	45	30	36.67
	PM _{2.5}	µg/m ³	9	60	18	20	19	21	18	16	19	16	15	21	15	18.00
	SO ₂	µg/m ³	9	80	11	12	10	14	12	8	11	9	8	14	8	10.56
	NO ₂	µg/m ³	9	80	23	25	24	28	26	21	24	23	19	28	19	23.67
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	0.05	BDL	BDL	BDL	BDL	BDL	0.05	0.05	0.05
	CO	mg/m ³	9	2 (8 hrs)	0.6	0.8	0.6	0.8	0.5	0.6	0.8	0.7	0.5	0.8	0.5	0.66
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 C : Ambient Air Quality Results

MONITORING LOCATION : OM & S BLOCK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.07.25	04.07.25	07.07.25	10.07.25	14.07.25	17.07.25	21.07.25	24.07.25	28.07.25	Max	Min	Avg.
OM & S BLOCK	PM ₁₀	µg/m ³	9	100	41	45	43	49	40	37	46	42	37	49	37	42.22
	PM _{2.5}	µg/m ³	9	60	20	23	21	24	20	18	23	21	18	24	18	20.89
	SO ₂	µg/m ³	9	80	13	14	15	16	11	9	13	10	9	16	9	12.22
	NO ₂	µg/m ³	9	80	26	31	29	32	27	24	29	28	23	32	23	27.67
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	21	20	21	BDL	BDL	20	21	BDL	21	20	20.60
	Lead (Pb)	µg/m ³	9	1	0.05	0.07	0.05	0.08	0.05	BDL	0.07	0.06	BDL	0.08	0.05	0.06
	CO	mg/m ³	9	2 (8 hrs)	0.8	0.9	0.7	0.8	0.6	0.7	0.8	0.9	0.6	0.90	0.60	0.76
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	21	BDL	BDL	20	22	BDL	22	20	21.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	0.5	BDL	0.6	BDL	BDL	0.5	BDL	BDL	0.60	0.50	0.53
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 D : Ambient Air Quality Results

MONITORING LOCATION : BITUMEN FILLING STATION

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.07.25	04.07.25	07.07.25	10.07.25	14.07.25	17.07.25	21.07.25	24.07.25	28.07.25	Max	Min	Avg.
BITUMEN FILLING STATION	PM ₁₀	µg/m ³	9	100	34	38	36	39	33	30	37	33	29	39	29	34.33
	PM _{2.5}	µg/m ³	9	60	17	20	18	20	16	15	19	17	15	20	15	17.44
	SO ₂	µg/m ³	9	80	10	13	11	12	9	7	11	8	9	13	7	10.00
	NO ₂	µg/m ³	9	80	22	26	24	25	22	19	23	21	18	26	18	22.22
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.6	0.7	0.6	0.7	0.6	0.8	0.7	0.7	0.5	0.80	0.50	0.66
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 E : Ambient Air Quality Results

MONITORING LOCATION : TUBE WELL 4A, NEAR MCO TANK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.07.25	04.07.25	07.07.25	10.07.25	14.07.25	17.07.25	21.07.25	24.07.25	28.07.25	Max	Min	Avg.
TUBE WELL 4A, NEAR MCO TANK	PM ₁₀	µg/m ³	9	100	37	45	37	43	34	32	36	38	31	45	31	37.00
	PM _{2.5}	µg/m ³	9	60	18	22	18	22	17	15	20	18	15	22	15	18.33
	SO ₂	µg/m ³	9	80	12	13	11	14	10	8	11	9	10	14	8	10.89
	NO ₂	µg/m ³	9	80	23	28	25	29	24	21	24	25	19	29	19	24.22
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.7	0.8	0.5	0.7	0.8	0.8	0.7	0.8	0.5	0.80	0.50	0.70
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature of Anirban Banerjee

TABLE - 1 F : Ambient Air Quality Results

MONITORING LOCATION : SECTOR – 21

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.07.25	04.07.25	07.07.25	10.07.25	14.07.25	17.07.25	21.07.25	24.07.25	28.07.25	Max	Min	Avg.
SECTOR - 21	PM ₁₀	µg/m ³	9	100	30	37	34	40	31	29	33	31	28	40	28	32.56
	PM _{2.5}	µg/m ³	9	60	15	18	16	19	15	14	18	16	15	19	14	16.22
	SO ₂	µg/m ³	9	80	BDL	5	BDL	5	BDL	BDL	4	BDL	BDL	5	4	4.67
	NO ₂	µg/m ³	9	80	19	22	21	23	20	18	20	21	17	23	17	20.11
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.5	0.7	0.6	0.7	0.6	0.7	0.6	0.5	0.5	0.70	0.50	0.60
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 G : Ambient Air Quality Results

MONITORING LOCATION : REFINERY HOSPITAL

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.07.25	04.07.25	07.07.25	10.07.25	14.07.25	17.07.25	21.07.25	24.07.25	28.07.25	Max	Min	Avg.
REFINERY HOSPITAL	PM ₁₀	µg/m ³	9	100	29	32	30	36	28	26	30	28	26	36	26	29.44
	PM _{2.5}	µg/m ³	9	60	15	17	14	19	13	14	16	15	13	19	13	15.11
	SO ₂	µg/m ³	9	80	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	NO ₂	µg/m ³	9	80	17	21	19	23	18	17	20	19	16	23	16	18.89
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.5	0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.4	0.50	0.40	0.43
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature of Anirban Banerjee

TABLE - 1 A : Ambient Air Quality Results

MONITORING LOCATION : IOCL MAIN GATE

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.08.25	04.08.25	07.08.25	11.08.25	13.08.25	18.08.25	21.08.25	25.08.25	28.08.25	Max	Min	Avg.
IOCL MAIN GATE	PM ₁₀	µg/m ³	9	100	45	49	41	47	42	40	48	39	44	49	39	43.89
	PM _{2.5}	µg/m ³	9	60	22	25	20	24	21	19	23	20	21	25	19	21.67
	SO ₂	µg/m ³	9	80	14	15	13	15	12	10	14	11	14	15	10	13.11
	NO ₂	µg/m ³	9	80	29	32	27	31	28	26	30	25	28	32	25	28.44
	Ozone	µg/m ³	9	100 (8 hrs)	20	23	BDL	20	BDL	BDL	21	BDL	22	23	20	21.20
	Lead (Pb)	µg/m ³	9	1	0.05	0.06	BDL	0.06	0.05	0.05	0.06	0.05	BDL	0.06	0.05	0.05
	CO	mg/m ³	9	2 (8 hrs)	0.8	1.0	0.7	0.8	0.7	0.8	0.9	0.7	0.7	1.0	0.7	0.79
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	20	BDL	20	BDL	20	21	20	BDL	21	20	20.20
	Benzene	µg/m ³	9	5 (Annual)	0.7	0.9	0.7	0.8	0.8	0.7	1.0	0.9	0.8	1.0	0.7	0.81
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 B : Ambient Air Quality Results

MONITORING LOCATION : QUALITY CONTROL LAB

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.08.25	04.08.25	07.08.25	11.08.25	13.08.25	18.08.25	21.08.25	25.08.25	28.08.25	Max	Min	Avg.
QUALITY CONTROL LAB	PM ₁₀	µg/m ³	9	100	36	39	32	37	33	31	38	30	35	39	30	34.56
	PM _{2.5}	µg/m ³	9	60	17	19	15	19	17	15	17	14	17	19	14	16.67
	SO ₂	µg/m ³	9	80	11	12	10	12	9	8	11	7	11	12	7	10.11
	NO ₂	µg/m ³	9	80	23	25	21	24	22	21	24	20	22	25	20	22.44
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.6	0.8	0.6	0.7	0.6	0.6	0.8	0.5	0.6	0.8	0.5	0.64
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	0.5	0.6	BDL	0.6	BDL	0.5	0.7	0.5	0.6	0.70	0.50	0.57
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 C : Ambient Air Quality Results

MONITORING LOCATION : OM & S BLOCK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.08.25	04.08.25	07.08.25	11.08.25	13.08.25	18.08.25	21.08.25	25.08.25	28.08.25	Max	Min	Avg.
OM & S BLOCK	PM ₁₀	µg/m ³	9	100	41	46	39	44	40	38	45	41	38	46	38	41.33
	PM _{2.5}	µg/m ³	9	60	20	23	19	24	21	19	22	20	18	24	18	20.67
	SO ₂	µg/m ³	9	80	13	14	12	14	11	9	13	13	9	14	9	12.00
	NO ₂	µg/m ³	9	80	27	30	25	29	27	24	28	26	24	30	24	26.67
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	22	BDL	BDL	BDL	BDL	20	21	BDL	22	20	21.00
	Lead (Pb)	µg/m ³	9	1	0.05	0.06	BDL	0.06	0.05	0.05	0.06	BDL	0.05	0.06	0.05	0.05
	CO	mg/m ³	9	2 (8 hrs)	0.7	0.9	0.7	0.8	0.7	0.8	0.9	0.7	0.7	0.90	0.70	0.77
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	20	BDL	BDL	20	20	20.00
	Benzene	µg/m ³	9	5 (Annual)	0.7	0.9	0.6	0.8	0.9	0.7	0.8	0.6	0.6	0.90	0.60	0.73
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 D : Ambient Air Quality Results

MONITORING LOCATION : BITUMEN FILLING STATION

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.08.25	04.08.25	07.08.25	11.08.25	13.08.25	18.08.25	21.08.25	25.08.25	28.08.25	Max	Min	Avg.
BITUMEN FILLING STATION	PM ₁₀	µg/m ³	9	100	32	38	32	35	33	30	35	28	32	38	28	32.78
	PM _{2.5}	µg/m ³	9	60	15	18	15	17	16	14	17	13	15	18	13	15.56
	SO ₂	µg/m ³	9	80	8	11	9	11	9	7	9	7	9	11	7	8.89
	NO ₂	µg/m ³	9	80	21	25	20	23	21	19	22	19	20	25	19	21.11
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.5	0.7	0.6	0.6	0.7	0.8	0.9	0.5	0.5	0.90	0.50	0.64
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	0.6	BDL	BDL	BDL	BDL	0.5	BDL	0.5	0.60	0.50	0.53
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature of Anurag Banerjee

TABLE - 1 E : Ambient Air Quality Results

MONITORING LOCATION : TUBE WELL 4A, NEAR MCO TANK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.08.25	04.08.25	07.08.25	11.08.25	13.08.25	18.08.25	21.08.25	25.08.25	28.08.25	Max	Min	Avg.
TUBE WELL 4A, NEAR MCO TANK	PM ₁₀	µg/m ³	9	100	39	43	35	41	36	33	38	31	35	43	31	36.78
	PM _{2.5}	µg/m ³	9	60	19	21	16	20	17	15	17	15	16	21	15	17.33
	SO ₂	µg/m ³	9	80	10	13	10	12	9	8	11	8	11	13	8	10.22
	NO ₂	µg/m ³	9	80	23	28	22	26	23	21	24	21	22	28	21	23.33
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	20	BDL	BDL	BDL	BDL	BDL	BDL	BDL	20	20	20.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.6	0.8	0.7	0.7	0.8	0.9	0.9	0.6	0.5	0.90	0.50	0.72
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	0.7	BDL	BDL	BDL	BDL	0.5	BDL	0.5	0.70	0.50	0.57
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 F : Ambient Air Quality Results

MONITORING LOCATION : SECTOR – 21

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.08.25	04.08.25	07.08.25	11.08.25	13.08.25	18.08.25	21.08.25	25.08.25	28.08.25	Max	Min	Avg.
SECTOR - 21	PM ₁₀	µg/m ³	9	100	32	38	31	33	30	27	33	27	31	38	27	31.33
	PM _{2.5}	µg/m ³	9	60	15	18	14	16	14	13	17	14	15	18	13	15.11
	SO ₂	µg/m ³	9	80	5	6	5	5	4	BDL	5	BDL	4	6	4	4.86
	NO ₂	µg/m ³	9	80	19	23	20	24	21	19	24	18	21	24	18	21.00
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.5	0.7	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.70	0.50	0.54
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Amr Banerjee

TABLE - 1 G : Ambient Air Quality Results

MONITORING LOCATION : REFINERY HOSPITAL

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring									Monitored Value		
					01.08.25	04.08.25	07.08.25	11.08.25	13.08.25	18.08.25	21.08.25	25.08.25	28.08.25	Max	Min	Avg.
REFINERY HOSPITAL	PM ₁₀	µg/m ³	9	100	29	33	27	31	25	27	32	28	30	33	25	29.11
	PM _{2.5}	µg/m ³	9	60	14	16	13	16	12	13	16	13	16	16	12	14.33
	SO ₂	µg/m ³	9	80	BDL	4	BDL	4	BDL	BDL	BDL	BDL	BDL	4	4	4.00
	NO ₂	µg/m ³	9	80	17	21	17	20	17	20	21	19	18	21	17	18.89
	Ozone	µg/m ³	9	100 (8 hrs)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	9	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	9	2 (8 hrs)	0.4	0.5	0.4	0.5	0.4	0.4	0.5	0.4	0.5	0.50	0.40	0.44
	Ammonia(NH ₃)	µg/m ³	9	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	9	5 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	9	1 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	9	6 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	9	20 (Annual)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 A : Ambient Air Quality Results

MONITORING LOCATION : IOCL MAIN GATE

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring			Monitored Value		
					01.09.25	04.09.25	08.09.25	Max	Min	Avg.
IOCL MAIN GATE	PM ₁₀	µg/m ³	3	100	49	41	52	52	41	47.33
	PM _{2.5}	µg/m ³	3	60	25	21	29	29	21	25.00
	SO ₂	µg/m ³	3	80	23	15	18	23	15	18.67
	NO ₂	µg/m ³	3	80	30	25	29	30	25	28.00
	Ozone	µg/m ³	3	100 (8 hrs)	23	BDL	24	24	23	23.50
	Lead (Pb)	µg/m ³	3	1	0.08	0.06	0.09	0.09	0.06	0.08
	CO	mg/m ³	3	2 (8 hrs)	0.8	0.7	0.8	0.8	0.7	0.77
	Ammonia(NH ₃)	µg/m ³	3	400	22	BDL	26	26	22	24.00
	Benzene	µg/m ³	3	5 (Annual)	0.8	0.5	0.7	0.8	0.5	0.67
	Benzo(a)Pyrene (BaP)	ng/m ³	3	1 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	3	6 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	3	20 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 B : Ambient Air Quality Results

MONITORING LOCATION : QUALITY CONTROL LAB

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring			Monitored Value		
					01.09.25	04.09.25	08.09.25	Max	Min	Avg.
QUALITY CONTROL LAB	PM ₁₀	µg/m ³	3	100	43	35	41	43	35	39.67
	PM _{2.5}	µg/m ³	3	60	22	17	20	22	17	19.67
	SO ₂	µg/m ³	3	80	19	12	15	19	12	15.33
	NO ₂	µg/m ³	3	80	25	20	24	25	20	23.00
	Ozone	µg/m ³	3	100 (8 hrs)	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	3	1	0.06	BDL	0.08	0.08	0.06	0.07
	CO	mg/m ³	3	2 (8 hrs)	0.7	0.5	0.6	0.7	0.5	0.60
	Ammonia(NH ₃)	µg/m ³	3	400	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	3	5 (Annual)	BDL	BDL	0.5	0.50	0.50	0.50
	Benzo(a)Pyrene (BaP)	ng/m ³	3	1 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	3	6 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	3	20 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 C : Ambient Air Quality Results

MONITORING LOCATION : OM & S BLOCK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring			Monitored Value		
					01.09.25	04.09.25	08.09.25	Max	Min	Avg.
OM & S BLOCK	PM ₁₀	µg/m ³	3	100	45	39	48	48	39	44.00
	PM _{2.5}	µg/m ³	3	60	24	21	27	27	21	24.00
	SO ₂	µg/m ³	3	80	21	14	17	21	14	17.33
	NO ₂	µg/m ³	3	80	28	24	27	28	24	26.33
	Ozone	µg/m ³	3	100 (8 hrs)	21	BDL	22	22	21	21.50
	Lead (Pb)	µg/m ³	3	1	0.07	BDL	0.10	0.10	0.07	0.09
	CO	mg/m ³	3	2 (8 hrs)	0.7	0.6	0.8	0.80	0.60	0.70
	Ammonia(NH ₃)	µg/m ³	3	400	BDL	BDL	24	24	24	24.00
	Benzene	µg/m ³	3	5 (Annual)	0.5	BDL	0.5	0.50	0.50	0.50
	Benzo(a)Pyrene (BaP)	ng/m ³	3	1 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	3	6 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	3	20 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 D : Ambient Air Quality Results

MONITORING LOCATION : BITUMEN FILLING STATION

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring			Monitored Value		
					01.09.25	04.09.25	08.09.25	Max	Min	Avg.
BITUMEN FILLING STATION	PM ₁₀	µg/m ³	3	100	38	32	41	41	32	37.00
	PM _{2.5}	µg/m ³	3	60	19	15	22	22	15	18.67
	SO ₂	µg/m ³	3	80	17	12	14	17	12	14.33
	NO ₂	µg/m ³	3	80	23	20	25	25	20	22.67
	Ozone	µg/m ³	3	100 (8 hrs)	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	3	1	0.05	BDL	0.08	0.08	0.05	0.07
	CO	mg/m ³	3	2 (8 hrs)	0.6	0.4	0.6	0.60	0.40	0.53
	Ammonia(NH ₃)	µg/m ³	3	400	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	3	5 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	3	1 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	3	6 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	3	20 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 E : Ambient Air Quality Results

MONITORING LOCATION : TUBE WELL 4A, NEAR MCO TANK

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring			Monitored Value		
					01.09.25	04.09.25	08.09.25	Max	Min	Avg.
TUBE WELL 4A, NEAR MCO TANK	PM ₁₀	µg/m ³	3	100	41	35	43	43	35	39.67
	PM _{2.5}	µg/m ³	3	60	21	17	22	22	17	20.00
	SO ₂	µg/m ³	3	80	20	13	15	20	13	16.00
	NO ₂	µg/m ³	3	80	25	22	24	25	22	23.67
	Ozone	µg/m ³	3	100 (8 hrs)	BDL	BDL	20	20	20	20.00
	Lead (Pb)	µg/m ³	3	1	BDL	BDL	0.07	0.07	0.07	0.07
	CO	mg/m ³	3	2 (8 hrs)	0.7	0.5	0.6	0.70	0.50	0.60
	Ammonia(NH ₃)	µg/m ³	3	400	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	3	5 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	3	1 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	3	6 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	3	20 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 F : Ambient Air Quality Results

MONITORING LOCATION : SECTOR – 21

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring			Monitored Value		
					01.09.25	04.09.25	08.09.25	Max	Min	Avg.
SECTOR - 21	PM ₁₀	µg/m ³	3	100	34	29	37	37	29	33.33
	PM _{2.5}	µg/m ³	3	60	19	14	18	19	14	17.00
	SO ₂	µg/m ³	3	80	BDL	BDL	4	4	4	4.00
	NO ₂	µg/m ³	3	80	21	18	22	22	18	20.33
	Ozone	µg/m ³	3	100 (8 hrs)	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	3	1	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	3	2 (8 hrs)	0.5	0.4	0.6	0.60	0.40	0.50
	Ammonia(NH ₃)	µg/m ³	3	400	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	3	5 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	3	1 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic(As)	ng/m ³	3	6 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	3	20 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

TABLE - 1 G : Ambient Air Quality Results

MONITORING LOCATION : REFINERY HOSPITAL

Location	Pollutants Monitored	Unit	No. of Samples analysed	Statutory Stipulation (24 Hrly)	Date of Monitoring			Monitored Value		
					01.09.25	04.09.25	08.09.25	Max	Min	Avg.
REFINERY HOSPITAL	PM ₁₀	µg/m ³	3	100	31	25	30	31	25	28.67
	PM _{2.5}	µg/m ³	3	60	17	12	14	17	12	14.33
	SO ₂	µg/m ³	3	80	BDL	BDL	BDL	0	0	0.00
	NO ₂	µg/m ³	3	80	18	14	17	18	14	16.33
	Ozone	µg/m ³	3	100 (8 hrs)	BDL	BDL	BDL	0	0	0.00
	Lead (Pb)	µg/m ³	3	1	BDL	BDL	BDL	0.00	0.00	0.00
	CO	mg/m ³	3	2 (8 hrs)	0.4	0.3	0.5	0.50	0.30	0.40
	Ammonia(NH ₃)	µg/m ³	3	400	BDL	BDL	BDL	0	0	0.00
	Benzene	µg/m ³	3	5 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Benzo(a)Pyrene (BaP)	ng/m ³	3	1 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Arsenic (As)	ng/m ³	3	6 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00
	Nickel (Ni)	ng/m ³	3	20 (Annual)	BDL	BDL	BDL	0.00	0.00	0.00

N.B.- * BDL- Below Detectable Limit



Signature

Annexure-2

Annexure-2

Average Final Treated Effluent Discharge Quality- Monthwise Inhouse QC anaysis report

Test Parameters	UOM	MINAS limits	April'2025	May'2025	June'2025	July'2025	Aug'2025	Sept'2025
pH	-	6-8.5	7.52	7.27	7.23	7.40	7.39	7.51
Phenol	ppm	0.35 ppm	0.263	0.271	0.266	0.270	0.252	0.254
Sulphide	ppm	0.5 ppm	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Oil Cont	ppm	5.0 ppm	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TSS	ppm	20 ppm	7.56	8.23	8.40	8.41	8.96	8.92
COD	ppm	125 ppm	83.68	90.92	83.36	65.93	79.36	70.77
BOD	ppm	15 ppm	5.46	7.39	6.79	4.73	6.27	4.49
CN	ppm	0.2 ppm	0.0397	0.0219	0.0259	0.0250	0.0244	0.0692
NH3	ppm	15 ppm	1.920	1.538	3.000	3.148	3.880	4.754
PO4	ppm	3 ppm	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003149
 Date: :23.04.2025
 Sample No. MSKGL/ED/2025-26/04/00269
 Sample Description : Ground Water
 Sampling Location : TW-9
 Sample Drawn on : 04.04.2025

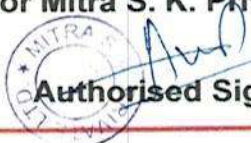
Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	7.72	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	<1.0	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	1370	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	94.8	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	680	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.52	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	27.97	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	1.02	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	8.98	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	351	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	<0.02	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	240	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002927
Date: :10.06.2025
Sample No. MSKGL/ED/2025-26/05/01313
Sample Description : Ground Water
Sampling Location : TW-9
Sample Drawn on : 21.05..2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25 °C	---	7.22	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	20	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	980	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	93.75	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	550	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.38	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	1.96	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	33.23	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	0.20	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	2.5	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	20.5	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	370.38	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	0.06	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.01	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	200	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002928
Date: :10.06.2025
Sample No. MSKGL/ED/2025-26/05/01314
Sample Description : Ground Water
Sampling Location : TW-16
Sample Drawn on : 21.05..2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25°C	---	7.67	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	1.8	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	920	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	99.97	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	510	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.29	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	37.98	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	0.11	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	1.56	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.05	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	16.4	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	405.4	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.01	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	160	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	11	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 

Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002929
Date: 10.06.2025
Sample No. MSKGL/ED/2025-26/05/01602
Sample Description : Ground Water
Sampling Location : Cluster-17
Sample Drawn on : 24.05.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25°C	---	7.76	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	4.2	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	1160	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	87.33	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	460	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.40	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	33.49	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	0.11	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	0.81	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.05	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	66.2	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	355.4	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	2.23	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.01	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	360	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	33	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002930
Date: :10.06.2025
Sample No. MSKGL/ED/2025-26/05/01603
Sample Description : Ground Water
Sampling Location : Claster-10
Sample Drawn on : 24.05.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25°C	---	7.91	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	3.6	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	1160	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	0.71	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	39.88	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	480	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.29	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	28.61	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	0.08	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	0.84	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.05	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	62.1	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	217	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	1.98	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.01	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	380	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002931
 Date: : 10.06.2025
 Sample No. MSKGL/ED/2025-26/05/01604
 Sample Description : Ground Water
 Sampling Location : Mohona Market
 Sample Drawn on : 24.05.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25 °C	---	7.05	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	1.7	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	950	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	76.93	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	520	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.34	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	30.44	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	0.06	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	0.86	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.05	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	45.2	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	317	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	0.15	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.01	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	340	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	6.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002932
Date: :10.06.2025
Sample No. MSKGL/ED/2025-26/05/01708
Sample Description : Ground Water
Sampling Location : Padma Pukur, Township
Sample Drawn on : 27.05.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

Sl No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25 °C	---	7.70	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	6.9	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	892	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	78.79	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	280	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.38	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	32.75	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	1.42	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.05	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	30.8	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	331	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	340	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002933
Date: 10.06.2025
Sample No. MSKGL/ED/2025-26/05/01709
Sample Description : Ground Water
Sampling Location : Manjushree
Sample Drawn on : 27.05.2025

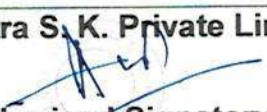
Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25°C	---	7.82	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	60	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	630	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	68.90	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	260	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.38	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	26.71	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	1.18	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.05	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	40.2	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	281.6	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	320	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	2200	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/002934
Date: :10.06.2025
Sample No. MSKGL/ED/2025-26/05/01710
Sample Description : Ground Water
Sampling Location : Durgachak
Sample Drawn on : 27.05.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<1.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 25°C	---	7.77	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	8.5	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	860	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	82.36	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	480	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.40	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	33.14	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	2.01	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.05	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	42.8	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	342	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	380	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 

Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003360
 Date: :09.09.2025
 Sample No. MSKGL/ED/2025-26/08/00827
 Sample Description : Ground Water
 Sampling Location : Sector-11
 Sample Drawn on : 25.08.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	7.46	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	86	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	1440	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	50.94	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	860	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	3.2	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	2.17	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	35.37	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	0.58	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	2.9	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	38.2	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	272.85	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	1.06	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	360	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003361
Date: :09.09.2025
Sample No. MSKGL/ED/2025-26/08/00828
Sample Description : Ground Water
Sampling Location : Sector-12
Sample Drawn on : 25.08.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

Sl No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	7.75	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	2.1	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	1480	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	39.06	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	370	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.50	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	34.86	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	2.32	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	32.8	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	240.6	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	1.41	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	360	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003362
Date: :09.09.2025
Sample No. MSKGL/ED/2025-26/08/00829
Sample Description : Ground Water
Sampling Location : Sector-17
Sample Drawn on : 25.08.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	7.64	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	4.4	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	864	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	58.79	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	370	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	5.5	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	34.34	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	2.8	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	28.4	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	288.21	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	1.64	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	380	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S.K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003363
 Date: :09.09.2025
 Sample No. MSKGL/ED/2025-26/08/00830
 Sample Description : Ground Water
 Sampling Location : Mohona Market
 Sample Drawn on : 25.08.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	7.75	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	3.8	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	280	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	54.14	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	280	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	5.6	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	31.13	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	2.9	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	32.6	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	263.38	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	0.17	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	300	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	<1.8	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 

Authorised Signatory 

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003364
Date: :09.09.2025
Sample No. MSKGL/ED/2025-26/08/00831
Sample Description : Ground Water
Sampling Location : Durgachak
Sample Drawn on : 25.08.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	8.0	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	5.6	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	718	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	54.86	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	210	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	1.2	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	28.26	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	1.80	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	22.8	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	251	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	240	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	Detected	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 

Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003365
Date: :09.09.2025
Sample No. MSKGL/ED/2025-26/08/00832
Sample Description : Ground Water
Sampling Location : Majushree
Sample Drawn on : 25.08.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

SI No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	7.55	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	3.8	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	820	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	62.20	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	210	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.98	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	0.6	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	32.75	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	1.45	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	18.9	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	290.18	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	0.17	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	240	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	Detected	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 

Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/003712
Date: :14.10.2025
Sample No. MSKGL/ED/2025-26/001933
Sample Description : Ground Water
Sampling Location : TW-9
Sample Drawn on : 05.09.2025

Reference No.& Date: 29376997, dtd-08.11.2024

ANALYSIS RESULT

Sl No.	Test Parameters	Unit	Result	Test Method
1	Colour	Hazen	<5.0	APHA (23rd Edition) 2120B 2017
2	Odour	---	Agreeable	APHA(23rd Edition)2150B
3	pH value at 24.8 °C	---	7.53	APHA(23rd Edition) 4500-H-B
4	Turbidity	N.T.U.	<1.0	APHA (23rd Edition) 2130B
5	Total Dissolved Solids	mg/l	960	APHA(23rd Edition) 2540C
6	Aluminium (as Al)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
7	Boron (as B)	mg/l	<0.5	APHA (23rd Edition)3120B 2017 (ICP OES)
8	Calcium (as Ca)	mg/l	71.29	APHA (23rd Edition) 3500 Ca B,2017
9	Chloride (as Cl)	mg/l	353	APHA (23rd Edition)4500-Cl B 2017
10	Copper (as Cu)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Fluoride (as F)	mg/l	0.42	APHA (23rd Edition)4500 - F C/D, 2017
12	Free Residual Chlorine	mg/l	<0.1	IS 3025 (Part 26)-1986 Rffm:2014
13	Iron (as Fe)	mg/l	<0.5	APHA (23rd Edition)3500 Fe B 2017
14	Magnesium (as Mg)	mg/l	31.41	APHA (23rd Edition) 3500 Mg B,2017
15	Manganese (as Mn)	mg/l	0.06	APHA (23rd Edition)3120B 2017 (ICP OES)
16	Mineral Oil	mg/l	<1.0	IS 3025 (Part 39)1991, Partition Infrared Method
17	Nitrate (as NO ₃)	mg/l	4.20	APHA (23rd Edition) 4500- NO ₃ -E, 2017
18	Phenolic Compounds (as C ₆ H ₅ OH)	mg/l	<0.001	APHA (23rd Edition)5530C 2017 (Chloroform Extraction)
19	Selenium (as Se)	mg/l	< 0.02	APHA (23rd Edition)3120B 2017
20	Sulphate (as SO ₄)	mg/l	68.4	APHA (23rd Edition) 4500-SO ₄ E 2017
21	Total Hardness (as CaCO ₃)	mg/l	307	APHA (23rd Edition) 2340 C 2017
22	Cadmium (as Cd)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
23	Cyanide (as CN)	mg/l	<0.05	APHA (23rd Edition)4500 CN- F 2017
24	Lead (as Pb)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
25	Mercury (as Hg)	mg/l	<0.001	IS 3025(Part 48)-1994; Rffm:2014
26	Arsenic(as As)	mg/l	<0.005	APHA (23rd Edition)3120B 2017 (ICP OES)
27	Total Chromium (as Cr)	mg/l	<0.05	APHA (23rd Edition)3120B 2017 (ICP OES)
28	Zinc (as Zn)	mg/l	<0.05	APHA (23rd Edition)3120B 2017
29	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	<0.03	APHA 23rd Edtn-2017, 3500 Cr B
30	Total Alkalinity (as CaCO ₃)	mg/l	238	APHA 23rd Edtn-2017, 2320B
31	Total coliform	/100ml	14	IS 1622 : 1981 (RA 2019)

for Mitra S. K. Private Limited

Report Prepared By 


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

Annexure-4

Environmental expenditure incurred in FY-2024-25 by IOCL Haldia Refinery						
S No	Item description	2024-25 Expenditure (Rs. Lakhs)				
		Quarter-1	Quarter-2	Quarter-3	Quarter-4	Annual
Revenue						
O&M contracts (Operation of ETP/STP/RO/TSDF/Oily Sludge Treatment/Biomethanation plant/Mobile Ambient Air/ Bio Medical Waste Handling etc.						
1	Operation of ETP	75.00	75.00	75.00	75.0	300.00
2	O & M Contracts for TTP-RO	49.40	47.60	49.40	51.4	197.78
3	Oily Sludge Treatment for recovery of Slop Oil	174.85	145.90	174.85	218.94	714.54
One Time Expenditure (ETP Chemicals, activated Carbon etc./ Bioremediation of oily Sludge/Disposal of Haz. Wastes, Spent Catalyst / Storage Tank Cleaning/ Tree Plantation etc.)						
1	ETP Chemicals like ACF & PSF	5.00	5.00	5.00	5.00	20.00
2	Disposal of Hazardous waste to TSDF through authorized agency	50.0	64.2	50.0	37.0	201.21
3	Disposal of Residual Oily Sludge to TSDF through authorized agency	54.66	60.00	75.00	75.04	264.70
4	Tree Plantation	0.00	1.00	0.00	0.00	1.00
Fees payable towards Statutoty authorities (for Consents, Authorisation/Water Cess/ Effluent Discharge etc.)						
1	Consent to Operate for Refinery	50.00	0.00	0.00	0	50.00
2	Pubic Hearing fees for New projects	0.00	0.00	0.00	0	0.00
3	Consent to Operate/ Establishment for before commissioning of new project plants	0.00	0.00	7.13	19.77	26.90
4	Pre-Commissioning Safety Audit by OISD	0.00	0.00	0.00	0	0.00
5	ETP Treated effluent & Effluent discharge monitoring by WBPCB	0.38	0.38	0.38	0.38	1.52
6	Quarterly Stack emission monitoring by WBPCB	0.23	0.23	0.23	0.26	0.95
AMC jobs (Online Stack/Treated Effluent / Ambient Air Monitoring)						
1	Chemical Treatment of ETP treated effluent water for using at Cooling tower & Fire water	17.56	15.69	17.56	14.55	65.36
Audit / Study / Consultancy jobs (Water Pinch Study/Audits; ISO Audits; Audits by External Agencies etc.						
1	ISO Audit + ISO Document updation job	0	0	0.5	0	0.50
2	QRA Study	0.00	0.00	0.00	7	7.00
5	Safety Audit as per MSIHC rules	0.00	0.00	0.00	9.22	9.22
6	GHG Audit	0.00	0.00	2.72	0	2.72
7	ETP Adequacy Study Job by EIL	0.00	0.00	0.00	0	0.00
Monitoring jobs (Ground water, soil, stack emissions, ambient air, fugitive emissions (LDAR) etc.						
1	Environmental Monitoring job	2.90	2.90	2.90	2.90	11.60
2	Ambient Air Quality Monitoring	3.77	3.77	3.77	3.77	15.08
Other Jobs (WED Celebrations/ Awareness & Training Programs/ Process Modifications/ Green Belt Development						
1	WED Celebration/ Awareness program	10.00	0.00	0.00	0.0	10.00
A	Total Revenue expenditure	493.8	421.7	464.4	520.2	1900.1
Capital Expenditure						
(ETP Modernisation/RO Plant/EIA&RA Studies/ Rainwater						
1	Ambient Air Quality Mobile van procurement	17	0	0	0	17.00
2	LED Lights & Solar PV system	0	0	0	0	0.00
3	EIA & RA study for new projects	0	0	0	0	0.00
B	Total Capital expenditure	0	0	0	0	17.00
		Q1	Q2	Q3	Q4	Annual
	Total Expenditure Rs lakhs	493.8	421.68	464.44	520.21	1917.08
	Amounts in Rs. Crore	4.9	4.22	4.64	5.20	19.17

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
P.O. - Haldia Oil Refinery ,
Pin - 721606

Report No. : MSKGL/ED/2024-25/005181
Date: : 09.09.2024
Sample No. MSKGL/ED/2024-25/08/01459-61
1621-22, MSKGL/ED/2024-25/09/00429-30
Sample Description : Noise

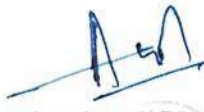
Reference No.& Date: 29376997, Date - 08/11/2023

ANALYSIS RESULT

SI No.	Sampling Location	Sampling Date	Leq dB(A) day	Leq dB(A) night
1	East of Tank No-113	21.08.2024 to 22.08.2024	67.8	57.8
2	East of SRU-5 Unit	21.08.2024 to 22.08.2024	68.8	56.3
3	Near DYTP Cooling Water	21.08.2024 to 22.08.2024	66.9	59.2
4	East of Tank No-109 (Crude LS) Boundary Area	22.08.2024 to 23.08.2024	66.8	58.6
5	East of LPG Horton Sphere (Boundary Area)	22.08.2024 to 23.08.2024	70.7	66.0
6	South East of LPG Bulk Loading Area (Boundary Area)	29.08.2024 to 30.08.2024	70.6	63.3
7	Delayed Coker unit South Side (Boundary Area)	29.08.2024 to 30.08.2024	68.9	60.7

Report Prepared By 

for Mitra S. K. Private Limited


Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
P.O.- Haldia Oil Refinery ,
Pin - 721606

Report No. : MSKGL/ED/2024-25/005188
Date: 08.10.2024
Sample No. MSKGL/ED/2024-25/09/00475-76
471-74,651-52
Sample Description : Noise

Reference No.& Date: 29376997, Date - 08/11/2023

ANALYSIS RESULT

SI No.	Sampling Location	Sampling Date	Leq dB(A) day	Leq dB(A) night
1	North of Tank No-111 (Boundary Area)	04.09.2024 to 05.09.2024	64.9	57.4
2	DHDS Colling Tower (Boundary Area)	04.09.2024 to 05.09.2024	70.3	64.5
3	Near TTL Out Gate No-4 Road-A (Boundary Area)	05.09.2024 to 06.09.2024	65.0	57.0
4	South Corner of TTL Out Gate No-4 (Boundary Area)	05.09.2024 to 06.09.2024	69.1	62.3
5	West ETP Control Road-A (Boundary Area)	06.09.2024 to 07.09.2024	63.5	56.0
6	Near Lube Oil Dram Storage Area	06.09.2024 to 07.09.2024	65.3	56.2
7	North West Corner of OHCU Plant Area Road A	09.09.2024 to 10.09.2024	63.2	56.0
8	Near New Flare Area	09.09.2024 to 10.09.2024	70.4	63.5

Report Prepared By 

for Mitra S. K. Private Limited


Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2024-25/005196
Date: :30.10.2024
Sample No. MSKGL/ED/2024-25/10/01065-1071
 MSKGL/ED/2024-25/10/01297-1306
Sample Description : Noise

Reference No.& Date: 29376997, Date - 08/11/2023

ANALYSIS RESULT

SI No.	Sampling Location	Sampling Date	Result Average dB(A)
1	FPU Furnace (Unit-105 FPU Unit)	17.10.2024	78.0
2	105 PM-08A (Unit-105 FPU unit)		83.1
3	105 PM-07A (Unit-105 FPU unit)		84.9
4	105 PM-04B (Unit-105 FPU unit)		86.9
5	OHCU Furnace (Unit-91)		73.1
6	91-PM-25B (Unit-91-OHCU)		87.4
7	91-PM-04A (Unit-91-OHCU)		91.5
8	OHCU Control Room Outside		68.2
9	OHCU Field Area	19.10.2024	63.5
10	OHCU Control Room Inside		59.1
11	OHCU Field Room		68.7
12	Battery Limit (U-92) PDS		79.0
13	92 P 16 A (U-92) PDS		80.6
14	HGU PDS (U-92) PDS		63.5
15	92 PM 11B (U-92) PDS		86.9
16	92 PM 01 (U-92) PDS		82.4
17	92 P 12 A (U-92) PDS		81.4

Report Prepared By 

for Mitra S. K. Private Limited


 Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
P.O.- Haldia Oil Refinery ,
Pin - 721606

Report No. : MSKGL/ED/2024-25/005203
Date: :30.10.2024
Sample No. MSKGL/ED/2024-25/10/01072-1081
Sample Description : Noise

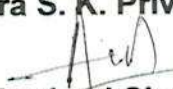
Reference No.& Date: 29376997, Date - 08/11/2023

ANALYSIS RESULT

SI No.	Sampling Location	Sampling Date	Result Average dB(A)
1	91-PM-09A (Unit-91-OHCU)	17.10.2024	79.6
2	91-PM-20B (Unit-91-OHCU)		82.4
3	91-PM-08B (Unit-91-OHCU)		84.4
4	MCC Room N2 Plant (HGU-2 Reformer U-92)		79.6
5	96 KM-01 (ii) C Air Compressor (HGU-2 U-92)		88.6
6	92 ED-11A (HGU-2 Reformer U-92)		82.0
7	96 KM-02 (115) B (HGU-2 Reformer U-92)		88.7
8	96 KM-01-9 (ii) A (HGU-2 Reformer-U-92)		88.9
9	HGU Reformer Furnace (HGU-2 U-92)		70.3
10	Battery limit (HGU-2 Reformer U-92)		73.7

Report Prepared By 

for Mitra S. K. Private Limited


Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
'INDIAN OIL CORPORATION LIMITED'
 P.O.- Haldia Oil Refinery ,
 Pin - 721606

Report No. : MSKGL/ED/2024-25/006893
Date: :16.01.2025
Sample No. MSKGL/ED/2024-25/01/00556-74
Sample Description : Noise

Reference No.& Date: 29376997, Date - 08/11/2023

ANALYSIS RESULT

Sl No.	Sampling Location	Sampling Date	Average dB(A)
1	CDU-1 and Trim Heater (U-II FOB Area)	07.01.2025	74.3
2	CDU-1 Furnace (U-II FOB Area)		77.0
3	11-PM-127 B (U-II FOB Area)		80.9
4	11-PM-102 A (U-II FOB Area)		92.5
5	11-PM-03 A (U-II FOB Area)		90.8
6	CDU-I Battery Limit (U-II FOB Area)		78.7
7	CRU Battery Limit Unit 21 and 22 CRU		75.9
8	CRU Funnace Unit-21 and 22 CRU		82.3
9	22 PM-02 A Unit-21 and 22 CRU		83.3
10	22 PM-01 C Unit 21 and 22 CRU		88.7
11	21 K-101 A Unit-21 and 22 CRU		75.4
12	FOB Control Room Inside		53.8
13	FOB Control Room Outside		59.4
14	Battery Limit (U-16-FOB)		71.7
15	16 PM- 107 B (U-16-FOB)		88.6
16	16 PM- 109 A		89.2
17	16 PM- 03 A (U-16-FOB)		87.9
18	CDU-11 Furnace (U-16-FOB)		75.9
19	CDU-11 and Trim Heater (U-16-FOB)		74.5

Report Prepared By 

for Mitra S. K. Private Limited



Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited

Annexure-6

IOCL-Haldia Refinery

Month-wise Total SO2 emission

MONTH	SO2 EMISSION in kg/hr
Apr-25	703
May-25	719
Jun-25	778
Jul-25	789
Aug-25	776
Sep-25	753
Average	753.00
MAX. LIMIT	980

Annexure-7

Average Report	
Industry(ies)	IOCL HALDIA
Station(s)	AAQMS_1
Parameter(s)	(SO2), (NOX), (CO), (NO2), (PM10), (NH3), (PM2.5), (O3), (Benzene)
Avg Period	Daily Avg
Date	From: 01-Sept-2025 To: 30-Sept-2025

N PARAMETER DATA OFFLINE / DATA NOT AVAILABLE

** CAAQMS-1 BENZENE DATA WA

Continuous Ambient Air Quality Monitoring Data									
Date & Time	AAQMS_1 (SO2(ug/m3))	AAQMS_1 (NOX(ug/m3))	AAQMS_1 (CO(mg/m3))	AAQMS_1 (NO2(ug/m3))	AAQMS_1 (PM10(ug/m3))	AAQMS_1 (NH3(ug/m3))	AAQMS_1 (PM2.5(ug/m3))	AAQMS_1 (O3(ug/m3))	AAQMS_1 (Benzene(ug/m3))
01/09/2025	10.630	17.97	0.63	12.43	48.99	11.07	26.94	25.98	N
02/09/2025	10.384	15.48	0.76	10.44	44.31	10.97	24.64	27.69	N
03/09/2025	10.311	14.22	0.79	9.67	42.78	10.96	24.18	29.52	N
04/09/2025	11.101	14.32	0.71	9.74	43.52	10.84	23.62	33.13	N
05/09/2025	10.383	14.65	0.78	10.22	44.77	10.89	24.61	37.20	N
06/09/2025	10.498	15.07	0.60	10.54	48.04	10.92	25.61	35.33	2.56
07/09/2025	10.638	15.04	0.61	10.56	46.10	10.96	24.83	33.53	2.27
08/09/2025	10.929	16.26	0.68	11.60	47.43	10.99	25.00	31.37	2.83
09/09/2025	10.807	16.43	0.66	11.47	47.76	10.98	25.75	28.66	2.95
10/09/2025	11.135	16.65	0.70	11.77	46.40	10.92	24.88	27.31	3.37
11/09/2025	10.566	16.71	0.61	11.87	47.18	10.97	24.90	33.40	5.05
12/09/2025	11.131	15.75	0.69	11.01	45.24	10.93	24.37	35.87	1.80
13/09/2025	11.442	15.07	0.63	10.88	43.68	10.85	23.51	37.55	2.14
14/09/2025	10.828	15.14	0.59	10.61	42.87	11.00	23.45	31.29	2.02
15/09/2025	11.225	15.18	0.61	10.86	43.24	10.94	23.60	34.26	3.00
16/09/2025	10.847	14.83	0.69	10.63	43.89	10.90	24.52	33.02	3.37
17/09/2025	10.821	15.08	0.66	10.65	44.36	10.96	22.94	30.36	3.32
18/09/2025	11.697	15.11	0.71	10.53	45.41	10.90	23.23	26.89	2.83
19/09/2025	11.527	16.33	0.73	11.66	46.11	11.07	25.76	27.57	2.47
20/09/2025	11.127	19.67	0.73	13.46	47.19	11.15	28.64	26.23	2.96
21/09/2025	10.206	16.56	0.54	11.87	48.39	11.11	29.44	29.54	2.17
22/09/2025	11.738	17.69	0.53	12.42	47.58	10.99	28.22	27.77	1.95
23/09/2025	12.392	16.26	0.63	11.76	44.37	10.99	25.26	33.22	2.24
24/09/2025	11.054	15.12	0.28	10.55	46.96	10.91	25.33	28.26	1.34
25/09/2025	12.281	16.78	0.66	11.28	46.45	11.01	25.44	27.26	1.82
26/09/2025	12.595	16.90	0.62	11.50	45.58	10.91	24.57	25.82	2.87
27/09/2025	12.084	14.98	0.71	10.46	43.88	10.89	25.06	36.02	2.25
28/09/2025	12.655	14.38	0.76	9.85	43.71	10.88	23.86	34.11	2.00
29/09/2025	12.748	17.79	0.62	12.26	45.98	10.93	23.81	27.88	1.75
30/09/2025	12.129	16.73	0.64	11.70	47.60	11.05	26.04	26.59	1.88
AVERAGE	11.264	15.938	0.652	11.142	45.659	10.961	25.067	30.754	2.528
LIMIT (24 hrs)	80	80	2 (8 hrs)	80	100	400	60	100 (8 hrs)	5 (Annual)

Annexure-8

Total plant area	610	acre
Green belt Area	417.82	acre
% green coverage	68.49%	

Years	Activities	No of trees	Green belt Area (acre)	Green belt Area (Hectare)	MoU Date
till 2016-17	Trees planted	68000	48	19.42	
2016-17	Trees planted	5200	5.2	2.10	
2017-18	Trees planted	3820	3.82	1.55	
2018-19	Trees planted	5000	5	2.02	
2019-20	Trees planted	6425	6.42	2.60	
2020-21	Tree planttaion in school and colleages	25925	6.44	2.61	
2020-21	Tree plantation in Geonkhali Water Treatment Plant	3750	14.82	6.00	09.11.2020
2020-21	Tree planttaion in Chaitanyapur Water Treatment Plant	2000	7.9	3.20	09.11.2020
2021-22	Miyawaki process tree planttaion in Mahishadal Rajbari	19200	1.58	0.64	30.07.2021
2021-22	Miyawaki process tree planttaion at Haldia Refinery and KV School	13000	1.7	0.69	
2021-22	Tree plantation in Greenbelt channel infront of Haldia Refinery	253	1	0.40	
2021-22	Tree plantation in Greenbelt channel infront of Haldia Refinery	1496	5.91	2.39	
2021-22	Along extn of HPL link road from City centre to Balughata along a stretch of 9800 mt	1000	3.95	1.60	09.11.2020
2021-22	CSB Tree plantation in Balughata Beat (Forest Land)	35200	54.34	21.99	05.07.2021
2021-22	Creation of Mangrove plantation at Beliarychar island	2000000	247.1	100.00	01.10.2021
2022-23	Miyawaki process tree planttaion near Haldia rly station	24000	2.22	0.90	
2023-24	Trees planted inside Township	661	0.67	0.27	
2024-25	Trees planted inside Township	1739	1.75	0.71	
		2216669	417.82	169.08	

REPORT ON TECHNO-ECONOMIC FEASIBILITY STUDY OF ZERO LIQUID DISCHARGE PLANT FOR HALDIA REFINERY, WEST BENGAL



IndianOil

M/S. INDIAN OIL CORPORATION LTD

2	30.10.2025	Issued as Final Report	UJ/DD	RM/CP	VS/PKG
1	03.10.2025	Issued Incorporating Client's comments	UJ/DD	RM/CP	VS/PKG
0	05.09.2025	Issued as Draft Report	UJ/DD	RM/CP	VS/PKG
Rev. No.	Date	Purpose	Prepared By	Checked By	Approved By

TABLE OF CONTENTS

Chapter	Title	Page
Executive Summary		
1	<u>Introduction</u>	10
1.1	Introduction	11
1.2	Scope of Work	13
1.3	Existing Treatment and Disposal Facility	13
1.3	Scope of Work	13
2	<u>Effect Assessment of Treated Effluent Discharge into river</u>	16
2.0	River Hoogly	17
2.1	Methodology adopted to carry out Effect Assessment	17
2.2	Effect Assessment	17
3	<u>Installation of New Zero Liquid Discharge Plant</u>	32
3.1	Design Basis for ZLD Plant	33
3.2	Overview of Zero Liquid discharge technologies	33
3.3	Zero Liquid Discharge Plant	35
3.4	Environmental Impacts due to Zero Liquid Discharge Plant	47
4	<u>Cost Estimation</u>	49
4.1	Description	50
4.2	Reference Document	50
4.3	Key Assumptions	50
4.4	Exclusions	50
4.5	Estimation Methodology	50
5	<u>Summary & Conclusion</u>	53
5.1	Summary	54

ANNEXURES

ANNEXURE-I	ELR data of April 2024 to March 2025
ANNEXURE-II	Surface Water Sampling Analysis data for July & Sept 2025
ANNEXURE-III	Hoogly river flow- Hydraulic Study Department, Kolkata
ANNEXURE-IV	Consent to Operate
ANNEXURE-V	Hoogly River Water Quality for 2024
ANNEXURE-VI	Map showing Surface water quality during High Tide
ANNEXURE-VII	Historical Data for Ground Water quality in last 10 years
ANNEXURE-VIII	Water Balance
ANNEXURE-IX	Electrical Load List
ANNEXURE-X	Equipment List
ANNEXURE-XI	Indicative Equipment Layout

LIST OF ABBREVIATIONS

IOCL	Indian Oil Corporation Limited
CONSULTANT	Engineers India Limited
EAC	Expert Appraisal Committee
ZLD	Zero Liquid Discharge
MEE	Multi Effect Evaporator
ATFD	Agitated Thin Film Dryer
RO-DM Plant	Reverse Osmosis based De-mineralization Plant
ETP	Effluent Treatment Plant
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TSDF	Treatment, Storage and Disposal Facility
CTBD	Cooling Tower Blowdown
UF	Ultra-filtration
HRSCC	High Rate Solids Contact Clarifier
DMF	Dual Media Filter
ACF	Activated Carbon Filter
TPD	Tonnes per day
TPH	Tonnes per hour
DYIP	Distillate Yield Improvement Project
TTP	Tertiary Treatment Plant
ELR	Effluent Leaving Refinery

EXECUTIVE SUMMARY

Introduction:

Haldia Refinery of M/s. Indian Oil Corporation Limited was commissioned in January 1975 at the district of Purba Medinipur, West Bengal. Original crude oil processing capacity of IOCL Haldia was 2.5 MMTPA. Later the capacity of Refinery was increased at stages and now the Refinery is expanded up to the processing capacity of 8.5 MMTPA.

During the Environmental clearance for 2nd catalytic Iso-Dewaxing unit of capacity 270 TMTA, EAC recommended IOCL Haldia Refinery to ensure Zero Liquid Discharge (ZLD) through the Environmental clearance letter dated 05/01/2021 as already committed by IOCL.

IOCL has constraints in achieving ZLD, particularly due to the lack of contiguous land and the associated issues with salt storage and disposal. Presently, IOCL is discharging the treated effluent specifically RO rejects in to Hoogly river meeting the permissible standard prescribed in the CTO as per the approval granted vide Consent to Operate (CTO) obtained on 27/05/2024 which is valid till 27.05.2029.

This was presented to Expert Appraisal Committee (EAC) of MoEFCC during the EAC meeting held on 09/01/2025 to 10/01/2025. EAC opined that due to proposed discharge of treated effluent into Hoogly river deterioration of water quality of Hooghly river and gradual contamination of groundwater will be there in long term.

In this regard, Expert Appraisal Committee suggested IOCL to submit the techno-economic feasibility for implementation of the latest ZLD technology for further consideration. IOCL Haldia agreed to submit the study report together with the effect assessment of treated effluent in the receiving body (Hooghly River) with relevant technical details. Accordingly, a Techno-Economic Feasibility Study has been carried out to assess the effect in the receiving body and feasibility for implementation of ZLD plant.

Assessment of effects of disposal of treated effluent into Hoogly river:

Presently, RO reject water from TTP and RODM plants with a total flow 200 m³/hr and combined TDS of ~9000 to 14000 ppm is being disposed to the Hoogly River.

In order to assess the impact in the river due to disposal of treated effluent, secondary data collected from West Bengal Pollution Control Board (WBPCB) is utilised. The WBPCB data is available for the location "Pathikhali" which is approximately at a distance of approx. 5 km upstream from disposal point. Considering, the WBPCB data as the base data which is flowing from the upstream of the disposal point, the resultant and incremental value with respect to the Effluent data is estimated considering the river flow collected from the Hydraulic Study Department.

From the same, it can be seen that, pH stays between ~7.57–7.61 with no effect. The TSS is already high in the river and RO reject with lower TSS, equalises the river's TSS locally. The incremental increase in COD and Ammonia-N are negligible with only respective percentage

increase of 0.001% & 0.031%. There is no change in Phosphate. TDS effluent in the effluent is high (14,000 mg/L) compared to river (406–586 mg/L), but the increment is ~0.085–0.166 mg/L, i.e., <0.03% of background indicating strong dilution or tidal dispersion. **The above resultant and incremental values confirm that the incremental load in to the river is negligible.**

Localized effect assessment at the point of disposal:

The disposal point is only 50 meter from the shore of the river. Hence, further check on the localized effect near the disposal point has also been carried out. It represents the pH is stable and neutral. The resultant increment of COD is marginal (~+0.003–0.004 mg/L) which is ~ 0.011 to 0.017%, indicating limited impact. Ammonical-N and Phosphate indicates negligible change. TDS resultant stays close to river background (~408–589 mg/L) with small positive increments (+2.18 to +2.94 mg/L) with only 0.5 to 0.7%. **With the above, the discharge is not noticeably altering the river water quality at the point of assessment during either tide or Ebb.**

This is further established with primary data collected and analysed with respect to spatial and temporal variations. A total of 64 Nos. of samples were collected at 16 locations around the disposal locations. The samples were collected for during July and September 2025 with Two (2) samples per location in a day with one sample during “High tide” condition and another in “Low Tide” condition. In order to assess the effects of treated effluent being discharged in to the river, Sampling and analysis of water quality has been carried out for the period July and September 2025.

Sampling & Analysis – Major parameters

Parameter	23.07.2025	23.07.2025	04.09.2025	04.09.2025
	Low Tide	High Tide	Low Tide	High Tide
pH	7.21 - 8.07	7.73 – 8.08	7.76 – 8.02	7.89 – 8.09
TDS, mg/l	434 - 523	581 - 684	497 - 625	579 - 844
BOD, mg/l	1.5 – 2	1.6 - 2	0.9 – 2.1	1.1 – 1.9
COD, mg/l	18.54 – 25.2	20.5 – 37.9	23.5 – 32	16 – 36
NH ₃ -N, mg/l	BDL – 0.21	BDL – 0.189	0.11 – 0.14	0.4 – 1.1
PO ₄ , mg/l	0.12 – 0.2	0.13 – 0.24	0.18 – 0.23	0.17- 0.23
Phenol, mg/l	BDL	BDL	BDL	BDL
Sulphide, mg/l	0.02 – 0.13	0.09 – 0.14	0.1 – 0.17	0.08 – 0.12

Note 1. Least count for Phenol: 0.001 mg/l.

Spatial analysis is carried out to know how quality of river gets effected at distances. The data collected within 15km distances at three level (Nearby, mid and far from disposal point). The data indicates that the discharge is not measurably altering the river water quality during either tide or Ebb.

Effect assessment with respect to Time is also carried out in order to assess the seasonal variations. River water quality of last 4 years is also referred to analyse for timely variation. The data represents, no major variations in TDS and other parameters (COD, NH₃ and PO₄) are in

declining mode. Thus, seeing the river water quality of past 4 years, the effluent disposal is not causing the major impact to river water quality.

Effect Assessment on Ground Water: At Haldia, 84 % of the area is alluvial plains. But in coastal/estuarine area around Haldia, it's noted that the soils are formed from silt carried by the Hooghly and Haldi rivers. The soil around haldia channel is silty-clay and has moderate percolation. Hence, quality of ground water around the refinery were also checked and found that the there is no impact in quality.

Moreover, where the treated effluent (i.e RO reject) is disposed in to Hoogly river is near the estuary. The Strong tidal and river currents in the Hooghly estuary quickly mix and transfers the discharge along the main channel and carryover of flow towards the sea rather than into groundwater.

Installation of New Zero Liquid Discharge Plant

The combined reject water from TTP and RODM plant which is currently being disposed to river shall be fed to the new Zero Liquid Discharge Plant for further processing. The ZLD plant shall be designed to Process 200 m³/hr of RO reject with the TDS of 9000-14000 mg/l.

After the water recovery from the RO system, about 64 m³/hr flow will be routed to the evaporation system. Accordingly, the capacity of evaporation system is considered as 2 chains of 32 m³/hr each including the internal recirculation flows. The overall recovery from the ZLD plant shall be ~95-98%. The recovered water from the ZLD plant shall be reused within the refinery.

The configuration of ZLD plant is selected based on techno-economic feasibility with the following technologies. Comparison of the technologies is presented in below table:

Parameter	Multi-Effect Evaporator (MEE)	Mechanical Vapor Compression (MVC)	Solar Pond
Principle	Multiple stages of evaporation using latent heat from previous stage	Mechanical compression of vapor to reuse latent heat	Natural solar evaporation in large ponds
Feed Concentration Limit	Can handle high TDS ($\geq 50,000$ mg/l)	Can handle high TDS ($\geq 50,000$ mg/l)	high TDS effluents ($\geq 150,000$ mg/l)
Energy Requirement	Requires thermal energy in terms of steam. Less power consumption ($\sim 3-8$ kWh/m ³)	High electrical energy compared to MEE (compressor $\sim 8-12$ kWh/m ³ distillate, but no external steam)	Relies on solar energy (very low operational energy)
Recovery Efficiency	Very high, $>90\%$ possible	High, $>90\%$ possible	Low, dependent on weather; slow evaporation

Operating Cost	Moderate due to LP steam consumption available in the refinery. Needs scaling control	High as power consumption is high compared to MEE	Very low (only maintenance), but land cost is high
Capital Cost	High (complex system with multiple effects)	High (compressor and robust design needed)	Low (earthwork, liners, land acquisition)
Maintenance	Scaling/fouling in evaporators, frequent descaling	Scaling/fouling in evaporators, frequent descaling	Minimal, mainly sludge removal and pond integrity
Land Requirement	Moderate	Moderate	Very high (large evaporation ponds needed)
Suitability	For concentration of RO reject	For concentration of RO reject	Final disposal of high TDS water
Limitations	High steam requirement, scaling issues	High CAPEX and high power consumer	Slow, climate-dependent, needs large land, accumulation of rain water

Based on the analysis, Reverse osmosis system followed by MEE technology coupled with an Agitated Thin Film Dryer (ATFD) or pusher centrifuge, offers a reliable and compact technology and the same is considered in zero liquid discharge plant for Haldia refinery.

Treatment system: The treated water from zero liquid discharge plant shall meet treated raw water quality which shall be used within the refinery complex as service water, cooling water makeup etc. Once the maximum water is recovered from the RO system, the remaining brine i.e RO reject is sent for evaporator section for further processing. After Evaporator & Dryer Section, only salts shall remain and all residual water will be recovered as condensate.

Salt Generation Estimation: The dried salt (having typically 8-10% moisture content) generated from the Evaporator Dryer System in the Zero Liquid Discharge Plant will be a mixture of multiple salts and will not find any applications within the refinery. These dried salts needs to be filled in bags / drums (or impervious containers) and then suitably disposed off to secured engineered landfill or other suitable locations. **The estimated quantity of salt generation from the new ZLD plant shall be ~80 to 100 TPD.**

Area Requirement The area requirement for the installation of new ZLD plant shall be 18000 m². The salt generated from the ZLD plant shall required to be disposed to secured landfill/TSDF. Around 10,000 to 12,000 m² area of land shall be required for Secured landfill pertaining to 5 years of salt generation. Further area shall be required for subsequent years of operation of secured landfill at TSDF.

CAPEX & OPEX: The Estimated EPCC cost of the ZLD plant is 223.28 Crore excluding GST and estimated operating cost is 149.0 Crores per annum.

Summary & conclusion: The effect assessment has been carried out on the present practice of disposal of treated effluent in river Hoogly with respect to spatial and temporal factors by sampling and analysis of quality of river at various locations from the disposal point. It is observed that, the disposal of treated effluent in to the river is not causing major deterioration in the quality of river as established in the report.

Also, Haldia channel is not utilized as a source of water either for drinking or agriculture purpose. This is because of the high concentration of TDS due to tidal effect. This high TDS is mostly observed during the dry season.

Based on the sampling analysis of the bio assay test, 100% survival of fish after 96 hours was observed which reveals that treated effluent has no adverse impact on aquatic life. This indicates that effluent quality is suitable for discharge in river in compliance with the treated effluent disposal standards which requires >90% fish survival for 96 hours.

In addition to above, effect of installing Zero liquid discharge plant is also studied. Installing a ZLD plant provides recovery of ~98 % water including steam condensate (maximum recovery).

Installing Zero Liquid Discharge plant shall also involve,

- High energy consumption with the electricity requirement of 2.3MW for plant operation which is much higher as compared to the disposal of treated effluent.
- Requirement of contiguous land for 18000m² for installation of ZLD plant. As confirmed by IOCL, Haldia Refinery does not have any land within the premises for installing the ZLD plant.
- About 25 TPH of LP Steam is required which requires installing additional boiler system and additional water consumption on continuous basis from the refinery at a defined cost. This will also increase the fresh water requirement of the refinery.
- High CAPEX (INR 223.28Cr.) & OPEX (INR 149Cr. per annum) associated with ZLD plant.
- Recirculating cooling water is required for ZLD plant (1500 to 2400 m³/hr) which would require separate Cooling Water system.
- Major concern in installing the ZLD plant is generation of dried salts (~80 to 100 TPD). A secured engineered landfill shall be required to dispose the salts with an area requirement of 10,000 m² to 12,000 m². In practical terms, Haldia Refinery is already in shortage of land, allocating such contiguous land within the refinery premises. the salt generated needs to be sent to TSDF. Before sending to TSDF, the salts needs proper handling and storage facility.
- Sending the salt to TSDF involves transportation through trucks (number of trucks 4-5) from the Refinery which shall have its impact with respect to vehicular movement and loading and unloading of salt generated.
- Further, there shall be risk of generation leachate in and around the secured landfill which carries its own risk of water contamination.

A comparison of the two systems disposal of treated effluent and ZLD is given in below table.

Table: Comparison of Disposal of treated Effluent vs. Zero Liquid Discharge Plant

Factor	Treated Effluent Disposal into River	Zero Liquid Discharge (ZLD)
Environmental Impact	Negligible impact on river and groundwater quality. (as discussed in the report)	Eliminates liquid discharge but creates significant secondary pollution: high GHG emissions from substantial energy use (~2.3 MW power, ~25 TPH steam) and generates ~80 to 100 TPD of solid salt waste, posing risks of potential landfill leachate contamination.
Capital Cost (CAPEX)	System already installed	High (INR 223.28 Cr.) - requires evaporators, crystallizers, brine concentrators, high TDS RO
Operating Cost (OPEX)	only pumping cost	High (INR 149 Cr. per annum) - high energy consumption for evaporation & concentration, high Steam, power, chemical and salt disposal costs.
Foot print	System already installed.	Substantial and infeasible: 18,000 m ² for ZLD plant including salt storage facility. And 10000 to 12000m ² area of land for Secured landfill at TSDF pertaining to 5 years of salt generation only.
Energy Requirement	Relatively low; limited to pumping	High; continuous steam/electricity for evaporators → higher carbon footprint. ~2.3 MW power and ~25 TPH of LP Steam.
Carbon Footprint	Negligible	Higher - energy-intensive, increases GHG emissions.
Solid Waste disposal	No solid waste generation	High - salt generation, ~80 to 100 Tonnes Per Day of dried salts, requiring complex and costly disposal.

CONCLUSION:

Based on the assessment in the techno economic study done for ZLD plant, it is concluded that:

- River disposal entirely avoids the above stated issues related to ZLD as the location where the treated effluent (RO reject) is being disposed is near the estuary where the TDS of the river is already high due to the tidal effect from the sea. This tidal effect gives an advantage creating the mixing of treated effluent with huge quality of water and provides sufficient dilution of the water quality.

- Further, the river water near the vicinity of Refinery is not used as a source for drinking and agriculture purpose. The stretch is predominantly utilized for maritime Boat/Ship navigation.
- As there is no increase in the pollutant concentration due to disposal of treated effluent disposal from Haldia refinery and no impact to the aquatic life and hence there is no Food chain contamination.
- Since there is no impact to either quality of river or to the aquatic life, there shall be no Livelihood impacts. i.e Fisherfolk, farmers and river-dependent communities does not face economic losses.
- Installation of ZLD plant shall require additional land, additional energy in terms of electricity and steam which will increase emissions and also the CAPEX and OPEX of the plant.
- The salt egeneration from ZLD plant shall required to be disposed to secured landfill/TSDF and entail additional logistics requirement and associated environmental risks.

CHAPTER NO. 1

INTRODUCTION

1.0 INTRODUCTION

Haldia Refinery of M/s. Indian Oil Corporation Limited was commissioned in January 1975 at the district of Purba Medinipur, West Bengal. It is situated 136 km downstream of Kolkata and near the confluence of river Hoogly and Haldi. Original crude oil processing capacity of IOCL Haldia was 2.5 MMTPA. Later the capacity of Refinery was increased at stages and now the Refinery is expanded up to the processing capacity of 8 MMTPA with the implementation of a new DCU along with Coker GasOil treater in February 2020.

The major products from Haldia Refinery include fuel oil products consisting of Liquified Petroleum Gas (LPG), Naphtha, Motor Spirit (MS), Superior Kerosene (SKO), Aviation Turbine Fuel (ATF), High Speed Diesel (HSD), Jute Batching Oil (JBO), Light Diesel Oil (LDO), Mineral Turpentine Oil (MTO), Ethanol Blended Motor Spirit (EBMS), Furnace Oil (FO), Low Sulphur Heavy Stock (LSHS), MARPOL FO, Bitumen, Petcoke, Sulphur, Sulfuric acid and lube oil base stocks such as API Group II/III Lube Oil Base Stocks (LOBS) of different grades. Also, Haldia Refinery produces residue products consisting of Furnace Oil (FO), MARPOL FO, Bitumen, Petcoke, Sulphur and Sulfuric acid. These products are dispatched through pipelines, Tank Wagon, Tanker trucks and Marine ships and Barges.

During the Environmental clearance for 2nd catalytic Iso-Dewaxing unit of capacity 270 TMTPA, EAC recommended IOCL Haldia Refinery to ensure Zero Liquid Discharge (ZLD) through the Environmental clearance letter dated 05/01/2021 as already committed by IOCL.

IOCL has constraints in achieving ZLD, particularly due to the lack of contiguous land and the associated issues with salt storage and disposal. Presently, IOCL is discharging the treated effluent specifically RO rejects in to Hoogly river meeting the permissible standard prescribed in the CTO as per the approval granted vide Consent to Operate (CTO) obtained on 27/05/2024 which is valid till 27.05.2029.

This was presented to Expert Appraisal Committee (EAC) of MoEFCC during the EAC meeting held on 09/01/2025 to 10/01/2025. EAC opined that due to proposed discharge of treated effluent into Hoogly river deterioration of water quality of Hooghly river and gradual contamination of groundwater will be there in long term.

In this regard, Expert Appraisal Committee suggested IOCL to submit the techno-economic feasibility for implementation of the latest ZLD technology for further consideration. IOCL Haldia agreed to submit the study report together with the effect assessment of treated effluent in the receiving body (Hooghly River) with relevant technical details.

Accordingly, M/s IOCL approached EIL to carry out the Techno-Economic Feasibility Study.

1.1 SCOPE OF WORK

The following is the scope of work for the Techno-Economic Feasibility Study.

- Carrying out Techno-Economic Feasibility Study for implementation of the latest ZLD technology at IOCL, Haldia Refinery keeping in view the challenges faced particularly due to the lack of contiguous land and the associated issues with salt storage and disposal.

- Estimation of Capital and Operating expenditures for the proposed ZLD plant. Cost estimates shall be carried out based on EIL's in-house data and budgetary quotations available for similar past projects. Cost estimates shall be subject to $\pm 30\%$ accuracy.
- Study shall be carried out for ZLD plant of 200 m³/h design feed capacity.
- Study shall be carried out for feed water quality based on EIL's in-house data of IOCL Haldia Refinery.
- Study shall be carried out for ZLD plant based on LP steam based Multi Effect Evaporator (MEE) followed by Agitated Thin Film Dryer (ATFD). Techno-economic consideration & evaluation of other latest technologies have to be considered and comparison of all the latest available technologies to be carried out based on the present constraints of IOCL Haldia Refinery. Latest technology providers to be consulted.
- Study report shall include specifically the effect assessment of treated effluent in the receiving body i.e Hoogly River with relevant technical details such as deterioration of water quality Hoogly River and contamination of ground water in long term by detail evaluation of characteristics determination of receiving body water at the upstream and downstream at multiple locations and also checking the dilution effect using dispersion model.
- Feasibility study report shall include the following technical details for the proposed ZLD plant:
 - ZLD Plant configuration.
 - Equipment List (including material selection).
 - General Plant Layout.
 - Schematic Flow Diagram.
 - Capital and operating expenditure for the proposed ZLD plant.
 - Estimation of utilities (including LP steam & electric power) required.
 - Estimation of chemicals required.
 - Estimation of quantity of Salt generated from ZLD plant.
 - Identification & assessment of environmental impacts due to installation and operation of ZLD Plant including salt disposal.
 - Comparison of options between ZLD versus discharge of 200 m³/hr of RO effluent.
 - Merits & de-merits of both the options (logistical, energy, disposal issues and other challenges).
 - Adequate monitoring mechanism to be adopted in both the cases.
 - To identify standby option for uninterrupted and any operational/maintenance issue of ZLD unit.
 - Summary & Conclusion and recommendation between the two options.

1.2 EXISTING TREATMENT AND DISPOSAL FACILITY

1.2.1 EXISTING TREATMENT FACILITY

Under the Haldia Refineries water management strategy, wastewater generated from the refinery process are treated in different water/waste water treatment plants to produce permeate, which is then reused in various refinery processes like make-up water for cooling towers and the DM plant. These plants are part of the Haldia Refinery's efforts to maximize water reuse and minimize effluent discharge. Brief details of these plants are given below.

Effluent Treatment Plants:

The Haldia Refinery operates two Effluent Treatment Plants (ETPs) of design capacity 600 m³/hr and 650 m³/hr to process all effluent water generated from process units, offsite facilities and storm/surface runoff. The effluent and surface runoff water undergo comprehensive physicochemical and biological treatment within the ETP system. The refinery maintains continuous compliance for the treated water effluent standards as per the Refinery standards.

Tertiary Treatment Plant:

To further minimize freshwater consumption, a state-of-the-art Reverse Osmosis (RO)-based Tertiary Treatment Plant (TTP) with a capacity of 1,250 m³/hr have been installed taking ETP treated effluent as feed. The TTP incorporates advanced technologies, including Dual Media Filtration (DMF), Ultrafiltration (UF), Micro Cartridge Filtration (MCF) and Reverse Osmosis. Following tertiary treatment, the recovered water is reused as cooling tower makeup water and demineralized (DM) water. About 120 m³/hr of reject water is disposed to River from TTP.

RO-DM plant (DYIP):

In-order to meet the DM water requirement, a RO-DM plant is provided in the Haldia Refinery under AISHWARYA PROJECT with raw water as feed. Raw water is supplied by Haldia Development Authority from Geonkhali. The DM water generation system comprises of Pretreatment section, RO system (including pre-treatment), Mixed Bed system and the storage and pumping facilities.

Two chains of RODM water plant have been installed with each chain to produce DM water at the rate of 3840 m³/day (i.e. 160 m³/hr * 24hrs) under normal condition to meet the DM water demand. RO reject including MB regeneration waste of about 80 m³/hr is disposed to River with a provision for routing to ETP.

1.2.2 EXISTING DISPOSAL FACILITY

Presently, RO rejects from TTP and RODM plants with a total flow 200 m³/hr and combined TDS of ~9000 to 14000 ppm is being disposed to the Hoogly River.

The quality of treated effluent being discharged to Hoogly river is presented in below table.

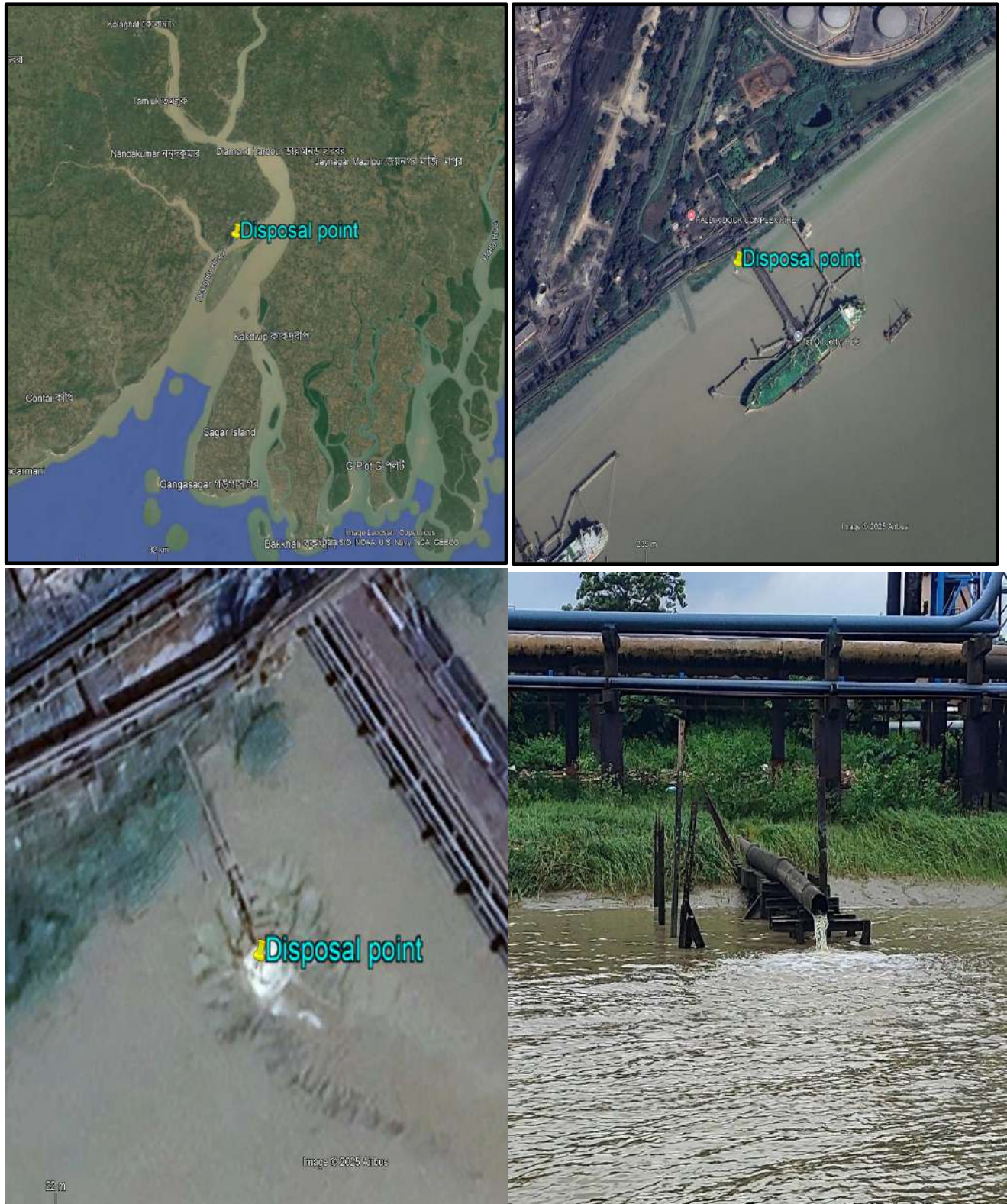
**Table 1.1: Effluent Leaving Refinery (ELR)
(Results for FY 2024-25)**

S. No.	Parameters	Unit	Standard	Average	Min	Max
1	pH value at 25°C	-	6.0 - 8.5	7.4	7.0	8.1
2	Copper (as au)	mg/l	1	0.023	0.020	0.05
3	Phenolic Compounds	mg/l	0.35	0.009	0.001	0.100
4	Cyanide (as CN)	mg/l	0.2	0.020	0.020	0.020
5	Lead as Pb)	mg/l	0.1	0.009	0.005	0.050
6	Mercury (as Hg)	mg/l	0.01	0.001	0.001	0.001
7	Nickel (as Ni)	mg/l	1	0.023	0.020	0.050
8	Total Chromium (as Cr)	mg/l	2	0.013	0.010	0.050
9	Zinc (as Zn)	mg/l	5	0.036	0.020	0.180
10	Hexavalent Chromium	mg/l	0.1	0.054	0.050	0.100
11	Vanadium (as V)	mg/l	0.2	0.050	0.050	0.050
12	Benzo(a)pyrene	mg/l	0.2	0.017	0.000	0.200
13	Benzene	mg/l	0.1	0.063	0.050	0.200
14	Total Suspended Solid	mg/l	20	11.3	3.6	20
15	BOD	mg/i	15	9.9	2.0	14.85
16	Chemical Oxygen Demand	mg/l	125	46.4	10.0	80
17	Oil and Grease	mg/l	5	5.0	5.0	5.0
18	Ammonical Nitrogen (as N)	mg/l	15	3.4	0.1	11.8
19	Total Kjeldahl Nitrogen	mg/l	40	5.4	0.3	20.5
20	Sulphide (as H ₂ S)	mg/l	0.5	0.1	0.1	0.3
21	Phosphate (as P)	mg/l	3	0.2	0.1	0.73

ELR data of April 2024 to March 2025 is provided in **Annexure-I**.

The approximate distance from the Refinery to the disposal point in the Hoogly river is 50m. The location of disposal point is shown in below images.

Figure No. 1.1: Treated Effluent Disposal Location



CHAPTER NO. 2

EFFECT ASSESSMENT OF TREATED EFFLUENT DISCHARGE IN TO RIVER

2.0 HOOGLY RIVER:

The Hooghly River is a distributary of the Ganges River which is about 260 km (160 miles) from its point of separation from the Ganges to the Bay of Bengal. It splits from the Ganges at Farakka Barrage, Nadia district, near Murshidabad flowing through cities like Hooghly, Howrah, Kolkata, and Haldia. It empties into the Bay of Bengal through the Hooghly estuary.

Near the IOCL's Haldia Refinery, the approximate width of Hooghly river ranges from 1km to 2km and the depth of river near the refinery ranges between 8m to 12m. This is because depths vary hourly with tide and seasonally with siltation.

The Hooghly is fed by controlled inflow from the Farakka Barrage (on the Ganga) and tides from the Bay of Bengal. The discharge (flow) of the river ranges from ~ 1,000 m³/s during dry season to 3000 - 20,000 m³/s during monsoon, especially without Farakka regulation. Typical TDS of the river ranges between 216 mg/l & 17846 mg/l. The tidal current effects are noted up to 130 km upstream of Kolkata.

2.1 METHODOLOGY ADOPTED TO CARRYOUT EFFECT ASSESSMENT:

The following methodology is adopted to assess the effect on river due to disposal of treated effluent from Haldia Refinery.

- Assessing chemical, physical and biological impacts.
- Assessment in terms of spatial extent i.e mixing zone, upstream and downstream zones.
- Assessing with respect to temporal extent i.e tidal effect and Seasonal variations).
- Assessing with respect to regulatory standards, i.e Refinery standard for treated effluent, water quality standards based on the end use of the river water).

2.2 ASSESSMENT OF EFFECT OF DISPOSAL OF TREATED EFFLUENT INTO HOOGLY RIVER

2.2.1 SAMPLING AND ANALYSIS OF RIVER HOOGLY

In order to assess the effect of treated effluent being discharged in to the river , Sampling and analysis of water quality shall be required to assess the impact with respect to physical, chemical and biological impacts. Hence, a complete river water quality study has been carried out by collecting the river water sampling and analysing the same as per standard methods.

As the treated effluent is already being disposed to the river, the impact can be measured directly from the quality of river. Accordingly, river sampling was done and results are tabulated in below sections.

The location for effluent disposal faces tide effect of the Sea. Considering the same, Sampling and analysis of Hooghly river water was carried out at 16 locations for Surface water with 7 at the upstream and 9 locations downstream of the disposal point and 5 locations for Ground water sampling. The data was collected during July and September 2025.

Figure No. 1.2: Sampling locations – All locations



Figure No. 1.3: Sampling locations – Close to Disposal point



Surface water locations

Ground water locations

A total of 64 Nos. of samples were collected at 16 locations. The samples were collected for during July and September 2025. Two (2) samples per location in a day with one sample during “High tide” condition and another in “Low Tide” condition were collected. The location of

disposal point is 22° 1'53.51"N and 88° 5'54.47"E. Sampling locations with coordinates are given below.

Table 1.2: Sampling locations – Surface water

S. No.	Location	Latitude	Longitude	Distance from Disposal Point	Position from disposal point
1	SW 1	22° 2'2.51"N	88° 6'9.02"E	500 m	Upstream
2	SW 2	22° 1'51.73"N	88° 6'14.72"E	585 m	Upstream
3	SW 3	22° 1'36.66"N	88° 5'52.52"E	520 m	Downstream
4	SW 4	22° 1'44.77"N	88° 5'44.57"E	388 m	Downstream
5	SW 5	22° 1'5.02"N	88° 5'24.15"E	1700 m	Downstream
6	SW 6	21°58'50.70"N	88° 3'22.95"E	7000 m	Downstream
7	SW 7	21°56'27.57"N	88° 1'18.12"E	12700 m	Downstream (Sea Side)
8	SW 8	21°54'32.05"N	88° 4'42.38"E	13600 m	Downstream (Sea Side)
9	SW 9	22° 2'42.94"N	88° 8'9.28"E	4175 m	Upstream
10	SW 10	22° 4'30.15"N	88°5'56.01"E	11700 m	Upstream
11	SW 11	22°1'51.83"N	88°5'54.02"E	50 m	Upstream
12	SW 12	22°1'55.46"N	88°5'59.54"E	55 m	Downstream
13	SW 13	22°1'50.43"N	88°5'52.89"E	160 m	Upstream
14	SW 14	22°1'55.76"N	88°6'4.63"E	100 m	Downstream
15	SW 15	22°1'47.33"N	88°5'52.14"E	300 m	Upstream
16	SW 16	22° 1'47.33"N	88° 5'52.14"E	200 m	Downstream

The range of major parameters are produced in below table for both Low tide and High tide condition. Complete Sampling and analysis data collected on 23.07.2025 and 04.09.2025 are given in **Annexure II**.

Table No. 1.3: Sampling & Analysis – Major parameters

Parameter	23.07.2025	23.07.2025	04.09.2025	04.09.2025
	Low Tide	High Tide	Low Tide	High Tide
pH	7.21 - 8.07	7.73 – 8.08	7.76 – 8.02	7.89 – 8.09
TDS, mg/l	434 - 523	581 - 684	497 - 625	579 - 844
BOD, mg/l	1.5 – 2	1.6 - 2	0.9 – 2.1	1.1 – 1.9
COD, mg/l	18.54 – 25.2	20.5 – 37.9	23.5 – 32	16 – 36
NH3-N, mg/l	BDL – 0.21	BDL – 0.189	0.11 – 0.14	0.4 – 1.1
PO ₄ , mg/l	0.12 – 0.2	0.13 – 0.24	0.18 – 0.23	0.17- 0.23
Phenol, mg/l	BDL	BDL	BDL	BDL

Sulphide, mg/l	0.02 – 0.13	0.09 – 0.14	0.1 – 0.17	0.08 – 0.12

Note 1. Least count for Phenol: 0.001 mg/L.

2.2.3 RIVER WATER FLOW / QUANTITY

The Hoogly river flowrate data has been collected from Hydraulic Study Department, Kolkata. Flow data pertains to the location in front of Haldia Oil Jetty 1 (Latitude 22° 1'45.44"N, Longitude 88° 6'14.38"E) dated 19.11.2024 and data is reproduced in table.

Figure No. 1.4: Location of Flow measurement data in Hoogly River



Table No. 1.4: Haldia River flow
(Source: Hydraulic Study Department, Kolkata)

Hours Location	Flow in front of Haldia Oil Jetty 1		Tide
	Cumec.	m ³ /hr	
0	5487	19753200	Ebb
1	3462	12463200	
2	1020	3672000	
3	5309	19112400	Flood
4	9809	35312400	
5	11646	41925600	
6	11138	40096800	
7	6048	21772800	
8	1045	3762000	Ebb
9	5431	19551600	
10	8660	31176000	
11	7675	27630000	
12	6024	21686400	

As per above table, the average flow during Ebb (River flow towards Sea) is 1,63,62,000 m³/hr and 3,16,44,000 m³/hr during flood (i.e Sea flow towards river).

Table No. 1.5: Historical data of Hoogly river flow

Date of Observation	Maximum Discharge during Flood		Maximum Discharge during Ebb	
	m ³ /s	m ³ /hr	m ³ /s	m ³ /hr
26.08.2014	20775	7,47,90,000	13287	4,78,33,200
07.06.2019	16553	5,95,90,800	10445	3,76,02,000
19.11.2024	11646	4,19,25,600	8660	3,11,76,000

The salinity of river is ranged from 2.16 ppt to 5.04ppt with the average of 3.08ppt during the sampling date of 19.11.2024. The above data collected from Hydraulic Study Department, Kolkata is attached as **Annexure-III**.

2.2.4 EFFECT ASSESSMENT ON RIVER:

At Haldia Refinery, the effluent being discharged is a treated effluent, i.e RO reject. The treated effluent meets the standards set by the West Bengal Pollution Control Board (WBPCB) vide the CTO issued (CTO attached as **Annexure-IV**) to the Refinery as indicated in ELR Data as attached in **Annexure-I**. The refinery has a real-time monitoring system to ensure the quality of the treated effluent standards before discharge. The refinery also submits the six-monthly compliance reports meeting the stipulations provided in the environmental clearances.

In order to assess the impact in the river due to disposal of treated effluent, complete one year data from January 2024 to December 2024 is also collected from West Bengal Pollution Control Board (WBPCB) and compiled table is provided in **Annexure-V**. The WBPCB data is available for the location "Pathikhali" which is approximately at a distance of approx. 5 km upstream from disposal point where one the sampling point is also located (i.e SW9).

Effect assessment:

Considering, the WBPCB data as the base data which is flowing from the upstream of the disposal point, the resultant and incremental value with respect to the Effluent data is estimated and presented in below table. Flow of the river is considered as collected from the Hydraulic Study Department.

Table No. 1.6: Resultant & Incremental quality of River Hoogly

S. No.	Parameters	River Quality	River Quality	Average Effluent quality	During Low Tide		During High Tide	
		16.7.25	08.09.25	quality	Resultant (16.7.25)	Increment (16.7.25)	Resultant (16.7.25)	Increment (16.7.25)
					Resultant (08.09.25)	Increment (08.09.25)	Resultant (08.09.25)	Increment (08.09.25)
1	pH	7.57	7.61	7.3775	7.570	-0.000002	7.570	-0.000001
					7.610	-0.000003	7.610	-0.000001
2	TSS, mg/l	876.00	314	11.292	875.989	-0.010570	875.995	-0.005465
					313.996	-0.00370	313.998	-0.001913
3	COD, mg/l	26.00	28.57	46.4333	26.00025	0.000250	26.000	0.000129
					28.5700	0.00022	28.570	0.000113
4	Ammonical Nitrogen, mg/l	BDL	0.13	3.4075	0	0.0000417	0	0.000022
					0.130	0.0000401	0.130	0.000021
5	Phosphate (as P) , mg/l	Not available	0.22	0.23	-	-	-	-
					0.220	0.0000001	0.220	0.0000001
6	TDS, mg/l	406	586.00	14000	406.166	0.166163	406.086	0.085918
					586.164	0.16396	586.085	0.084780

Considering, the WBPCB data as the base data which is flowing from the upstream of the disposal point, the resultant and incremental value with respect to the Effluent data is estimated. From the same, it can be seen that, pH stays between ~7.57–7.61 with no effect. TSS is already high in the river and RO reject with lower TSS equalizes the river's TSS locally. The incremental increase in COD and Ammonia-N are negligible with only respective percentage increase of 0.001% & 0.031%. There is no change in Phosphate. TDS in the effluent is high (14,000 mg/L) compared to river (406–586 mg/L), but the increment is ~0.085–0.166 mg/L, i.e., <0.03% of background indicating strong dilution or tidal dispersion.

The above resultant and incremental values confirm that the incremental load in to the river is negligible.

Localized effect assessment at the point of disposal:

The disposal point is only 50 meter from the shore of the river. Hence, further check on the localized effect near the disposal point has also been carried out. Accordingly, the river flow has been estimated based on the velocity and depth of river near the disposal point as detailed below.

- Width of river at the disposal point = 1.35 km
- Depth of Hoogly river in the Haldia channel =12m (Range 8-12 m based on season & siltation)
- Velocity of the river during low tide = 1.5 m/sec

- Velocity of the river during high tide = 2 m/sec

Considering the bed of the river is in the parabolic or semi-circular cross section, the depth gradually decreases and reaches to 0 at the side of the river.

Depth of parabola = Depth of river $\times (1 - 4X^2 / W^2)$

X = distance from centerline i.e. 1350/2 minus 50m from the shoreline = 625m

Accordingly, depth is calculated as 1.712 m at the disposal point.

Flow of river at disposal point during low tide= 256.8 m³/s (9,24,480 m³/hr - low tide)

Flow of river at disposal point during low tide= 342.4 m³/s (12,32,640 m³/hr - High tide)

Based on the above, the resultant and incremental values for localized zone is presented below.

**Table No. 1.7: Resultant & Incremental quality of River Hoogly – Localized river flow
(During Low Tide)**

S. No.	Parameters	River quality	River quality	Average Effluent quality	During Low Tide		During High Tide	
		16.7.25	08.09.25		Resultant (16.7.25)	Increment (16.7.25)	Resultant (16.7.25)	Increment (16.7.25)
		16.7.25	08.09.25		Resultant (08.09.25)	Increment (08.09.25)	Resultant (08.09.25)	Increment (08.09.25)
1	pH	7.57	7.61	7.3775	7.570 to	-0.000042	7.570	-0.000031
					7.610	-0.000050	7.610	-0.000038
2	TSS, mg/l	876.00	314.00	11.2917	875.813	-0.187029	313.951	-0.140279
					313.935	-0.065473	875.860	-0.049107
3	COD, mg/l	26.00	28.57	46.4333	26.004	0.004420	26.003	0.002898
					28.574	0.003864	28.573	0.003315
4	Ammonical Nitrogen, mg/l	BDL	0.13	3.4075	0.001	0.000737	0.001	0.000532
					0.131	0.000709	0.131	0.000553
5	Phosphate (as P), mg/l	Not available	0.22	0.23	-	-	-	-
					0.220	0.000002	0.220	0.000002
6	TDS, mg/l	406.00	586.00	14000	408.940	2.940260	408.205	2.176114
					588.901	2.901328	588.176	2.205315

The above table, represents the pH is stable and neutral. The resultant increment of COD is marginal (~+0.003–0.004 mg/L) which is ~ 0.011 to 0.017%, indicating limited impact. Ammonical-N and Phosphate indicates negligible change. TDS resultant stays close to river background (≈408–589 mg/L) with small positive increments (+2.18 to +2.94 mg/L) with only 0.5 to 0.7% increase.

Bottom line: With the above calculation, the discharge is not noticeably altering the river water quality at the point of assessment during either tide or Ebb.

This is further established with primary data collected and analysed with respect to spatial and temporal variations.

Effect assessment with respect to Spatial/distance:

Spatial analysis helps to know how quality of river gets effected at distances. It is carried out in 3 levels,

- Near the disposal point (0 – 300m)
- Mid field (300m – 2Km)
- Far field (2Km – 15Km)

Near the disposal point, i.e from disposal point to 300m, the sampling locations SW11, SW12, SW13, SW14, SW15 & SW16.

The concentration of pollutants at these sampling points are depicted in below maps and graphs.

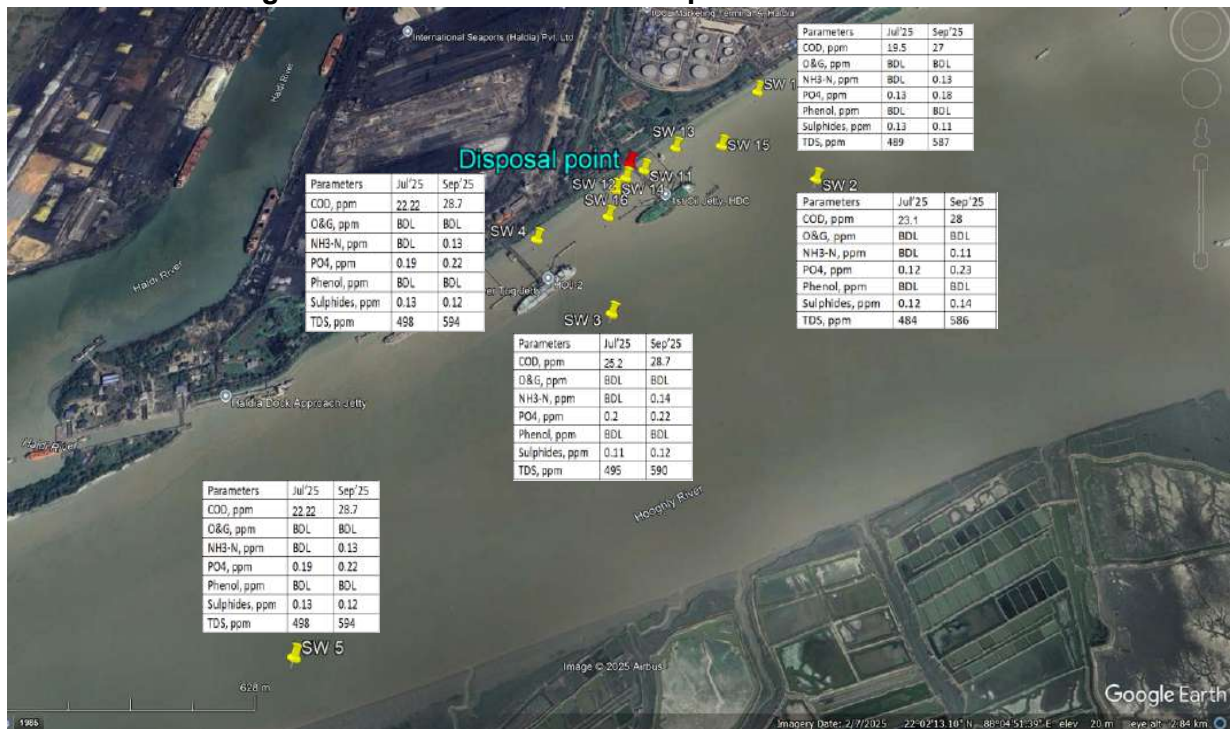
Figure no. 1.5: Concentration of parameters near disposal point



As per sampling analysis data of river water sample near the disposal location, total Dissolved Solids remain stable around 468–625 mg/L, indicating no salinity rise due to effluent disposal. RO reject water is having TDS of 14,000 mg/L, but, Its discharge volume is low (200 m3/hr) compared to the river's flow (1,63,62,000 m3/hr during EBB and 3,16,44,000 m3/hr during flood). The mixing and dispersion rate in a large estuarine channel is extremely high. The residence time of the reject plume is short, so it's quickly flushed seaward. Therefore, its local TDS impact is negligible in the overall river TDS background.

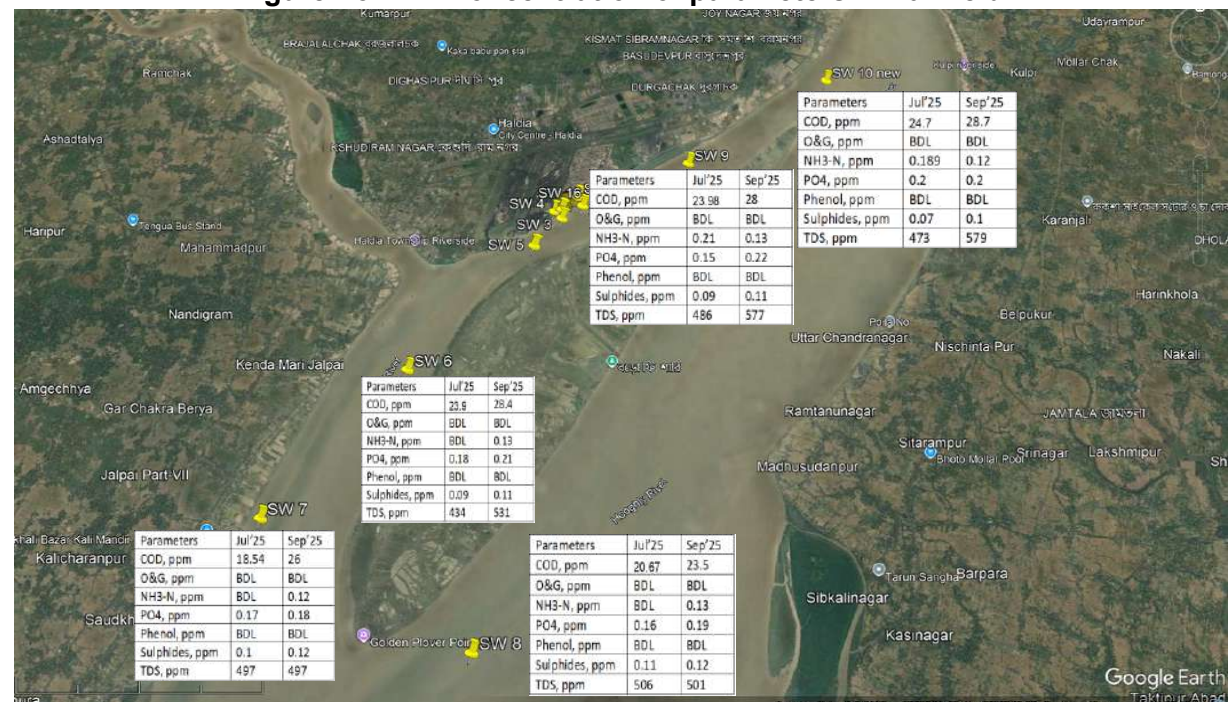
Mid field (300m – 2Km), The sampling locations SW1, SW2, SW3 & SW4 falls in this range from the disposal point. The concentration of pollutants at these sampling points are depicted in below maps and graphs.

Figure no. 1.6: Concentration of parameters in Mid field



Far field (2Km – 15Km), the sampling locations SW5, SW6, SW7, SW8, SW9 & SW10 falls in this range from the disposal point. The concentration of pollutants at these sampling points are depicted in below maps.

Figure no. 1.7: Concentration of parameters in Far field



Note: Similar graph for High tide is provided in **Annexure VI**.

Above analysis for Near the disposal point, Mid field and Far field, clearly indicate that river water quality up to 15 km from the discharge point remains unaffected, confirming that effluent disposal has negligible influence on the Hooghly River environment.

Effect assessment - Temporal:

In order to assess the seasonal variations, the resultant increment for 2024 is calculated considering the river flow of 1000 m³/s (3600000m³/hr) for dry season and 3000 m³/s (10800000m³/hr) for wet season, (Source: Seasonal variability of physico chemical characteristics of the Haldia channel of Hooghly estuary, India).

Table No. 1.8: Resultant for Dry and Wet season

S. No.	Parameters	River Quality	River Quality	Effluent quality	Resultant	Increment Load	Resultant	Increment Load
		22.04.2024	22.07.2024		22.04.2024		22.07.2024	
1	pH	8.40	8.00	7.3775	8.400	-0.000057	8.000	-0.000012
2	TSS, mg/l	150.00	150.00	11.2917	149.992	-0.007706	149.997	-0.002569
3	COD, mg/l	50.00	46.00	46.4333	50.000	-0.000198	46.000	0.000008
4	Ammonical Nitrogen, mg/l	0.18	0.12	3.4075	0.180	0.0001793	0.120	0.0000609
5	Phosphate (as P)	0.04	0.12	0.23	0.040	0.040011	0.120	0.120002
6	TDS, mg/l	11420	7620.00	14000	11420.14	0.143	7620.12	0.118

The effluent (RO reject) is cleaner than the river for TSS but slightly higher for Ammonical-N and Phosphate. During dry season, the effect is slightly higher (still minimal) than wet season, as expected with less dilution in dry weather. There is a increase in traces for Ammonical-N, Phosphate and TDS but still negligible.

River water quality of last 4 years is also referred to analyse for timely variation.

Table No. 1.9: Quality of river from 2022 to 2025

Parameter s	2022			2023			2024			2025		
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
pH	7.21	8.02	8.67	7.8	8.29	9.05	7.40	9.09	33.00	7.81	7.57	8.01
TSS, mg/l	74.00	467	1228	18	447	850	49.7	350	772	358	74	876
COD, mg/l	10.08	24.3	37.24	11.8	35.4	59.76	14.4	30	74.51	35.4	15.4	96.74
NH3-N, mg/l	0.10	0.27	1.02	0.06	0.32	1.56	0.11	0.22	0.62	0.57	0.10	1.08

PO ₄ , mg/l	0.01	0.17	2.12	0.04	0.14	0.26	0.04	0.16	0.28	0.21	0.14	0.26
TDS, mg/l	268	3317	9750	312	3962	16374	224	3783	11420	406	4150	13000

The above data represents, no major variations in TDS and other parameters (COD, NH₃ and PO₄) are in declining mode. Thus, seeing the river water quality of past 4 years, the effluent disposal is not causing the major impact to river water quality.

2.2.2 EFFECT ASSESMENT ON GROUND WATER

To check the impact on ground water due to effluent disposal into a river, sampling and analysis has been carried out for ground water near the disposal location.

Table No. 1.10: Sampling locations – Ground water

S. No.	Location	Latitude	Longitude
1.	GW 1	22° 2'39.54"N	88° 6'17.61"E
2.	GW 2	22° 4'7.76"N	88° 7'58.06"E
3.	GW 3	22° 5'51.69"N	88°10'52.17"E
4.	GW 4	22° 1'32.05"N	88° 3'36.63"E
5.	GW 5	22° 3'40.70"N	88° 4'16.31"E

Sampling of ground water carried out on 23.07.2025 & 04.09.2025 and the same are provided in below tables.

**Table No. 1.11: Ground water Sampling Analysis data
Date of sampling: 23.07.2025**

Parameters	Unit	GW-1	GW-2	GW-3	GW-4	GW-5
pH		7.61	7.59	7.64	7.55	7.61
Turbidity	NTU	<1	<2	<1	<1	<1
Temperature	Degree	24.6	24.5	24.5	24.6	25.5
Colour	Hazen	<1	<1	<1	<1	<1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Salinity	ppt	< 2	< 2	< 2	< 2	< 2
Oil & Grease	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total Suspended Solid	mg/l	8	10	12	15	16
Total Dissolved Solids	mg/l	936	944	943	956	921
Total Alkalinity	mg/l	296.5	297	298.4	302	290.6

Total Hardness	mg/l	375	378	377.4	380	370
Calcium Hardness	mg/l	225	229	224.6	228	222
Magnesium Hardness	mg/l	150	149	152.8	152	148
Chloride	mg/l	393	395	392	388	387
Fluoride	mg/l	0.52	0.48	0.54	0.53	0.48
Copper	mg/l	0.005	0.003	0.0008	0.0061	0.0006
Sulphates	mg/l	9.6	10.4	9.9	10.4	10.5
Sodium	mg/l	76.96	77.26	78.4	75.46	80.5
Iron	mg/l	BDL	BDL	BDL	BDL	BDL
Potassium	mg/l	6	5.8	5.8	6.5	6.8
Nitrates	mg/l	0.34	0.29	0.36	0.41	0.42
Manganese	mg/l	0.063	0.058	0.61	0.056	0.056
Arsenic	mg/l	BDL	BDL	BDL	BDL	BDL
Mercury	mg/l	BDL	BDL	BDL	BDL	BDL
Zinc	mg/l	0.048	0.051	0.046	0.05	0.052
Nickel	mg/l	BDL	BDL	BDL	BDL	BDL
Cadmium	mg/l	BDL	BDL	BDL	BDL	BDL
Total Chromium	mg/l	BDL	BDL	BDL	BDL	BDL
Lead	mg/l	BDL	BDL	BDL	BDL	BDL
Selenium	mg/l	0.0005	0.0005	0.0005	0.0005	0.0005
Cyanide	mg/l	0.001	0.001	0.001	0.001	0.001
Total Phosphate	mg/l	0.15	0.17	0.12	0.19	0.21
Sulphide	mg/l	0.01	0.01	0.01	0.01	0.01
Phenol	mg/l	BDL	BDL	BDL	BDL	BDL
Vanadium	mg/l	0.04	0.037	0.036	0.004	0.006
DO	mg/l	7.8	7.7	7.7	8	7.6
COD	mg/l	40	36	42	38	28
BOD	mg/l	0.42	1.29	0.85	0.59	0.65
Ammonical Nitrogen	mg/l	0.05	0.07	0.07	0.08	0.02
Total Kjeldahl Nitrogen	mg/l	0.1	0.14	0.14	0.16	0.04
Total Nitrogen	mg/l	0.95	1.01	1.01	1.04	0.86
Benzene	mg/l	0.01	0.01	0.01	0.01	0.01
Benzo (a)-Pyrene	mg/l	0.0001	0.0001	0.0001	0.0001	0.0001

Table No. 1.12: Ground water Sampling Analysis data
Date of sampling: 04.09.2025

Parameters	Unit	GW-1	GW-2	GW-3	GW-4	GW-5
pH		7.98	7.12	7.71	7.78	8.03
Turbidity	NTU	<1	<2	<1	<1	<1
Temperature	Degree	24.2	24.3	24.2	24.1	24.4

Colour	Hazen	<1	<1	<1	<1	<1
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Salinity	ppt	< 2	< 2	< 2	< 2	< 2
Oil & Grease	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
TSS	mg/l	6	8	7	9	11
TDS	mg/l	1006	924	708	782	641
Total Alkalinity	mg/l	305	295	276	284	228.5
Total Hardness	mg/l	380	375	360	324	342
Calcium Hardness	mg/l	228	225	208	216	196
Magnesium Hardness	mg/l	152	150	152	108	146
Chloride	mg/l	390	385	372	365	346
Fluoride	mg/l	0.52	0.46	0.47	0.49	0.41
Copper	mg/l	0.0046	0.0026	0.0005	0.0053	0.0005
Sulphates	mg/l	9.8	10.8	9.6	9.8	8.8
Sodium	mg/l	78.2	76.58	72.8	73.32	70.2
Iron	mg/l	BDL	BDL	BDL	BDL	BDL
Potassium	mg/l	5.94	6	5.6	6.1	6.5
Nitrates	mg/l	0.35	0.27	0.33	0.37	0.39
Manganese	mg/l	0.062	0.055	0.56	0.048	0.052
Arsenic	mg/l	BDL	BDL	BDL	BDL	BDL
Mercury	mg/l	BDL	BDL	BDL	BDL	BDL
Zinc	mg/l	0.051	0.048	0.039	0.048	0.05
Nickel	mg/l	BDL	BDL	BDL	BDL	BDL
Cadmium	mg/l	BDL	BDL	BDL	BDL	BDL
Total Cr	mg/l	BDL	BDL	BDL	BDL	BDL
Lead	mg/l	BDL	BDL	BDL	BDL	BDL
Selenium	mg/l	0.0005	0.0005	0.0005	0.0005	0.0005
Cyanide	mg/l	0.001	0.001	0.001	0.001	0.001
Total Phosphate	mg/l	0.17	0.15	0.1	0.14	0.19
Sulphide	mg/l	0.01	0.01	0.01	0.01	0.01
Phenol	mg/l	BDL	BDL	BDL	BDL	BDL
Vanadium	mg/l	0.036	0.032	0.025	0.0035	0.006
DO	mg/l	7.7	7.8	7.9	7.7	7.8
COD	mg/l	38	34	32	32.6	16
BOD	mg/l	0.3	0.51	0.45	0.73	0.28
NH3-N	mg/l	0.06	0.06	0.08	0.09	0.03
TKN	mg/l	0.12	0.12	0.16	0.18	0.06
Total Nitrogen	mg/l	0.98	0.98	1.04	1.07	0.89
Benzene	mg/l	0.01	0.01	0.01	0.01	0.01
Benzo (a)-Pyrene	mg/l	0.0001	0.0001	0.0001	0.0001	0.0001

2.2.5 Impact Assessment on ground water Quality

Salinity Increase:

In tidal zones like Haldia, the Hooghly River and shallow aquifers are hydraulically connected through alluvial sediments which can cause saltwater intrusion through bank infiltration, especially during high tide. Over the time, ions can migrate into shallow groundwater leading to groundwater salinization. The groundwater around the refinery (GW-1 to GW-5) shows much TDS values (640–1000 mg/L) during July and September which shows no major impact in ground water.

Heavy metals/micro-pollutants:

In the analysis of the ground water sample collected from villages surrounding the disposal points, the heavy metal concentration in the river is very less i.e in BDL which is well within the drinking water standard.

Table No. 1.13: Comparison of Values in GW analysis with IS 10500 standards

Parameters	Unit	Max	IS10500
Copper	mg/l	0.0061	0.05
Iron	mg/l	BDL	0.3
Arsenic	mg/l	BDL	0.01
Mercury	mg/l	BDL	0.001
Zinc	mg/l	0.052	5
Nickel	mg/l	BDL	0.02
Cadmium	mg/l	BDL	0.003
Total Chromium	mg/l	BDL	0.05
Lead	mg/l	BDL	0.01
Cyanide	mg/l	0.001	0.05

Overall, It is observed from the data collected that there is no increase in the pollution load and also it is within the permissible limits of the drinking standards.

At Haldia, 84 % of the area is alluvial plains. But in coastal/estuarine area around Haldia refinery, it's noted that the soils are formed from silt carried by the Hooghly and Haldi rivers. The soil around Haldia channel is silt clay and has moderate percolation. Accordingly, quality of ground water around the refinery were also checked and found that the there is no impact in quality.

Moreover, where the treated effluent (i.e RO reject) is disposed in to Hoogly river is near the estuary. The Strong tidal and river currents in the Hooghly estuary quickly mix and transfers the discharge along the main channel and carryover of flow towards the sea rather than into groundwater.

This is also verified with the historical data (collected from WBPCB for location near Refinery) and is provided in **Annexure VII**.

CHAPTER NO.3

INSTALLATION OF NEW ZERO LIQUID DISCHARGE PLANT

3.0 INTRODUCTION:

This chapter describes the assessment on the feasibility for installation of zero liquid discharge plant at Haldia Refinery and it's corresponding impact on the environment.

The design criteria considered for Zero liquid discharge plant is provided in below sections:

3.1 Design basis for ZLD plant

The combined reject water from TTP and RODM plant which is currently being disposed to river shall be fed to the new Zero Liquid Discharge Plant for further processing. The discharge flow from each stream are provided in the following table:

Table No. 1.14: Quantity of Effluent to ZLDP

S. No.	Description	Quantity (m ³ /hr)
1.	RO reject from TTP	120
2.	RO reject from DYIP RO-DM plant	80
Total effluent generation		200

The ZLD plant shall be designed to Process 200 m³/hr of RO reject effluents and shall generate treated water equivalent to the raw water quality.

Feed Effluent Quality

The design quality of feed effluent to the ZLD plant is provided in the below table:

Table No. 1.15: ZLD plant feed Water Quality

S. No.	Parameters	Quality
1	pH	7.55
2	Turbidity, NTU (5 min settled)	2.90
3	Total suspended solids, mg/l	25
4	Total dissolved solids, mg/l	14000
5	Total Hardness, mg/l	3764
6	Ca Hardness, mg/l	1073
7	Magnesium Hardness, mg/L	1810
8	Total Alkalinity CaCO ₃	2342
9	Chlorides as as Cl, mg/l	4687
10	Sulphates as SO ₄ , mg/l	3161

11	Iron Total, as Fe, mg/l	0.27
12	Total Silica as SiO ₂ , mg/l	40
13	Oil & Grease, mg/l	5
14	Zinc	0.18
15	Phosphate as P, mg/l	0.73
16	BOD(3 days, 27°C), mg/L	23
17	COD, mg/L	80
18	Phenols, mg/L	0.1
19	Sulphides, as S, mg/L	0.3
20	Ammonia as N, mg/L	25
21	Ammonical Nitrogen, mg/L	12
22	TKN, mg/L	20.5
23	Cyanide as CN, mg/l	0.02
24	Hexavalent Chromium, mg/l	0.10
25	Total Chromium as Cr, mg/l	0.05
26	Lead as Pb, mg/l	0.05
27	Mercury as Hg, mg/l	0.00
28	Nickel as Ni, mg/l	0.05
29	Copper as Cu, mg/l	0.05
30	Vanadium as V, mg/l	0.05
31	Benzene, mg/l	0.20
32	Benzo Pyrene, mg/l	0.20
33	Sodium, as Na, mg/L	650
34	Nitrates, mg/L	2.4
35	Fluoride, mg/l	2.9
36	Pottassium, mg/l	218
37	Barium as Ba, mg/l	0.2
38	Strontium as Sr, mg/l	1.3
39	Carbonate as CO ₃ , mg/l	17.35
40	Boron as B, mg/l	1.73

Notes:

The above design quality values are based on combining the quality of TTP RO reject and DYIP RODM plant RO reject based on the analysis data.

A water balance on overall feed, reject and water recovery is attached as **Annexure-VIII**. based on the same, ZLD plant with a capacity of 200 m³/hr is designed consisting of the following treatment sections:

- Pretreatment section
- RO section
- Evaporator & Dryer section

After the water recovery from the RO system, about 64 m³/hr flow will be routed to the evaporation system. Accordingly, the capacity of evaporation system is considered as 2 chains of 32 m³/hr each including the internal recirculation flows. The overall recovery from the ZLD plant shall be ~95-98%. The recovered water from the ZLD plant shall be reused within the refinery. The evaporator system shall be designed meeting the following criteria.

There shall be no liquid effluent discharge from the Refinery. However, the dried salt extracted from the effluent is required to be disposed safely.

3.2 OVERVIEW OF ZERO LIQUID DISCHARGE TECHNOLOGIES

Water shall be recovered from the effluent by incorporating the latest technologies and the recovered water shall be utilized within the Refinery. After recovering the water to the maximum extent possible, the remaining salts which shall be present in the form of dissolved salts shall be extracted. To meet this, a Zero Liquid Discharge (ZLD) Plant shall be required which shall consists of a pre-treatment section, recycle section and zero liquid discharge section to optimize recovery from the feed effluent streams. The feed effluent water processed by the ZLD plant will be recovered as treated raw water, suitable for various applications including Cooling Water Makeup, Service Water, as backup to DM plant feed, and/or fire water makeup.

All Zero liquid discharge systems typically involve concentration of the Effluent by evaporative and concentrator units by using Thermal or Electrical Energy or a combination of both to concentrate the dissolved salts / solids in the effluent and recover the evaporative water as condensate. The effluent (liquor) from the evaporative system is then further concentrated beyond saturation limits to move the salts out of the solution through precipitation / Crystallization. The Condensate recovered in the evaporative process is of good quality and can be used as a supplement to raw water.

The Evaporation / Concentration unit may be preceded by a pretreatment section for conditioning the Feed and may also include a RO processing Unit to recover good quality permeate water before the Effluent is sent to the evaporation unit. This also provides for a capacity reduction in the final treatment for achieving the Zero Liquid Discharge.

a. REVERSE OSMOSIS

Reverse Osmosis is the process of forcing a solvent from a region of high solute concentration through a semipermeable membrane to a region of low solute concentration by applying a pressure in excess of the osmotic pressure. The most important application of reverse osmosis is the separation of pure water from seawater and brackish waters. Seawater or brackish water is pressurized against one surface of the membrane, causing transport of salt-depleted water across the membrane and emergence of low TDS water from the low-pressure side. The RO System can deliver up

to 7 - 8 % concentration of dissolved salts in the Reject Stream. To accomplish the complete Zero Liquid Discharge System, this RO Reject Stream must be further processed in a Thermal / Mechanical Evaporator and Dryer unit.

So for a complete ZLD System, the RO unit shall be the First step to process the Effluent and generate good quality Permeate water for reuse and thereby reducing the final Evaporation / Dryer load which is typically done through a thermal or a Mechanical Evaporator / Dryer unit depending upon the availability of Steam / Power and Other Utilities.

Advantages:

- Proven Process
- Consistent Performance
- Lower energy costs as compared to thermal processes and other evaporative process
- Removes dissolved contaminants

Disadvantages:

- High Operating pressures
- Recoveries for Sea Water Systems are low
- Issues in disposing rejects (Requires Final Evaporator / Dryer Unit)
- Requires pretreatment to avoid membrane fouling.
- Energy cost increases with higher TDS

RO being a membrane-based separation process, operates at comparatively lower energy requirements and effectively reduces the feed load on thermal units by 60–70%. This not only optimizes capital and operating costs but also enhances system reliability. Thus, adoption of RO pretreatment prior to thermal concentration represents the most techno-economically viable option for achieving ZLD.

b. EVAPORATION / CONCENTRATION SYSTEM

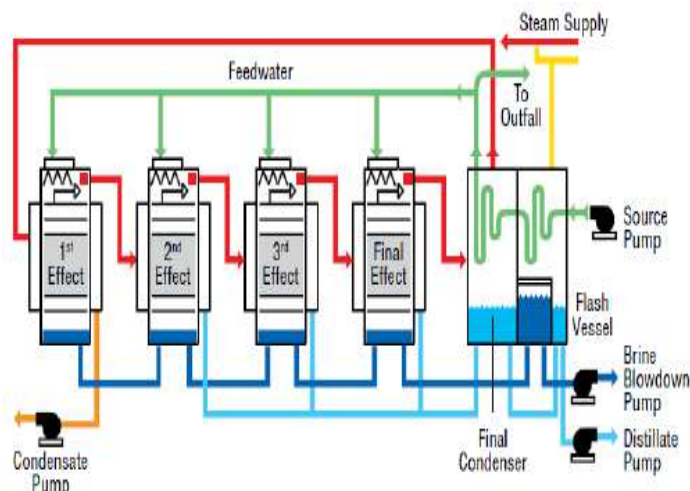
Several Concepts and Processes for Zero Liquid Discharge systems are prevalent and have been implemented across industries depending upon the requirements and availability of Utilities. The Following major technologies which is widely used in industries are studied to achieve Zero Liquid Discharge from the complex.

- a. Multiple Effect Evaporator
- b. Mechanical Vapor Recompression Evaporators (MVC)
- c. Solar/Evaporation Pond

a. Multiple Effect Evaporator

In this system, Feed effluent is passed through pre-heaters, calandrias and vapour separators of various effects at controlled rate. The evaporation takes place under vacuum, which shall be maintained mainly by vacuum system. Steam is supplied as a heating medium.

The feed is preheated in pre-heaters before going into the 1st effect. The circulating brine in the 1st effect heating element shall be heated with steam through TVR which condenses on the shell side. The heated and concentrated brine slurry which is circulating in the tube side of the heating element is discharged from each heating element into its respective vapour separator. The vapour is separated from the brine/slurry in the vapour separators. Mesh-pad droplet separators are provided to virtually eliminate droplet carry over with vapours leaving the vapour separators. Vapours from the 1st effect vapour separator are discharged into the shell side of the 2nd effect heating element (where they condense) whereas a part of the vapours are discharged into the suction of the TVR.



The vapours from the 2nd effect vapour separator shall be discharged in to the 3rd effect heating element and so on. The vapours shall be condensed in a surface condenser or any other suitable system. The concentrated product at the desired concentration shall continuously be taken out from the system.

The concentrated feed shall then be passed through a Dryer Unit with forced circulation type or falling film type so as to recover maximum quantity of distillate / condensate from the feed and salts as a dry product shall be provided. The condensate/ Distillate shall be recycled back as treated Water and the solids/salts shall be disposed off as solids or crystals (having moisture content less than 8-10%) from the plant. The solids shall be discharged to a dumpster for removal to landfill.

Advantages:

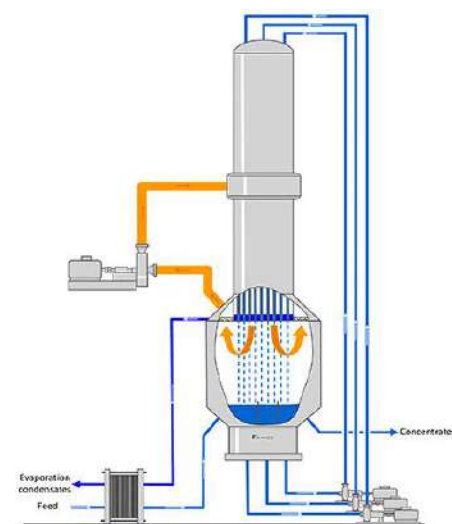
- Flexibility in Operation
- Complete Recovery of Condensate as treated Water for Reuse
- Production of very high quality (TDS <10 ppm) product water from the plant.
- By concentrating effluents and minimizing liquid discharge, MEEs help industries comply with stringent environmental norms.
- Although initial CAPEX is significant, the reduced steam and power requirements lower OPEX in the long run.
- Effective for handling RO rejects, high-TDS brine, and complex industrial wastewater streams.
- Less power consumption than MVC. ~3–8 kWh_e/m³

Disadvantages:

- Requirement external source of steam
- High Capital Costs
- Descaling, tube cleaning, and preventive maintenance are required, adding to O&M costs.
- High end Metallurgy
- Cleaning Requirements and downtime
- High-TDS and hardness-rich effluents cause scaling on heat transfer surfaces, reducing efficiency and increasing downtime.

Multi-Effect Evaporators (MEE) system is generally preferred in applications where surplus low-cost heat energy is available, particularly when such energy has limited alternative economic value.

b. Mechanical Vapour Compression (MVC)



The Mechanical Vapour Compression (MVC) is a thermal desalination technology that uses mechanical energy to recycle water vapor for seawater/brackish water desalination. It is widely applied in small- to medium-scale plants, particularly where electricity is available and steam supply is limited.

The vapor produced by the evaporator is sent to a MVC installation, to be compressed and heated up. It is then resent to the evaporator to the outside of the tubes to be used as a heating steam. In this process, the evaporator is also used as the condenser for the vapour evaporation. Antiscalant is added for cleaning the calandrias to prevent scaling formation. Oxygen scavenging dosing system is also provided to remove condensable gases from the system.

Advantages:

- MVC reuses vapor by compressing it mechanically, eliminating the need for large quantities of external steam. Plant operation is easy and minimized and also requires minimal supervision.
- MVC requires fewer evaporator effects compared to MEE, resulting in a smaller plant layout and reduced space requirements.
- Furthermore, the plant utilizes electricity as single source of external energy.
- MVC often requires no cooling water as vapor is recycled within the system.
- MVC systems are usually highly automated, with fewer manual interventions once optimized.

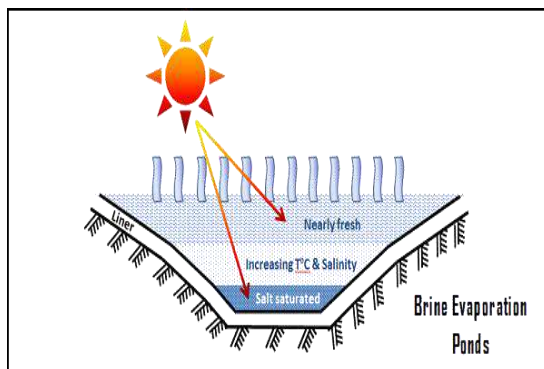
Disadvantages:

- MVC systems require costly compressors, specialized metallurgy and sophisticated controls, making their CAPEX significantly higher than MEE. Steam is required for startup.
- Compressors are complex, sensitive to fouling/scaling and require frequent inspection, increasing downtime and O&M costs.
- MVC systems are less robust against high TDS effluents, which MEEs can handle more effectively with chemical dosing and cleaning.
- MVC consumes large amounts of electricity (compressor-driven), making it uneconomical. Uses **8–12 kWh/m³**.
- Due to scaling/fouling on heat transfer surfaces and compressor internals, MVC requires more frequent chemical cleaning and shutdowns.
- Economical only for small to medium capacity plants, for large flows i.e. in case of refinery effluents, MEE is usually more feasible.

While MVC systems are compact and energy-efficient compared to MEE, they are more capital-intensive and rely heavily on electricity, which increases operating expenditure. Given that steam is abundantly available in the refinery, MVC does not present a clear economic advantage over MEE in this case.

c. Solar/Evaporation Ponds

Solar ponds are ponds constructed to retain and hold-up the waste water with very large surface areas that promote surface evaporation through natural heat transfer from air and solar energy. The evaporation ponds are generally provided in facilities that either have less effluent generation or no discharge permitted. They require a large area and if space is not a limiting factor in the premises, these can provide for an alternative to Zero Liquid discharge systems. They can be more suitable in cases where there are effluents that are generated are less in quantity or are generated very intermittently.



Advantages:

- Volume of waste requiring treatment is lowered thus achieving a reduction in costs
- Higher efficiency up to 99%
- Negligible power/steam cost compared to MEE and MVC
- Can handle **high TDS effluents ($\geq 150,000$ mg/L)** that are difficult for evaporators.
- Low skilled manpower requirement.

Limitations:

- Ponds occupy large areas. Not feasible in land scarce areas.

- Efficiency depends heavily on sunlight, temperature, and humidity. In cloudy, rainy, or humid regions, evaporation rates are low, reducing performance. Seasonal variation makes year-round reliability challenging.
- Evaporation is naturally slow compared to mechanical or thermal concentration methods. This results in long retention times, requiring larger ponds and storage capacity
- If the evaporation ponds are not properly lined, the high TDS water i.e brine can seep into the ground, contaminating soil and groundwater with salts or toxic substances. Lining materials (HDPE/Clay) increases the construction cost.
- No recovery of water
- Odor generation
- Filling up of evaporation pond during the rainy season
- Disposal/utilization of salts which are accumulated in ponds over time remains an issue.
- Requires periodic cleaning of pond

Based on the evaporation data specific to Haldia, the required surface area for handling the reject load of 64 m³/hr (~1536 m³/day) was calculated. The area required for solar evaporation pond shall be 500m X 440m (2,20,000 sqm).

The Following Table summarises the Processes that are considered for Zero Liquid Discharge Facility.

**Table No. 1.16: Summary of Processes and Treatment Systems
of ZLD technologies**

Parameter	Multi-Effect Evaporator (MEE)	Mechanical Vapor Compression (MVC)	Solar Pond
Principle	Multiple stages of evaporation using latent heat from previous stage	Mechanical compression of vapor to reuse latent heat	Natural solar evaporation in large ponds
Feed Concentration Limit	Can handle high TDS ($\geq 50,000$ mg/l)	Can handle high TDS ($\geq 50,000$ mg/l)	high TDS effluents ($\geq 150,000$ mg/l)
Energy Requirement	Requires thermal energy in terms of steam. Less power consumption (~3–8 kWh/m ³)	High electrical energy compared to MEE (compressor ~8–12 kWh/m ³ distillate, but no external steam)	Relies on solar energy (very low operational energy)
Recovery Efficiency	Very high, >90% possible	High, >90% possible	Low, dependent on weather; slow evaporation
Operating Cost	Moderate due to LP steam consumption available in the refinery. Needs scaling control	High as power consumption is high compared to MEE	Very low (only maintenance), but land cost is high

Capital Cost	High (complex system with multiple effects)	High (compressor and robust design needed)	Low (earthwork, liners, land acquisition)
Maintenance	Scaling/fouling in evaporators, frequent descaling	Scaling/fouling in evaporators, frequent descaling	Minimal, mainly sludge removal and pond integrity
Land Requirement	Moderate	Moderate	Very high (large evaporation ponds needed)
Suitability	For concentration of RO reject	For concentration of RO reject	Final disposal of high TDS water
Limitations	High steam requirement, scaling issues	High CAPEX and high power consumer	Slow, climate-dependent, needs large land, accumulation of rain water

In order to know the specific requirements for evaporation of the RO reject of 64 m³/hr, techno-commercial offers were obtained from the following ZLD plant suppliers for MEE technology followed by ATFD/Pusher Centrifuge:

1. M/s AEON India Ltd., Pune
2. M/s Unitop Acquacare Ltd., Thane
3. M/s Chemprocess Systems Private Ltd., Ahmedabad
4. M/s SS Techno Limited, Pune

Table No. 1.17: Comparison of Offers from ZLD plant suppliers

ZLD Plant Supplier	M/s AEON India	M/s Unitop	M/s Chem Process	M/s SSP
System Configuration	MEE + Pusher Centrifuge	MEE + ATFD	MEE + Pusher Centrifuge	MEE+ Pusher centrifuge
Steam requirement	13 TPH (steam @ 12 kg/cm ² .g)	17.6 TPH (steam @ 5 kg/cm ² .g)	12.544 TPH @ 8 kg/cm ² .g)	22.09 TPH @ 3.5 kg/cm ² .g)
Cooling water requirement	1400 m ³ /hr	1200 m ³ /hr	1030 m ³ /hr	2400 m ³ /hr
Power consumption	2300 KWH	2000 KWH	1800 KWH	1400 KWH
Tentative area requirement for Tech structure		35m X 40m	68m X 68m	80m X 50m
Estimated Cost (INR)		68,75,00,000/-	56,70,40,000/-	34,04,00,000/-

c. SELECTION OF ZLD TECHNOLOGY

Based on the above, Reverse osmosis system followed by MEE technology coupled with an Agitated Thin Film Dryer (ATFD) or pusher centrifuge, offers a reliable and compact technology. Key considerations for this include:

- ✓ RO system is applied for more water recovery
- ✓ Utilization of Steam: MEE relies mainly on steam as the energy source, using multiple effects to recycle latent heat where as MVC consumes significant electrical energy to drive compressors.
- ✓ MEEs are mechanically simpler having fewer rotating parts compared to MVC systems that require compressors which (prone to wear and maintenance.
- ✓ MEE is usually applied for larger capacity, where as MVC and Solar pond are applied for smaller capacity.
- ✓ Lower OPEX than MVC as steam is already available.
- ✓ Lower Land Footprint: Compared to solar ponds, MEEs require only a fraction of the land, making them highly suitable for space-constrained industrial complexes.
- ✓ Proven reliability in refineries.
- ✓ Operational Reliability: Independent of climatic variations, ensuring consistent performance across all seasons.
- ✓ Salt Management: Integration with ATFD/Pusher centrifuge enables effective handling of high-TDS brines and crystalline in a controlled manner

3.3 ZERO LIQUID DISCHARGE PLANT

This section describes the details of Zero Liquid Discharge Plant.

3.3.1 Treatment Philosophy and Configuration of ZLD Plant

The following Configuration of Zero Liquid Discharge Plant is considered for design:

➤ Solids Content at the RO system Outlet

Component	Unit	RO system (RO-II) Outlet Water
Solids Content	%	5 – 6

➤ Solids Content at the Multi Effect Evaporator Outlet

Component	Unit	Evaporator Outlet Water Quality
Solids Content	%	30.0

➤ Moisture Content in Solids (Salts) at the Dryer Outlet

Component	Unit	Dryer Outlet Water Quality
Moisture Content in Dry Solids	%	10 (Maximum)

The Solids out of the Drying Unit shall be suitable for filing and packing in bags/drums for transferring to the landfill site.

3.3.2 Treatment Scheme

The treatment process in the ZLD plant consists of the following stages of treatment:

Pre-Treatment Section

- **High Rate Solid Contact Clarifier- I (HRSCC)** (for bulk removal of Silica and total suspended solids).
- **Dual Media Filter (DMF)** (for removal of residual suspended matter).
- **Activated Carbon Filter (ACF)** (for polishing of the DMF outlet water contaminants including BOD and COD).

Ultra-Filtration Section

- **Auto Backwash Filter-I (ABF)** (for removal of residual suspended load for direct feeding to UF Skids).
- **Ultra Filtration (UF) skids** (for ultra-filtration of effluent to render it suitable for direct feeding to reverse osmosis section).

Reverse Osmosis Section

- **Cartridge Filter-I (CF)** (for removal of any foreign suspended matter and protection of RO-I membranes).
- **Reverse Osmosis-I (RO-I) skids** (for removal of TDS) along with associated high pressure pumping, chemical dosing & cleaning facilities.
- **Reverse Osmosis-II (RO-II) skids** (for removal of TDS) along with associated high pressure pumping, chemical dosing & cleaning facilities.

Evaporator Dryer Section

- **Evaporator and Dryer System** (for absolute recovery of water and to extract the dissolved salts from the RO-II reject stream to generate dried solid salts).

Sludge Handling & Treatment Section

- **Centrifuge** (for dewatering of chemical sludge from HRSCC).

Chemicals Handling Section

- **Ferric Chloride (FeCl_3) storage and dosing system** (for coagulation purpose in HRSCC system).

- **Lime storage and dosing system** (for increasing pH in the HRSCC system for enhancing precipitation).
- **Antiscalant storage and dosing system** (to prevent scaling in the RO membranes).
- **Sodium Meta Bi Sulphite (SMBS) storage and dosing system** (for reduction of free chlorine in the RO inlet water).
- **Polyelectrolyte (PE) storage and dosing system** (as coagulant aid in the HRSCC system).
- **HCl storage and dosing system** (for neutralizing the pH of the HRSCC effluent stream and at the inlet of RO-I & RO-II section and for UF CEB).
- **Sodium Hypochlorite (NaOCl) storage and dosing system** (for UF CEB).
- **Caustic (NaOH) storage and dosing system** (for UF CEB).
- **Soda Ash (Na₂CO₃) storage and dosing system** (for softening purpose in HRSCC system).
- **Dewatering Polyelectrolyte (DWPE) storage and dosing system** (for the purpose of dewatering of chemical sludge in centrifuge).
- **RO cleaning Chemicals** as per Membrane Supplier Recommendation.
- **UF Cleaning Chemicals** as per Membrane Supplier Recommendation.
- **Evaporator- Dryer System Cleaning Chemicals** as per System Supplier Recommendation.

Equipment for ZLD plant is attached as **Annexure X**

Evaporator system (MEE) Configuration:

The Evaporator system shall have the following Major System/Units:

Table No. 1.18: Design Capacities

Unit	No. of Units	Design Capacity per Unit/Chain
Pre-Treatment Section	1 Working	100 m ³ /hr Net Feed
Multi – Effect Evaporator	2 Working	32 m ³ /hr Feed Capacity each
Dryer Unit (ATFD or Pusher centrifuge)	2 Working	4.5 m ³ /hr Brine Feed Capacity each

3.3.2 Treated Water Quality

The treated water quality at the outlet of the Zero Liquid Discharge Plant is as specified in the following table:

Table No. 1.19: Treated Water Quality at ZLDP Outlet

Sr. No.	Parameter	Unit	Specification
1.	Temperature	Deg C	40 (Max)
2.	pH	-	6.5 - 7.5
3.	Total Dissolved Solids (TDS)	ppm	< 400
4.	Total Suspended Solids (TSS)	ppm	< 1.0

The treated water at the outlet of ZLD plant shall be recycled as treated raw water for use in the refinery complex. There shall be no Liquid effluent generated from the Plant and only dried salts as produced which shall be sent for disposal. The dried salts generated from the Evaporator Dryer System (~80 to 100 TPD) in the Zero Liquid Discharge Plant shall require disposal to a Secured Landfill or TSDF after collection and storage in impervious containers.

3.3.3 Treated Water Quality for ZLD Plant at Different Stages:

The treated permeate water quality as required from different treatment sections of the ZLD plant is indicated in the table below:

Table No. 1.20: Treated Water Quality for ZLD Plant at Different Stages

Parameters	Unit	UF –I Outlet	RO-I Inlet	RO-I Permeate	RO-II Permeate	MEE Inlet	Dryer Outlet (including steam condensate)
Total Flow	m ³ /h	227	200	120	48	57.7	~13.7
Flow / Chain	m ³ /h	227	200	120	48	57.7	~13.7
TSS	mg/l	<1	Nil	Nil	Nil	Nil	Nil
Turbidity	NTU	<1	Nil	Nil	Nil	Nil	Nil
SDI	-	< 3					
Oil	mg/l	Nil	Nil	Nil	Nil	Nil	Nil
TDS	mg/l		≤ 14000	≤ 413	≤ 250		≤ 250
Colloidal Silica as SiO ₂	mg/l	BDL	Nil	Nil	Nil	Nil	Nil

3.3.4 Chemicals and Utilities Estimation

The tentative chemical requirement for the new ZLD plant is provided in the table below:

Table No. 1.21: Estimated Chemical Quantities for the new ZLD Plant

S. No.	Chemical	Quantity in kg/day Considered for Supply as 100 % Chemical Conc
1	FeCl ₃	90
2	Lime	149500
3	Antiscalant	155
4	Sodium Meta Bisulphite (SMBS)	10
5	NaOCl	5
6	NaOH	30
7	Polyelectrolyte	15
8	Soda Ash	9000
9	DWPE	15

Note:

1. The cleaning chemicals requirement for UF system, RO system and Evaporator-Dryer System shall be additional.

The tentative utility requirement for the new ZLD plant is provided in the table below:

Table No. 1.22: Estimated Utility Requirement for the new ZLD Plant

S. No	Utility	Quantity
1	Power	2.3 MW
2	Instrument Air	400 Nm ³ /hr
3	LP Steam	~25 TPH

The Electrical Load List document for new ZLD plant is attached as **Annexure-IX**.

3.3.5 Salt Generation Estimation

The dried salt (having typically 8-10% moisture content) generated from the Evaporator Dryer System in the Zero Liquid Discharge Plant will be a mixture of multiple salts and will not find any applications within the refinery. These dried salts needs to be filled in bags / drums (or impervious containers) and then suitably disposed off to secured engineered landfill or other suitable locations.

The estimated quantity of salt generation from the new ZLD plant shall be ~80 to 100 TPD.

Handling and Disposal Considerations for ZLD Salts:

The salts generated from the ZLD system, are hygroscopic in nature. Hygroscopic salts have a strong tendency to absorb atmospheric moisture, leading to:

- Caking and hardening during storage, which complicates handling and transportation.
- Formation of saline leachate potentially resulting in surface runoff and infiltration.
- Increased risk of environmental contamination, as the dissolved salts can migrate into surrounding soils and groundwater aquifers.

Salts should be collected in fully enclosed, corrosion-resistant containers (HDPE-lined bags/drums) immediately after discharge from the ATFD/dryer to prevent moisture ingress. Around 10,000 to 12,000 m² area of land shall be required for Secured landfill for disposing 5 years of salt generated. Further area shall be required for subsequent years of operation. Since, there is no contiguous land available within the refinery for providing the secured landfill, the salt generated should be transported to a TDSF facility. But, proper storage facility should be available before the filled bags are sent to TDSF. shall be stored in 3 Nos. Salt Storage Sheds equivalent to 15 days storage as minimum requirement. Approximately, an area of 500 m² shall be required for storage and handling of salts before sent to secured landfill.

During transport to a secured landfill or authorized TSDF, salts must be carried in sealed trucks or lined containers to prevent accidental spillage. Vehicles should be equipped with tarpaulin covers with mandatory cleaning protocols after unloading. Also, compliance with Hazardous waste and management rules, 2016 and CPCB guidelines must to be ensured for safe disposal of salts in landfill sites.

3.3.6 Area Requirement

The tentative area requirement for the installation of new ZLD plant shall be 18000 m² including salt storage space. The indicative equipment layout for the new ZLD plant is attached as **Annexure-XI**.

3.4 ENVIRONMENTAL IMPACTS DUE TO ZERO LIQUID DISCHARGE PLANT

The implementation of Zero liquid Discharge (ZLD) plant facilitates recovery of most of the water. Treated water recovered through reverse osmosis, multi-stage evaporation and crystallization units will be reused in process operations, cooling towers and DM water generation systems there by reducing the dependency on freshwater sources.

Even though, installation of ZLD plant provides some benefits, it also have significant negative impacts on environment as described below.

1. Energy and Carbon Footprint Considerations

- The advanced treatment and thermal evaporation processes in ZLD systems are energy-intensive either in the form of steam or electricity.
- When electricity is used as energy source, the evaporation involves higher electricity consumption and associated greenhouse gas (GHG) emissions.
- On the other hand, when steam is used in the process, Steam generation requires large volumes of freshwater for boilers and cooling, which can stress local water resources. Huge

consumption of heating source such as oil / gas for steam generation shall contribute to depletion of non-renewable resources.

- Additional emissions will be there from furnace/ heater and shall be dispersed through stacks. In long term, the air environment will be impacted due to emission from stacks.

2. Generation and Management of Solid Waste

- There shall be generation of ~80 to 100 TPD of solid salt from ZLD plant, requiring secured landfill disposal, which involves additional land, logistics, and regulatory compliances.
- Storage and handling of dried salts from ZLD plant requires proper handling and storage facilities which involves human interference causing health impact to the operating personnel.
- Since there is no land available with IOCL Haldia refinery for putting up secured landfill, this dried salts generated from ZLD plant has to be disposed in a TSDF (Treatment, Storage & Disposal facility).
- Salt disposal shall also cause air pollution during transportation of salts.
- There shall be requirement of approximately 4 – 5 trucks for transporting the salts to TSDF. Emission from Trucks is one of the contributors to air pollution and fuel guzzling with serious public health and climate change consequences. Rapid growth in the economy and trade is continuously expanding road based freight traffic, bringing more and more trucks on roads.
- Handling and storage of dried salts at TSDF site shall again cause potential environmental implications.
- Mostly, the salts collected in the TSDF is managed in secured landfill. This causes the chances of water pollution if the salts are not properly stored and managed. There is no secondary use of the salts generated there by causing increase in load of landfill causing additional area requirement. This shall cause neighbouring villages in trouble.

CHAPTER NO.4

COST ESTIMATION

4.0 SCOPE

To carry out Techno-Economic Feasibility Study for implementation of the latest ZLD technology at IOCL, Haldia Refinery keeping in view the challenges faced particularly due to the lack of contiguous land and the associated issues with salt storage and disposal.

4.1 REFERENCE DOCUMENT

Equipment List & technical specifications based on Engineering inputs and various correspondences.

4.2 KEY ASSUMPTIONS

The basic assumptions made for working out the cost estimate are as under:

- Cost estimate is valid as of December 2025.
- Execution methodology is LSTK mode of execution.
- No provision has been kept for future exchange rate variation.
- Construction duration 24 months

4.3 EXCLUSIONS

Provision for the following have been excluded from the Project cost estimate:

- Site Development, Infrastructure Facilities
- EPCM / PMC Fee, License Fee / BDEP
- Land
- Exchange rate variation
- Owners Construction Period Expenses, CER / CSR
- Cost provision for General facilities (Office equipment and furniture, workshop equipments, canteen and welfare equipments, safety and medical equipments, training center equipments etc.) has been excluded
- Removal of unseen / unidentified underground obstructions
- Catalyst/Chemical for initial fill

4.4 ESTIMATION METHODOLOGY

Cost estimate is based on cost information available from EIL's current in-house cost data and Engineering inputs for cost estimation purpose. In-house cost data has been analyzed and adopted for estimation after incorporating specific project conditions. Cost data has been updated to prevailing price level using relevant economic indices.

These Cost estimates are subject to identified scope of work and engineering inputs / technical information, the qualifications, assumptions and exclusions stated herein.

The accuracy of these estimates is targeted at $\pm 30\%$ based on the methodology used and the quality of the information available for cost estimation

Estimated EPCC cost of the facilities in B/L is 223.28 Crore excluding GST and O&M cost.

Plant and Machinery

Cost provision for equipment has been made based on sized equipment list and in house data.

Cost provision for Buildings is based on plinth area basis

Cost Provision for Piping, Electrical, Instrumentation is on factor basis.

Civil structural work has been worked out based on factor and MTO provided

Indirect Costs, Exchange Rates

The cost estimate is based on following Exchange Rates & Indirect costs:

Exchange Rate	NA
Inland freight	2.5% of FOB cost of imported equipment and ex-works cost of indigenously sourced equipment
Insurance	0.5% of total cost

Statutory Taxes and Duties

Provision for statutory taxes & duties as applicable has been made as under:

GST	18% Considered

Engineering Cost

Residual Process design & Detailed Engineering, Procurement services & Project Management cost has been considered 3.5% of plant & machinery cost.

Construction Site facilities:

- Cost provision towards construction site facilities has been kept @ 1.5% of plant & machinery cost.

Start-up & Commissioning Including Vendor Serviceman

- Cost provision for Start-up & Commissioning has been considered @ 1.5% of plant and machinery cost.
- Start up and commissioning provision does not include the cost for raw material, utilities, and feed and catalysts chemicals consumptions, if any.

Repayment and Repair During DLP

- Cost provision for Repayment and Repairs during DLP has been considered @ 0.25% of Plant and Machinery cost.

Contingency

- Provision for Project Contingency @ 5%

Contractors LSTK Add-on

- Financing Charges has been considered @ 1.2% of total Project Cost
- Contractors Liability has been considered @ 2.5% of total Project Cost
- Contractor's Profit has been considered @ 5% of total Project Cost

Operating cost

One year operating cost has been worked out based on the input provided for Chemical, consumables, utilities (power and steam) and man-power requirement.

Estimated operating cost is 149.0 Crores.

CHAPTER NO.5

SUMMARY & CONCLUSION

5.0 SUMMARY

The effect assessment has been carried out on the present practice of disposal of treated effluent in river Hoogly with respect to spatial and temporal factors by sampling and analysis of quality of river at various locations from the disposal point. It is observed that, the disposal of treated effluent in to the river is not causing major deterioration in the quality of river as established in chapter 2.

Also, Haldia channel is not utilized as a source of water either for drinking or agriculture purpose. This is because of the high concentration of TDS due to tidal effect. This high TDS is mostly observed during the dry season.

Based on the sampling analysis of the bio assay test, 100% survival of fish after 96 hours was observed which reveals that treated effluent has no adverse impact on aquatic life. This indicates that effluent quality is suitable for discharge in river in compliance with the treated effluent disposal standards which requires >90% fish survival for 96 hours.

In addition to above, effect of installing Zero liquid discharge plant is also studied. Installing a ZLD plant provides recovery of ~98 % water including steam condensate (maximum recovery).

Installing Zero Liquid Discharge plant shall also involve,

- High energy consumption with the electricity requirement of 2.3MW for plant operation which is much higher as compared to the disposal of treated effluent.
- Requirement of contiguous land for 18000m² for installation of ZLD plant. As confirmed by IOCL, Haldia Refinery does not have any land within the premises for installing the ZLD plant.
- About 25 TPH of LP Steam is required which requires installing additional boiler system and additional water consumption on continuous basis from the refinery at a defined cost. This will also increase the fresh water requirement of the refinery.
- High CAPEX (INR 223.28Cr.) & OPEX (INR 149Cr. per annum) associated with ZLD plant.
- Recirculating cooling water is required for ZLD plant (1500 to 2400 m³/hr) which would require separate Cooling Water system.
- Major concern in installing the ZLD plant is generation of dried salts (~80 to 100 TPD). A secured engineered landfill shall be required to dispose the salts with an area requirement of 10,000 m² to 12,000 m². In practical terms, Haldia Refinery is already in shortage of land, allocating such contiguous land within the refinery premises. the salt generated needs to be sent to TSDF. Before sending to TSDF, the salts needs proper handling and storage facility.
- Sending the salt to TSDF involves transportation through trucks (number of trucks 4-5) from the Refinery which shall have its impact with respect to vehicular movement and loading and unloading of salt generated.
- Further, there shall be risk of generation leachate in and around the secured landfill which carries its own risk of water contamination.

A comparison of the two systems disposal of treated effluent and ZLD is given in below table.

Table 1.23: Comparison of Disposal of treated Effluent vs. Zero Liquid Discharge Plant

Factor	Treated Effluent Disposal into River	Zero Liquid Discharge (ZLD)
Environmental Impact	Negligible impact on river and groundwater quality. (as discussed in the report)	Eliminates liquid discharge but creates significant secondary pollution: high GHG emissions from substantial energy use (~2.3 MW power, ~25 TPH steam) and generates ~80 to 100 TPD of solid salt waste, posing risks of potential landfill leachate contamination.
Capital Cost (CAPEX)	System already installed	High (INR 223.28 Cr.) - requires evaporators, crystallizers, brine concentrators, high TDS RO
Operating Cost (OPEX)	only pumping cost	High (INR 149 Cr. per annum) - high energy consumption for evaporation & concentration, high Steam, power, chemical and salt disposal costs.
Foot print	System already installed.	Substantial and infeasible: 18,000 m ² for ZLD plant including salt storage facility. And 10000 to 12000m ² area of land for Secured landfill at TSDF pertaining to 5 years of salt generation only.
Energy Requirement	Relatively low; limited to pumping	High; continuous steam/electricity for evaporators → higher carbon footprint. ~2.3 MW power and ~25 TPH of LP Steam.
Carbon Footprint	Negligible	Higher - energy-intensive, increases GHG emissions.
Solid Waste disposal	No solid waste generation	High - salt generation, ~80 to 100 Tonnes Per Day of dried salts, requiring complex and costly disposal.

CONCLUSION:

Based on the assessment in the techno economic study done for ZLD plant, it is concluded that:

- River disposal entirely avoids the above stated issues related to ZLD as the location where the treated effluent (RO reject) is being disposed is near the estuary where the TDS of the river is already high due to the tidal effect from the sea. This tidal effect gives an advantage creating the mixing of treated effluent with huge quality of water and provides sufficient dilution of the water quality.

- Further, the river water near the vicinity of Refinery is not used as a source for drinking and agriculture purpose. The stretch is predominantly utilized for maritime Boat/Ship navigation.
- As there is no increase in the pollutant concentration due to disposal of treated effluent disposal from Haldia refinery and no impact to the aquatic life and hence there is no Food chain contamination.
- Since there is no impact to either quality of river or to the aquatic life, there shall be no Livelihood impacts. i.e Fisherfolk, farmers and river-dependent communities does not face economic losses.
- Installation of ZLD plant shall require additional land, additional energy in terms of electricity and steam which will increase emissions and also the CAPEX and OPEX of the plant.
- The salt egeneration from ZLD plant shall required to be disposed to secured landfill/TSDF and entail additional logistics requirement and associated environmental risks.
-

REFERENCES:

1. *Methodology for Reclamation of Nayachara Island by Dredge Material from Jellingham Shoal of Hooghly Estuary by DCI TSHD Conference Paper · December 2017*
2. *A Study to Identify Locations Suitable of Deep Sea Port Operations in the State of West Bengal.*
3. *Tidal Bore Dynamics of a Mixed Estuary: The Hoogly River, India.*
4. website: <http://slusi.dacnet.nic.in> (Soil type)
5. *Seasonal variability of physico chemical characteristics of the Haldia channel of Hooghly estuary, India.*
6. *Water quality modelling for a tidal estuary - application to Hooghly estuary, east coast of India.*

ANNEXURE-I
ELR DATA OF APRIL 2024
TO MARCH 2025

Parameters	Unit	30.04.24	15.05.24	13.06.24	06.07.24	08.08.24	30.09.24	23.10.24	14.11.24	28.12.24	10.01.25	11.02.25	10.03.25
pH value at 25 ^u C		7.06	7.21	7.09	7.63	7.54	6.97	7.15	7.15	8.1	7.34	7.47	7.82
Copper (as au)	mg/l	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05
Phnenoic Compounds (aS CsH5OH)	mg/l	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1
Cyanide (as CN)	mg/l	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Lead tas Pb)	mg/l	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.05
Mercury (as Hg)	mg/l	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel (as Ni)	mg/l	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05
Total Chromium (as Cr)	mg/l	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05
Zinc (as Zn)	mg/l	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.18	0.05
Hexavalent Chromium (as Cl)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1
Vanadium (as Vj)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Benzo(a)pyrene	mg/l	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.2
Benzene	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2
Total Suspended Solid	mg/l	25	4.8	15	4.2	3.6	7.2	4.7	13	17	18	13	10
BOD	mg/i	14	14.85	12	13	2	9.8	5.2	14	10	12	4.1	7.5
COD	mg/l	52	80	44	56	10	42	20	76	76	60	16	25.2
Oil and Grease	mg/l	5	5	5	5	5	5	5	5	5	5	5	5
Ammoniacal Nitrogen (as N)	mg/l	0.1	1.2	0.72	0.1	0.1	0.68	0.51	11.8	11	2.9	0.48	11.3
Total Kjeldahl Nitrogen	mg/l	0.32	1.5	0.84	0.3	0.3	0.82	0.64	12.5	20.5	13.5	0.55	12.6
Sulphide (as H2S)	mg/l	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3
Phosphate (as P)	mg/l	0.26	0.12	0.05	0.73	0.05	0.21	0.05	0.63	0.21	0.27	0.09	0.09

ANNEXURE-II
SURFACE WATER SAMPLING
ANALYSIS DATA FOR JULY &
SEPTEMBER 2025

Date of sampling: 23.07.2025

[illegible]

Surface water Sampling Analysis data (High Tide scenario)

Date of sampling: 23.07.2025

[illegible]

Hexavalent Chromium	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Chromium	mg/l	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Lead	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Selenium	mg/l	0.0007	0.0008	0.0007	0.0005	0.0007	0.0005	0.0006	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
Cyanide	mg/l	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Phosphate	mg/l	0.18	0.23	0.22	0.22	0.19	0.21	0.18	0.19	0.22	0.2	0.23	0.23	0.22	0.23	0.22	0.22
Sulphide	mg/l	0.13	0.14	0.12	0.12	0.13	0.11	0.12	0.12	0.11	0.1	0.17	0.11	0.12	0.12	0.13	0.13
Phenol as phenolic compounds	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DO	mg/l	7.3	7.2	7.7	7.1	7.8	7.1	7.7	7.5	7.7	7.3	7.4	7.1	7.3	7.2	7.3	7.0
COD	mg/l	27	28	28.7	28.7	28.2	28.4	26	23.5	28	28.7	32	31	28	29	28	28
BOD	mg/l	1.7	1.65	1.8	1.9	2	1.9	1.7	1.8	2.1	1.8	1.7	1.8	1.6	0.9	1.6	1.5
Ammonical Nitrogen	mg/l	0.13	0.11	0.14	0.13	0.14	0.13	0.12	0.13	0.13	0.12	0.14	0.14	0.13	0.13	0.13	0.12
TKN	mg/l	5	3.2	2.4	3.5	3.5	2.8	4.1	3.2	5.2	4.7	3.2	4.1	3.2	2.9	2.7	3.3
Total Nitrogen	mg/l	8.5	5.2	4.5	6.3	6	4.7	8	5.3	9.5	7.2	6.2	8.1	6.2	5.2	4.9	7.8
Total Phosphorous	mg/l	0.26	0.37	0.36	0.34	0.28	0.32	0.36	0.31	0.22	0.4	0.38	0.38	0.32	0.35	0.32	0.41
Total residual Chlorine	mg/l	0.15	0.15	0.12	0.13	0.2	0.17	0.20	0.22	0.16	0.18	0.2	0.19	0.23	0.18	0.16	0.17
Total Coliform	MPN/100ml	75	66	81	78	72	64	100	64	63	85	72	72	67	78	59	74
Feacal Coliform	MPN/100ml	20	19	25	20	25	15	35	16	20	25	20	25	15	18	10	26
Bio Assay test	%	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
Benzene	mg/l	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo Pyrene	mg/l	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

#100 % survival of fish after 96 hours in 100% water

*Agreeable

BDL- Below detectable limit

Cadmium	mg/l	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Hexavalent Chromium	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Chromium	mg/l	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.000 5	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Lead	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Selenium	mg/l	0.001 9	0.000 9	0.000 5	0.062	0.000 9	0.000 6	0.000 5	0.000 6	0.000 5	0.0005	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
Cyanide	mg/l	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total Phosphate	mg/l	0.17	0.17	0.21	0.2	0.22	0.19	0.18	0.17	0.19	0.17	0.18	0.21	0.23	0.2	0.22	0.19
Sulphide	mg/l	0.11	0.12	0.08	0.13	0.12	0.12	0.12	0.1	0.11	0.08	0.12	0.12	0.12	0.13	0.13	0.11
Phenol	mg/l	0.000 6	0.000 8	0.000 8	0.000 9	0.000 8	0.000 7	0.001 5	0.000 8	0.000 9	0.0008	0.0005	0.0006	0.0006	0.0006	0.0008	0.0005
Vanadium	mg/l	0.001 7	0.001 6	0.014	0.024	0.018	0.000 9	0.028	0.014	0.016	0.014	0.013	0.011	0.01	0.012	0.0007	0.013
DO	mg/l	7.8	7.3	7.5	7.8	7.3	7.1	7	7.7	7.2	7.1	7.3	7.2	7.2	7.6	7	7.3
COD	mg/l	25	28	26	30	36	24	36	28	24	26	24	19	18	23	16	25
BOD	mg/l	1.1	1.65	1.8	1.9	1.9	1.9	1.7	1.8	1.9	1.8	1.7	1.8	1.6	1.7	1.6	1.5
NH3-N	mg/l	0.13	0.12	0.14	0.13	0.14	0.15	0.12	0.13	0.13	0.12	1.1	1.3	1	0.9	0.4	0.46
TKN	mg/l	10	4.2	3.8	5	3.4	3.4	9	4.2	12	5.8	4.2	5.4	3.8	4.6	2.4	6.2
Total Nitrogen	mg/l	15.8	7.1	6.5	8.3	5.9	5.9	14.3	7.1	18.8	9.5	7.1	8.9	6.5	7.7	4.4	10.1
Total Phosphorous	mg/l	0.32	0.55	0.48	0.6	0.23	0.41	0.86	0.43	0.35	0.43	0.43	0.4	0.32	0.42	0.31	0.42
Total residual Chlorine	mg/l	0.24	0.23	0.23	0.21	0.24	0.19	0.19	0.17	0.22	0.16	0.19	0.21	0.17	0.19	0.21	0.18
Total Coliform	MPN/1 00ml	110	105	120	150	118	145	165	145	138	152	155	160	150	165	145	165
Feacal Coliform	MPN/1 00ml	45	40	42	52	32	25	25	28	42	40	35	45	40	60	25	40
Bio Assay test	%	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
Benzene	mg/l	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Benzo Pyrene	mg/l	0.000 1	0.000 1	0.000 1	0.000 1	0.000 1	0.000 1	0.000 1	0.000 1	0.000 1	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

#100 % survival of fish after 96 hours in 100% water

*Agreeable

ANNEXURE-III

**HOOGLY RIVER FLOW- HYDRAULIC
STUDY DEPARTMENT, KOLKATA**

Fwd: Confirmation of Visit and Submission of Undertaking – Request for River Data**From :** PRANAB DAS <pranab.das@kolkataporttrust.gov.in>

Thu, Sep 04, 2025 03:55 PM

Subject : Fwd: Confirmation of Visit and Submission of Undertaking – Request for River Data 5 attachments**To :** SENSANTANU@INDIANOIL.IN, SAHARAHUL@indianoil.in**Cc :** CHE <che@kolkataporttrust.gov.in>, RANJAN MAHAPATRA <ranjan.mahapatra@kolkataporttrust.gov.in>, Piyush Kumar <kumarpiyush@kolkataporttrust.gov.in>, hsedepthaldiarefinery@indianoil.in, KUMARNIKHIL@INDIANOIL.IN, MENAKA R <r.menaka@eil.co.in>, PARVEEN KUMAR GOEL <pk.goel@eil.co.in>, VIKRAM SINGH <vikram.singh@eil.co.in>Dy. General Manager (HS & E)
IOCL
Haldia Refinery

The data of Hooghly river, as requisitioned vide attached letter kindly note the following:

1. The Velocity, Flow Rate/the Discharge through the Haldia channel (adjacent to Haldia Refinery) for a complete tidal cycle in the year of 2024(November) is given in the table below:

Table A

Date of Observation : 19.11.2024									
Location of Observation: In front of Haldia Oil Jetty 1									
			Sagar Range: 3.08m						
Position- F (22° 01' 45.44"N 88° 06' 14.38"E)				Position- G (22° 01' 28.76"N 88° 06' 33.53"E)					
Hour after Low Water at Sagar	Actual Velocity (m/Sec) at Surface	Direction (in Degree) at Surface w.r.t North	Salinity of Surface Water in ppt	Hour after Low Water at Sagar	Actual Velocity (m/Sec) at Surface	Direction (in Degree) at Surface w.r.t North	Salinity of Surface Water in ppt	Tide	Cross-Sectional Discharge of Haldia Channel in Cumec
0	1.50	234		0	1.74	222		EBB	5487
1	1.47	171		1	0.96	256			3462
2	0.53	181	2.88	2	0.91	252	2.16		1020
3	2.09	110		3	1.67	54		FLOOD	5309
4	2.15	77		4	1.93	71			9809
5	2.26	66	2.88	5	1.93	44	2.34		11646
6	1.93	302		6	1.63	355			11138
7	1.75	76	3.6	7	1.38	112	3.4	EBB	6048
8	0.32	333		8	0.54	134			1045
9	2.47	261		9	1.33	232			5431
10	1.92	232		10	1.88	270			8660
11	2.36	208	2.36	11	1.90	242	5.04		7675
12	2.00	234		12	1.89	242			6024

2. Similar data at the area 14Km downstream of the above point is given in the table below:

Table B

Date of Observation : 13.11.2024									
Location of Observation: Gangra (D/S of River Haldi)									
			Sagar Range: 3.32m						
Position- A(21° 56' 26.75"N 88° 01' 12.07"E)				Position- B(21° 55' 56.29"N 88° 02' 32.15"E)				Tide	Cross-Sectional

Hour after Low Water at Sagar	Actual Velocity (m/Sec) at Surface	Direction (in Degree) at Surface w.r.t North	Salinity of Surface Water in ppt	Hour after Low Water at Sagar	Actual Velocity (m/Sec) at Surface	Direction (in Degree) at Surface w.r.t North	Salinity of Surface Water in ppt		Discharge of Haldia Channel in Cumec
0	2.00	205		0	0.75	235		EBB	3682
1	1.48	57		1	1.06	351		FLOOD	266
2	3.12	63		2	1.44	360			15223
3	2.68	329	1.44	3	1.85	49	1.08		19279
4	2.19	320		4	1.92	63			18741
5	1.84	343		5	1.60	72			9486
6	1.17	67	1.44	6	1.24	51	1.44	EBB	421
7	1.58	180		7	1.11	240			7723
8	1.74	174		8	2.01	127			12191
9	2.69	162		9	1.80	157			13980
10	2.59	188	1.44	10	1.78	167	1.44		11360
11	2.45	207		11	1.47	191		EBB	9578
12	1.94	200	1.08	12	0.81	199	0.72		7516

3. The Historical data for the year 2014,2019 & 2024 are given in Table C:

Table C

Historical Maximum Velocity, Maximum Discharge at the Same Cross-Section, mentioned in Table A					
Date of Observation	Maximum Velocity in m/sec & direction w.r.t North		Maximum Discharge in cumec		Sagar Range
	Flood	Ebb	Flood	Ebb	
26.08.2014	2.04 (78°)	1.74 (244°)	20775	13287	4.13m
07.06.2019	2.49 (74°)	1.92 (238°)	16553	10445	4.03m
19.11.2024	2.4 (77°)	2.66 (250°)	11646	8660	3.08m

Thanks & Regards,

Pranab Das
Executive Engineer
for Chief Hydraulic Engineer
Syama Prasad Mookerjee Port, Kolkata

From: "SAHA, RAHUL (सहा, राहुल)" <SAHARAHUL@indianoil.in>
To: "CHE" <che@kolkataporttrust.gov.in>
Cc: "Shri Rathendra Raman, IRTS, Chairman SMPK" <chairman@kolkataporttrust.gov.in>, "Dy Chairman KDS" <dy.chairman.kds@kolkataporttrust.gov.in>, "RANJAN MAHAPATRA" <ranjan.mahapatra@kolkataporttrust.gov.in>, "Piyush Kumar" <kumarpiyush@kolkataporttrust.gov.in>, "PRANAB DAS" <pranab.das@kolkataporttrust.gov.in>, KUMARA8@indianoil.in, beheraj@indianoil.in, SENSANTANU@INDIANOIL.IN, "MENAKA R" <r.menaka@eil.co.in>, "PARVEEN KUMAR GOEL" <pk.goel@eil.co.in>, "VIKRAM SINGH" <vikram.singh@eil.co.in>, "CHIRANJIBI PATTANAIK" <c.pattanaik@eil.co.in>
Sent: Monday, August 25, 2025 3:08:24 PM
Subject: Confirmation of Visit and Submission of Undertaking – Request for River Data

Respected Sir,

Thank you for your kind response regarding our request.

We wish to confirm that our consultant from EIL, **Ms. R. Menaka, AGM (EWS)**, shall visit the office of **Dr. Ranjan Mahapatra, Dy. Chief Hydraulic Engineer**, in due consultation with him.

We sincerely appreciate your support in facilitating this process.

With Regards,

Rahul Saha
Manager (H,S&E)
Indian Oil Corporation Limited || Haldia Refinery
Tel (O): 03224-22-3617 | saharahul@indianoil.in
Phone No.: 6901253996



From: CHE <che@kolkataporttrust.gov.in>

Sent: 25 August 2025 12:14

To: Sen, Santanu (সেন, শান্তনু) <SENSANTANU@INDIANOIL.IN>; SAHA, RAHUL (সহা, রাহুল) <SAHARAHUL@indianoil.in>

Cc: Shri Rathendra Raman, IRTS, Chairman SMPK chairman@kolkataporttrust.gov.in; Dy Chairman KDS <dy.chairman.kds@kolkataporttrust.gov.in>; RANJAN MAHAPATRA <ranjan.mahapatra@kolkataporttrust.gov.in>; Piyush Kumar <kumarpiyush@kolkataporttrust.gov.in>; PRANAB DAS <pranab.das@kolkataporttrust.gov.in>

Subject: Fwd: Request for Historic River Flow Data of Hooghly River at Haldia

CAUTION: External email. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hydraulic Study Department (তোয়ালিকী অধ্যয়ন বিভাগ)
20, Garden Reach Road, Kolkata - 700043



Dy. General Manager

(HSE)
Indian Oil Corporation Limited
Haldia Refinery

Sir,

Ref. your trailing mail, it is requested to send your representative to this office in consultation with Dr. Ranjan Mahapatra, Dy. Chief Hydraulic Engineer (Mob : 9674720105). The required data will not be used for any other purpose than the stated one. Accordingly, an undertaking may please be arranged.

Rgds


Suman Mukhopadhyay (সুমন মুখোপাধ্যায়)
Chief Hydraulic Engineer (মুখ্য তোয়ালিকী अभियन्ता)

From: "SAHA, RAHUL (সহা, রাহুল)" <SAHARAHUL@indianoil.in>

To: "SUMAN MUKHOPADHYAY" <suman.m@kolkataporttrust.gov.in>, "CHE" <che@kolkataporttrust.gov.in>

Cc: hsedepthaldia refinery@indianoil.in, SENSANTANU@INDIANOIL.IN, KUMARNIKHIL@INDIANOIL.IN

Sent: Thursday, August 14, 2025 2:23:05 PM

Subject: Request for Historic River Flow Data of Hooghly River at Haldia

Respected Sir,

Please find attached a formal letter from IOCL - Haldia Refinery requesting historic hydrological data of the Hooghly River at Haldia.

The data is required for carrying out pollutant dispersion analysis as part of our Impact Analysis study.

This study is being conducted by M/s Engineers India Limited (EIL), a QCI-NABET accredited consultant, for submission to the Ministry of Environment, Forest and Climate Change (MoEF&CC).

We kindly request your good office for support in sharing the relevant parameters to facilitate timely completion of the study.

Your support in this regard will be highly appreciated

With Regards,

Rahul Saha
Manager (H,S&E)
Indian Oil Corporation Limited || Haldia Refinery
Tel (O): 03224-22-3617 | saharahul@indianoil.in
Phone No.: 6901253996



अस्वीकरण

यह संदेश इंडियनऑयल मेसेजिंग गेटवे, भारत से भेजा गया है। इस इलेक्ट्रॉनिक संदेश में निहित जानकारी और इसके साथ कोई भी संलग्नक केवल प्रेषित व्यक्ति (यों) के लिए ही है और इसमें स्वामित्व, गोपनीय या विशेषाधिकार प्राप्त जानकारी हो सकती है। यदि आप वांछित प्राप्तकर्ता नहीं हैं तो आपको इस ई-मेल को प्रसारित, वितरित या कॉपी नहीं करना चाहिए। कृपया इसकी सूचना तुरंत प्रेषक को दें और इस संदेश की सभी प्रतियां और सभी संलग्नक नष्ट कर दें।
राजभाषा हिन्दी में हम आपके पत्रों का स्वागत करते हैं।

Disclaimer

This Message was sent from IndianOil Messaging Gateway, India. The information contained in this electronic message and any attachments to this message are intended for the exclusive use of the addressee(s) and may contain proprietary, confidential or privileged information. If you are not the intended recipient, you should not disseminate, distribute or copy this e-mail. Please notify the sender immediately and destroy all copies of this message and any attachments.

We welcome your communications in Rajbhasha Hindi.

अस्वीकरण

यह संदेश इंडियनऑयल मेसेजिंग गेटवे, भारत से भेजा गया है। इस इलेक्ट्रॉनिक संदेश में निहित जानकारी और इसके साथ कोई भी संलग्नक केवल प्रेषित व्यक्ति (यों) के लिए ही है और इसमें स्वामित्व, गोपनीय या विशेषाधिकार प्राप्त जानकारी हो सकती है। यदि आप वांछित प्राप्तकर्ता नहीं हैं तो आपको इस ई-मेल को प्रसारित, वितरित या कॉपी नहीं करना चाहिए। कृपया इसकी सूचना तुरंत प्रेषक को दें और इस संदेश की सभी प्रतियां और सभी संलग्नक नष्ट कर दें।
राजभाषा हिन्दी में हम आपके पत्रों का स्वागत करते हैं।

Disclaimer

This Message was sent from IndianOil Messaging Gateway, India. The information contained in this electronic message and any attachments to this message are intended for the exclusive use of the addressee(s) and may contain proprietary, confidential or privileged information. If you are not the intended recipient, you should not

disseminate, distribute or copy this e-mail. Please notify the sender immediately and destroy all copies of this message and any attachments.
We welcome your communications in Rajbhasha Hindi.

 **Request Letter for Historic River Flow Data of Hooghly River at Haldia.pdf**
1 MB

ANNEXURE-IV
CONSENT TO OPERATE



Government of West Bengal

This document having UDIN **24-G-GA000004-C-1716804531960** has been created by **WEST BENGAL POLLUTION CONTROL BOARD** with authorised person's Aadhaar no XXXXXXXX6156 on **03:38PM, May 27, 2024**.

This document is available at UDIN platform till 03:38PM, May 27, 2029.



Authorised Signatory
(E-signed)
Department of IT&E

The document is downloaded from <https://udin.wb.gov.in/>



WEST BENGAL POLLUTION CONTROL BOARD
Paribesh Bhawan, 10A, Block LA, Sector III
Salt Lake City, Bidhan Nagar, Kolkata – 700 106, INDIA
Website : www.wbpcb.gov.in, e-mail : wbpcbnet@wbpcb.gov.in

Category of the Industry : RED

Application Type: CTO

CTO No.: WBPCB/4890720/2024

Date : 27/05/2024

Consent to Operate (CTO) under Section 25 & 26 of the Water (Prevention and Control of Pollution) Act, 1974 as amended and Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended.

Reference: Application No.: 4890720

The West Bengal Pollution Control Board (hereinafter referred to as State Board) under the provisions of Section 25 & 26 of the Water (Prevention and Control of Pollution) Act, 1974 as amended and Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended, and Rules and Orders made thereunder hereby grants Consent to **INDIAN OIL CORPORATION LTD, HALDIA REFINERY** (hereinafter referred to as Applicant) for its unit located at **Haldia, P.O-Haldia Oil Refinery, Dist-Purba Medinipur, Pin-721606**. for the period from **27/05/2024 to 31/05/2029** to operate the industrial unit/project and to discharge liquid effluent and gaseous emission from the premises / land of the industrial unit/project, in accordance with the conditions as mentioned below, provided that on any day at any instance the quantity and quality of liquid discharge and gaseous emission shall not exceed the permissible limit as specified in this consent letter and in the Environment (Protection) Act, 1986 and Rules thereunder, as amended.

Breach of the conditions and / or failure to comply with the directions as mentioned below shall render the industry/project liable for prosecution under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 as amended and Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended.

The State Board reserve the right to revoke, withdraw or make any reasonable variation / change / alter the conditions of this consent letter giving one month's notice to the industry.

Conditions :

- 1 This Consent is valid for the following activities :

"This is computer generated document from OCMMS by WBPCB"

WBPCB/4890720/2024

Page1



Sl.No	Name of Activity/Products/By-products	Production Capacity (Per Month)
1	Refining of crude oil (to produce below mentioned product)-capacity not exceed	8.0 Million Tonnes/Year
2	MS-BS-VI&BS-IV	111778.3 Metric Tonnes/Month
3	LPG	25890 Metric Tonnes/Month
4	Naphtha	25397 Metric Tonnes/Month
5	ATF	35646 Metric Tonnes/Month
6	SKO	32005 Metric Tonnes/Month
7	HF HSD	320893 Metric Tonnes/Month
8	Diesel BS-VI	92933.3 Metric Tonnes/Month
9	JBO	1932 Metric Tonnes/Month
10	Fuel Oil	6797 Metric Tonnes/Month
11	H2SO4	11250 Metric Tonnes/Month
12	Sulphur	10800 Metric Tonnes/Month
13	Petcoke	24967 Metric Tonnes/Month
14	Lube Oil Base stock	12994 Metric Tonnes/Month
15	Lube Oil Base Stock-CDW-II	14000 Metric Tonnes/Year
16	Lube Oil Base Stock-CDW-II	199000 Metric Tonnes/Year
17	Bitumen	41597 Metric Tonnes/Month
18	Transformer oil from CDW-II	15000 Metric Tonnes/Year
19	Light white oil from CDW-II	12000 Metric Tonnes/Year
20	Medium white oil from CDW-II	14000 Metric Tonnes/Year
21	Diesel from CDW-II	9000 Metric Tonnes/Year
22	Naphtha from CDW-II	4000 Metric Tonnes/Year
23	Fuel gas from CDW-II	2000 Metric Tonnes/Year
24	Hydrogen	15000 Metric Tonnes/Year

2 The industry shall remain responsible for quantity and quality of liquid effluent and air emission.

3 Daily waste water generation and discharge shall not exceed :

No. of outlets	Source of Waste Water	Quantity in Kilo Liters/day	Place of discharge
1	Refinery process	<240 m3/hr	River Hooghly

4 To bring into any altered or new outlet / outfall or to change the place of discharge, the industry shall have to inform the Board and obtain prior permission of the Board in this effect.

5 The industry shall provide comprehensive facility for treatment of industrial liquid waste and domestic liquid waste (sewage, sullage and liquid effluent generated from canteen), and operate and maintain the same continuously so that the quality of final effluent conforms to the Standard as given below:

"This is computer generated document from OCMMS by WBPCB"



Outlet No.	Nature of effluent	Parameters and standard			Frequency of sampling
		Parameters	Standards	Unit	
01	Industrial	pH	6.0-8.5		quarterly
01	Industrial	Oil & Grease	5.0	mg/L	quarterly
01	Industrial	Biological Oxygen Demand (BOD)	15.0	mg/L	quarterly
01	Industrial	Chemical Oxygen Demand (COD)	125.0	mg/L	quarterly
01	Industrial	Total suspended Solid (TSS)	20.0	mg/L	quarterly
01	Industrial	Phenols	0.35	mg/L	quarterly
01	Industrial	Sulphides, as S	0.5	mg/L	quarterly
01	Industrial	Cyanides, (as CN-)	0.20	mg/L	quarterly
01	Industrial	Ammoniacal Nitrogen, as N	15.0	mg/L	quarterly
01	Industrial	Phosphates, as P	3.0	mg/L	quarterly
01	Industrial	Hexavalent Chromium, as Cr+6	0.1	mg/L	quarterly
01	Industrial	Total Chromium, as Cr	2.0	mg/L	quarterly
01	Industrial	Lead, as Pb	0.1	mg/L	quarterly
01	Industrial	Zinc, as Zn	5.0	mg/L	quarterly
01	Industrial	Nickel, as Ni	1.0	mg/L	quarterly
01	Industrial	Copper, as Cu	1.0	mg/L	quarterly
01	Industrial	v	0.2	mg/L	quarterly
01	Industrial	Benzene	0.1	mg/L	quarterly
01	Industrial	Benzo(a)-Pyrene	0.2	mg/L	quarterly
01	Industrial	Hg	0.01	mg/L	quarterly
01	Industrial	TKN	40.0	mg/L	quarterly

Provisions shall be made to install sensor-based Water Quality monitoring system and flow meter to share the information with the state board on a Real Time basis.

6 Daily water consumption for the following purposes shall not exceed

SL NO.	Purpose of Water Use	Quantity (KL/Day)
1.	Domestic	2088.0
2.	Cooling	17520.0
3.	Boiler	11040.0
4.	Others(Plantation)	3240.0

- 7 The Industry shall install suitable digital device for measuring the volume of water consumed for different purposes as mentioned above giving correct result to the satisfaction of the State Board. The device shall be able to provide information to disseminate the quantity on a real time basis.
- 8 All the stacks connected to various sources of emissions must be designated by numbers.
- 9 The industry shall install comprehensive pollution control equipment and operate and maintain the same to conform to the standard as given below:
- 10 The industry shall provide ports in the stack(s) and other necessary permanent facilities such as ladder, platform etc. for monitoring / sampling the air emissions and the same shall be made available for inspection and use by the State Board’s staff as well as State Board’s authorized agencies.
- 11 Waste generation, treatment and disposal shall be as specified below :

"This is computer generated document from OCMMS by WBPCB"



S.No	Description of Waste	Quantity	Treatment and Disposal

The Industry shall obtain Authorisation for waste and also register for EPR wherever applicable.

- 12 The industry shall take adequate measures for control of noise level from its own sources within the premises within the limit given below :

Time	Limit in dB (A) Leq
Day time (06 a.m. to 10 p.m.)	65
Night time (10 p.m. to 06 a.m.)	55

Noise barriers should be installed if the Noise Level is found to be exceeding the desired levels.

- 13 The industry shall at all times maintain good house-keeping and control pollution (including fugitive emissions) from all sources to maintain clean environment in & around factory premises and in surrounding areas.
- 14 The Industry shall bring about at least 33% of the total land area under the tree cover.
- 15 The Industry shall provide sufficient alternate electric power source like Green DG or Storage Battery System etc. to operate all pollution control facilities. In absence of such alternate power source, the production shall be stopped/controlled to conform to the conditions of the Consent.
- 16 The industry shall install a separate energy meter showing the consumption of energy for operation of pollution control devices and shall install suitable device for measuring the volume of water consumed for different purposes as mentioned in Sl.No. 3.
- 17 The Industry shall provide drainage system for discharge of industrial and domestic effluent and a separate drainage system for storm-water.
- 18 The industry shall maintain a separate register showing consumption of chemicals used in pollution control systems.
- 19 The Industry shall get the samples of hazardous wastes / leachates analysed at least once in a year from a laboratory recognised by the West Bengal Pollution Control Board and ensure that they conform to the limits stipulated. Test reports shall be sent to the Board.
- 20 The Industry shall submit the Environmental Statement Report for the financial year ending 31st March of the current year in the prescribed form (Form V) as required under the provisions of Rule 14 of the Environment (Protection) [Second Amendment] Rules 1992 by 30th September of every year, to the WBPCB.
- 21 The Industry shall allow the officers of the State Board to enter into the premises of the unit at any reasonable time to inspect the pollution control systems and shall provide adequate and safe facility for collection of air, wastewater and solid waste samples for monitoring by the State Board as well as by authorized agencies of the State Board, as and when required by them.
- 22 The industry shall maintain an Inspection Book in the factory premises which shall be made available to inspecting officers of the State Board for inspection, review and to write down any direction or observation as is deemed necessary during the inspection.
- 23 The Industry shall furnish to the State Board all information in respect of quality, quantity, rate of discharge, place of discharge of liquid effluent and air emission.
- 24 The Industry shall maintain adequate number of qualified and trained personnel among its staff for proper maintenance and operation of the effluent treatment and/or emission control devices and for overall environment management of the industry.
- 25 The Industry shall have to make registration for the use of groundwater if any, with State Water Investigation Directorate (SWID).

"This is computer generated document from OCMMS by WBPCB"

WBPCB/4890720/2024

Page4



- 26 The Industry shall intimate to the State Board immediately of any occurrence or apprehension of occurrence of discharge of any poisonous, noxious or pollutants in excess of quality as well as quantity as mentioned earlier to any receiving water body/receiving system or to atmosphere owing to accident or other unforeseen incident/event including natural disaster. The Applicant shall (i) take all steps adequate to prevent such accident discharge / release of poisonous, noxious or pollutants and to limit their consequences to persons and the environment, (ii) provide to the persons working on the site with the information, training and equipment including antidotes necessary to ensure their safety and mitigate the accidental release of poisonous noxious or pollutants to the environment.
- 27 If the Industry is using Diesel Generator set or generating any other hazardous waste, it should install a Digital Display Board to discriminate all information as stipulated in this regard.
- 28 The industry shall make an application to the State Board in the prescribed form for renewal of the consent at least 120 (one hundred & twenty) days before the date of expiry of this Consent.
- 29 The industry shall not make any alteration / expansion / modification in the existing manufacturing process and equipment, pollution control system and shall not alter or bring in any new outlet/outfall or stack or change the place of discharge, without prior approval of the Board.
- 30 The industry shall comply with all applicable Environmental Acts and Rules.
- 31 The Industry shall comply with the provisions of relevant Waste Management Rules and also submit Annual Returns / Manifests on regular basis.
- 32 Concealing factual data or submission of false or fabricated data/information may result in revocation of Consent to Operate and attract action under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981.

Special Conditions:

1. The unit shall comply with the environmental standards for emission & effluent discharge as per GSR no. 186(E) dated 18.03.2008 issued by MoEF & CC.
2. Emission sources and standards are attached herewith.
3. No untreated effluent even floor wash/surface runoff containing oil or other hazardous substances will be allowed to discharge GBC.
4. HW to be disposed on regular basis and manifest to be submitted to WBPCB.
5. The unit shall reuse/recycle the Treated ETP effluent as much as possible to reduce BOD Load in the recipient water-body <30Kg/day.

Any violation of the aforesaid conditions shall entail cancellation of this Consent for Operate.

For and on behalf of West Bengal Pollution Control Board



27/05/2024

**Environmental Engineer
Haldia Regional Office**

"This is computer generated document from OCMMS by WBPCB"

WBPCB/4890720/2024

Page5



Sl. No	Stack ht. from G.L (in mt)	Stack attached to	Type of Fuel		Concentration of parameters not to exceed (mg/NM ³)				Frequency of emission sampling
			Gas	Liquid	SO _x	NO _x	CO	PM	
1	53.8	CDU-1	F.G.	IFO	To be computed based on heat supplied by gas & liquid fuel	To be computed based on heat supplied by gas & liquid fuel	To be computed based on heat supplied by gas & liquid fuel	To be computed based on heat supplied by gas & liquid fuel	Quarterly
2	60.0	CDU-1 (Trim Heater)	F.G.	IFO					
3	54.9	CDU-2	F.G.	IFO					
4	65.5	CDU-2 (Trim Heater)	F.G.	IFO					
5	47.8	VDU-1	F.G.	IFO					
6	60.0	VDU-1 (Trim Heater)	F.G.	IFO					
7	35.2	FEU	F.G.	IFO					
8	60.0	Gas Turbine -1	F.G.	Naphtha					
9	60.0	Gas Turbine -2	F.G.	Naphtha					
10	60.0	Gas Turbine -3	F.G.	Naphtha					
11	39.0	VBU	F.G.	IFO					
12	60.0	VDU-2	F.G.	IFO					
13	60.0	OHCU - 2 nos.	F.G.	IFO					
14	60.0	FPU - new	F.G.	IFO					
15	60.0	DCU - new	F.G.	IFO					
16	60.0	DHDT	F.G.	IFO					
17	35.7	PDA	---	IFO	1700	450	200	100	
18	80.0	TPS (Boiler- I)	---	IFO	1700	450	200	100	
19	80.0	TPS (Boiler- II)	---	IFO	1700	450	200	100	
20	80.0	TPS (Boiler-III)	---	IFO	1700	450	200	100	
21	80.0	TPS (Boiler-IV)	---	IFO	1700	450	200	100	
22	40.5	CRU	F.G.	---	50	350	150	10	
23	30.3	KHDS	F.G.	---	50	350	150	10	
24	21.5	HFU	F.G.	---	50	350	150	10	
25	60.0	DHDS	F.G.	---	50	350	150	10	
26	65.0	MSQU-2 nos.	F.G.	---	50	350	150	10	
27	60.0	CIDW-3 nos.	F.G.	---	50	350	150	10	
28	63.0	SRU-II	---	---	---	350	150	---	
29	63.0	SRU-III	---	---	---	350	150	---	
30	60.0	SRU-IV	---	---	---	250	100	---	
31	60.0	FCCU (heater)	F.G.	---	50	350	150	10	
32	100.0	FCCU (regenerator)	Coke	---	1700	450	400	100	
33	60.0	HGU-I PDS	F.G.	0	50	350	150	10	
34	60.0	HGU-I Reformer	---	Naphtha	1700	450	200	100	
35	60.0	HGU-II PDS (new)	F.G.	---	50	250	100	5	
36	60.0	HGU-II Reformer -(new)	---	Naphtha	850	350	150	50	
37	65.0	CGO-HDT-3 nos.	F.G.	---	50	250	100	5	
38	63.0	DYIP SRU-V	---	---	---	250	100	---	
39	60.0	CIDW- reactor feed furnace	F.G.	--	50	250	100	5	
40	60.0	CIDW-vacuum column feed furnace	F.G.	--	50	250	100	5	
41	60.0	WSA plant	F.G.	--	To be computed based on efficiency	250	100	--	



ANNEXURE-V
HOOGLY RIVER WATER QUALITY
FOR 2024

Parameters	Unit	03.01 .24	17.0 1.24	05.02 .24	19.02. 24	04.03. 24	19.03. 24	02.04 .24	06.05. 24	04.06. 24	24.06. 24	09.07 .24	22.07. 24	06.08. 24	20.08 .24	10.09 .24	23.09 .24	01.10 .24	21.1 0.24	11.1 1.24	18.1 1.24	13.1 2.24	16.12. 24
Ammonia-N	mg/l	0.11	-	0.28	0.25	0.26	BDL	0.19	0.14	0.15	0.47	0.19	0.12	0.62	0.15	0.11	BDL	0.14		BDL	BDL	BDL	BDL
BOD	mg/l	1.20	-	1.15	1.75	1.95	1.6		1.3	1.35	1.4	2.65	1.15	2.25	2.1	1.65	2.4	2.8	1	1.75	1.45	1.1	1.55
Conductivity	µs/cm	6008	587 1	3029	4310	8052	6198		15650	16200	14640	1187 0	10120	4058	1002	3112	610.4	343	226 0	539. 7	317 8	418 2	5913
Dissolved O2(DO)	mg/l	6.4	-	6.5	5.9	5.8	5.7	5.1	6.7	5.1	5.9	5.2	5.5	5.6	5.2	6	5.5	5.1	5	6.4	6.5	6.6	7
E-coli	MPN/1 00ml	3300	330 0	2200	2300	7900	4600	4900	4600	7000	4900	4900	7900	7900	7000	4600	4900	1100 0	790 0	790 0	790 0	700 0	4600
Fecal Coliform	MPN/1 00ml	7000	700 0	4900	4600	13000	7000	7900	7000	11000	7900	1100 0	13000	13000	1100 0	7000	9400	1700 0	130 00	140 00	130 00	110 00	11000
Fecal Streptococci	MPN/1 00ml	240	220	200	170	490	330	330	460	460	330	460	490	490	330	330	490	390	490	790	490	330	460
Nitrate-N	mg/l	0.54	0.26	0.28	0.73	0.09	0.18	0.88	0.31	0.55	0.38	0.74	1.2	1.11	0.6	1.34	1.21	2.22	1.4	0.54	0.87	0.95	0.82
pH	Unit	8.1	7.6	8.1	7.8	7.9	7.9	8.4	8.4	8.4	8.4	8.1	8	7.8	7.4	8.02	7.83	7.53	7.85	7.65	7.67	7.87	7.94
Temperature(Water)	°C	28	17	26	26	29	27	32	28	30	31	32	26	30	31	32	29	32	30	27	27	22	23
Total Coliform	MPN/1 00ml	1300 0	110 00	9400	7000	17000	14000	1700 0	14000	22000	14000	2200 0	24000	28000	2200 0	1400 0	3000 0	4800 0	220 00	280 00	220 00	170 00	22000
Boron	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Calcium	mg/l	185	237	131	153	270	206.4	299.0 4	252	206.4	299	208.8	277.68	106.8	34.4	60.48	24.08	20.64	49.2	34.4	111. 41	100. 8	144.48
Chloride	mg/l	2152	201 0	936	1330	3815	2699.1 6	4060. 44	5332.3 9	4647.5	5298.3 6	4628. 35	3450	1199.6	246.3 8	694.8 2	78.27	29.78	595	39.9 8	813. 93	114 1.5	1707.2 7

COD	mg/l	37	-	22	20	32.34	29.12	31.95	49.5	30	74.51	41.84	46	19.61	24.74	24.75	14.56	20	14.43	20	39	25.77	22
Fluoride	mg/l	0.33	0.22	0.36	0.31	0.32	0.13	0.28	0.3	0.28	0.38	0.38	0.4	0.3	0.6	0.45	0.358	0.353	0.41	0.34	0.36	0.39	0.425
Magnesium	mg/l	91	34	33	51	129.76	108.66	86.51	288.68	355.26	194.64	190.27	69.12	56.23	29.26	20.41	8.36	16.72	33.87	10.45	47.9	44.9	46.95
Nitrite N	mg/l	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	BDL	0.09	0.04	0.01	0.01	0.02	0.02	0.02	0.02	0.004	0.02	0.02
Phenolphthalei n Alkanity	mg/l	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	6	Nil	Nil	Nil	nil	Nil	Nil	Nil	Nil	Nil	Nil		Nil
Phosphate-P	mg/l			0.17	0.2	0.15	0.16	0.17	0.13	0.11	0.19	0.13	0.12				0.12	0.18	0.2	0.22	0.28	0.18	0.22
		0.13	0.13											0.04	0.07	0.15							
Potassium	mg/l	59.59	48.78	21.8	34.7	74.3	174.1	82.1	125	124	125	83.7	72.6	32	11.8	21.5	7.2	6	16.5	4.9	63.1	32.5	35.9
Sodium	mg/l	1158.42	1078.11	549.5	757.1	894.7	834.2	1657.1	1800	1808	1800	2485	2285	706	158.9	420.4	32.8	26.8	337.5	28.4	551.1	191.4	886.8
Sulphate	mg/l	345.18	436.47	85.91	185.75	554	400.23	431.69	934.58	926	904	249.41	549.36	173.98	69.2	75.25	55.69	25.71	101	27.48	122.32	153.14	215.97
Total Alkalinity	mg/l	144	136	168	148	150	146	146	138	130	138	118	100	92	92	117.5	88	94	111.3	123.9	118.5	131	134
Total Dissolved Solids(TDS)	mg/l		3878	1708	2526	6672	3120	6440	9482	5882	7890	10580	7620	1590	480	1104	358	224	1032	224	1840	1622	822
		3234																					
Total Fixed Solids(TFS)	mg/l		2988	1622	1968	6406	2866	6218	8622	5224	7198	9870	6966	1480	468	1030	556	204	982	218	1768	1580	760
		2872																					
Total Hardness as CaCo3	mg/l	836	730	464	592	1210	963.2	1103.6	1818	1978	1548.6	1305	979	498.4	206.4	235.2	94.16	120	262	129	308.52	436.8	554
Total Suspended Solids(TSS)	mg/l	318	314	186	262	388	384	272	476	582	910	772	150	192	710	536	284	492	168	304	500	268	300
Turbidity	NTU	282	330	176	82	200	196.4	210.2	27.9	41.6	12.4	22.4	12.6	28.7	60.6	186.7	341	76	67.8	100	39.7	158	85.9

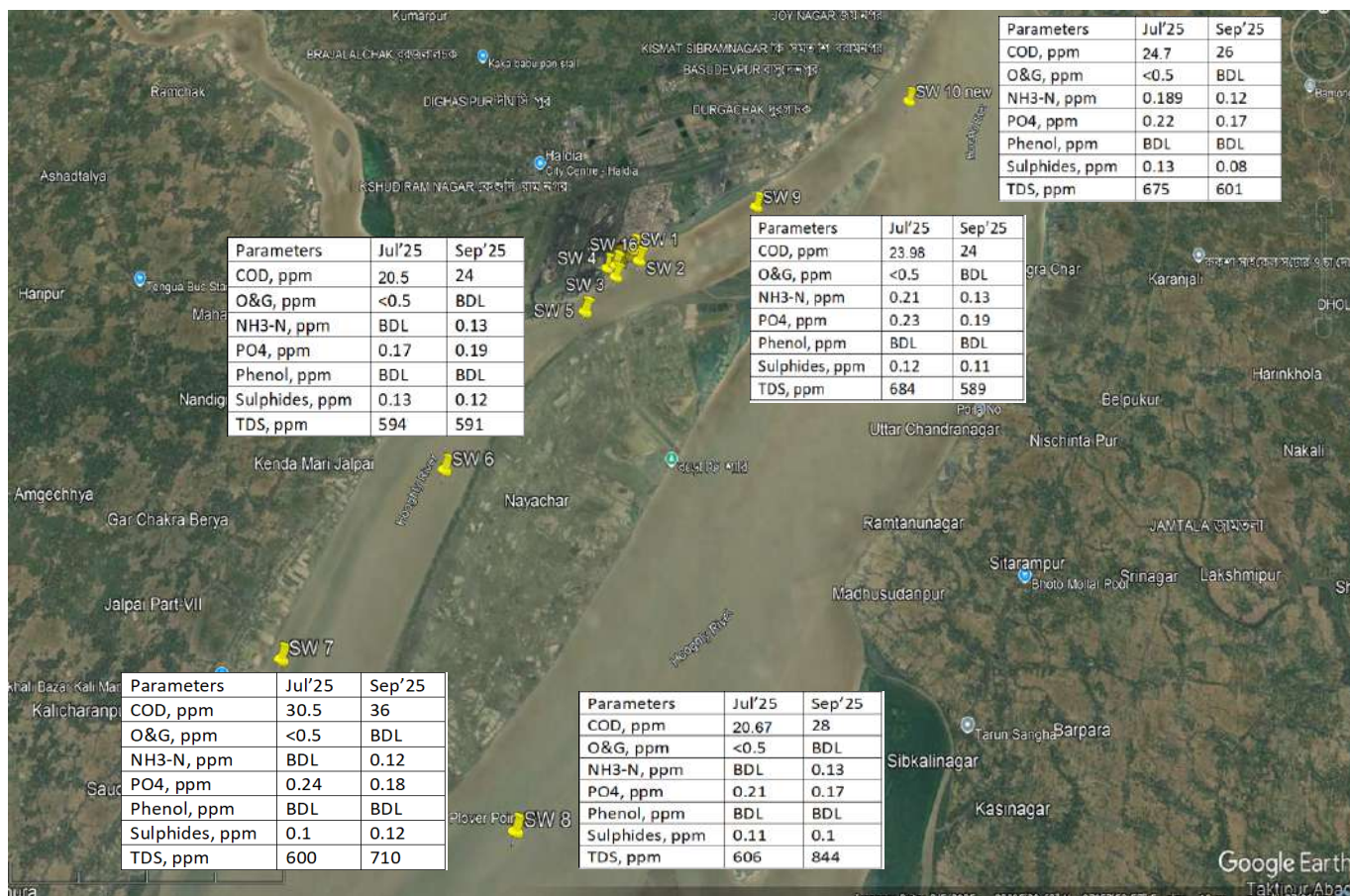
(Source: West Bengal pollution control Board, Location: Pathikhali, Haldia)

Parameters	Unit	06-01-25	20-1-25	04-02-25	17-2-2025	03-03-2025	17-3-2025	02-04-2025	21-4-2025	05-05-25	19-5-25	02-06-25	16-6-25	01-7-25	16-7-25	4-8-2025	18-8-25	08.09.25	16.09.25
Ammonia-N	mg/l	BDL	BDL	1.08	BDL	0.51	0.10	0.20	BDL	BDL	0.751	BDL	BDL	BDL	BDL	0.392	BDL	BDL	0.13
BOD	mg/l	2.60	1.60	1.80	1.45	2.00	1.75	1.80	2.30	2.75	1.90	2.50	1.15	1.85	1.25	2.35	1.75	2.50	1.70
Conductivity	µs/cm	7228	6473	8748.0	9633	15010	16880	15660	16530	10250	10140	16140.0	10720	2707.0	730	488.7	415.7	812.7	2116.0
Dissolved O2(DO)	mg/l	7.0	6.8	6.6	6.8	6.0	6.3	7	6.5	6.7	7.1	6.2	6.1	5.9	6.2	5.5	5.8	5.7	5.9
E-coli	MPN/100ml	4900	4900	7000	4900	4900	4900	7900	4900	3300	4900	7000	7000	7900	7900	7900	4600	4900	7000
Fecal Coliform	MPN/100ml	9400	7900	11000	9400	9400	11000	14000	11000	7000	7900	14000	13000	17000	17000	17000	9400	7900	11000
Fecal Streptococci	MPN/100ml	490	330	490	460	460	490	700	470	170	490	700	790	330	1300	1100	330	330	460
Nitrate-N	mg/l	2.11	1.020	0.54	0.880	2.03	1.46	0.766	0.745	BDL	0.328	0.359	0.813	0.854	0.215	0.255	0.237	0.60	0.146
pH	Unit	7.97	7.86	7.81	7.67	7.83	7.88	7.82	7.76	7.85	8.01	7.96	7.86	7.91	7.57	7.58	7.62	7.61	7.86
Temperature(Water)	°C	22	22	25	28	27	29	29	33	30	32	31	28	28	30	28	29	30	27
Total Coliform	MPN/100ml	14000	17000	24000	17000	17000	22000	28000	22000	13000	17000	28000	28000	22000	28000	35000	14000	17000	22000
Boron	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Calcium	mg/l	80.64	172.00	127.28	194.88	201.60	221.76	127.28	240.80	147.84	127.68	275.52	141.04	50.40	34.95	32.68	16.80	43.68	79.12
Chloride	mg/l	774.36	2233.35	1749.46	3522.31	3982.45	4020.03	1749.46	4273.85	3277.71	2481.50	5757.08	3573.36	635.97	181.0	49.63	199.93	199.93	545.93

COD	mg/l	45.27	38.14	27.72	39.22	58.31	21.00	27.72	96.74	71.09	30.02	38.10	22.55	20.62	26.00	15.53	15.39	28.57	21.34
Fluoride	mg/l	0.356	0.350	0.387	0.410	0.418	0.448	0.387	0.496	0.451	0.476	0.657	0.579	0.456	0.452	0.586	0.456	0.404	0.464
Magnesium	mg/l	151.15	58.51	125.39	110.22	200.04	240.86	125.39	229.88	191.87	216.37	281.69	165.10	44.91	4.90	11.49	14.28	22.45	14.63
Nitrite N	mg/l	0.02	0.020	0.06	0.070	0.12	0.03	0.06	0.022	0.008	0.022	0.021	0.023	0.017	0.024	0.083	0.046	0.032	0.069
Phenolphthalein Alkanity	mg/l	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Phosphate-P	mg/l	0.24	0.22	0.25	0.20	0.17	0.26	0.25	0.26	0.23	0.14	0.25	0.17	0.17	0.22	0.17	0.18	0.22	0.16
Potassium	mg/l	89.9	81.0	54.8	55.8	103.8	113.4	54.8	110.9	75.3	73.3	141.8	83.7	23.7	12.2	6.2	4.8	9.7	15.5
Sodium	mg/l	1149.9	976.9	1206.3	1388.0	237.2	445.7	1206.3	1698.0	2158.1	1927.4	2250.5	1193.0	345.9	74.6	28.7	11.9	59.7	153.9
Sulphate	mg/l	307.95	248.91	324.12	359.42	343.10	1082.10	324.12	1249.65	724.00	486.35	1488.80	957.00	148.95	441.42	80.24	82.24	45.69	101.66
Total Alkalinity	mg/l	147.40	153.30	156.00	166.40	162.24	150.96	156.00	140.70	153.30	136.50	134.20	128.10	98.70	92.70	91.02	102.90	99.00	107.80
Total Dissolved Solids(TDS)	mg/l	4614.00	3424	1812.00	3642	4238	4500	1812	5120	4372	7802	13000.00	6012	1542.00	406	262	264.00	586.00	1180.00
Total Fixed Solids(TFS)	mg/l	4324.00	3380	1660.00	3482	3892	3960	1660	3988	4066	6298	11420.00	5360	1478.00	320	174	214.00	512.00	974.00
Total Hardness as CaCo3	mg/l	823.20	670.8	834.20	940.8	1327.2	1545.60	834.20	1548.	1159.20	1209.60	1848.00	1032	310.80	107.52	129	100.80	201.60	258.00
Total Suspended Solids(TSS)	mg/l	840.00	660	94.00	276	464	176	94	176	74	416	158.00	112	588.00	876	168	118.00	314.00	344.00
Turbidity	NTU	512.00	315	37.2	31.9	624	115.2	37.2	239	55.4	265	81.5	97.4	376.0	621	124	142.0	571.0	119.0

(Source: West Bengal pollution control Board, Location: Pathikhali, Haldia)

ANNEXURE-VI
MAP SHOWING SURFACE
WATER QUALITY DURING
HIGH TIDE





ANNEXURE-VII

HISTORICAL DATA FOR

GROUND WATER QUALITY IN

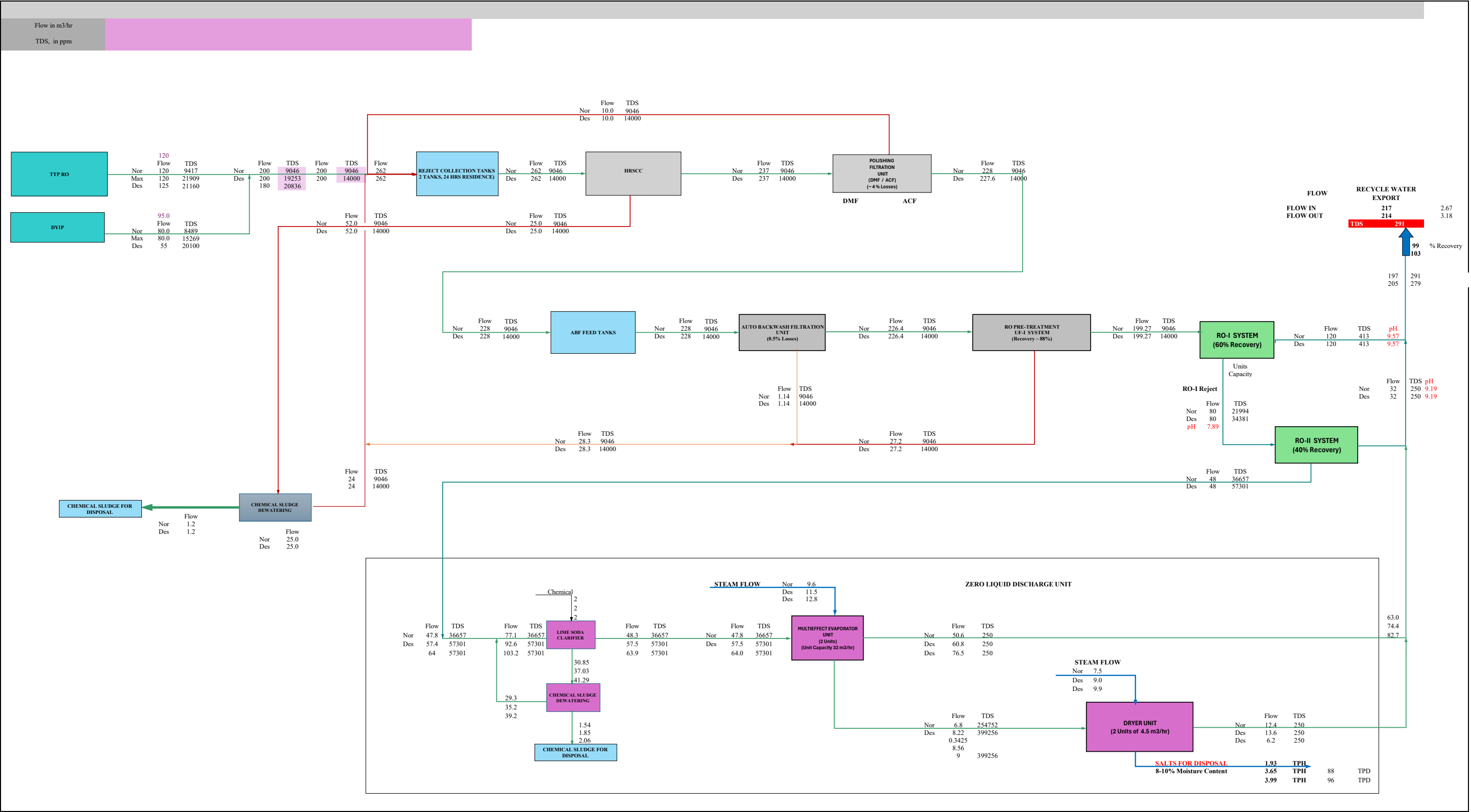
LAST 10 YEARS

Last 10 Year Ground water Quality data of West Pollution control Board at IOCL Halida Refinery

		WPCB 27.04.15	WPCB 12.04.16	WPCB 12.04.17	WPCB 12.10.17	WPCB 18.04.18	WPCB 06.10.18	WPCB 26.04.19	WPCB 25.10.19	WPCB 09.10.20	WPCB 20.04.21	WPCB 08.10.21	WPCB 19.04.22	WPCB 19.10.22	WPCB 19.04.23	WPCB 10.10.23	WPCB 16.04.24	WPCB 16.10.24	WPCB 04.04.25
Parameters	Unit																		
pH value at 25oC	-	8.05	7.69	7.70	7.45	7.24	7.15	7.69	7.36	7.69	7.97	7.26	7.73	7.95	8.20	7.70	7.40	7.55	7.57
Copper (as au)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenolic Compounds	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (as CN)	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead as Pb)	mg/l	BDL	-	BDL	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.012	-	-	BDL	0.015
Mercury (as Hg)	mg/l	BDL	-	BDL	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Nickel (as Ni)	mg/l	BDL	-	BDL	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Total Chromium (as Cr)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc (as Zn)	mg/l	BDL	-	BDL	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.11
Hexavalent Chromium	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (as V)	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solid	mg/l	4.0	36	16	6	20	6	8	4	22	22	4	12	16	30	18.00	20.00	10.00	30
BOD	mg/l	0.55	2.90	0.50	0.50	0.55	0.40	0.60	1.20	0.55	0.55	0.55	0.95	0.65	0.55	0.55	0.95	0.65	0.85
COD	mg/l	2.42	7.68	6.89	6.48	4.54	6.71	8.06	6.39	6.12	6.63	7	4	8.92	15.16	15.30	4.08	9.00	6.24
Oil and Grease	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammoniacal Nitrogen	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	1.05	0.97	0.15	BDL	1.06
Total Kjeldahl Nitrogen	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide (as H2S)	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphate (as P)	mg/l	0.004	0.02	0.02	BDL	BDL	BDL	0.04	0.02	0.19	0.02	0.01	BDL	0.22	BDL	BDL	BDL	0.04	0.04
Total Dissolved Solid	mg/l	1148	1540	1192	1148	1204	1142	1254	1126	1094	3560	730	1358	2196	1482	1456	1628	1422	1360

ANNEXURE-VIII

WATER BALANCE



ANNEXURE-IX
ELECTRICAL LOAD LIST

ELECTRICAL LOAD LIST (ZERO LIQUID DISCHARGE STUDY OF IOCL HALDIA REFINERY)

DOCUMENT No. C118-000-17-42-ELL-1001, Rev. A

SERVICE		W	S	CAPACITY	HEAD	TYPE	Pump Eff.	PUMP BHP	Motor Eff. at Full Load	Duty : Cont / Int	Operating Hours	Estimated KW Load per Unit	Total Power Consumption
				m³/hr	mWC		Assumed	Calculated	Assumed				
							%		%	C / I	Hr	KW	KW
PUMPS													
1	HRSCC-I Feed Pumps	1	1	262	15	Hor. Cent.	75%	19.10	83.0%	C	24	17.20	17.20
2	Filter Feed Pump	1	1	237	40	Hor. Cent.	75%	46.06	84.0%	C	24	41.00	41.00
3	Filter Backwash Pump	1	1	240	25	Hor. Cent.	75%	29.15	85.0%	I	4	25.65	25.65
4	Centrifuge Feed Pumps	2	1	40	20	Hor. Cent.	60%	4.86	75.0%	C	24	4.84	9.69
5	ABF Feed Pumps	1	1	226.5	40	Hor. Cent.	75%	44.02	84.0%	C	24	39.19	39.19
6	Backwash Waste Transfer Pump	1	1	30	20	Hor. Cent.	55%	3.98	81.0%	C	24	3.67	3.67
7	UF Backwash Pumps (NOTE-1)	1	1	1160	30	Hor. Cent.	75%	169.10	88.0%	I	8	143.67	143.67
8	Cartridge Filter-I Feed Pumps	1	1	199	40	Hor. Cent.	75%	38.68	80.0%	C	24	36.15	36.15
9	RO-I Feed Pumps (VFD Driven)	1	1	199	150	Hor. Cent.	75%	145.04	88.0%	C	24	123.24	123.24
10	RO-II Feed Pumps (VFD Driven)	1	1	80	200	Hor. Cent.	70%	83.30	84.0%	C	24	74.14	74.14
11	RO Cleaning Circulation Pumps	1	1	180	30	Hor. Cent.	70%	28.11	85.0%	I	12	24.73	24.73
12	Permeate Water Transfer Pump	1	1	205	60	Hor. Cent.	75%	59.77	87.0%	C	24	51.36	51.36
13	FeCl ₃ Solution Dosing Pumps for HRSCC-I	1	1	0.3	20	Metering	20%	0.11	81.0%	C	24	0.10	0.10
14	FeCl ₃ Solution Dosing Pumps for UF-I	1	1	0.01	20	Metering	20%	0.004	81.0%	C	24	0.003	0.003
15	Milk to Lime Transfer Pumps	1	1	20	15	Hor. Cent.	30%	3.64	81.0%	I	12	3.36	3.36
16	Lime Solution Dosing Pumps for HRSCC-I & lime soda clarifier in ZLD	2	1	21	20	Metering	55%	2.78	81.0%	C	24	2.57	5.14
17	Polyelectrolyte Solution Dosing Pumps for HRSCC-I	1	1	0.5	20	Metering	20%	0.18	81.0%	C	24	0.17	0.17
18	Antiscalant Solution Dosing Pump for RO-I & RO-II	1	1	0.015	45	Metering	20%	0.01	81.0%	C	24	0.01	0.01
19	Sodium Bisulphite Solution Dosing Pumps	1	1	0.01	45	Metering	20%	0.01	81.0%	C	24	0.01	0.01
20	HCl Dosing Pumps for RO-I & RO-II	2	1	0.01	45	Metering	20%	0.01	81.0%	C	24	0.01	0.02
21	HCl Dosing Pumps for HRSCC-I	1	1	0.02	20	Metering	20%	0.01	81.0%	C	24	0.01	0.01
22	Caustic unloading Pumps	1	1	15	15	Hor. Cent.	50%	1.64	75.0%	I	12	1.63	1.63

ELECTRICAL LOAD LIST (ZERO LIQUID DISCHARGE STUDY OF IOCL HALDIA REFINERY) DOCUMENT No. C118-000-17-42-ELL-1001, Rev. A

DOCUMENT No. C118-000-17-42-ELL-1001, Rev. A

SERVICE		W	S	CAPACITY	HEAD	TYPE	Pump Eff.	PUMP BHP	Motor Eff. at Full Load	Duty : Cont / Int	Operating Hours	Estimated KW Load per Unit	Total Power Consumption	
				Assumed	Calculated		Assumed							
				%			%	C / I	Hr					KW
PUMPS														
23	CEB-I (HCl) Dosing Pump UF		1	1	0.9	25	Metering	20%	0.41	81.0%	I	12	0.38	0.38
24	CEB- II (NaOH) Dosing Pump UF		1	1	1.6	35	Metering	20%	1.02	81.0%	I	12	0.94	0.94
25	CEB-III (NaOCl)Dosing Pump UF		1	1	0.9	35	Metering	20%	0.57	81.0%	I	12	0.53	0.53
26	DWPE Solution Dosing Pumps for HRSCC centrifuge		1	1	0.15	20	Hor. Cent.	20%	0.05	85.0%	C	24	0.05	0.05
27	Soda Ash Solution Dosing Pump (HRSCC-I)		1	1	0.2	20	Metering	20%	0.07	81.0%	C	24	0.07	0.07
AGITATORS AND MISCELLANEOUS ITEMS														
28	Flash Mixer		1				Vertical				C	24	2.00	2.00
29	HRSCC- I Sludge Sump Agitator		2				Vertical				I	12	4.00	8.00
30	Antiscalant Solution Dosing Tanks Agitators		2				Vertical				I	12	2.00	4.00
31	Sodium Bisulphite Solution Dosing Tanks Agitators		2				Vertical				I	12	2.00	4.00
32	RO Cleaning Tank Agitator		1				Vertical				I	12	4.00	4.00
33	Lime solution dosing tank agitators		4				Vertical				I	12	2.00	8.00
34	FeCl ₃ Solution Dosing Tank Agitators		2				Vertical				I	12	2.00	4.00
35	PE dosing tank agitator		2				Vertical				I	12	2.00	4.00
36	Soda Ash dosing tank agitator		2				Vertical				I	12	2.00	4.00
37	DWPE (Chemical) Solution Dosing Tanks Agitators		2				Vertical				I	12	2.00	4.00
38	HRSCC - I Mechanism		1				Vertical				C	24	10.00	10.00
BLOWERS AND COMPRESSORS														
39	Filter Air scouring blowers		1	1	650	5	Lobe	30%	39.48	81.0%	I	4	36.44	36.44
TOTAL ELECTRICAL LOAD CONSIDERING DESIGN MARGIN , SAY, KW														
764.0														
NOTES														
1	THE UF BACKWASH PUMPS SHALL REQUIRE APPROXIMATELY 10 START / STOP OPERATION PER HOUR AS PER PROCESS REQUIREMENTS - ELECTRICAL TO ADVISE ANY SPECIFIC CONDITION/REQUIREMENT TO BE SPECIFIED IN THE PROCESS DATASHEET FOR THE SAME													
2	The Differential Heads of the Pumps/ Blowers have been estimated for Electrical Load Calculations and shall be finalised During Detailed Engineering													
3	Electric Load for other Miscellaneous items like Internal and External PLANT Lighting, AC Package, Exhaust Fans, Laboratory Points, Electrical Hoist (in Chemical House) shall be Additional for the Water Block Package													

ELECTRICAL LOAD LIST (ZERO LIQUID DISCHARGE STUDY OF IOCL HALDIA REFINERY) **DOCUMENT No. C118-000-17-42-ELL-1001, Rev. A**

DOCUMENT No. C118-000-17-42-ELL-1001, Rev. A

SERVICE		W	S	CAPACITY	HEAD	TYPE	Pump Eff.	PUMP BHP	Motor Eff. at Full Load	Duty : Cont / Int	Operating Hours	Estimated KW Load per Unit	Total Power Consumption
				m ³ /hr	mWC		Assumed	Calculated	Assumed				
P U M P S													
11	Lime soda clarifier feed pumps	1	1	103.5	30	Hor. Cent.	70%	16.17	83.0%	C	24	14.56	14.56
12	Evaporator feed pumps	2	1	32	45	Hor. Cent.	60%	8.75	75.0%	C	12	8.72	17.44
13	Lime soda clarifier sludge transfer pumps	3	1	40	25	Hor. Cent.	60%	6.07	80.0%	I	16	5.68	17.03
14	Lime soda clarifier centrate transfer pumps	1	1	40	60	Hor. Cent.	65%	13.46	80.0%	I	16	12.58	12.58
16	ZLD Plant Drain transfer Pumps	1	1	5	20	Hor. Cent.	30%	1.21	75.0%	I	4	1.21	1.21
18	Antiscalant Solution Dosing Pumps for ZLD	1	1	0.055	45	Metering	20%	0.05	81.0%	C	24	0.04	0.04
21	Soda Ash solution dosing pumps for ZLD	1	1	2	20	Metering	20%	0.73	81.0%	C	24	0.67	0.67
25	FeCl ₃ Solution Dosing Pumps for ZLD	1	1	0.01	20	Metering	20%	0.004	81.0%	C	24	0.003	0.003
29	Polyelectrolyte Solution Dosing Pumps for Lime soda clarifier in ZLD	1	1	0.15	20	Metering	20%	0.05	81.0%	C	24	0.05	0.05
37	DWPE Solution Dosing Pumps for ZLD centrifuge	1	1	0.25	20	Metering	20%	0.09	81.0%	C	24	0.08	0.08
AGITATORS AND MISCELLANEOUS ITEMS													
49	Lime Soda clarifier Mechanism	1				Vertical				C	24	10.00	10.00
MEE & ATFD DETAILS													
50	MEE Recirculation Pump-1	2	1	1800	20	Hor. Cent.	70%	187.42	83.0%	C	24	168.83	337.67
51	MEE Recirculation Pump-2	2	1	1070	20	Hor. Cent.	70%	111.41	83.0%	C	24	100.36	200.73
52	MEE Recirculation Pump-3	2	1	1070	20	Hor. Cent.	70%	111.41	83.0%	C	24	100.36	200.73
53	MEE Recirculation Pump-4	2	1	1070	20	Hor. Cent.	70%	111.41	83.0%	C	24	100.36	200.73
54	MEE Concentrate Pump	2	1	12	20	Hor. Cent.	50%	1.75	75.0%	C	24	1.74	3.49
55	CIP Pump	2	1	60	40	Metering	20%	43.73	84.0%	C	24	38.93	77.85
56	Seal Water Pump	2	2	18	40	Hor. Cent.	50%	5.25	81.0%	C	24	4.84	9.69
57	Mother Liquour Pump	2	1	12	20	Hor. Cent.	50%	1.75	81.0%	C	24	1.61	3.23
58	Settling Tank recirculation pump	2	1	10	20	Hor. Cent.	50%	1.46	81.0%	C	24	1.35	2.69
59	Vacuum Pump	2	1	900	7		55%	41.74	81.0%	C	24	38.53	77.06
60	ATFD	2	0	6									300.00
BLOWERS AND COMPRESSORS													
													1487.5

ELECTRICAL LOAD LIST (ZERO LIQUID DISCHARGE STUDY OF IOCL HALDIA REFINERY) DOCUMENT No. C118-000-17-42-ELL-1001, Rev. A

ELECTRICAL LOAD LIST (ZERO LIQUID DISCHARGE STUDY OF IOCL HALDIA REFINERY) DOCUMENT No. C118-000-17-42-ELL-1001, Rev. A

SERVICE				W	S	CAPACITY	HEAD	TYPE	Pump Eff.	PUMP BHP	Motor Eff. at Full Load	Duty : Cont / Int	Operating Hours	Estimated KW Load per Unit	Total Power Consumption
						Assumed	Calculated		Assumed						
				m ³ /hr	mWC	%			%	C / I	Hr	KW	KW		
P U M P S															
TOTAL ELECTRICAL LOAD CONSIDERING DESIGN MARGIN , SAY, KW															1636.3
NOTES															
1	The Differential Heads of the Pumps/ Blowers have been estimated for Electrical Load Calculations and shall be finalised During Detailed Engineering														
2	Electric Load for other Miscellaneous items like Internal and External PLANT Lighting, AC Package, Exhaust Fans, Laboratory Points, Electrical Hoist (in Chemical House) shall be Additional for the Water Block Package														

ANNEXURE-X

EQUIPMENT LIST

EQUIPMENT LIST
RODM PLANT
AT
HALDIA REFINERY
FOR INDIAN OIL CORPORATION LTD.

0	03.10.2025	ISSUED FOR FINAL REPORT	UJ/DD	RM/CP	VS/PKG
Rev. No	Date	Purpose	Prepared by	Reviewed by	Approved by

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
1.	2W	Reject Collection Tank	Effective Capacity: 3176 m ³ Size: 17 m dia x 14 m L.D. + 1m F.B. + 0.5m D.V.D	Duplex Stainless Steel (DSS)
2.	2(1W+1S)	HRSCC Feed Pumps	Capacity: 262 m ³ /hr Head: 15 m	C: SS316L, I: SS316L
3.	1W	Flash Mixing Tank	Effective Capacity: 3.4 m ³ L x B x H: 1.5 m x 1.5 m x 1.5 m + 0.3m F.B.	RCC Epoxy Screed Lining
4.	1W	Flash Mixer	Diameter: 500 mm	I:SS316 L S:SS431
5.	1W	High Rate Solid Contact Clarifier (Including Flocculation Zone)	Capacity: 262 m ³ /hr Size: 15.5 m dia x 3.5 m SWD + 0.5 m FB	RCC Epoxy Screed Lining
6.	1W	Filter Feed Tank	Effective Capacity: 62.5 m ³ L x B x H: 5 m X 5 m x 2.5 m SWD + 0.5 m FB	RCC Epoxy Screed Lining
7.	2(1W+1S)	Filter Feed Pump	Capacity: 237 m ³ /hr Head: 40 m	C: SS316L, I: SS316L
8.	3(2W+1S)	Dual Media Filters	Capacity: 237 m ³ /hr each Dia: 4 m dia, Height.: 2.6 m	CS Epoxy Coated
9.	3(2W+1S)	Activated Carbon Filters	Capacity: 237 m ³ /hr each Dia: 4 m dia, Height.: 3.7 m	CS Epoxy Coated
10.	2(1W+1S)	Filter Backwash pumps	Capacity: 240 m ³ /hr Head: 25 m	C: SS316L, I: SS316L

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
11.	2(1W+1S)	Filter Air Blowers	Capacity: 650 Nm ³ /hr Head: 5 m	C: CI Gr. 260 I: CI Gr. 260 S: EN-8
12.	1W	HRSCC Sludge Sump (2 Compartments)	Effective Capacity: 390 m ³ Overall Size: 10 m L X 13 m W x 3 m L.D. + 0.5m F.B. min	RCC Epoxy Coated
13.	4W	HRSCC Sludge Sump Agitator (2 per compartment)	Diameter: 1500 mm	Impeller: SS 316L Shaft : SS 431
14.	3(2W+1S)	Centrifuge feed pumps	Capacity: 40 m ³ /hr Head: 20 m	Casing: CI + Nitrile Rubber Lined Stator & Rotor: SS316
15.	3(2W+1S)	Centrifuge	Capacity: 40 m ³ /hr	Bowl: SS316L Shaft/Scroll: SS316L
16.	1	ABF Feed Tank	Effective Capacity: 477 m ³ Size: 9 m dia x 7.5 m L.D. + 1m F.B. + 0.5m D.V.D	CS Epoxy Painted
17.	2 (1W+1S)	ABF feed Pumps	Capacity: 226.4 m ³ /hr Head: 40 m	C: SS316L, I: SS316L
18.	2 (1W+1S)	Auto Backwash Filters-I	Capacity: 226.4 m ³ /hr Rating : 200µm	Shell: SS, Mesh: SS316

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
19.	2(1W+1S)	Ultra-Filtration Skids-I (Note-1)	Capacity: 199 m ³ /hr Net Permeate flow per skid (88% recovery)	Membrane: PVDF/PES
20.	1W	Backwash Waste Holding Sump-I	Effective Capacity: 30 m ³ L x B x D: 4 m x 3 m x 3 m	RCC Epoxy Coated
21.	2(1W+1S)	Backwash Waste Transfer Pump (Vertical Centrifugal)	Capacity: 30 m ³ /hr Head: 20 m	C: CS, I:CS
22.	2W	RO-I Feed Tank	Effective Capacity: 397 m ³ Size: 8.5 m dia x 7 m L.D. + 1m F.B. + 0.5 m D.V.D.	CS Epoxy Coated
23.	2(1W+1S)	UF Backwash pumps	Capacity: 1160 m ³ /hr Head: 30 m	C: CS, I:CS
24.	2(1W+1S)	Cartridge Filter-I Feed Pumps	Capacity: 199 m ³ /hr Head: 40 m	C: SS316L, I:SS316L
25.	2(1W+1S)	RO-I Cartridge Filters	Capacity: 199 m ³ /hr Rating : 5µm absolute	Shell: CS Epoxy Coated; Cartridge Membrane: PP
26.	3(1W+1S+ 1SSB)	RO-I Feed Pumps (VFD Driven)	Capacity: 199 m ³ /hr Head: 150 m	C: SS316L, I:SS316L
27.	2(1W+1S)	Reverse Osmosis-I (RO) Skid	199 m ³ /hr feed flow each skid; 119.6 m ³ /hr net permeate flow each skid; 60% Recovery (Minimum)	Membrane-Polyamide / Tube: FRP/GRP (ASME)
28.	1W	RO-II Feed Tank	Effective Capacity: 78.5 m ³ Size: 5 m dia x 4 m L.D. + 0.5m F.B. + 0.5m D.V.D	CS with Glass Flake Vinyl Ester Lining

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
29.	3(1W+1S+ 1SSB)	RO-II Feed Pumps (VFD Driven)	Capacity: 80 m ³ /hr Head: 200 m	C:SDSS; I:SDSS
30.	2(1W+1S)	Reverse Osmosis-II (RO) Skid	80 m ³ /hr feed flow each skid; 32 m ³ /hr net permeate flow each skid; 40% Recovery (Minimum)	Membrane-Polyamide / Tube: FRP/GRP (ASME)
31.	1	Permeate water storage tank	Effective Capacity: 397 m ³ Size: 8.5 m dia x 7 m L.D. + 1m F.B. + 0.5m D.V.D.	CS Epoxy Painted
32.	2(1W+1S)	Permeate water transfer pumps	Capacity: 205 m ³ /hr Head: 60 m	C: CS, I:CS
33.	2W	FeCl ₃ Solution Dosing Tank	Effective Capacity: 0.5 m ³ each Size: 0.8 m dia x 1 m L.D. + 0.25m F.B. + 0.25m D.V.D.	FRP
34.	2W	FeCl ₃ Solution Dosing Tank Agitators	Diameter: 300 mm	SS316L
35.	2(1W+1S)	FeCl ₃ Solution Dosing Pumps for HRSCC-I	Capacity: 30 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
36.	2(1W+1S)	FeCl ₃ Solution Dosing Pumps for UF-I	Capacity: 10 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
37.	1	Lime slaker system and associated facilities	Capacity: 2300 kg/hr	DDE

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
38.	2 (1W+1S)	Milk to lime transfer pumps	Capacity: During detail engg. Head: 15 m	C: SS316, I: SS316
39.	4W	Lime Solution Dosing Tank	Effective Capacity: 122 m ³ each Size: 6.4m X 6.4m X 3 m L.D. + 0.5m F.B. + 0.5m D.V.D.	FRP
40.	4W	Lime Solution Dosing tank Agitator	Diameter: 1500 mm	SS316L
41.	3(2W+1S)	Lime Solution Dosing Pumps for HRSCC-I & Lime soda clarifier in ZLD	Capacity: 21 m ³ /hr Head: 20 m	C: SS304, I: SS304
42.	2W	Polyelectrolyte Solution Dosing Tank	Effective Capacity: 7.6 m ³ each Size: 2.2 m dia x 2 m L.D. + 0.5m F.B. + 0.5m D.V.D.	FRP
43.	2W	Polyelectrolyte Solution Dosing tank Agitator	Diameter: 700 mm	SS316L
44.	2(1W+1S)	Polyelectrolyte Solution Dosing Pumps for HRSCC-I	Capacity: 500 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
45.	2W	Antiscalant Solution Dosing Tanks	Effective Capacity: 0.8 m ³ each Size: 1.0 m dia x 1 m L.D. + 0.25m F.B. + 0.25m D.V.D.	FRP
46.	2W	Antiscalant Solution Dosing Tanks Agitators	Diameter: 400 mm	SS 316 L

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
47.	3(2W+1S)	Antiscalant Solution Dosing Pumps for RO-I and RO-II	Capacity: 15 LPH Head: 45 m	C: PP/PVDF, D:TEFLON
48.	2W	Sodium Bisulphite Solution Dosing Tanks	Effective Capacity: 0.5 m ³ each Size: 1 m dia x 0.8 m L.D. + 0.5 m F.B. + 0.5m D.V.D.	FRP
49.	2W	Sodium Bisulphite Solution Dosing Tanks Agitators	Diameter: 300 mm	SS 316 L
50.	2(1W+1S)	Sodium Bisulphite Solution Dosing Pumps	Capacity: 10 LPH Head: 45 m	C: PP/PVDF, D:TEFLON
51.	2W	HCl Dosing Tank	Effective Capacity: 0.8 m ³ each Size: 1.0 m dia x 1 m L.D. + 0.25m F.B. + 0.25m D.V.D.	FRP (Vinyl ester resin)
52.	3(2W+1S)	HCl Dosing Pumps for RO-I & RO-II	Capacity: 10 LPH Head: 45 m	C: PP/PVDF, D:TEFLON
53.	2W	CEB-I (Acid) Dosing Tanks for UF	Effective Capacity: 1.8 m ³ each Size: 1.2 m dia x 1.5 m L.D. + 0.5m F.B. + 0.5m D.V.D.	FRP (Vinyl ester resin)
54.	2(1W+1S)	HCl Dosing Pumps for UF CEB	Capacity: 900 LPH Head: 35 m	C: PP/PVDF, D:TEFLON
55.	3(2W+1S)	HCl Dosing Pumps for HRSCC-I outlet	Capacity: 20 LPH Head: 20 m	C: PP/PVDF, D:TEFLON

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
56.	2W	NaOCl Dosing Tanks	Effective Capacity: 1.8 m ³ each Size: 1.2 m dia x 1.5 m L.D. + 0.5m F.B. + 0.5m D.V.D.	FRP
57.	2(1W+1SB)	CEB-III (NaOCl) Dosing Pumps	Capacity: 900 LPH Head: 35 m	C : PP/PVDF, D : TEFLON
58.	1W	RO Cleaning Tank	Effective Capacity: 15 m ³ Size: 3 m dia x 2.5 m L.D. + 0.5m F.B. + 0.5m D.V.D.	FRP
59.	1W	RO Cleaning Tank Agitator	Diameter: 1000 mm	SS 316L
60.	2(1W+1SB)	RO Cleaning Circulation Pumps	Capacity: 180 m ³ /hr, 30 m head	C : SS 316L, I : SS 316 L
61.	1	RO Cleaning Cartridge filters	Capacity: 180 m ³ /hr Rating : 5 µm (Absolute)	Shell: CSEP, Cartridge Membrane: PP
62.	2(1W+1SB)	Caustic Unloading Pumps	Capacity: 15 m ³ /hr Head: 15 m	C : SS 316L, I : SS 316 L
63.	1W	Caustic Dosing Tank	Effective Capacity: 3.2 m ³ each Size: 1.6 m dia x 1.7 m L.D. + 0.5m F.B. + 0.5m D.V.D.	KCS (PWHT)
64.	3(2W+1SB)	Caustic Dosing Pumps for UF- CEB	Capacity: 1600 LPH Head: 35 m	C : PP/PVDF, D : TEFLON

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
65.	2W	Soda Ash Solution Dosing Tanks	Effective Capacity: 25 m ³ each Size: 3.3 m dia x 3m L.D. + 0.5m F.B. + 0.5m L.D.	FRP
66.	2W	Soda Ash Solution Dosing Tanks Agitators	Diameter: 1000 mm	SS 316 L
67.	2(1W+1S)	Soda Ash Solution Dosing Pumps (HRSCC-I)	Capacity: 200 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
68.	2W	DWPE Solution Dosing Tanks	Effective Capacity: 4.6 m ³ each Size: 1.8 m dia x 1.8 m L.D. + 0.5m D.V.D. + 0.5m F.B.	FRP
69.	2W	DWPE Solution Dosing Tanks Agitators	Diameter: 500 mm	SS 316 L
70.	2(1W+1S)	DWPE Solution Dosing Pumps for HRSCC Centrifuge	Capacity: 150 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
71.	1	Chemical House (Double storey building)	30m [L] x 25m [W] x 12.0 m [H]	RCC frame structure + Brick work
72.	1	Sub Station cum Control Room Building	Overall Size: 35.0m [L] x 25.0m [W] (double storey)	RCC frame structure + Brick work
73.	1	UF cum RO Shed	Overall Size: 35 m [L] x 25 m [W] x 6m [H] (covered)	Precoated galvalume steel sheet roofing and side cladding
74.	1	Centrifuge Building	17 m [L] x 8 m [W] x 12.5 m [H]	RCC column structure with shed on the first floor

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
75.	1	Shed for lime slaker system	20 m X 20 m	Precoated galvalume steel sheet roofing and side cladding

NOTES:

1. *W: Working; SB: Stand by; L: Length; B: Breadth/Width; H: Height; SWD: Side Water Depth; D: Depth; I: Impeller; S: Shaft; EP: Epoxy Painted; EL: Epoxy Lined; SDSS: Super Duplex Stainless Steel*

EQUIPMENT LIST
ZERO LIQUID DISCHARGE PLANT
AT
HALDIA REFINERY
FOR INDIAN OIL CORPORATION LTD.

0	03.10.2025	ISSUED FOR FINAL REPORT	UJ/DD	RM/CP	VS/PKG
Rev. No	Date	Purpose	Prepared by	Reviewed by	Approved by

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
1.	2W	ZLD Feed Tanks	Effective Capacity: 760 m ³ Size: 11 m dia x 8 m L.D. + 1m F.B. + 0.5m D.V.D.	CS Epoxy Painted
2.	2(1W+1S)	Lime Soda Clarifier Feed Pumps	Capacity: 103.5 m ³ /hr Head: 30 m	C:SDSS; I:SDSS
3.	1	Lime Soda Clarifier	Capacity: 103.5 m ³ /hr Size: 10.5 m dia x 3.0 m SWD + 0.5 m FB	RCC Epoxy Coated
4.	1W	Evaporator Feed Tank	Effective Capacity: 68.7 m ³ Size: 5 m dia x 3.5 m L.D. + 0.5m F.B. + 0.5m D.V.D.	C: SDSS; I: SDSS
5.	3(2W+1S)	Evaporator Feed Pumps	Capacity: 32 m ³ /hr Head: 45 m	C:SDSS; I:SDSS
6.	2W	Zero Liquid Discharge Plant Package (Including all associated equipment and accessories like Chemical Dosing & Mixing Tank, Pre -Heaters, Flash Vessel, Surface Condenser, Vacuum pumps / Ejector, Vapor ducting, Condensate / Distillate storage, ATFD etc.)	Feed Capacity: 32 m ³ /hr each train	
7.	1	Lime Soda Clarifier sludge sump	Overall Effective Capacity: 470 m ³ Overall size: L x B x D: 12.5 m X 12.5 m x 3 m LD + 0.5 m DVD + 0.5 m FB	RCC Epoxy Coated

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
8.	2W per compartment	Lime soda clarifier sludge sump agitator	Diameter: 2000 mm	I: SS316L S: SS431
9.	4 (3W+1S)	Lime soda clarifier sludge transfer pumps	Capacity: 40 m3/hr Head: 25 m	C: SDSS I: SDSS
10.	4 (3W+1S)	ZLD centrifuge	Capacity: 40 m3/hr	Bowl: SDSS Shaft/Scroll: SDSS
11.	1	Lime soda clarifier centrate collection sump	4.5 m X 4.5 m X 2m S.W.D. + 0.5m F.B.	RCC
12.	2 (1W+1S)	Lime Soda clarifier centrate transfer pumps	Capacity: 40 m3/hr Head: 60 m	C: SS316L I: SS316L
13.	1	ZLD Plant Drain sump	Effective Capacity: 32.5 m3 L x B x D: 3.6 m X 3.6 m x 2.5 m LD + 0.2 m DVD + 0.3 m FB	RCC Epoxy Coated
14.	2 (1W+1S)	ZLD Plant Drain Transfer Pumps (Vertical Centrifugal)	Capacity: 5 m3/hr Head: 20 m	C: SDSS I: SDSS
15.	2(1W+1S)	FeCl ₃ Solution Dosing Pumps for ZLD	Capacity: 10 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
16.	2(1W+1S)	Polyelectrolyte Solution Dosing Pumps for Lime soda clarifier in ZLD	Capacity: 150 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
17.	2(1W+1S)	Antiscalant Solution Dosing Pumps for ZLD	Capacity: 55 LPH Head: 45 m	C: PP/PVDF, D:TEFLON
18.	2(1W+1S)	Soda Ash Solution Dosing Pumps (ZLD)	Capacity: 2000 LPH Head: 20 m	C: PP/PVDF, D:TEFLON

S. NO.	NOS.	EQUIPMENT DESCRIPTION	SIZE (EACH UNIT)	MOC
19.	2(1W+1S)	DWPE Solution Dosing Pumps for ZLD Centrifuge	Capacity: 250 LPH Head: 20 m	C: PP/PVDF, D:TEFLON
20.	1	Tech Structure for Evaporator Dryer Package	L x B: 40 m x 20 m: Ht: 15 m	
21.	3	Salt Storage Shed	10m X 5m X 3m (each shed)	Precoated galvalume steel sheet roofing and side cladding

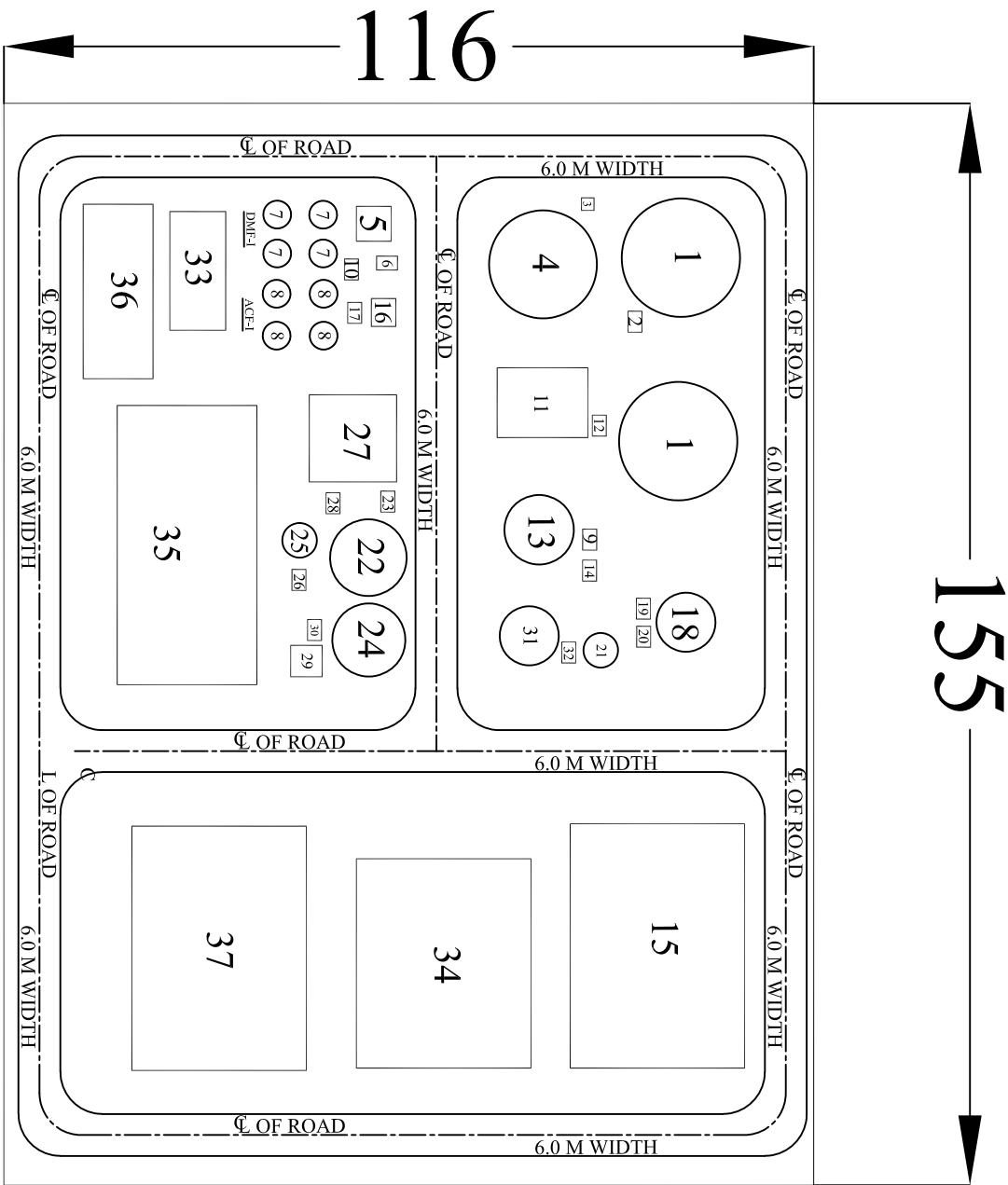
NOTES:

1. ***W: Working; SB: Stand by; L: Length; B: Breadth/Width; H: Height; SWD: Side Water Depth; D: Depth; I: Impeller; S: Shaft; EP: Epoxy Painted; EL: Epoxy Lined; SDSS: Super Duplex Stainless Steel***

ANNEXURE-XI

INDICATIVE EQUIPMENT LAYOUT

Izlkrw vKjKk ,oa bleao fufgr fMtkbu bothfu; LkZ bofMk; k fyfeYm dh LkoiRfr gSA ;s ek= m/kj fn, x, gSo vKj m/kkdrKz us ;g Li"V LkeXSRk dk; k gS fd u rks mUGso iqWq eqfmrz dk; kk tk,xk,u u dyd dh tk,xk,u
 u m/kj fn, tk,xk,u u lznfKZr fd, tk,oxs vKj u gh Lkhfr vKj futh iz;ksx ds vykok budk dksbZ VJ; iz;ksx gksxk vKj ;g iz;ksx m/kj nsus okys jkjk m/kkdrKz dks fyfkr : esa nh xbZ
 Lkghr LkZ gksk ksign and details given on this format are the property of ENGINEERS INDIA LIMITED. They are merely loaned on the borrower's express agreement that they will not be reproduced, copied, exhibited or used, except in the limited way permitted by a written consent given by the lender to the borrower for the intended use.



AREAS - 17971.8649

SL NO.	DESCRIPTION
1.	REJECT COLLECTION TANK
2.	HRSCC-I FEED PUMP
3.	FLASH MIXING TANK-I
4.	HRSSC
5.	FILTER FEED TANK
6.	FILTER FEED PUMP
7.	DUAL MEDIA FILTER
8.	ACTIVATED CARBON FILTER
9.	FILTER BACKWASH PUMP
10.	FILTER AIR BLOWER
11.	HRSCC SLUDGE SUMP
12.	HRSCC SLUDGE TRANSFER PUMP
13.	ABF FEED TANK
14.	ABF FEED PUMP
15.	UF CUM RO SHED
16.	BACKWASH WASTE HANDLING SUMP
17.	BACKWASH WASTE TRANSFER PUMP
18.	RO-I FEED TANK
19.	UF BACKWASH PUMP
20.	CARTRIDGE FILTER FEED PUMP
21.	RO-II FEED TANK
22.	ZLD FEED TANK
23.	LIME SODA CLARIFIER FEED PUMP
24.	LIME SODA CLARIFIER
25.	EVAPORATOR FEED TANK
26.	EVAPORATOR FEED PUMP
27.	LIME SODA CLARIFIER SLUDGE SUMP
28.	LIME SODA CLARIFIER SLUDGE PUMP
29.	LIME SODA CLARIFIER CENTRATE COLLECTION SUMP
30.	LIME SODA CLARIFIER CENTRATE TRANSFER PUMP
31.	PERMEATE STORAGE TANK
32.	PERMEATE TRANSFER PUMP
33.	CENTRIFUGE BUILDING
34.	CHEMICAL HOUSE
35.	TECH STRUCTURE
36.	SALT STORAGE SHED
37.	SUB STATION CUM CONTROL ROOM

REF. DWG. NO.	REFERENCE DRAWING TITLE

[illegible]

**इंजीनियर्स
इंडिया लिमिटेड**
(PUBLIC COMPANY LIMITED)
**ENGINEERS
INDIA LIMITED**
(A Govt. of India Undertaking)

 INDIAN OIL CORPORATION LIMITED, batm; u wk; y dk wkszsj's ku fyf TECHNO ECONOMIC FEASIBILITY STUDY FOR IMPLEMENTATION OF LATEST HALDIA REFINERY	

INDICATIVE LAYOUT						
ZLD PLANT						
SCALE	JOB NO.	UNIT	DIVN.	DEPT.	DWG. NO.	REV.
NIL	C118	000	17	42	1001	0
14			15		16	



National Accreditation Board for
Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

QUALITY CONTROL LABORATORY, HALDIA REFINERY

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

**"General Requirements for the Competence of Testing &
Calibration Laboratories"**

for its facilities at

MEDINIPUR EAST, HALDIA, WEST BENGAL, INDIA

in the field of

TESTING

Certificate Number: TC-10599

Issue Date: 10/05/2024

Valid Until: 09/05/2026

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Entity: Indian Oil Corporation Ltd.

Signed for and on behalf of NABL



N. Venkateswaran
Chief Executive Officer

SANMARG ENGINEERING VALIDATION AND ASSESSMENT PVT. LTD.

This Certificate Is Issued To

Indian Oil Corporation Limited

HALDIA REFINERY

Haldia-721606, West Bengal

To certify that ERDMP of Haldia Refinery has been assessed with respect to the requirements of PNGRB Notification GSR 39(E) PNGRB Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP) Regulations 2010 including Amendment Regulations 2020

Date of Issue : 06th Aug 2025

Valid Upto : 05th Aug 2028



Audit Date: 30th July to 01st Aug 2025

Chapters: 31 Nos.

Annexures: 30 Nos.

Audit report No: SEVA/DMP/2025/07/IOCL HALDIA REF

Document No: IOCL/HR/HSE/ERDMP/REV-04/AUG 2025

Ref: SEVA conformity audit Observations / Recommendation and compliance plan submitted by IOCL.

Certificate is issued based on Compliance report submitted.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



INDEX

SL. NO.	ITEM	PAGE NO.
1	Preface	02
2	Acknowledgement	03
3	Safety Audit Team	04
4	About MTPL	05
5	About Haldia Refinery, Indian Oil Corporation Ltd.	06-08
6	Note-Worthy Observations	09-11
7	Executive Summary	12
8	Introduction & Objective of External Safety Audit	13
9	Scope of Work	14
10	Methodology	15
11	Terms of Reference	15
12	Standards	16
13	Confidentiality	16
14	Disclaimer	16
15	OH & S Code of Practice	17-21
16	Records Examined as per IS 14489	22-23
17	Names and Designation of Persons Witnessed the Audit	23
18	Block Flow Diagram of IOCL Haldia Refinery	24
19	Organisation Chart of IOCL Haldia Refinery	25
20	IS-14489 Safety Audit Checklist	26-55
21	Observations & Recommendations for Haldia Refinery	56-71



**HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE**



PREFACE

I am happy to write a foreword for the Safety Audit Report. Purpose of the Audit is to carry out a systematic, critical appraisal of all potential hazards involving personnel, premises, services & operation method, to ensure that occupational Safety & Health System fully satisfy the legal requirements and those of company's written safety policies, objectives & progress. During the conduct & preparation of Safety Audit, we have taken every aspect of Factors related to Safety. Safety Audit is a validation process of the Organization's compliance with safety laws. It is to mention here that, this cannot be a substitute to the organization's internal control mechanism. Our experts visited the site and observe carefully and evaluate the factory's prevention and control measures and practices in place and readiness to face an emergency. An evaluation by MTPL enhances the credibility and sustainability of the factory's internal safety control mechanism.

In every field, safety measures are required to be defined, may it be road safety, Mining Safety, Industrial Safety, Occupational Safety or Fire safety. Consciously or unconsciously one can get caught in the danger. Unaware of safety measures is surely the condition leading to meet an accident. This Audit report is an eye opening endeavour considered at large by our group of Auditors.

I congratulate the Auditors of MTPL & Employees of Haldia Refinery, Indian Oil Corporation Limited of involved in it and look forward that they will not stop at this stage only. They will put their foot on another ladder in order to escalate the height of the knowledge of this domain.

I wish every success to be ambitious and to reach the goals.

**Dr. Lalit Kumar Das Mohapatra
Chief Executive Officer,
Manupama Technologies Pvt. Ltd.**



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



ACKNOWLEDGEMENT

The Oil & Natural Gas Industry handles highly inflammable hydro-carbons in all physical forms – solid, liquid & gas – and operates processes under high temperature and pressure with presence of Oxygen (air) and many a times active source of ignition. Therefore, the safety in Petroleum and Natural Gas Industry is of paramount importance. It is not only critical for the operators' manpower and assets but also, by the very nature of possible adverse outcomes of safety system failure, critical for society at large - as such adverse outcomes may spill over the boundary of the industry establishment.

The industry also carries out regular External Safety Audits, Internal Safety Audits and conducts periodic mock drills both on-site and off-site.

Our team (MTPL) is grateful to the management and employees of Haldia Refinery, Indian Oil Corporation Limited, for extending their full co-operation during the period of conducting the audit. The whole audit process was witnessed by respective in-charges from each department visited during audit in Haldia Refinery, Indian Oil Corporation Limited.

We are especially thankful to

- **Mr. Atanu Sanyal (ED & Refinery Head)**

For his kind consideration and coordination during the External Safety Audit.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



SAFETY AUDIT TEAM

Manupama Technologies Pvt. Ltd., Jamshedpur, Jharkhand

(An ISO 9001/14001/45001/50001/29990 Certified Company)
(An ISO/IEC 17025 & ISO 17020 Compliant Organization)
(Member of ISNT, IIW, National Safety Council, India & Quality Council of India)
(QIB Certified by Trade Council, 712 H Street, Washington DC 20002)
(Member-IGBC-Indian Green Building Council)

AUDIT DATE

21st to 23rd August '25

TEAM MEMBERS REPORT CONCLUDED BY

Dr. Lalit Kumar Das Mohapatra

(Lead Auditor-ISO 9001, EMS 14001, OHSMS 45001, EnMS 50001, ISO/IEC 17025, ISO 3834, ISO 14064)
(Project Management-IIT-Delhi, EGM DTP-IIT-Bombay, EDHRM-IIM-Calcutta, PGDBA-IMT-Ghaziabad,
Six Sigma Green-USA) (Member- International Association of Engineers, Hong Kong & International Public
Safety Association, USA, Quality Council of India, Safety Diploma-DGFASLI & NPC, Govt. of India)

PLANT VISITED AND INSPECTED BY

Mr. Mukul Chandra Mahato

(BTech-Elect, PGDIS, LA-OHSMS, 12+ years of Exp)

Mr. Alak Baruah

(B. Tech (Elect.), LA-OH&S, DGFASLI Trained Safety Auditor)

REPORT PREPARED BY

Ms. Khushboo Kumari

(B. Tech/Mech., Auditor - OH&S)

WITNESSED BY

Mr. Ajay Kumar

(Sr. Manager/HSE)

WE ARE THANKFUL TO

Mr. Atanu Sanyal (ED, Refinery Head)



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



ABOUT MTPL

MTPL, a Women Entrepreneurship Company (Manupama Technologies Pvt. Ltd.) is the leading Consultancy, Training, Inspection, Verification, Testing, Auditing and Certification Company. We have a core team of Field Specific Professionals serving various Govt./PSU Organizations such as Indian Railway, NHPC, NTPC, PSU owned Power Projects, AAI, Defense Establishments, IOCL, HPCL, ESIs and several State Govt Establishments across the Country.

Manupama Technologies Pvt. Ltd. is a Corporate Member of following Reputed Bodies

- QCI (NBQP) National Board for Quality Promotions, Quality Council of India, Govt. of India
- Indian Society for Non-Destructive Testing
- Indian Institute of Welding (Member Society of International Institute of Welding)
- National Safety Council
- Indian Green Building Council
- Gold Member of MSME Global Mart
- Women Entrepreneurs India
- Welding Academy, The Netherlands
- International Association of Engineers, Hong Kong
- International Public Safety Association
- Information Technology Professionals Association
- International Management Research and Technology Consortium, USA
- International Association of Outsourcing Professionals
- International Environment Forum
- International Society of Substance Use Professional



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



ABOUT IOCL HALDIA REFINERY

Haldia Refinery is the **4th refinery of Indian Oil Corporation Ltd.** located in East Midnapore district of West Bengal, at the confluence of rivers Haldi and Hooghly, 136 km away from Kolkata. The refinery was commissioned in 1975 with an installed capacity of 2.5 million metric tons per annum (MMTPA) in technical collaboration with M/s. TECHNIP-ENSA of France for Fuel sector and M/s. Industrial Export of Romania for Lube sector. The Refinery is spread over an area of about 612 acres.

Fuel Oil Block comprises CDU, NHDT, CRU, and KHDS. The initial processing capacity was increased to 2.75 MMTPA in April 1989 and further enhanced to through in-house de-bottlenecking to 3.6 MMTPA in 1996. In 1997, the second Crude Distillation Unit was added to increase the refinery capacity to 4.6 MMTPA. With the commissioning of the 2nd VDU and secondary processing facilities, the Refinery became capable of processing 6.0 MMTPA of crude oil. Subsequently, Capacity expansion from 6.0 to 7.5 MMTPA along with addition of Once-Through Hydro cracking Unit (1.7 MMTPA), Hydrogen Generation Unit, Sulphur Recovery Units, Revamp of Crude Distillation Unit-CDU-II and related Utilities & Offsite facilities was done in year 2010. Capacity expansion of refinery was done from 7.5 to 8.0 MMTPA along with implementation of new DCU along with and Coker Gas Oil treater in Feb'20.

Lube Oil Block (LOB), comprises of VDU-I, Propane De-asphalting (PDA), Catalytic De-waxing Units (I & II) and Extraction unit, Hydro-Finishing Unit (LHFU), Visbreaking Unit (VBU). The Catalytic Iso-Dewaxing Unit - I, commissioned in 2003, is the first of its kind in India to produce superior quality API Group II Lube Oil Base Stocks having lower pour point, very low Sulphur content, and higher Viscosity Index as compared to the conventional API Group-I Lube Base Stocks. Haldia Refinery **produces eco-friendly Bitumen emulsion and has recently introduced new products viz. API Gr-III LOBS and Low Sulphur Bunker Fuel (MARPOL) in line with the IMO specifications.**

In the year 2023, Haldia Refinery successfully commissioned Catalytic Iso-Dewaxing Unit-II which is first-of-its-kind installation in India. This 270 TMTA CIDW-II constructed with a significant investment of approx. Rs 1019 crore will produce advanced Group III Lubricant Oil Base Stock (LOBS) in the country which will lead to import-substitution in the spirit of Atmanirbhar Bharat. Newly commissioned Catalytic Iso-Dewaxing Unit-II shall provide flexibility to the refinery by production of superior API Gr-III LOBS products (4 cSt; 6 cSt & 8 cSt) and speciality grade LOBS (like Transformer Oil; Light White Oil; Medium White Oil etc). This special grade LOBS containing less than 10 ppmw Sulphur with a Pour point between minus 15 & minus 18 deg C with excellent low temperature properties making them ideal for use in automotive formulations. They also possess excellent oxidation characteristics, inherently high Viscosity Index (122-131) & low volatility (6 to 15 % wt) to make them ideal for usage in passenger cars and for heavy-duty diesel vehicles to meet the most stringent



HALDIA REFINERY INDIAN OIL CORPORATION LIMITED EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



specifications of engine oil. API Gr-III products will be used by mainly BS-VI compliant OEM engine oils for car manufacturers. Haldia Refinery will become pioneer in producing API Gr-III LOBS on larger scale among Indian refineries. The LOBS import dependence will reduce by around 8%, thereby saving valuable foreign exchange.

Following units were added to meet the fuel specifications.

- Improvement in diesel quality and distillates yield (hydrocracker) project along with refinery expansion from 6.0 MMTPA to 7.5 MMTPA had objective to produce Euro-III/IV/VI quality HSD, and refinery expansion to improve distillate yield. The project consisted of OHCU (1.7 MMTPA), HGU, SRU, Revamp of CDU-II (2.4 to 4.1 MMTPA). The project was completed in 2010.
- Improvement in quality and distillate yield project along with refinery expansion from 7.5 MMTPA to 8 MMTPA had objective to improve distillate yield, product quality and capacity expansion from 7.5 to 8.0 MMTPA. CDU-1 capacity revamp (from 3.4 to 3.9 MMTPA), new DCU (1.7 MMTPA), new CGO-T (1.4 MMTPA), DHDT (1.2 MMTPA) and associated facilities was included. The project was implemented in two phases with Phase-I in 2019 and Phase-II in 2020.
- Further to meet the local sulphuric acid demand, India's first Wetgas Sulphuric Acid plant of 375 MTPD was commissioned in 2022. The unit will supply 40 TPH High Pressure Steam to the steam network of Refinery, thereby contributing to the NetZero goals of Indian Oil.

Major products: Finished products from Haldia Refinery include both fuel oil products and lube oil base stocks.

- **Fuel Products:** LPG, Naphtha, Motor Spirit, Superior Kerosene (SKO), Aviation Turbine Fuel (ATF), BS-VI High Speed Diesel, Jute Batching Oil (JBO)
- **Lube Oil products:** API Group II/III Lube Oil Base Stocks of different grades,
- **Residues:** Furnace Oil (FO), MARPOL FO, Bitumen, Petcoke, Sulphur and Sulphuric acid.

UTILITIES

- 4 Nos. Boilers (3X125MT/hr. and 1X150MT/hr.)
- 4 Nos. Turbo Generators (3X 10.5 MW and 1X 16.5 MW)
- 3 Nos. Gas Turbines (3X 20 MW)
- 3 Nos. HEAT Recovery Steam Generation Unit (1X100 MT/hr. and 2X130 MT/hr.)
- Process Cooling Tower (PCT CT)- 9 Nos. cells of capacity 2300 M3 each
- DHDS CT -7 Nos. cells of capacity 3000 M3 each
- OHCU + FPU CT – 4 Nos. cells of capacity 3000 M3 each



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



- TPS Cooling Tower (TPS CT) – 3 Nos. cells of capacity 3000 M3 each
- GT Cooling Tower (GT CT) – 8 Nos. cells of capacity 125 M3 each
- DYIP CT-3 Nos. cells of capacity 4000 M3/hr. each
- 5 NOS DM PLANT CHAINS
- 2 Nos. Of Mixed Bed Resin System (Mb-6/7) For Production of Dm. Water From Tip Ro Permeate.
- DYIP- DM Plant 2 x 160 M3/hr.
- DYIP- Instrument Air Dryer 4720 Nm3/hr.
- NITROGEN : Two Plants
At DHDS Block: 1350 Nm3/hr. N₂ gas + 275 NM3/hr. Liquid N₂
At OHCU Block: 1600 Nm3/hr. N₂ gas + 400 NM3/hr. Liquid N₂
- Existing flare – 54” (HC Flare) /
- DYIP Flare – 60” (HC Flare) / 16” Staged/ 13” (acid)

OFFSITES

- Effluent Treatment Plant (650m3/hr+ 600 m3/hr)
- TTP-RO of 1250 m3/hr capacity
- LPG Storage & Despatch (4 nos. Horton Spheres + 3 nos. Mounded bullets)
- Propane Storage (3 nos. bullets)
- Bitumen Drum Filling & Despatch
- TANK TRUCK Loading Gantry
- TANK WAGON Loading Gantry
- TANK FARMS (196 storage tanks)
- Solvent Storage & Handling
- Product Dispatch Facilities
PPL-HMR (2.5 MMT)
PPL-HBPL (1.0 MMT)
Coastal – Barge /Tanker
- Nos. H2SO4 storage tanks & transfer system (i.e., Tanker & Barge Loading facilities through loading bays) under BS-VI



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



NOTE-WORTHY OBSERVATIONS

- ✓ *ISI marked rubber mats have been provided in front of the electrical panels.*
- ✓ *Regular checking of earth pit resistance is being carried out. All earth pits are marked with numbers except some. Resistance value and date of testing properly displayed at each earth pit. Equipments have been provided with two earthing at different locations Pipe lines have been provided with earthing and bonding system to discharge the static electrical charges. Equipment, switches on panels are labeled.*
- ✓ *Artificial respiration chart is displayed in sub-station, D.G. Room. Flame- proof fittings are installed wherever necessary and are maintained in good condition.*
- ✓ *Sufficient nos. of high mast tower and other lights are provided meeting requirement of adequate illumination.*
- ✓ *Earthing of all Flood light tower has been provided & found in order.*
- ✓ *Earthing of feeder pillar box has been provided and found in order.*
- ✓ *All the firefighting systems and equipments are approved, tested and maintained as per guidelines laid down by the OISD 144 & OISD 150& CCE approval. The design and standards adopted in the protection system as per the OISD standard*
- ✓ *Sufficient nos. of Portable Fire Extinguishers, Water Sprinkler Systems, Hydrant System, Monitors, Portable foam trolleys etc.*
- ✓ *Majority of employees are trained in Fire Fighting.*
- ✓ *Regular maintenance of the Extinguishers, Hydrant etc. is being carried out as specified in the OISD Standards*
- ✓ *License no was found displayed prominently.*
- ✓ *Safety, Health and Environment Policy is to be displayed at conspicuous locations in the plant.*
- ✓ *Training calendar is evident; training need assessment is being carried out.*
- ✓ *Fire & Safety dept. conducts safety training programs for the TT crew & employees.*
- ✓ *All categories of workmen have been trained in safety induction training.*
- ✓ *The record of the training is maintained. It contained the attendance sheet of the participants, the feedback forms from the trainees and also the overall impressions of the trainer about the level of the participants etc.*
- ✓ *Safety Pocket Booklet is available for the plant, however it is recommended to prepare it in the local Language and should contain all plant safety rules and emergency numbers and to be distributed to all stake holders.*
- ✓ *The management was found committed to comply with all statutory requirements under various*



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



applicable Acts and Rules.

- ✓ *The following Act/rules are applicable in the plant and are being complied by the management:*
 - *Water (Prevention & Control of pollution) Act, 1974 & 1978*
 - *Air (Prevention & Control of Pollution) Act, 1981.*
 - *MSHISC, Rules, 1989.*
 - *Gas Cylinder Rules, 2016*
 - *SMPV (U) Rules, 2016*
 - *Factory Act, 1948*
- ✓ *All statutory licenses are valid and being updated by location as per statutory rules and guidelines. The statutory licenses are valid and being renewed within time.*
- ✓ *Accident register is maintained. Every accident is reported through internal accident form titled as report of Accident.*
- ✓ *There is a system for classifying and analyzing near miss incidences. All near miss incidences are reported and investigated. The responsibility of maintaining the record is vested to plant manager.*
- ✓ *Accidents are discussed in the meeting of safety committee. "Near-miss Incident" are registered online. This is an excellent practice whereby the employees are encouraged to inform even small incidents which are normally not reported.*
- ✓ *The unit has carried out comprehensive HAZOP/QRA Hazard Identifications & Risk Assessment for all activities.*
- ✓ *Safety audits by external agencies as well as internal auditors are being carried out time to time and recommendations are being complied in time bound manner.*
- ✓ *Health & Safety Management System Audit is done by Safety dept. Unit head do the audit every month.*
- ✓ *Intercompany audits have been carried out as per OISD rules.*
- ✓ *Health check-up of employees as well as contract workmen are carried out on regular intervals.*
- ✓ *First aid boxes have been provided at various locations, it was indicated that the workmen have been given first aid training.*
- ✓ *Ambulance and emergency vehicles are available.*
- ✓ *As per Indian Electricity Rule, it is necessary to give first-aid training to employees and especially those who are working in switchyard, panel room etc. Regular training is imparted to employees.*
- ✓ *The necessary Personal Protective Equipments have been provided to the workmen, and it was observed that all of the workers were using them.*
- ✓ *The overall standard of housekeeping in the installation was good.*



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



- ✓ *Different areas were clearly marked and connected with each other with proper internal roads.*
- ✓ *The installation being open and noise level found well within permitted levels for industrial areas.*
- ✓ *Work place environment monitoring is being carried out at regular interval internally as well as by external experts*
- ✓ *In the company all new appointees go for pre-employment medical examination and are recruited only after declared medically fit.*
- ✓ *Health check-up camps are organized on regular basis.*
- ✓ *The management has developed and enforced the safe operating procedures.*
- ✓ *Work permit system defined in OISD 105 is being followed at the installation. Following permits are in practice:*
 - *Hot Work*
 - *Cold work*
 - *Electric work*
 - *Work at height*
 - *Confined Space etc.*
- ✓ *Unit has formulated a comprehensive On-Site Emergency plan (ERDMP) as per PNGRB guidelines.*
- ✓ *All drivers carrying the LPG have been given training in safe handling of products. It was observed that drivers are also carrying TREM card.*
- ✓ *Liquid waste effluents are treated with the help of Effluent treatment plan and treated water is internally used.*
- ✓ *LPG, Class A, B, C Hydrogen, Nitrogen was found stored in above ground vessels by adopting all Safety measures as per PESO approved layout and OISD Guidelines.*
- ✓ *The AG storage tanks have dyke walls to contain the products in case of spillage or leakage.*
- ✓ *No smoking, fire and explosion hazard directives are displayed prominently.*
- ✓ *Control room, ECD, gas leak detectors and walky-talky arrangements are available.*
- ✓ *Emergency Plan and procedure are prepared and vetted by PNGRB.*
- ✓ *Hazardous chemicals antidotes are available in the plant for acid and alkalis.*
- ✓ *Fire hydrants, monitors, DCPs were found provided and found adequate. Further, in case of major accident, further help may be sought from the nearby other industries/mutual aid members.*
- ✓ *Accident Risk Analysis is done prominently.*



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



EXECUTIVE SUMMARY

Safety audit have been made mandatory at regular interval to make Oil Refineries safer and check accidents. It has already drawn Risk Assessment & Safety Management Plan and Risk Assessment has been completed in most of the Oil Refineries.

Potential hazards associated in oil & gas sectorial activities due to existing Fire Prone conditions of the Site, method of Safe housekeeping & Workplace / Factory Safe Practices have been identified by IOCL, Haldia Refinery.

IOCL, Haldia Refinery has also established a structured multi-disciplinary Internal Safety Organization to assist the line management at various levels in matters related to Safety. Time-bound action programmes to eliminate or to reduce or to avoid the identified risks for each refinery has been chalked out along with review mechanism.

Safety Audit is an important tool for identification organizational and operational policy, practices and their effectiveness against accident prevention program. Safety audit is a technique for undertaking a critical appraisal of the effectiveness of safety program. It is meant to identify the basic direction as well as specific area of action where plant safety performance is to be improved. It is also tool for ensuring, that the plant operation and maintenance procedure match the intent and the standards. It seeks to review operating procedures and identify equipment / process changes that could have introduced new hazards apart from reviewing adequacy of maintenance and safety inspection. Improving the safety standards and practices, results in accident free operation, saves valuable human life and company's property and time. It is therefore essential to conduct a safety audit at intervals of predetermined period. In this report an attempt has been made to show audit report as per Indian Standard IS 14489:2018 code of practices for occupational safety and health.

Oil refinery comes on 9th position of the schedule I under section 2(cb) of The Factories Act 1948. Refining is a process to split crude oil into its many parts (or fractions) which are then reprocessed into useful products. The products of refinery can be hazardous not only in their final state but as they are being processed and refined. These hazards can be fire & explosion hazard, chemical hazard, electrical hazard etc. So a great concern is needed to minimize the occurrence of these hazards and for this purpose it is very necessary to find out the hazard present in the working area. In our Report we are performing the safety review of the refinery by using checklist method. In this report we find out the Hazard in different Dept. of Refinery and make the Checklist of Hazard identified and safety measure existing in the department and the Safety Measures required in the department. Checklists are the predefined list of guidelines, task, questions, statutory safety provisions & rules against which processes, tasks, components etc. are compared. Checklists are detailed procedural guide (useful when procedures are too complex or lengthy to Memorize). Checklists help in improving safety and also prompt the Workforce to work safely. Checklists are very useful when carefully developed, timely updated, and properly used. Checklist is as per IS-14489.

This analysis is aimed to determine the hazards in refinery. Furthermore; this report helps the management for adopting best practices to minimize the hazard at workplace.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



INTRODUCTION

A Safety Audit is a systematic, objective and documented evaluation of the Safety Systems and Procedures. It examines and assesses, in details, management system, facilities and activities of the organization on safety aspects assess the prevailing hazards, the level of prevention, protection and emergency management preparedness and subsequently prepare a recommendation to upgrade safety inputs to avert mishaps and limit consequences. Generally, it is seen that, as the focus is more on production related activities, the factories tend to disregard or overlook the fire prevention and control procedures set up. Fire prevention and safety measures always require a close monitoring. The active involvement and support of everyone from the top management to the shop floor personnel is critical in implementation and ensuring compliance and a safe workplace. Safety Audit is a validation process of the factory's compliance with safety laws. It is to mention here that, this cannot be a substitute to the factory's internal control mechanism. Our experts visit the site and observe carefully and evaluate the factory's fire prevention and control measures and practices in place and readiness to face a fire emergency. A detailed observation is a gap analysis tool which will help to bridge the gap to ensure compliance with safety laws. An evaluation enhances the credibility and sustainability of the factory's fire safety internal control mechanism.

OBJECTIVE

The objective of safety audit is to:

- Carry out a systematic, critical appraisal of all potential Fire hazards involving personnel, premises, services & operation method.
- Ensure that Safety & Health System fully satisfy the legal requirements and those of institutional safety policies, objectives & progress.
- Verify compliance with established standards (regulations, internal policies and department wise standards of practice).
- Identify deviation from designed and planned operating and maintenance procedure and standards.
- Identify conditions or operating procedures that could lead to an accident and significant losses to life or property.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



SCOPE OF WORK

The Safety Audit shall be done for the entire operational area of Haldia Refinery and broadly include:

- Safety Management Systems
- Safety training Plans
- PPE Norms and practices
- Compliance with Statutory requirements pertaining to Safety
- Fire hazards and their Control measures
- Mechanical/Physical hazards
- Electrical System and safeguards
- Safe Operating and Maintenance procedures.
- Review of Emergency Planning, Preparedness and Response Systems
- Safe handling and Storage of hazardous chemicals
- Giving comments and recommendations in the form of Safety Audit Report as per IS 14489

The Agency shall carry out the Safety Audit of all Process Units and facilities:

- Fuel Oil Block-FOB (CDU-1, CDU-2, NHT, CRU, KHDS)
- Lube Oil Block-LOB (VDU-1, PDA, FEU, LHFU, VBU, CIDW)
- DHDS Block (DHDS, HGU-1, MS Quality Up gradation Units, VDU-2, FCCU, SRUs, old N2 plant)
- OHCU Block (HGU-2, FPU, OHCU, new N2 plant)
- Distillate Yield Improvement Project (Delayed Coker Unit, CGO hydrotreater, LPG Merox etc.
- Oil Movement and storage (Tank Farms, Pump Houses, Tank Truck Loading Gantry and Tank Wagon
- Loading Gantry) LPG storage and loading facilities
- Effluent Treatment Plant
- Captive Power Plant-1 (TPS Block), Captive Power Plant -2 (GT Block) and Utilities Block.
- Electrical substations
- Quality Control Laboratory, Central Workshop, Central Warehouse, Fire & Safety facilities,
- Occupational Health Centre
- BS-VI phase-1 units; DHDT and Sulphuric Acid plant



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



METHODOLOGY

Methodology adopted in carrying out the Safety Audit:

- On acceptance of the Work Order, IOCL Haldia Refinery may provide information/documents for preparatory work before undertaking the field work.
- Opening meeting with Head of Departments and other Senior Executives.
- Study the relevant documents pertaining to safety procedures and systems in different areas/sub areas
- Study of accidents/incidents and fires/injuries
- Discussions/interviews of plant accompanied by Plant personnel.
- Evaluate the Safety management system and suggest improvement with respect to standards and/or present best safety practices.
- Closing meeting with senior executives and presentation of major findings.
- Submission of Safety Audit report as per MSIHC rules.

TERMS OF REFERENCES

- ✓ To assess compliance of Haldia Refinery, Indian Oil Corporation Ltd. about Health & Safety policies and procedures.
- ✓ Assess the management of risk in line with Safety Manuals / Handbooks, reflecting Haldia Refinery, Indian Oil Corporation Ltd. safety policies and procedures.
- ✓ To identify any high-risk activities and practices.
- ✓ To ensure that goods and services financed have been considered under relevant health and safety law.
- ✓ To confirm the management system and document control of health and safety documentation, such as risk and hazard assessments.
- ✓ Proactively review activities and their control processes, providing recommendations for improvement.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



STANDARDS

External Safety Audit was carried out with reference to the following Standards

- IS: 14489:2018 Occupational Health and Safety Audit Code of Practice.
- Occupational Safety Health & Working Conditions Code 2020
- West-Bengal Factories Rules
- ISO 45001:2008- Occupational Health & Safety Management System
- Manufacture Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989
- Applicable OISD Standards, Guidelines and Recommended Practices.
- CEA Safety Regulations 2010
- Applicable Indian (BIS) standards on safety
- Other applicable international safety standards (API, CCPS, NFPA, OSHA, HSE UK, etc.)

Benefits of the Audit:

External Safety audits enable the organizations to address the issues by identifying the following:

Identifying all significant Occupational Health Hazards, Evaluation of the existing control measures, determining the additional control measures required, Evaluation of the current fire detection and fire-fighting facilities, testing of all fire safety equipment and precautions, Training and instruction to all occupants of premises about Occupational Safety.

CONFIDENTIALITY

The audit focused determining whether the OH&S System, as a minimum standard, satisfied the requirements of *Safety Management System –specification with guidance for use*. The Audit was undertaken from 21st to 23rd Aug'2025. Information obtained from heads of all concern departments to assist in this OH&S System audit report will remain confidential and will only be used for purposes associated with the safety purpose of Haldia Refinery, Indian Oil Corporation Ltd.

DISCLAIMER

Safety Audit Report has been prepared by M/s Manupama Technologies Pvt. Ltd. for the sole purpose of assessing the standard of the Safety Management of Haldia Refinery, Indian Oil Corporation Ltd, which reflects the prevailing condition in the refineries;

M/s Manupama Technologies Pvt. Ltd. is not responsible for any non-implementation or violation of statutory requirements at a later stage by any authority in this regard.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



INDIAN STANDARD
OCCUPATIONAL HEALTH AND
SAFETY AUDIT — CODE OF PRACTICE

BUREAU OF INDIAN STANDARDS

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 2016* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

1. SCOPE

This standard establishes audit objectives, criteria and practices and provides guidelines for establishing, planning, conducting and documenting observations of audit(s) on occupational health and safety systems at work place.

It provides guidelines for evaluating the effectiveness of health and safety programs, verifying the availability and implementation of elements of occupational health and safety systems and the system's ability to achieve defined safety objectives. This standard focuses on general Occupational Health and Safety Audit to be carried out in various industries including Major Accident Hazard industries. Specific audits can be carried out in areas identified based on the general Occupational Health and Safety Audit or in the high risks operations or when there is a high frequency of accidents. Based on the identified elements, type of hazards and nature of the work carried out, a detailed safety audit checklist for conducting the audit should be developed.

This standard can be used as a guideline for self-demonstration of conformance to IS / ISO 45001 to others and for compliance to IS 15793.

2. REFERENCES

The Indian Standards listed below contain provisions which, through reference in this text, constitute provisions of this Indian standard. At the time of publication, the editions indicated were valid. All standards are subject to revisions, and parties to agreements based on this Indian standard are encouraged to investigate the possibility of applying the most recent editions of the Indian Standards indicated below.



HALDIA REFINERY INDIAN OIL CORPORATION LIMITED EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



IS/ISO No. Title

15793: 2007 Managing environment, occupational health and safety legal compliance — Requirements of good practices

45001: 2018 Occupational health and safety management system —Requirements with guidance for use (second revision)

3 TERMINOLOGIES

For the purpose of this standard, the following terms and definitions shall apply:

3.1 Auditee — an organization to be audited.

3.2 Audit Team — A team of persons designated as auditors who are suitably qualified and have experience to perform these audits.

NOTE — the auditor designated to lead the audit team and manage a safety audit is called a ‘Audit Team Leader’ (lead auditor).

3.3 Client — an organization which appoints auditing agency / team to carry out third party audit on its behalf.

3.4 Nonconformity — the non-fulfilment of specified requirement.

3.5 Observation — a statement of fact made in the course of an audit and preferably substantiated by objective evidence.

3.6 Objective Evidence — Qualitative or quantitative information, records or statements of fact, which is based on observation, measurement or test and which can be verified.

3.7 Occupational Health and Safety Audit (Audit) — A systematic, objective, documented and independent evaluation to determine whether, the activities conform to the requirements of the occupational health and safety systems and procedures.

3.8 Occupational Health and Safety (OH & S) System — the organizational structure, Responsibilities, procedures, processes and resources specified by top management of an organization as required for implementing occupational health and safety objectives.

3.9 Organization — Company, corporation, firm, enterprise or institution or part or combination thereof whether incorporated or not, public or private, that has its own functions and administration

3.10 Recommendation — Suggestion made by the audit team in the course of audit for improvement in the OH & S system.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



4 AUDIT GOALS, OBJECTIVES, ROLES AND RESPONSIBILITIES

4.1 Audit Goals

Audits are normally designed to achieve one or more of the following goals:

- a) To provide the auditee with an opportunity to assess its own OH & S system against a OH & S system standard and identify areas for improvement;
- b) To determine the conformity of the implemented OH & S system with specified requirements and identify areas for improvement; and
- c) To meet regulatory requirements.

4.2 Audit Objectives

OH & S audits are conducted with the following objectives:

- a) To carry out a systematic, critical appraisal of all potential hazards involving personnel, plant, services and operation method; and
- b) To ensure that OH & S system fully satisfies the legal requirements and those of the company's written safety policies, objectives and program.

4.3 Roles and Responsibilities

4.3.1 Auditors

4.3.1.1 Audit team

It is desirable to have the OH & S audit team comprising of two or more auditors; with different specialized backgrounds, which are complementary. One of the auditors should be designated as the lead auditor and should have overall charge and responsibility. Auditors should be qualified, trained and experienced in the related areas.

4.3.1.2 Lead auditor's responsibilities

4.3.1.3 Auditors' responsibilities

4.3.1.4 Auditors' duties

4.3.1.5 Attributes of auditors

4.3.2 Client

Client should:

- a) Determine the need for and the purpose of the OH & S audit and initiate the process;
- b) Select the auditing organization;



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



- c) Agree in consultation with the lead auditor the general scope of the audit such as what OH & S system standard or document is to be selected as reference and the time schedule;
- d) Define the audit reporting requirements;
- e) State specific confidentiality requirements, if any;
- f) Receive the audit report; and
- g) Determine follow-up action to be taken in consultation with the auditee.

4.3.3 Auditee

5 AUDIT METHODOLOGY

5.1 Initiating the OH & S Audit

5.1.1 Scope

5.1.2 Audit Frequency

The need to perform an audit is determined by the client, taking into account specified or regulatory requirements and any other pertinent factors. Significant changes in management, organization, policy, techniques or technologies, and products that could affect the OH & S system, or changes to the system itself and the results of recent previous audits, are typical of the circumstances to be considered when deciding audit frequency. It is desirable that organizations have a combination of external and internal OH & S audit system. While the external audit in respect of organizations may be conducted once in two years, or as specified by any statute, the frequency of internal audit may be set once in every year. Records of accidents and dangerous occurrences should be examined and used to identify high-risk areas and activities and consequently the frequency of internal audit may be increased.

5.1.3 Preliminary Review of Auditee's Requirements of OH & S System

5.2 Preparing the OH & S Audit

5.2.1 Audit Plan

5.2.2 Audit Team Assignments

5.2.3 Working Documents of the Audit Team

5.2.4 Questionnaire of Preliminary Information



HALDIA REFINERY INDIAN OIL CORPORATION LIMITED EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



5.3 Executing the OH & S Audit

5.3.1 Opening Meeting

5.3.2 Presentation by Auditee

5.3.3 Examination of Records

5.3.4 Field Visit

5.3.5 Interviews

5.3.6 Audit Observations

5.3.7 Audit Recommendations

5.3.8 Closing Meeting with Auditee

5.4 OH & S Audit Documents

5.4.1 Audit Report Preparation

5.4.2 Report Content

5.4.3 Report Distribution

5.4.4 Record Retention

6 OH & S AUDIT COMPLETION

The audit is completed upon submission of the audit report to the client / auditee.

7 ACTIONS FOR IMPLEMENTATION OF OH & S AUDIT REPORT

The auditee is responsible for determining and initiating corrective action on audit recommendations.

The auditee should prepare an action plan for implementation of audit report; specifying action by concerned departments and time limits for completion. This may be in consultation with the auditing organization or client. The time limit for completion may be decided considering the importance and safety implications of the recommendation. One of the most important follow-up actions is the communication of the content of the audit report to appropriate personnel in the auditee organization. The agreed recommendations for action with target dates for implementation of the recommendations should also be conveyed to implementing agency.



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



RECORDS EXAMINED DURING THE SAFETY AUDIT AS PER IS 14489

- 1) OH & S policy;
- 2) Safety organization chart;
- 3) Training records on safety fire and first-aid;
- 4) Record of plant safety inspections;
- 5) Accident investigation reports;
- 6) Accidents, dangerous occurrences and near miss incidents - statistics and analysis;
- 7) Record of tests and examinations of equipment and structures as per statutes;
- 8) Standard Operating Procedures (SOP) for various operations;
- 9) Record of work permits;
- 10) Record of work environment monitoring (flammable, toxic and explosive substances);
- 11) Maintenance, testing and calibration records of fire detection and fire fighting equipment;
- 12) Medical records of employees;
- 13) Records of industrial hygiene surveys (noise, ventilation, illumination, dust etc.);
- 14) Material Safety Data Sheets (MSDS);
- 15) On-site emergency plans and record of Mock Drills;
- 16) Records of storage of hazardous solid waste and its disposal;
- 17) Records of gaseous emissions and effluent discharges to the environment;
- 18) Housekeeping inspection records;
- 19) Minutes of safety committee meetings;
- 20) Statutory licenses and approvals;
- 21) Records of any modifications carried out in plant or process;
- 22) Maintenance procedure and records;
- 23) Instrumentation and equipment calibration and testing records;
- 24) Planned shutdown maintenance procedures;
- 25) In service inspection manuals, records including that of material handling;
- 26) OH & S budget;
- 27) Inspection books and other statutory records;
- 28) Records of previous audits and safety analysis;
- 29) Procedures for safe transportation of hazardous substances;



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



- 30) Calibration records;
- 31) Records for break-down of plants during the process of manufacture;
- 32) Records for waste material generated and their disposal;
- 33) SOP for disposal of waste materials; and
- 34) Records for issue of PPE items to the personnel working in process building.

NAME & DESIGNATIONS OF PERSONS WHO WITNESSED THE AUDIT

Following persons were interviewed during audit: -

- *Mr. Ajay Kumar (Senior Manager/HSE) – Coordinator*
- *Mr. Kumar Jaivardhan (Sr. Manager) – Fire & Safety*
- *Mr. SM Raut (Sr. Manager) – Fire & Safety First Aid Centre*
- *Mr. Prasenjeet Chatterjee (Doctor)*
- *Mr. Jalaluddin (Doctor) Substation 62*
- *Mr. Priyatam (Amel) Main Control Room*
- *Mr. Mirza Altonia (Sr. Manager/Spnm)*
- *Mr. Swapnil Shah (Sr. Manager/Spnm)*





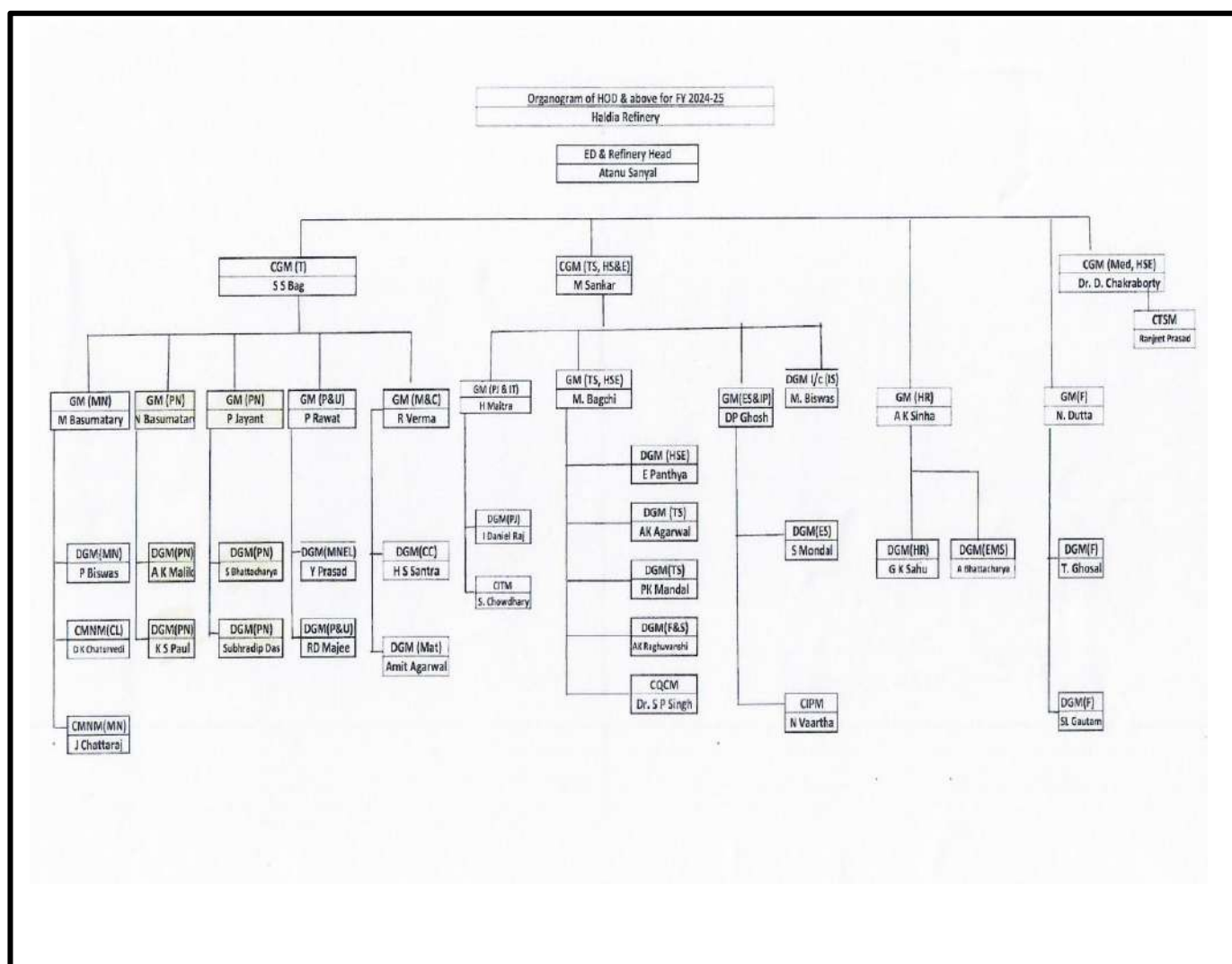
HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



ORGANISATION CHART OF HALDIA REFINERY





HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



IS: 14489 SAFETY AUDIT CHECKLIST IN LINE WITH MSIHC RULE

Annex C-IS 14489:2018 (Clause 5.3.4) Checklist for Safety Audit			
Instructions: In Remarks, use Y or N or N/A, If Remarks is Yes, Please write Evidence Ref. details, if available			
C-1 OH & S MANAGEMENT			
Sl. No.	C-1.1 OH & S Policy	Remarks	Evidence Ref
1	Does the organization have OH & S policy?	Yes	Physically verified
2	Who has signed the OH & S policy?	Yes	Executive Director/Head of Refinery
3	Whether the OH & S policy is per guidelines of the statutory provisions?	Yes	Occupier of the factory is to prepare the Health & Safety Policy.
4	When was the OH & S policy declared and adopted?	Yes	The Health & Safety Policy has been declared by the company
5	Whether the OH & S policy reviewed periodically?	Yes	Physically verified
6	Whether the OH & S policy is available in local language and made known to all?	Yes	Hindi, English & Bengali
7	What was the last date of updation?	Yes	November, 2022
8	Does the policy find a place in the annual report?	Yes	Annual report of IOCL is issued for IOCL company as a complete entity.
C-2 OH & S ORGANIZATIONAL SET UP			
Sl. No.	C-2.1 Safety Department	Remarks	Evidence Ref
1	Does the factory have a safety department and what is strength of safety department?	Yes	HSE department, the strength of the safety department is 6.
2	Whether the strength and qualifications of Safety Officers are as per the statutes?	Yes	Physically verified
3	Does the head of safety department report to the Chief Executive?	Yes	Report to CGM (HSE)
4	How often are the safety officers retrained in the latest techniques of total safety management? What is the frequency of retraining?	Yes	Regular training Imparted to them.
5	What additional duties the safety officer is required to do?	No	No other additional duties. The safety officer is required to do.
6	What is the power of safety officer vis-a-vis unsafe condition or unsafe act?	Yes	To advise the concerned departments in a factory in planning and organizing measures necessary for the effective control of personal injuries.
Sl. No.	C-2.2 Safety Committee(s)	Remarks	Evidence Ref
1	Does the factory have a safety committee(s)? What are the types, structures and terms of reference of the	Yes	Physically verified, Heads-Management Health and Safety Committee -Meetings headed by



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



	committees?		ED
2	Is the constitution of the safety committee(s) as per the statute?	Yes	Physically verified
3	How are the members of safety committee(s) selected? (elected / nominated)	Yes	Nominated
4	How often are the meetings of safety committee(s) held?	Yes	Monthly
5	Are the recommendations of the committees(s) implemented?	Yes	Copy of meeting marked to all concerned with instructions for implementation. Implementation monitored by HSE dept. and reviewed in next meeting.
6	Are the minutes of the safety committee(s) meetings circulated among the members?	Yes	Copy of meeting marked to all concerned with instructions for implementation. Implementation monitored by HSE dept.
7	Are the minutes forwarded to the trade union(s) and chief executive and occupier?	Yes	Physically verified
8	Whether the management and trade union play their active roles in supporting and accepting the committee(s) recommendations?	Yes	Committee have members from management and from trade unions; both play active role during meetings and are part of recommendation process.
9	How are the safety committee(s) members apprised of the latest development in safety, health and environment?	Yes	Physically verified
Sl. No.	C-2.3 Safety Budget	Remarks	Evidence Ref
1	What is the annual safety budget?	Yes	Actual figure is not disclosed, but Sufficient budget is provided to them regarding safety.
2	How much percentage is this budget of the total turnover of the company?	No	Not disclosed.
3	How much budget has been utilized till date?	No	Data not available
4	Is the safety budget adequate?	Yes	Physically verified
5	How is the safety budget arrived at?	Yes	As per projections given by safety department.
6	What is the pattern of expenditure for the last five years?	Yes	Increasing
7	What are the approved sanctions for the expenditure in this budget?	Yes	Physically verified
8	Does this budget get reflected in the annual report of the company?	No	Physically verified
Sl. No.	C-3 SAFETY MANUAL	Remarks	Evidence Ref



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



1	What is the periodicity of updation / review of safety manual?	Yes	No fixed periodicity(If authority changes or if any inclusion or exclusion in policy needed)
2	Does the safety manual adequately address all the hazards in the plant?	Yes	Physically verified
3	Are the employee made aware of safety rules / instruction mentioned in the safety manual?	Yes	Physically verified
Sl. No.	C-4 STANDARD OPERATING PROCEDURES (SOP)	Remarks	Evidence Ref
1	Are written Standard / safe operating procedures available for all operations and processes?	Yes	Physically verified
2	Whether the written Standard / safe operating procedures are displayed or made available and explained in the local language to the workers?	Yes	Physically verified
3	Whether concerned section and safety department prepares standard / safe operating procedure jointly?	Yes	SOP is prepared by concerned department only.
4	Are standard / safe operating procedures reviewed and updated?	Yes	It is practice to update safe operating procedures if needed. Otherwise reviewed and updated annually.
5	Have the workers been informed of the consequences of failure to observe the standard / safe operating procedures?	Yes	Physically verified
Sl. No.	C-5 PLANT MODIFICATION PROCEDURES	Remarks	Evidence Ref
1	What is the system for effecting any change in the existing plant, equipment or process?	Yes	Physically verified.
2	Whether the P & I diagrams and other related documents are updated accordingly?	Yes	Physically verified
3	Whether hazard assessment done before implementation of modification?	Yes	Physically verified.
Sl. No.	C-6 WORK PERMIT SYSTEM	Remarks	Evidence Ref
1	What types of work permits exist in the factory?	Yes	Hot work permit, cold work permit, work at height, Radiography, Excavations, confined space, electrical permit
2	Are the necessary forms detailing required safety precautions have been prepared and used for each type of work-permit?	Yes	Physically verified
3	Is the responsibility assigned to authorized person for issuing of safety work permit?	Yes	Responsibility assigned to authorized person.
4	Is the copy of safe work permit sent to safety officer before execution of the job?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



5	Is validity period specified in the safety work permit?	Yes	Vary as per type of permit ,job location and normal/Shutdown
6	Are the records of work permit available and maintained in proper order?	Yes	Records present with the fire & safety department.
Sl. No.	C- 6.1 Control Measures for Work at Height	Remarks	Evidence Ref
1	Is adequate safe access provided to all places where workers need to work?	Yes	Physically verified
2	Are all such access in good condition?	Yes	Physically verified
3	Are all scaffolds are properly designed and erected?	Yes	Physically verified
4	Are scaffolds inspected every day before work begins?	Yes	Physically verified
5	Are ladders securely clamped or lashed in place?	Yes	Physically verified
6	Are planks in good condition?	Yes	Physically verified
7	Are scaffold walkaways, platforms, runs or stairs free of debris, grease, any unnecessary obstruction and projecting nails?	Yes	Physically verified
8	Are the scaffolds higher than 20 m.? If yes, is a netting or intermediate railing provided between toe-boards and hand railings?	Yes	Physically verified
9	Are folding stepladders properly used?	Yes	Physically verified
10	Are ladders set up at the proper slope of about 1:4?	Yes	Physically verified
11	Do workers use hand lines to lift tools or materials?	Yes	Physically verified
12	Are proper ladders used around electrical hazards?	Yes	Physically verified
13	On sloping roofs, are crawling boards, lifelines, safety belts and edge protection provided where needed?	Yes	Physically verified
14	Whether the weak spots, skylights, or deteriorated asbestos-cement boards through which a worker might fall while working in the roof has been identified and safety net provided appropriately?	Yes	Physically verified
15	Are the workers being medically examined for their fitness to work at height?	Yes	Physically verified
Sl. No.	C-6.2 Work in Confined Space	Remarks	Evidence Ref
1	Is work permit system followed for working in confined space?	Yes	Physically verified
2	Whether monitoring of the atmosphere inside the confined space is carried out and ensured that there is no flammable or toxic gas in the area?	Yes	Physically verified
3	Whether the person entering the confined space is using suitable personal protective equipment (PPE)?	Yes	Physically verified
4	Is rescue team available in case of any emergency?	Yes	Physically verified



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



Sl. No.	C-7 CONTRACTORS' SAFETY SYSTEM	Remarks	Evidence Ref
1	Is there any system for selection of contractors?	Yes	Physically verified
2	Are there any guidelines on contractor's safety and training?	Yes	safety training provide to them.
3	Whether contract document includes necessary safety and welfare clauses as per statutes?	Yes	Physically verified
4	Is there any programme to ensure use of PPE by contractors personnel?	Yes	Supervisor verify them
5	Do the contractors have their own safety organization?	Yes	Physically verified
6	Are the contractors reporting all accidents and injuries?	Yes	Physically verified
7	Are contractor workers trained to observe safety at work place?	Yes	Physically verified
8	Whether contractor workers are engaged in process / operations? If yes, are they aware of safe operating procedures?	Yes	Contractors workers are engaged in process.
Sl. No.	C-8 PLANT DESIGN AND LAYOUT	Remarks	Evidence Ref
1	Whether hazardous operations in the plant are segregated?	Yes	Physically verified
2	Whether occupational health & safety aspects are considered during the design?	Yes	Physically verified
3	Are all the equipment provided with adequate space for working, maintenance etc.?	Yes	Physically verified
4	Are the storage tanks provided with enough space / clearance between them?	Yes	Physically verified
5	Whether the plant layout has taken care of the movement of fire-fighting equipment and emergency exits?	Yes	Physically verified
Sl. No.	C-9 MEDICAL MANAGEMENT OF ACCIDENTS	Remarks	Evidence Ref
1	Are medical facilities available with trained first aid staff and equipment in round the clock shift for all including contractors?	Yes	Total number of first aid trainer- 356
2	Is the ambulance van available for round the clock basis with the dedicated driver?	Yes	3 ambulance drivers are available in different shifts at the first aid centre.
3	Is there any mutual aid scheme available with the nearest hospitals to manage and treat injuries during emergency?	Yes	They have their own hospital.
4	Are the workers / contractor workers aware of emergency medical facilities?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



Sl. No.	C-10 MANAGEMENT OF EMERGENCIES (NATURAL / MAN-MADE)	Remarks	Evidence Ref
1	Does the system exist to detect and control these Emergencies?	Yes	Physically verified
2	Are the employees aware of the measures to be taken during emergencies?	Yes	Physically verified
Sl. No.	C-11 EMPLOYEES SELECTION AND PLACEMENT	Remarks	Evidence Ref
1	Whether norms are available for selection of different category of employees?	Yes	Physically verified
2	Whether pre-employment medical examination is being conducted for employees?	Yes	Physically verified
3	Is there any procedure to evaluate safety awareness and record of the employees during their promotion?	Yes	Physically verified
C-12 SAFETY CULTURE			
Sl. No.	C-12.1 Attitudes of Managers	Remarks	Evidence Ref
1	Do the managers follow the plant safety rules at all times?	Yes	Physically verified
2	What are their attitudes towards safety reviews and audits?	Yes	Positive attitude
3	What is the response of management to safety violation?	Yes	Positive response
4	Whether safety related decisions are taken in consultation with the workers?	Yes	Physically verified
5	What is the attitude of the managers towards non use of personal protective equipment?	Yes	Managers act positively to adhere the usage of PPEs
Sl. No.	C-12.2 Attitudes of Workers	Remarks	Evidence Ref
1	Whether workers are aware of the consequences of their wrong actions?	Yes	Physically verified
2	Are laid down safe working procedures followed strictly?	Yes	Physically verified
3	What is the attitude of the workers towards their own mistake, which can prejudice safety?	Yes	Attitude to rectify mistakes and learn from them is present.
4	Do the workers report near miss incidents and suggest safety improvements?	Yes	Physically verified
5	Are the workers aware of the system of rewards and sanctions relating to safety matters?	Yes	Physically verified
6	What is the attitude of workers towards use of personal protective equipment?	Yes	Positive attitude
Sl. No.	C-13 STATUTORY LICENSES, APPROVALS AND RECORDS	Remarks	Evidence Ref



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



1	Whether all the safety related Acts / Rules (with latest amendments) applicable to your organization identified, informed to all employees and complied?	Yes	Physically verified
2	Whether the licences have been validated?	Yes	Physically verified
Sl. No.	C-14 MOTIVATIONAL AND PROMOTIONAL MEASURES FOR OH & S	Remarks	Evidence Ref
1	Does the factory have occupational health and safety suggestion scheme?	Yes	Physically verified
2	Are occupational health and safety contests organized in the factory?	Yes	Physically verified
3	Does the factory participate in National Awards?	Yes	Physically verified
4	Has the factory been awarded during last five years?	Yes	Physically verified
5	Does the organization publish safety bulletin / newsletters?	Yes	Physically verified
6	Whether the safety bulletins are widely distributed?	Yes	Physically verified
7	How is the occupational health and safety information including accident statistics disseminated in the factory? (Bulletin boards, Newsletter etc.)	Yes	Bulletin boards
8	What are the activities conducted during National Safety day / week?	Yes	Safety quiz, sports, Safety trainings
9	What is the percentage of Workers participating in the various safety promotional activities?	Yes	Almost all
Sl. No.	C-15 HAZARD IDENTIFICATION AND JOB SAFETY ANALYSIS	Remarks	Evidence Ref
1	Was an initial process hazard analysis (PHA) completed?	Yes	Physically verified
2	What are the stages of PHA? Whether a dedicated group is identified for PHA?	Yes	Physically verified
3	Was the PHA appropriate for the complexity of the process and identify, evaluate, and control the hazards involved in the process?	Yes	Physically verified
4	Does the hazard evaluation use one or more of the following PHA methodologies: What-If Analysis, Process Checklist, Hazard and Operability Study (HAZOP), Failure Mode and Effects Criticality Analysis (FMECA), Fault Tree Analysis (FTA) or any other appropriate equivalent methodology?	Yes	Hazard and Operability Study (HAZOP) and Hazard identification & Risk Analysis Study (HIRA)
5	Does PHA assures addressing issues of inherent safety features with respect to material and their properties?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



6	Does the PHA address the hazard identification, incidents history, consequences of failures (engineering and administrative controls), human factors, consequent analysis with respect to possible safety and health effects of failure of controls?	Yes	Physically verified
7	What are the stages of PHA? Whether a dedicated group is identified for PHA?	Yes	Physically verified
8	Does the system exist to promptly address findings and recommendations of PHA?	Yes	Physically verified
9	Are the PHA's updated and revalidated at least every five years by a qualified team to assure that the PHA is consistent with the current process?	Yes	Physically verified
10	Whether the activities requiring Job Safety Analysis have been identified?	Yes	Physically verified
11	Whether the identified jobs for Hazard Identification have been carried out by trained and experienced persons?	Yes	Physically verified
12	Whether the checklists have been prepared on each Job Safety Analysis and are being used while carrying out the job?	Yes	Physically verified
Sl. No.	C-16 PRODUCT SAFETY	Remarks	Evidence Ref
1	Whether hazards arising from use of the products are identified?	Yes	Physically verified
2	Whether material safety data sheet prepared for the products?	Yes	Physically verified
3	Are all the products labelled and packed appropriately?	Yes	Physically verified
4	Whether safety instructions are given along with products?	Yes	Physically verified
5	Whether policy exists for recall of products?	Yes	Physically verified
Sl. No.	C-17 SAFETY TRAINING	Remarks	Evidence Ref
1	Whether training needs have been identified?	Yes	Physically verified
2	Is there any programme of induction training, its duration and topics covered?	Yes	Physically verified
3	Whether the assessment of the trainees has been carried out?	Yes	Physically verified
4	What are the infra-structural facilities available for training?	Yes	Physically verified
5	Whether training is conducted by qualified person?	Yes	Physically verified
6	Whether trainers are being re-trained from time to time?	Yes	Physically verified
7	Whether proper records of training program conducted are maintained?	Yes	Physically verified
8	How training programs are evaluated?	Yes	Physically verified



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



9	Whether schedule for training on occupational health and safety is available and maintained?	Yes	Physically verified
10	Whether the training programmes are reviewed?	Yes	Physically verified
11	Are all the employees periodically trained / retrained and what is the frequency of such training?	Yes	Physically verified
12	Are the retraining needs identified whenever a new process / products and change in existing process introduced?	Yes	Physically verified
13	Whether training covers top management?	Yes	Physically verified
14	How many hours of safety training is given to different employees?	Yes	Physically verified
Sl. No.	C-18 CHANGE MANAGEMENT	Remarks	Evidence Ref
1	Are there written procedures for managing change to process chemicals, technology, equipment and procedures and changes to facilities that affect the plant process / system operation?	Yes	Management of change (MOC) is available.
2	Do the procedures assure that the technical basis for the proposed change addressed prior to any change?	Yes	Physically verified
3	Do the procedures assure that the impact of the change on safety and health addressed prior to any change?	Yes	Physically verified
4	Do the procedures assure that modifications to operating procedures are addressed prior to any change?	Yes	Physically verified
5	Do the procedures assure that the necessary time period for the change is addressed prior to any change?	Yes	Physically verified
6	Do the procedures assure that the authorization requirements for the proposed change are addressed prior to any change?	Yes	Physically verified
7	Are employees involved in operating a process, and maintenance and contract employees whose job tasks will be affected by change informed of, and trained in, the change prior to the start-up of process or affected part of process / operations?	Yes	Physically verified
8	Is the safety information is reviewed and updated on changes?	Yes	Physically verified
9	Are the operating procedures or practices updated?	Yes	Physically verified
Sl. No.	C-18.2 Mechanical Integrity	Remarks	Evidence Ref
1	Does the mechanical integrity program include for all mechanical equipment including pressure vessels and storage tanks, piping and components, relief devices and vent systems, emergency shutdown systems, pumps, control systems?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



2	Are there written procedures to maintain the on-going integrity of process equipment?	Yes	Physically verified
3	Whether training been provided to each employee involved in maintaining the on-going integrity of process equipment?	Yes	Physically verified
4	Are inspections and tests performed on each item of process equipment included in the program?	Yes	Physically verified
5	Do the inspection and test frequencies meet the manufacturer's recommendation and good engineering practice?	Yes	Physically verified
6	Are inspections and tests performed more frequently if determined necessary by operating experience?	Yes	Physically verified
7	Are deficiencies in equipment that are outside limits corrected before further use so as to assure safe operation?	Yes	Physically verified
8	In the construction of new plants and equipment, whether quality assurance programme is implemented to ensure that equipment fabricated is suitable for the process?	Yes	Physically verified
9	Are appropriate checks and inspections made during equipment installation stage?	Yes	Physically verified
10	Are the suitability of maintenance materials, spare parts and equipment ensured during maintenance?	Yes	Physically verified
C-19 PHYSICAL HAZARD			
Sl. No.	C-19.1 Housekeeping	Remarks	Evidence Ref
1	Are all the passages, floors and the stairways in good condition?	Yes	Physically verified
2	Is glass door taped or otherwise marked to make it visible to workers?	Yes	Physically verified
3	Do you have the system to deal with the spillage?	Yes	Physically verified
4	Do you have sufficient disposable bins clearly marked and whether these are suitably located? Are containers of refuse (waste) and trash emptied at the end of every day or soon after they are full? Are the containers or bins regularly cleaned?	Yes	Physically verified
5	Are drip trays positioned wherever necessary?	Yes	Provided at necessary places
6	Do you have adequate localized extraction and scrubbing facilities for dust, fumes and gases? Please specify.	Yes	Exhaust fan and ventilation is provided.
7	Whether walkways are clearly marked and free from obstruction?	Yes	Physically verified
8	Do you have any inter-departmental competition for good housekeeping?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



9	Has your organization elaborated good housekeeping practices and standards and made them known to the employees?	Yes	Physically verified
10	Are there any working conditions, which make the floors slippery? If so, what measures are taken to make them safe?	Yes	Regular cleaning is done.
11	Does the company have adequate measures to suppress polluting dust arising out of materials stored on the roadside?	Yes	Physically verified
Sl. No.	C-19.2 Machine and General Area Guarding	Remarks	Evidence Ref
1	Whether machinery and equipment which can cause physical injuries to operator have been identified?	Yes	Physically verified
2	Are all moving parts and point of operation of machinery adequately guarded?	Yes	Physically verified
3	Are all fixed guards securely bolted in position and in good condition?	Yes	Physically verified
4	Are all interlock guards for prevention of physical injury in good condition?	Yes	Physically verified
5	Are all emergency stop buttons effective and clearly labelled?	Yes	Physically verified
6	Are the operators for machines having moving parts aware of the danger of working with loose clothing?	Yes	Physically verified
7	Are the openings where there is free fall hazard covered or fenced securely?	Yes	Physically verified
Sl. No.	C-19.3 Material Handling	Remarks	Evidence Ref
1	Is adequate equipment available for handling materials?	Yes	Adequate equipment available
2	Are the workers aware of the hazards associated with material being handled?	Yes	Physically verified
3	Where manual handling is necessary, are the workers been trained? Do they practice this? Are workers warned for lifting of excessive weight? (Maximum weight of material for adult male and female are 55 Kg and 30 Kg respectively)	Yes	Physically verified
4	Do workers follow safe procedures for storage of materials?	Yes	Physically verified
5	Is the register maintained to record particulars of examination of all lifting machines, tools and tackles?	Yes	Physically verified
6	Are all the statutory examinations and tests carried out and certified by competent person(s)?	Yes	Statutory examinations and tests carried out & certified by competent person
7	Are the operators of crane, lifts, hoists and other mechanized operations adequately qualified?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



8	Is the safe working load clearly marked?	Yes	Physically verified
9	Has the person employed to operate crane, forklift, or to give signals to crane been medically examined for eyesight and colour vision?	Yes	Pre-employment medical check-up is carried out.
10	Is the frequency of eyesight and colour vision examination as per the latest rules?	Yes	Physically verified
Sl. No.	C-19.4 Electrical Safeguarding	Remarks	Evidence Ref
1	Are licensed electricians available for electrical work?	Yes	Physically verified
2	Whether area classification for electrical equipment has been carried out?	Yes	Physically verified
3	Do the electrical fittings conform to area classification for electrical equipment?	Yes	Physically verified
4	Is a ground fault current interrupter system (ELCB) in use?	Yes	ELCB is installed at necessary places.
5	Are all connections made by using appropriate plugs, receptacles or enclosures? Are fuses provided?	Yes	Fuse is provided at necessary places.
6	Are there any make shift connection bare wires or damaged cables?	Yes	Physically verified
7	Is there a system of ensuring periodical inspection of hand tools, extension boards used for electrical work?	Yes	Physically verified
8	Do the workers use proper types of PPE during the working on live line?	Yes	Physically verified
9	Is the separate work permit issued for working on high voltage line?	Yes	Physically verified
10	Whether the process(s) and equipment that generate and accumulate static charge have been identified?	Yes	Product pipelines, storage tanks, tank wagons loading and tank lorry loading etc.
11	Whether all such equipment including pipelines for flammable materials are properly bonded and earthed?	Yes	Physically verified
12	Whether earth pit resistance is measured and the record maintained?	Yes	Electrical resistance maintained through regular maintenance, periodic inspection done and recorded
13	Whether lightning arrestor has been installed and is adequate?	Yes	Physically verified
Sl. No.	C-19.5 Safety in Storage and Warehousing	Remarks	Evidence Ref
1	Whether the Material Safety Data Sheet for all chemicals is available?	Yes	Physically verified
2	Are the chemicals stored as per their hazardous properties including the incompatibility?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



3	Are all containers clearly, indelibly labelled? Are all chemicals stored as per safety regulations?	Yes	Physically verified
4	Whether all racks and steel cages have sufficient load bearing capacity?	Yes	Physically verified
5	Is adequate natural ventilation provided to store room? Is there any emergency exit?	Yes	Physically verified
6	Whether adequate fire-fighting arrangement existing in flammable chemical storage?	Yes	Physically verified
7	Whether methodology for handling spillages of hazardous chemical available along with the equipment required handling the spillage?	Yes	Physically verified
8	Whether aisles are marked and emergency exits displayed?	Yes	Physically verified
Sl. No.	C-19.6 Hazard Assessment for New Equipment	Remarks	Evidence Ref
1	What is the system for effecting any change in the existing plant, equipment?	Yes	It is done through MOC procedure
2	Is there system for evaluating hazards from new equipment?	Yes	HAZOP analysis is done.
3	Whether the P and I diagrams and other related documents are updated accordingly?	Yes	Physically verified
4	Is any Job Hazard Analysis (JHA) carried out after installation of new equipment?	Yes	Physically verified
Sl. No.	C-19.7 Hazards from Radiation Sources	Remarks	Evidence Ref
1	Whether licences have been obtained for storage / handling of radioactive material?	Yes	Physically verified
2	Whether approved Radiological Safety Officer appointed?	Yes	Radiological safety officer appointed
3	Whether appropriate PPEs are used against radiation hazards?	Yes	Physically verified
4	Is the flooring of the radioactive material handling area amenable for proper decontamination?	Yes	Physically verified
5	Is the storage room of radiation source as per the licence condition?	Yes	Physically verified
6	Are all persons working in the facility have radiation safety training?	Yes	Physically verified
7	Is the operators handling devices using radioactive materials qualified and possess the necessary certificate?	Yes	Physically verified
8	Is the periodical radiation monitoring carried out?	Yes	Physically verified
9	Are the records of inventory of radioactive material maintained in the standard format and submitted to the competent authority as per the period specified?	Yes	Physically verified
10	Are emergency handling tools available?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



11	Are the personnel monitoring badges (TLD, Pocket dosimeter etc.) assigned and worn by each radiation worker?	Yes	Physically verified
12	Are the radiation symbol and red light displayed as required	Yes	Red light is used to indicate Assembly point & green is for eye wash.
C-20 CHEMICAL HAZARD			
Sl. No.	C-20.1 Transportation of Hazardous Substances	Remarks	Evidence Ref
1	What potentially hazardous materials are transported to or from the site (including wastes)	Yes	Various potentially hazardous materials (petroleum products and by products & by-products) are transported in solid, liquid and gaseous form.
2	What mode of transport are used? 1) Road, 2) Rail, and 3) Pipelines	Yes	Materials are transported via Road, Rail & Pipelines
	1) Road		
i	Does the company employ licenced vehicle of its own / outside sources?	Yes	Outsourced vehicle
ii	Are the loading / unloading procedures in place and safety precautions displayed?	Yes	Physically verified
iii	Is there a provision to check the healthiness of road tanker with respect to explosives rules?	Yes	Physically verified
iv	Are loaded tankers or trucks parked in a specific area on-site?	Yes	Physically verified
v	Do all truck and tanker drivers carry transport emergency (TREM) card or instruction booklet?	Yes	Physically verified
vi	Do all truck and tanker drivers get training in handling emergencies during transport?	Yes	Physically verified
vii	Are all the tankers marked for proper Hazchem code?	Yes	Physically verified
	2) Rail		
i	What hazardous materials are transported by rail?	Yes	Physically verified
ii	Does the company have a direct siding on site?	Yes	Physically verified
iii	Are tankers or other wagons used in transportation?	Yes	Physically verified
	3) Pipelines		
i	What materials are transported to and from the site by pipelines?	Yes	Crude Oil & various Petroleum Products (liquid & gas)
ii	Are the pipelines underground or over ground?	Yes	Both
iii	Are corrosion protection measures employed in pipelines?	Yes	Physically verified
iv	Whether intermediate booster pumps are used?	Yes	Physically verified
v	What are the maximum, minimum and average transfer rates?	Yes	Physically verified
vi	Are the pipelines extended in the public domain?	Yes	Physically verified
vii	Are the pipelines dedicated for each type of	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



	chemicals?		
viii	Are the pipelines fitted with safety equipment such as leak detectors, automatic shut-off valves etc.?	Yes	Physically verified
ix	What is the frequency and method of testing of the pipeline?	Yes	Physically verified
x	Is there written procedure for tackling leakages in pipeline?	Yes	Physically verified
Sl. No.	C-20.2 Handling of Hazardous Substances	Remarks	Evidence Ref
1	What are the hazardous substances handled in the factory?	Yes	Records maintained by HSE dept.
2	Whether quantity of hazardous substances is above the threshold limit specified in the Manufacture, Storage and Handling of Hazardous Substances Rule, 1989? If yes, then required documentation is available as per the rule.	Yes	Physically verified
3	Whether written procedure for handling the hazardous substance is available and operators are trained for handling such substances including actions required in case of leakages and spillages?	Yes	Physically verified
4	Are the employees aware of the hazards arising from hazardous substances and safety precautions to be taken during handling of these?	Yes	Physically verified
Sl. No.	C-20.3 Material Safety Data Sheets (MSDS)	Remarks	Evidence Ref
1	Are the material safety data sheets available for all the chemicals handled, used and manufactured in the factory?	Yes	Crude Oil, H ₂ S & various Petroleum Products (liquid & gas)
2	Whether the latest MSDS are displayed at strategic locations?	Yes	Physically verified
3	Is it available in local language?	Yes	It is available in local language.
Sl. No.	C-20.4 Spill Control Measures	Remarks	Evidence Ref
1	Whether spill control procedure is available?	Yes	Physically verified
2	Whether spill collection pit / sump is available at the workplace?	Yes	Physically verified
3	Whether methodology for recovery / disposal of collected material has been established?	Yes	Physically verified
Sl. No.	C-20.5 Storage of Hazardous Substances	Remarks	Evidence Ref
1	Whether storage vessels are identified with the capacity as required under MSIHC, Rules 1989.	Yes	Physically verified
2	What are the storage pressure and temperature?	Yes	Physically verified
3	Whether vessels are above ground / underground?	Yes	Above ground
4	If any of the tanks storing flammable material, whether electrical equipment and fittings are as per electrical area classification?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



5	Is the bunded area takes into account the total quantity of the largest tank?	Yes	Physically verified
6	Whether the bund perimeter takes into consideration of trajectory of leak from tank?	Yes	Physically verified
7	Are the vessels properly bonded and earthed and whether periodically checked and record maintained?	Yes	Records is maintained by elect. Maintenance department
8	Are the vessels fitted with remotely controlled isolation valves?	Yes	Physically verified
9	Are vessels provided with emergency vent, relief valve, bursting disc, level indicator, pressure gauge, overflow line?	Yes	Physically verified
10	Where do such vents discharge?	Yes	Physically verified
11	Are the vessels provided with alarms for high level, high temperature and high pressure?	Yes	Physically verified
12	Are standby empty tanks or any other alternate systems provided for emptying / transfer in case of emergencies?	Yes	Physically verified
13	What are the provisions made for fire-fighting / tackling emergency situations around the storage vessels?	Yes	Physically verified
14	Has any consequence analysis for loss of containment been carried out?	Yes	Physically verified
15	Whether the vessels are tested as per statute?	Yes	Physically verified
16	Whether log sheets are filled up on daily basis for recording the parameters of these vessels?	Yes	Records were maintained
17	Whether monitors for detection of leakage of flammable / toxic material installed?	Yes	Physically verified
18	Whether the chemicals stored are as per their compatibility?	Yes	Physically verified
Sl. No.	C-20.6 Gas Cylinders	Remarks	Evidence Ref
1	What is the various gas cylinders used in the plant?	Yes	Ammonia, Chlorine
2	Are valid licenses available for storing all these cylinders?	Yes	Physically verified
3	Are the cylinders stored and segregated as per their compatibility?	Yes	Physically verified
4	What are the measures taken for combating any emergency in the cylinders storage area?	Yes	physically verified
5	Whether integrity test certificates are obtained from the suppliers of the cylinders?	Yes	physically verified
6	Are the cylinders chained and secured properly along with the valve caps and proper identification colour code?	Yes	physically verified
7	Are the cylinders protected from heat or sun and rain?	Yes	Cylinder were kept under the shed.



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



8	Whether monitors for detection of leakage of flammable / toxic gas installed?	Yes	physically verified
Sl. No.	C-20.7 Labelling and Colour Coding	Remarks	Evidence Ref
1	Are all the containers, vessels and storage tanks labelled for its content and capacity?	Yes	Proper tagging was done.
2	Whether the pipelines are colour coded as per IS 2379?	Yes	Yes Proper colour coding was done.
3	Is any plant specific colour code followed?	Yes	Different colour codes for petroleum products, utilities, etc. Colour scheme displayed
4	Whether the colour codes are displayed conspicuously in the working areas?	Yes	Physically verified
Sl. No.	C-20.8 Hazardous Waste Management	Remarks	Evidence Ref
1	Is identification done for various types of hazardous wastes?	Yes	As per HW Authorization
2	Are these quantities less than those specified by the Hazardous Wastes (Management & Handling) Rules, 1989?	Yes	Physically verified
3	What are their disposal modes?	Yes	Disposal through authorised recycler
4	What are the systems / measures adopted for controlling air / water / land pollution?	Yes	Such types of system exist
5	Whether the solid waste like combustibles, plastic, metals etc. segregated?	Yes	Physically verified
C-21 FIRE AND EXPLOSION HAZARD			
Sl. No.	C-21.1 Organisational Set-up for Fire Fighting	Remarks	Evidence Ref
1	What is the total strength of fire station and fire crew?	Yes	2 fire station, 13 operators, Shift in-charge & managers
2	How many fire crews are available in each shift?	Yes	operators & Shift in-charge
3	Is there fire squad identified in each shift?	Yes	Physically verified
4	Standing fire order is available with latest revision?	Yes	Physically verified
5	How is the communication with fire station?	Yes	Through walkie talkie, Manual call point, Telephones & Running caller
6	Does fire safety inspections carried out?	Yes	Physically verified
7	Does emergency procedure available for leakage or combustion of flammables?	Yes	Procedure available
8	What measures are available to control the fire load in the plant area?	Yes	Physically verified
9	Whether technical knowledge and skills of the manager and staff responsible for overall fire safety of the plant is adequate?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



10	How many major and minor incidents / fires were there in the factory during the last five years? Give department / plant wise.	Yes	Physically verified
11	Have all the fires / incidents been investigated and corrective actions taken? Give break-up.	Yes	Physically verified
12	Resources:		
	Adequacy of protective clothing (coat, trouser, gloves, boots and helmets);	Yes	Adequate
	Availability of SCBA for fire-fighting operations and spare cylinders (at least 2 for each SCBA);	Yes	Available
	Adequacy of hose, nozzles, ladders, lighting equipment and pumps; and	Yes	Adequate
	Communication facility at fire station, walkie talkie sets during fire-fighting.	Yes	Through walkie talkie, Manual call point, Telephones & Running caller
Sl. No.	C-21.2 Built in Safety in Civil Design and Construction	Remarks	Evidence Ref
1	Whether the two safe means of escape available? Are they in separate directions?	Yes	Physically verified
2	Is emergency exits provided to the building handling flammables?	Yes	Physically verified
3	Whether emergency lights are provided?	Yes	Physically verified
4	Whether fire / smoke detectors are installed in fire prone areas?	Yes	Physically verified
5	Whether fire call points are provided in different areas?	Yes	Physically verified
6	Whether Fire hydrants are provided near the buildings?	Yes	Physically verified
7	Is ventilation system in plant handling flammables is adequate to prevent formation of flammable mixtures?	Yes	Physically verified
8	Is adequate separation is provided between combustible / flammable materials and other material to restrict the fire growth?	Yes	Physically verified
9	Access routes for fire fighting operations is available for areas having high fire load	Yes	Physically verified
10	Whether building changes interferes with fire detection and / or fire suppression systems?	Yes	Physically verified
11	Whether building changes cause unreasonable fire loading / openings in the fire rated walls?	Yes	Physically verified
Sl. No.	C-21.3 Built in Safety in Electric Circuits and Equipment	Remarks	Evidence Ref
1	Are the electrical equipment in areas where flammables mixture is likely to be present of flame-proof type?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



2	Are lightning arrestors are provided to the buildings / structures storing flammable materials?	Yes	Physically verified
3	Whether adequate bonding and grounding of electrical equipment / pipelines provided?	Yes	Physically verified
Sl. No.	C-21.4 Explosive Substances	Remarks	Evidence Ref
1	Whether necessary license / approval taken from concerned statutory bodies?	Yes	Physically verified
2	Whether systems for explosion suppression, high speed fire detection with deluge, sprinklers, explosion venting etc. are provided?	Yes	Physically verified
3	Whether explosion resistant walls or barricades are provided around explosive storage?	Yes	Physically verified
4	Whether explosive substance storage areas are restricted for entry?	Yes	Physically verified
5	Whether only trained persons are handling explosive substances?	Yes	Physically verified
6	Whether explosive substances are stored and transported in approved containers only?	Yes	Physically verified
7	Whether electrical fixtures in areas handling explosives are explosion proof type?	Yes	Physically verified
8	Whether adequate measures are taken to prevent any sources of ignition where explosive substances are handled?	Yes	Physically verified
Sl. No.	C-21.5 Fire Safety in Handling Flammable and Explosive materials	Remarks	Evidence Ref
1	Whether emergency procedure is available for control of leakage?	Yes	Physically verified
2	Whether emergency measures are displayed locally in case of accidental spillage / leakage?	Yes	Physically verified
3	Whether facility is provided for safe drainage of combustible or flammable liquids in case of leakages?	Yes	Physically verified
4	Whether highly flammable liquids are stored under inert atmosphere?	Yes	Physically verified
5	Whether flammable storage tanks are provided with flame arrestors?	Yes	Physically verified
6	Whether suitable PPEs are provided?	Yes	Safety Shoes, Goggles, Hemet, IFR Overall, Hand gloves, Ear plug & Nose Mask
Sl. No.	C-21.6 Fire Detection and Alarm System	Remarks	Evidence Ref
1	What type of fire detection and alarm system provided?	Yes	Smoke detectors, Manual call point, portable gas detectors
2	Whether all fire prone areas of the plant are covered with fire detection system?	Yes	Physically verified



HALDIA REFINERY **INDIAN OIL CORPORATION LIMITED** **EXTERNAL SAFETY AUDIT AS PER MSIHC RULE**



3	Whether fire detection equipment and smoke alarms in good operating condition?	Yes	Physically verified
4	Whether the numbers of fire call points are adequate and free from obstruction?	Yes	Adequate
5	Whether regular inspection / maintenance / testing of fire detection and alarm system carried out and records maintained	Yes	Records were maintained by inspection department
6	Whether any atmospheric monitoring is carried out for explosive mixture of gases or vapours?	Yes	Gas detectors are installed at prone areas.
7	Whether emergency power supplies are provided to fire detection and fire alarm system?	Yes	Emergency power supply is provided.
8	Whether smoke detectors are located considering ventilation pattern?	Yes	Physically verified
9	Whether annunciation of fire is local or in the control room or in both places?	Yes	Both
10	Whether fire panel is constantly attended?	Yes	Physically verified
Sl. No.	C-21.7 Passive and Active Fire Protection System	Remarks	Evidence Ref
1	What are the passive fire protection measures available? (barriers, doors, dampers etc.)	Yes	Physically verified
2	Are the areas requiring fire barriers identified?	Yes	Physically verified
3	Whether the fire barrier provided is of adequate ratings?	Yes	The fire barrier is of adequate rating.
4	Whether ventilation ducts in flammable areas have been provided with isolation dampers of suitable fire rating?	Yes	Physically verified
5	Whether sprinklers / deluge are installed wherever necessary?	Yes	Physically verified
6	Whether regular inspection / maintenance / testing of fire protection system carried out and records maintained?	Yes	Regular inspection is being carried out and records were maintained by fire & safety department.
Sl. No.	C-21.8 Fixed Fire Extinguishing System	Remarks	Evidence Ref
1	What are the sources of firewater and whether they are dedicated to the fire extinguishing system?	Yes	ETP water and water from Geonkhali are the sources of firewater
2	Whether the capacity of dedicated water reservoir is adequate to supply to hydrants for minimum 2 h?	Yes	Physically verified
3	Whether un-interrupted power supply is provided to the firewater pumps?	Yes	Physically verified
4	Whether the extinguishing medium selected is appropriate to the class of fire (water, gaseous, foam, dry powder)?	Yes	Physically verified
5	Whether fire hydrants layout is available?	Yes	Physically verified
6	Whether additional (over minimum requirement) fire hoses, nozzles are available?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



7	Whether the hydrants lines are kept pressurized?	Yes	Physically verified
8	Whether regular inspection / maintenance / testing of fixed fire extinguishing systems carried out and records maintained?	Yes	Physically verified
Sl. No.	C-21.9 Portable Fire Extinguishing System	Remarks	Evidence Ref
1	Whether suitable type and numbers of fire extinguishers provided?	Yes	Adequate number of fire extinguisher is provided.
2	Whether the fire extinguishers are located at conspicuous position and easily accessible? Are they fully charged and tagged?	Yes	At most of the places
3	Whether fire extinguishers periodically inspected, tested, refilled and records maintained?	Yes	Fire extinguishers were inspected quarterly & records were maintained by Fire and safety department.
4	Whether defective / unchecked fire extinguishers present at site?	No	Physically verified
5	Whether additional fire extinguishers are available?	Yes	Physically verified
Sl. No.	C-21.10 Fire Fighting Equipment and Facilities	Remarks	Evidence Ref
1	Whether fire tenders (water / foam) are available?	Yes	Total 6 number of fire extinguisher available
2	Whether the fire-fighting system and equipment approved, tested and maintained as per relevant standard?	Yes	Physically verified
3	Whether the SCBA / fire suit provided to fire fighting team for immediate action?	Yes	Physically verified
4	What is system for maintenance / recharge of SCBA?	Yes	Done by fire & safety department
5	Is proper access available for fire fighting equipment?	Yes	Physically verified
6	Whether fire hose cabinets are in good condition, easily visible, and accessible?	Yes	Fire hose cabinets are in good condition, easily visible, and accessible
7	Whether drill tower is available? Are fire personnel carrying out regular fire drill?	Yes	Physically verified
8	What is the communication facility at fire station? Is it adequate?	Yes	Fixed Telephone, Walkie and Base station connected with all control rooms and office building.
Sl. No.	C-21.11 Fire Drill	Remarks	Evidence Ref
1	Whether mock fire drills are conducted? What is the frequency of drills?	Yes	Last mock fire drill was conducted on 14/08/2024 (Mock Drill No :- 02/2024-25), Quarterly
2	Whether fire drills are also performed in night shift	Yes	Physically verified
3	Whether feedback of fire drill is documented?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



4	What is the system of mutual-aid scheme?	Yes	Mutual aid scheme is available with nearby organisations like Paradip, Haldia, Barauni Pipeline of IOCL, Haldia Petrochemicals Limited & MCPI Private Limited
Sl. No.	C-21.12 Fire Fighting Training	Remarks	Evidence Ref
1	Whether there is a system of providing fire-fighting training to plant personnel?	Yes	Yes, mock drills are conducted monthly. Onsite drills are conducted quarterly.
2	What is the frequency and duration of such training? Whether training records are maintained?	Yes	Monthly & Quarterly
3	Whether fire squads are identified for different areas for first-aid fire fighting and rescue, and suitably trained?	Yes	Physically verified
4	Are all personnel conversant with the fire prevention and protection measures?	Yes	Physically verified
5	Whether the fire staff are sent for refresher / advanced training courses?	Yes	Physically verified
Sl. No.	C-21.13 Static Electricity and Lightning	Remarks	Evidence Ref
1	Whether all vessels and pipes are provided with suitable bonding and grounding?	Yes	Physically verified
2	Whether arrangement has been made for grounding the tanker containing flammable liquid during loading / unloading?	Yes	Physically verified
3	Whether spark resistant tools are provided?	Yes	Physically verified
4	Whether lightning protection is provided and is adequate?	Yes	Physically verified
5	Whether antistatic clothing, hand gloves and footwear are provided?	Yes	Physically verified
Sl. No.	C-21.14 Pressure Relief System	Remarks	Evidence Ref
1	Whether the listing of all 'pressure plants' [as defined under Factories Act] has been done?	Yes	Physically verified
	C-22 INDUSTRIAL HYGIENE / OCCUPATIONAL HEALTH		
Sl. No.	C-22.1 Ventilation, Illumination, Noise, Vibration, Heat stress and Non-ionizing Radiations	Remarks	Evidence Ref
	C-22.1.1 Ventilation		
1	Whether any ventilation study has been carried out?	Yes	Physically verified
2	Whether natural ventilation is adequate or not?	Yes	Adequate
3	Whether dust / fumes / hot air is generated in the process?	Yes	Physically verified
4	Is there any exhaust ventilation system in any section of the plant?	N/A	NA
5	Is periodic / preventive maintenance of ventilation	Yes	Periodic Maintenance is done.



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



	system carried out and record is maintained?		
6	Does any ventilation system re-circulate the exhausted air in work areas?	No	Physically verified
7	Is the work environment assessed and monitored for chemical and physical hazards?	Yes	Done on regular basis
8	Whether PPE are provided to workers exposed to dust / fumes and gases?	Yes	Physically verified
Sl. No.	C-22.1.2 Illumination	Remarks	Evidence Ref
1	Whether illumination study has been carried out for the assessment of illumination level?	Yes	Physically verified
2	Is there any system of periodical cleaning and replacing the light fittings / lamps in order to ensure that they give the intended illumination levels?	Yes	Physically verified
3	Are the workers subject to periodic optometry tests and records maintained?	Yes	Workers are subjected to periodic optometry test & records were maintained.
4	Are emergency lighting available at first aid centre.	Yes	Physically verified
Sl. No.	C-22.1.3 Noise	Remarks	Evidence Ref
1	Whether any noise study conducted?	Yes	Conducted on regular basis.
2	Are there any machines / processes generating high-noise?	Yes	Compressors & Turbines
3	Whether engineering and administrative controls been implemented to reduce noise exposure below the permissible limits?	Yes	Physically verified
4	Is there a system of subjecting all those employees to periodic audiometric test who work in high level noise areas?	Yes	Physically verified
5	Whether the workers are made aware of the ill effects of high noise?	Yes	Physically verified
6	Whether ear muffs / plugs are provided and used?	Yes	Physically verified
Sl. No.	C-22.1.4 Vibration	Remarks	Evidence Ref
1	Are there equipment which contribute excess level of vibrations and whether they are identified?	Yes	Physically verified
2	Whether any vibration study has been carried out?	Yes	Physically verified
3	Are the measures taken to combat vibration to acceptable levels?	Yes	Physically verified
4	What is the frequency for measurements of vibration?	Yes	Physically verified
5	Are the records of measurements and maintenance of equipment / system maintained?	Yes	Physically verified
Sl. No.	C-22.1.5 Heat Stress / Cold stress (Extremes of Temperature)	Remarks	Evidence Ref
1	Are there sources from equipment increasing the heat load in work places?	Yes	Physically verified
2	Whether evaluation of heat stress is carried out?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



3	Whether natural ventilation is adequate to minimize the heat stress in work environment?	Yes	Physically verified
4	Are resources available to deal with very hot or very cold conditions (drinking water, lined gloves, insulated boots)?	Yes	Physically verified
5	Do workers know the symptoms of heat cramps / heatstroke or frost bite / hypothermia?	Yes	Physically verified
6	Are the personal protective equipment suitable for reducing the effects of heat stress available?	Yes	Physically verified
Sl. No.	C-22.1.6 Non-ionising Radiations	Remarks	Evidence Ref
1	Does the work involve likely exposure to non-ionising radiations (ultraviolet, infrared, radiofrequency, microwaves, lasers, etc.)	N/A	N/A
2	Whether risk assessment have been done for all work areas involving presence of non-ionising radiations?	N/A	N/A
3	Are the work areas displayed with relevant safety signs?	N/A	N/A
4	Are the employees aware about the hazards of non-ionising radiations?	N/A	N/A
5	Does written procedures exists for working in non-ionising radiations?	N/A	N/A
6	Is the work environment monitored periodically for physical hazards and control measures initiated whenever deviation from permissible values is observed?	N/A	N/A
7	Whether suitable personal protective equipment are provided to workers exposed to non-ionising radiations?	N/A	N/A
Sl. No.	C-22.2 Work Place Monitoring for Hazardous Chemicals	Remarks	Evidence Ref
1	Whether the dust, fumes, smoke aerosols and mist are monitored as per statute and records maintained?	Yes	Physically verified
2	What are the types of detectors used for monitoring concentration of hazardous chemicals?	Yes	Gas detectors provided (HC,H2S,H2,Cl2 & CO)
3	Is any alarm system installed for any leakage of hazardous chemicals?	Yes	Physically verified
4	Are antidotes available for toxic chemicals?	Yes	Physically verified
5	Are control measures initiated whenever deviation from permissible values is observed?	Yes	Physically verified
Sl. No.	C-22.3 First Aid Facilities and Occupational Health Centre (OHC)	Remarks	Evidence Ref
1	Are adequate numbers of first aid boxes provided? Give location details?	Yes	Approx. 80 nos. of first aid boxes are kept at different locations
2	Are qualified / trained first aiders available in each	Yes	Available



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



	shift?		
3	How many qualified / trained first aiders are available at each plant / department?	Yes	Approx. 400 trained first aiders are available
4	How many persons are trained / given refresher training in first aid in a year?	Yes	Annually Refresher training provided
5	Whether occupational health centre is provided?	Yes	Physically verified
6	Does OHC conform to the provisions of the existing statutes?	Yes	Physically verified
7	Are the Medical Attendants / Doctors available in each shift?	Yes	Physically verified
8	What facilities are available for transportation of the injured to hospital?	Yes	Total 3 number of Ambulance present in the plant.
9	Are the names of the trained first aiders displayed?	No	Names of the trained first aiders to be displayed.
10	Are the name of nearest hospitals and its telephone number available in OHC?	Yes	Available in ECC as well as at hospital
11	Does the plant have any special preventive medicine program?	Yes	Physically verified
12	Is ambulance posted in proper place and is it available whenever required?	Yes	physically verified
13	Are sufficient numbers of anti-dotes available in case of any emergency?	Yes	Physically verified
14	Are fire safety measures provided in first aid centre?	Yes	Physically verified
15	Are emergency lighting arrangements available at first aid centre?	Yes	physically verified
Sl. No.	C-22.4 Periodic Medical Examination	Remarks	Evidence Ref
1	Whether the periodical medical examination of employees, required under relevant statute is carried out?	Yes	Periodical Medical examination is carried out half-yearly and yearly
2	Whether it is ensured that contractors employee are medically examined during pre-employment as well as during the course of employment?	Yes	Physically verified
3	During the periodical medical examination of the workers, are they examined as per the hazardous process in which they work? (First schedule of The Factories Act, 1948)	Yes	Physically verified
4	Are the records of all such examination maintained?	Yes	Records were kept in hospital
Sl. No.	C-22.5 Personal Protective Equipment and Emergency Equipment	Remarks	Evidence Ref
1	Whether list of required PPE for each hazardous activity is available?	Yes	Physically verified
2	Whether feedback from workers obtained during selection of PPE?	Yes	Physically verified
3	Have the workers been trained in proper use of PPE including BA sets?	Yes	Physically verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



4	What is the system of procurement, inspection, issue, maintenance and replacement of PPE?	Yes	PPEs are replaced as per needs.
5	Whether qualitative and quantitative fit-check for respirators is ensured prior to use?	Yes	Physically verified
6	What are the arrangements for safe custody and storage of PPE?	Yes	Lockers provide to them.
7	Are the contractor's workers provided with the required PPE?	Yes	By the concerned contractor
8	Do the PPE conform to any standard?	Yes	As per relevant IS code.
9	Are sufficient eye wash fountains and safety showers available?	Yes	Physically verified
10	Whether appropriate respiratory protective devices are available in accordance to the hazard potential?	Yes	Physically verified
11	Are the staff members trained in the right uses of respiratory protective devices?	Yes	Physically verified
Sl. No.	C-22.6 Occupational Diseases	Remarks	Evidence Ref
1	Whether pre-employment medical check-up data available?	Yes	Records were kept in hospital
2	During the medical check-up, is any person found having occupational diseases mentioned in 3rd schedule of The Factories Act, 1948?	No	Physically verified
3	Whether the medical practitioner informed the Chief Inspector of Factories about the occurrence of the occupational disease?	NA	Not available
C-23 ACCIDENT / INCIDENT REPORTING, INVESTIGATION AND ANALYSIS			
Sl. No.	C-23.1 Accident Reporting and Database Management	Remarks	Evidence Ref
1	What is the procedure for accident / incident / dangerous occurrence reporting?	Yes	As per standard reporting format
2	Whether the accident data for the last five years for reportable and non-reportable accidents are available?	Yes	Physically verified
Sl. No.	C-23.2 Accident Investigation	Remarks	Evidence Ref
1	Are all the accidents investigated?	Yes	Physically Verified
2	Whether accident investigation procedure is documented?	Yes	Well established system of accident reporting exists through Online Portal
3	Whether accident investigation reports are submitted to top management?	Yes	Physically Verified
4	How are the findings from accident investigation reports communicated to workers?	Yes	Accident investigation is done and are properly documented and kept in files
Sl. No.	C-23.3 Analysis of Accidents	Remarks	Evidence Ref
1	Whether accident analysis is done as per IS 3786?	Yes	Physically Verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



2	Whether root causes of accidents are analysed?	Yes	Physically Verified
3	Is the accident statistics effectively utilized? If yes, how?	Yes	Data analysed by F&S/ HSE dept. and monitored at top level
4	What nature of injuries occurred during the last five years?	Yes	Mostly minor injuries like cut
Sl. No.	C-23.4 Implementation of Recommendations	Remarks	Evidence Ref
1	How does the management ensure implementation of the recommendations to avoid recurrence of accidents and incidents?	Yes	Action Plan prepared and implemented after thorough investigation of incidents
Sl. No.	C-23.5 Reporting and Investigation of Near-miss Incidents	Remarks	Evidence Ref
1	Are all near-miss incidents reported and investigated?	Yes	Physically Verified
2	Is there any system of classifying and analysing the near-miss incidents?	Yes	Physically Verified
C-24 EMERGENCY PREPAREDNESS			
Sl. No.	C-24.1 Site Specific Details	Remarks	Evidence Ref
1	Are the site area maps (including layout, access roads and assembly points) available in control room / emergency control centre?	Yes	Plant layout is available.
Sl. No.	C-24.2 Duties and Responsibilities of Key Personnel	Remarks	Evidence Ref
1	Is the hierarchy of emergency response personnel right from site emergency controller downward, and alternative officials identified?	Yes	Physically Verified
2	Are the duties and responsibilities assigned to the designated officials during emergency, both during and outside normal working hours clearly identified and understood by them?	Yes	Physically Verified
Sl. No.	C-24.3 Identification of Emergencies and Accident Scenario	Remarks	Evidence Ref
1	Are the possible accident scenarios leading to emergency identified and known to the operating personnel?	Yes	Physically Verified
2	Are approved emergency preparedness plans (onsite and off-site) in place?	Yes	Included in safety training.
Sl. No.	C-24.4 Declaration and Termination of Emergency	Remarks	Evidence Ref
1	Is the list of designated officials who are to be communicated about declaration and termination of emergency available in the control room / emergency control centre?	Yes	Physically Verified
2	Are the methods of communication (siren, public address system etc.) for declaration and termination of an emergency known to all the workers?	Yes	Physically Verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



Sl. No.	C-24.5 Resources-evacuation / Transport	Remarks	Evidence Ref
1	Are the following resources (equipment, personnel and procedures) required to handle emergency available?	Yes	Physically Verified
	Communications,	Yes	Available in ERDMP Ref. no.- BOSAI/0137
	Public announcement systems	Yes	Physically Verified
	Monitoring of hazardous releases into the environment,	Yes	Monitoring Equipment are placed like SO2 analyzers
	Emergency shelters at the facility	Yes	Assembly points are available(total 10 nos.)
	Emergency exits with proper illumination, with uninterrupted power supply ,	Yes	Physically Verified
	Direction for emergency exit / escape route marked in haulage / Alleyways,	Yes	Mentioned
	Transport for evacuation of plant personnel,	Yes	Will be available in case of emergency
	Medical care including administration of antidotes, and	Yes	Available in Hospital
	Security / maintenance of law and order	Yes	Physically Verified
Sl. No.	C-24.6 Communication Facilities	Remarks	Evidence Ref
1	Does the emergency control centre have direct communication links with the fire station and the plant control room?	Yes	Physically Verified
2	Are there adequate alarm points from which an emergency alarm can be raised?	Yes	Physically Verified
3	Is there infrastructure available for ensuring backup electric power supply for communication links where required?	Yes	Physically Verified
Sl. No.	C-24.7 Medical Care	Remarks	Evidence Ref
1	Is the procedure for emergency medical care available?	Yes	Physically Verified
2	Whether the system has been tested at regular frequency through mock drill / exercises for its adequacy?	Yes	Through normal quarterly mock drill and annual Health facility mock drill
3	Does the system of periodic replacement of antidotes and medicines required in emergency exist?	Yes	Physically Verified
Sl. No.	C-24.8 Updation of Emergency Plan	Remarks	Evidence Ref
1	Is the emergency plan updated based on the feedback from the periodic drills / exercises?	Yes	Physically Verified
2	Are the contact details of all concerned officials kept updated in the emergency plan?	Yes	Physically Verified
Sl. No.	C-24.9 Periodic Drills / Exercises	Remarks	Evidence Ref
1	Are mock-exercises conducted at stipulated intervals?	Yes	Mock drills conducted on quarterly basis. Previous Mock drill



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



conducted on 14/08/2024

2	Are the scenarios varied in the mock-exercises to ensure that all possible factors including meteorological conditions, affected plant personnel covered?	Yes	Physically Verified
3	Whether emergency preparedness Plans have been tested and reviewed at regular frequency through mock drill for its adequacy	Yes	Physically Verified
Sl. No.	C-24.10 Training of Plant Personnel	Remarks	Evidence Ref
1	Are the plant personnel trained in handling emergency equipment?	Yes	Physically Verified
Sl. No.	C-24.11 Public Awareness Programmes	Remarks	Evidence Ref
1	Are public awareness programs conducted for the people around the site regarding the actions to be taken in case of off-site emergency?	Yes	Physically Verified
Sl. No.	C-24.12 Mutual-aid Programme	Remarks	Evidence Ref
1	Are the types of accidents where external organizations would be involved in remedial actions identified? Are their responsibilities defined?	Yes	Mutual Aid Scheme exists with neighbouring industries
2	Is the plant responsible for rendering mutual aid assistance to any other external organizations? Does this assistance affect the plant's emergency preparedness?	Yes	It doesn't effect the plant's emergency preparedness
3	Whether the communication channels for mutual assistance identified and known with and between two organizations?	Yes	Physically Verified
Sl. No.	C-24.13 Emergency Control Centre	Remarks	Evidence Ref
1	Is the emergency control centre located beyond the effective distances of identified emergency scenarios?	Yes	Physically Verified
2	If the emergency control centre is located within the effect distance, is it suitably protected that it will be available in case of emergency?	Yes	Physically Verified
	C-25 SAFETY INSPECTION		
Sl. No.	C-25.1 Inspection Programme	Remarks	Evidence Ref
	Are checklists available for inspections? For example availability of checklists like:	Yes	Internal & external checklist are available
1	Handling, Storage and Transportation of hazardous chemicals;	Yes	Physically Verified
2	Electrical hazards;	Yes	Physically Verified
3	Fire safety;	Yes	Physically Verified
4	Hand and portable power tools;	Yes	Physically Verified
5	Machine hazards;	Yes	Physically Verified
6	Lifting equipment;	Yes	Physically Verified
7	Ladders and scaffolding;	Yes	Physically Verified



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE



8	Environmental Monitoring;	Yes	Physically Verified
9	Civil structure;	Yes	Physically Verified
10	House-keeping;	Yes	Physically Verified
11	Emergency equipment; and	Yes	Physically Verified
12	Gas cylinder and other pressure vessels used / available in the organization	Yes	Physically Verified
Sl. No.	C-25.2 Safety Related Deficiency (SRD) Report	Remarks	Evidence Ref
1	Are SRDs generated based on the area wise checklists?	Yes	Physically Verified
2	What is the procedure for resolving the SRDs?	Yes	Physically Verified
3	Whether the procedure exists for notification and root cause analysis of non-conformities and action taken on them?	Yes	Physically Verified
Sl. No.	C-25.3 Safety Inspection Records	Remarks	Evidence Ref
1	Are the safety inspection records maintained?	Yes	Record is maintained
Sl. No.	C-25.4 Methodology and Inspection Team	Remarks	Evidence Ref
1	Is there written procedure for safety inspection?	Yes	Physically Verified
2	Whether safety inspection is carried out by a designated team?	Yes	Physically Verified
3	What is the frequency of safety inspections?	Yes	Safety inspections are done during shut down.
4	Whether an inspection report is generated?	Yes	Physically Verified
Sl. No.	C-25.5 Compliance of Recommendations	Remarks	Evidence Ref
1	To whom the recommendations are submitted	Yes	HODs, CGMs/GMs & ED
2	Are recommendations of safety inspections complied in time?	Yes	Physically Verified
3	Is compliance of recommendations sent to top management?	Yes	Physically Verified
4	Is compliance of recommendations reviewed by safety committee?	Yes	Physically Verified
5	Does top management follows-up the compliance?	Yes	Physically Verified



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



OBSERVATIONS & RECOMMENDATIONS

SL. NO.	OBSERVATIONS	SECTIONS	RISK CATEGORY (LOW/MED./HIGH)	RELEVANT CLAUSES/FACTORY RULES	RECOMMENDATIONS	TIMELINE FOR COMPLIANCE
1	Gas detector common alarm was showing false indication in HWC.	BS-VI	Medium	C-21.6 as per IS 14489:2018	Calibrate gas detector to prevent false alarms in HWC. Investigate root cause and perform regular maintenance.	Within a week
2	In Interlock Bypass register Sl. no. 14, 15, 16 only date of lifting of bypass was mentioned but time was not mentioned.	BS-VI	Low	C-25.1 as per IS 14489:2018	Ensure that both date and time are documented for lifting of bypasses (Sl. no. 14, 15, 16) in the Interlock Bypass register for accurate record-keeping and operational clarity. Update procedures to include time notation for all bypass events.	Within a month
3	Repeater panel ACDB-62711, FDR- 29F1 was showing fault indication.	BS-VI	Medium	CEA RULES REGULATIONS Ch. VI-48	Investigate and rectify the fault indication on Repeater panel ACDB-62711, FDR-29F1. Perform necessary troubleshooting, repairs, or replacements to ensure normal operation and prevent potential disruptions.	Within a week



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



4	Two waterjet Fire Blanket found along with PPEs found expired on 05/2025.	BS-VI	High	C-21.10, C-25 as per IS 14489:2018	Replace the expired water jet Fire Blankets and PPEs immediately to ensure effective fire safety and protection. Procure new, certified equipment before the expiration date to maintain operational safety and compliance.	Immediate
5	Inside PPE box one pair of chemical hand gloves found damaged.	BS-VI	Low	C-22.5, as per IS 14489:2018	Replace the damaged chemical hand gloves in the PPE box immediately to ensure personnel protection and safety. Inspect other PPEs for damage or expiration and replace as necessary.	Immediate
6	One of the exhaust fan in battery room was found out of order	BS-VI	Low	The Factories Act 1948 Ch. III- 13	Repair or replace the faulty exhaust fan in the battery room promptly to ensure proper ventilation, prevent hydrogen gas accumulation, and maintain a safe environment for personnel and equipment.	Within a week
7	Inergen cylinder banks were not identified & labelling of cylinders were not done.	BS-VI	Low	Gas Cylinder Rules 2016 Rules- 9	Identify and label the Inergen cylinder banks properly to ensure accurate tracking, maintenance, and operation. Implement a clear labelling system to prevent mix-ups and ensure compliance with safety standards.	Within a week
8	In the Displayed SOP of Inergen system it was marked with marker that for 4 different zones system was in Auto mode and for 1 zone it was in manual mode but in actual practice all the zones were kept in manual mode. SOP should	BS-VI	Low	C-4 as per IS 14489:2018	Update the SOP to reflect the actual system configuration, showing all zones in manual mode. Ensure accurate documentation to prevent confusion and ensure operational consistency. Verify and update other SOPs as necessary to	Within a month



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



	be updated accordingly.				maintain accuracy.	
9	Safety Policy was not displayed in the Control Room.	BS-VI	Medium	C-1.1,1 as per IS - 14489:2018	Display the Safety Policy prominently in the Control Room to ensure visibility and awareness among personnel. This will reinforce the organization's commitment to safety and facilitate a culture of safety-conscious operations.	Within two or three months
10	Roof seepage and leakage on wall was observed inside rack room above DB 02.	BS-VI	Medium	C-25.1,9 as per IS 14489:2018	Inspect and seal gaps, ensure proper drainage, and waterproof the roof to prevent future leaks.	Within two to three months
11	Fire NOC of hospital was not available.	Hospital	Medium	C-25 as per IS 14489:2018	Obtain the Fire NOC (No Objection Certificate) for the hospital as soon as possible to ensure compliance with fire safety regulations and avoid potential risks.	Within a week
12	List of location of first aid and their approved custodian was available but no records found for the first aid training of custodian. First aid training of custodian is mandatory as per Factories Act.	Hospital	Low	The Factories Act Ch. V-45	Provide first aid training to the custodians as per the Factories Act and maintain records of the training to ensure compliance.	Within a month
13	First aid leaflet was not found in first aid boxes.	Hospital	Low	The Factories Act-77	Ensure first aid leaflets are included in all first aid boxes to provide guidance on basic first aid procedures and emergency response.	Within a week



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



14	Organogram in Medical Emergency Plan was not updated to represent all persons involved in emergency activities like RMO, Head sisters, X-Ray technicians.	Hospital	Low	C-24 as per IS 14489:2018	Update the organogram in the Medical Emergency Plan to include all relevant personnel, such as RMO, Head Sisters, X-Ray technicians, and others involved in emergency activities, to ensure clear roles and responsibilities.	Within a month
15	Medical Emergency Mock drill was done on 10.12.2024 but mock drill report was not found.	Hospital	Medium	C-24.9 as per IS 14489:2018	Prepare and maintain a comprehensive report for the Medical Emergency Mock drill conducted on 10.12.2024, detailing the drill's objectives, outcomes, and areas for improvement.	Within a month
16	It was found that the generated Biomedical waste was around 150Kg per month but the authorization was only for 75 kg per month.	Hospital	Low	C-19.1 as per IS 14489:2018	Apply for authorization renewal/amendment to increase the limit to 150 kg/month and implement waste minimization strategies to reduce biomedical waste generation.	Within two to three months.
17	No provision of red light outside X-Ray Room	Hospital	Medium	C-19.7 as per IS 14489:2018	Install a red light outside the X-Ray room to indicate when radiation is being used, ensuring safety for others and preventing accidental exposure.	Within a month



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



18	Emergency exits of Hospital was found locked.	Hospital	High	C-8,5 as per IS 14489:2018	Immediately unlock and ensure all emergency exits are accessible, functional, and clearly marked to guarantee safe evacuation in case of emergencies.	Immediate
19	AED available in hospital was 75 % discharged only 25 % of the battery was in working condition.	Hospital	Medium	C-24 as per IS 14489:2018	Replace the AED battery immediately to ensure the device is fully functional and ready for use in case of cardiac emergencies.	Immediate
20	Needle cutter was not used. Needles should first be cut and then dipped in sodium hypochlorite solution to avoid reuse of needles.	Hospital	High	C-24.7 as per IS 14489:2018	Implement the use of a needle cutter to safely cut needles before disinfecting them in sodium hypochlorite solution, preventing potential reuse and reducing infection risks.	Immediate
21	No shed was available for biomedical waste storage area. Containers containing biomedical waste found filled with water.	Hospital	Low	C-19.1,4 as per IS 14489:2018	Provide a shed or covered area for biomedical waste storage to protect containers from rain and ensure a clean environment. Also, regularly empty and clean the containers to prevent water accumulation and potential contamination.	Within a week



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



22	Separate compartments for storage of biomedical waste was not available only two compartments were available. Identification of compartments with type of biomedical waste to be stored was not done.	Hospital	Medium	C-19.1,4 as per IS 14489:2018	Provide separate, clearly labeled compartments for different types of biomedical waste (e.g., infectious, non-infectious, sharps, etc.) to ensure proper segregation and minimize risks. Ensure each compartment is identified with signage indicating the type of waste to be stored.	Within a month
23	No fire detector or fire extinguishers kept near PSA plant.	Hospital	High	C-21.9 as per IS 14489:2018	Install fire detectors and fire extinguishers near the PSA (Pressure Swing Adsorption) plant to ensure timely detection and response to potential fires, enhancing safety and minimizing risks.	Within two months
24	Bar code stickers of only yellow colour bag was available. Bar code stickers were not available for red, blue, white bags.	Hospital	Low	C-20.7 as per IS 14489:2018	Provide bar code stickers for all categories of biomedical waste bags (red, yellow, blue, and white) to ensure accurate tracking and compliance with waste management regulations.	Within a month
25	Fire Panel was showing battery missing issue and it was kept in switched off condition.	Hospital	Medium	C-25.1,3 as per IS 14489:2018	Replace the missing battery in the fire panel and ensure it's switched on and functioning properly to guarantee timely alerts in case of a fire emergency.	Within a week



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



26	Fire extinguisher in Ambulance no. WB 29C 9171 found discharged.	Hospital	High	C-21.9 as per IS 14489:2018	Recharge or replace the discharged fire extinguisher in Ambulance WB 29C 9171 immediately to ensure it's ready for use in case of an emergency.	Immediate
27	One fan inside the Ambulance no. WB 29C 9171 was not working.	Hospital	Low	C-21.1, 24.7 as per IS 14489:2018	Repair or replace the non-functional fan in Ambulance WB 29C 9171 to maintain a comfortable environment for patients during transport.	Within a month
28	Oxygen flowmeter was not working inside the Ambulance no. WB 29C 9171.	Hospital	High	C-24.7 as per IS 14489:2018	Repair or replace the oxygen flowmeter in Ambulance WB 29C 9171 immediately to ensure accurate oxygen delivery to patients during transport.	Immediate
29	Assembly point near hospital was not designated.	Hospital	Low	C-24.1,1 as per IS 14489:2018	Designate and clearly mark an assembly point near the hospital for emergency evacuations, ensuring a safe gathering area for patients, staff, and visitors.	Immediate
30	TPI validity of 20 T EOT crane found expired on 11/08/25 in 84 Compressor House	LOB	Medium	C-25.1,6 as per IS 14489:2018	Renew the Third Party Inspection (TPI) certification for the 20 T EOT crane in the 84 Compressor House as soon as possible to ensure compliance with safety regulations and prevent potential risks.	Immediate
31	No sprinkler system installed on furnace	LOB	High	C-21.7,5 as per IS 14489:2018	Install a sprinkler system on the furnace to enhance fire safety and provide a means of quickly controlling and extinguishing potential fires.	Within a week



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



32	U 31/32 pump changeover schedule of August was not available in the file. Schedule of upto July was only present.	LOB	Low	C-18.2,1 as per IS 14889:2018	Ensure the U 31/32 pump changeover schedule for August is properly documented and filed, and verify that all relevant schedules are up-to-date and readily available for reference.	Within a month
33	In Interlock Bypass Record of VDU-1 it was observed that 31-ID 101, 31FS W, 203 was bypassed and signed by CGM(T)/CGM(Maint). Normalization of Bypass was not yet done. Formation of multidisciplinary committee as per SOP was not evident and MOC was not found.	LOB	Low	C-4 as per IS 14489:2018	Normalize the bypass of 31-ID 101, 31FS W, 203 immediately and ensure adherence to the Standard Operating Procedure (SOP) by: - Forming a multidisciplinary committee to review and approve the bypass. - Conducting a Management of Change (MOC) process. - Documenting all procedures and approvals for future reference.	Immediate
34	Siren codes were not displayed.	LOB	Low	C-20.7 as per 14489:2018	Display the siren codes prominently to ensure that personnel are aware of the different signals and can respond accordingly in emergency situations.	Within a week
35	Gas detectors 61GDT109-05[6-70], 61GDCRPH39[8-11], 61GDT_406_22[8-21] were found blinking with red colour. Sensors of gas detectors to be checked	OM & S	Medium	C-20.6 as per IS 14489:2018	Investigate and rectify the issue with the gas detectors (61GDT109-05, 61GDCRPH39, 61GDT_406_22) showing red blinking indicators, which may indicate faulty sensors, calibration issues, or gas detection. Check and calibrate the sensors as needed to ensure accurate gas detection and prevent potential hazards.	Immediate



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



36	Display of Emergency Information Panel (EIP) on vehicle no. WB 41 J 7744 found faded.	OM & S	High	C-24 as per IS 14489:2018	Replace or repaint the Emergency Information Panel (EIP) on vehicle no. WB 41 J 7744 to ensure the critical information is clearly visible and easily accessible in case of an emergency.	Within a week
37	Labeling/identification of some of the bays were missing.	OM & S	Low	C-20.7 as per IS 14489:2018	Label and identify all bays clearly to ensure easy navigation, efficient operations, and enhanced safety. This will also help in maintaining organization and reducing potential errors.	Within a month
38	No Fire extinguisher placed near ESD WSA BAY Panel.	OM & S	High	C-21.9 as per IS 14489:2018	Install a fire extinguisher near the ESD WSA BAY Panel to ensure readily available firefighting equipment in case of an emergency, enhancing safety and compliance with fire safety regulations.	Within a month
39	Display of MSDS was not done in Gantry Area	OM & S	Low	C-20.3 as per IS 14489:2018	Display the Material Safety Data Sheets (MSDS) in the Gantry Area to provide critical information on handling, storage, and emergency procedures for hazardous materials, ensuring worker safety and compliance with regulations.	Within a week



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



40	Test details of earth pit TTL-INST-EP-03 near WSA BAY Panel became due on 22/03/2025.	OM & S	Low	C-19.4, 12 as per IS 14489:2018 and The Factories Act 1948- 33	Schedule and conduct the earth pit test for TTL-INST-EP-03 near the WSA BAY Panel as soon as possible, given its due date of 22/03/2025, to ensure the earthing system's integrity and safety.	Immediate
41	CBFS line was not in use but still labelled. It should be identified as not in use line	OM & S	Low	C-20.7 as per IS 14489:2018	Update the label on the CBFS line to reflect its current status as "Not in Use" to avoid confusion and ensure accurate identification during operations and maintenance activities.	Immediate
42	One of the nozzle of eyewash was not clean near sulphuric acid bay.	OM & S	Medium	The Factories Act 1948 Ch.III-11	Clean and inspect the eyewash nozzle near the sulphuric acid bay to ensure it's free from contamination and functioning properly for emergency situations. Schedule regular maintenance for all eyewash stations.	Immediate
43	Foot paddle system was not installed in the eyewash. Foot operated eyewash or safety shower is recommended. Opening closing valve on the pipe to eyewash found broken.	OM & S	Medium	C-22.5,9 as per IS 14489:2018 The Factories Act 1948 Ch.IV-35	Install a foot-operated system for the eyewash and repair/replace the broken valve to ensure hands-free operation, allowing users to flush their eyes without contamination risk. This enhances safety near the sulphuric acid bay.	Within a month
44	No Test Date Due Date found displayed at site near TTL weigh bridge of 60 MT.	OM & S	Low	C-25.1 as per IS 14489:2018	Display the test due date for the 60 MT TTL weighbridge to ensure timely calibration and maintenance, maintaining accuracy and compliance with regulatory requirements.	Within a month



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



45	Many empty rejected bitumen drums found kept near bitumen filling area. Hazardous empty drums should be disposed off.	OM & S	Medium	C-20.8 as per IS 14489:2018	Dispose of the empty rejected bitumen drums properly, following hazardous waste disposal guidelines, to maintain a safe and clean working environment near the bitumen filling area. Regularly inspect and remove such waste.	Within a week
46	Drain cover outside the conveyor belt of Filling machine F/M-4, F/M-5 found missing at many places.	OM & S	Medium	C-19.2,7 as per IS 14489:2018	Replace the missing drain covers outside the conveyor belts of F/M-4 and F/M-5 to prevent tripping hazards, ensure safe passage, and maintain a clean environment. Promptly repair or replace missing covers.	Within a month
47	Colour code was not displayed	OM & S	Low	C-20.7 as per IS 14489:2018	Display relevant color codes for safety and compliance.	Within a month
48	Vegetation growth found inside 132 KV switchyard	OM & S	Low	C-19.1 as per IS 14489:2018	Clear the vegetation growth inside the 132 KV switchyard to ensure safety, prevent electrical hazards, and maintain compliance with regulatory requirements. Regularly inspect and maintain the area.	Within a month
49	Traces of oil found floating in open storm water drains	ETP	Medium	C-20.4 as per IS 14489:2018	Contain and clean up the oil spill in the storm water drains to prevent environmental contamination and potential hazards. Implement measures to prevent future spills and ensure proper waste disposal.	Within a week



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



50	Inspection chart on 75 Kg Fire Extinguisher outside control room was not updated. It was over due on 03/2025.	ETP	Low	C-25, C-21.5 as per 14489:2018	Update the inspection chart for the 75 Kg fire extinguisher outside the control room and ensure timely inspections to maintain fire safety and compliance. Schedule the overdue inspection ASAP.	Within a week
51	Cable drums kept at site without any stopper.	ETP	Low	C-22.1,7 as per IS 14489:2018	Use stoppers or wedges on the cable drums to prevent rolling or movement, ensuring site safety and preventing potential accidents or damage. Secure the drums properly.	Immediate
52	Many chemicals found kept without any identification. MSDS not properly displayed in Chemical house, ETP-II	ETP	Low	C-20.7,C-16 as per IS 14489:2018	Label all chemicals with proper identification and ensure Material Safety Data Sheets (MSDS) are displayed correctly in the Chemical House and ETP-II area. This ensures safe handling, storage, and compliance with safety regulations.	Within a week
53	Railing found corroded and damaged at bottom portion on treated water Effluent Tank-B.	ETP	Medium	C-21.2 as per IS 14489:2018	Repair or replace the corroded and damaged railing around the Treated Water Effluent Tank-B to ensure safety and prevent accidents. Prioritize maintenance to prevent further deterioration.	Within a month
54	One Staircase in ETP found rusted.	ETP	Medium	The Factories Act 1948 Ch. IV-32	Repair or replace the rusted staircase in the ETP to ensure structural integrity and prevent accidents. Regular maintenance can help prevent such issues.	Within a month



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



55	No proper MSDS available in the chemical storage of ETP area.	ETP	Low	C-20.3, 19.5,1 as per IS 14489:2018	Ensure proper MSDS is available in the ETP chemical storage area. This will provide critical information on handling, storage, and emergency procedures for the chemicals stored.	Within a week
56	Chemicals are not stored in designated place in ETP area.	ETP	Low	C-20.5,18 as per IS 14489:2018	Store chemicals in designated areas in the ETP to ensure safe handling, prevent accidents, and comply with regulations. Proper storage also facilitates easier inventory management and emergency response.	Within a week
57	Refinery Fire water layout displayed in fire station was old.	Fire Department	Low	C-21.0 as per IS 14489:2018	Update the refinery fire water layout displayed in the fire station to ensure accurate information and effective emergency response. This will help firefighters respond quickly and safely in case of an incident.	Within a month
58	SOP of main pump, jockey pumps was not displayed in fire pump house	Fire Department	Low	C-4 as per IS 14489:2018	Display SOPs for main and jockey pumps in the fire pump house for safe and efficient operation.	Within two months
59	No TPI certificate found on Hydra parked outside the fire pump house.	Fire Department	Low	C-25 as per IS 14489:2018	Ensure the hydra parked outside the fire pump house has a valid tpi (third party inspection) certificate to guarantee its safe operation and compliance with regulatory requirements. schedule an inspection if necessary.	Within two months



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



60	Limit switch of hydra parked outside the fire pump house was not working	Fire Department	Medium	C-21.10 as per IS 14489:2018	Repair or replace the limit switch of the hydra parked outside the fire pump house to ensure safe and proper operation. this will prevent potential accidents or equipment damage.	Within a week
61	Fire pump house contains diesel and is considered hazardous area but not water sprinkler installed in fire pump house.	Fire Department	Medium	C-21.4,2 as per IS 14489:2018	Install water sprinklers in the fire pump house, considering its hazardous nature due to the presence of diesel. this will enhance fire safety and protection in the area.	Within two to three months
62	The fire network diagram in the main entrance of the Fire department was not updated.	Fire Department	Low	C-19.6,3 as per IS 14489:2018	Update the fire network diagram at the main entrance of the Fire department to ensure it accurately reflects the current fire safety infrastructure, facilitating effective emergency response and maintenance.	Within a month
63	In fire pump house building roof sheet not available, Rain water may directly fall on Diesel fire pump and nearby batteries, needs immediate attention.	Fire Department	Low	C-25.1,9 & NBC Code – 5.1.2	Install roof sheets in the fire pump house to protect the diesel fire pump and nearby batteries from rainwater exposure. This will help prevent damage, ensure reliable operation, and maintain safety. Immediate attention is recommended.	Within two to three months
64	The limit switch of the Hydra boom working fire pump house (used for the drain construction) is not working.	Fire Department	Low	C-25.1,2 as per IS 14489:2018	Repair or replace the faulty limit switch of the Hydra boom in the fire pump house to ensure safe and proper operation, preventing potential accidents or equipment damage.	Within a week



HALDIA REFINERY

INDIAN OIL CORPORATION LIMITED

EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



65	In the Hospital we have observed that the medical waste generation per month (i.e. June/July25) is more than the sanctioned quantity by the competent authority.	Fire Department	Low	C-20.8,2 as per IS 14489:2018	Conduct a waste audit, implement proper segregation, and optimize waste reduction, train staff, and review protocols to manage excess medical waste. Partner with certified disposal services for efficient waste management.	Within a month
66	Continuity jumpers in Hydrocarbon line, one sample check done in STG (LPG Vaporizer Area), where jumpers are not there.	TPS, GT and Hospital, Area.	Low	C-25.1,3 as per IS 14489:2018	Install continuity jumpers in hydrocarbon lines across all areas to ensure electrical continuity and safety.	Within a month
67	Checked the LUX level records in Electrical maintenance where, as per record in DYIP (RODM) area, lux level was recorded well below the norms, should take necessary corrective actions there to improve Lux level.	TPS, GT and Hospital, Area.	Loq	C-19.4 as per IS 14489:2018	Improve lux levels in the DYIP (RODM) area by installing additional lighting or maintaining existing fixtures to meet prescribed norms. update records after implementation.	Within two to three weeks
68	Checked the lightening arrestor study, total 97no of observations /recommendations are there but could not see documented evidence of the compliance status of all the recommendations in planning department.	TPS, GT and Hospital, Area.	Low	C-25 as per IS 14489:2018	Document evidence of compliance status for all 97 lightning arrestor study recommendations in the planning department.	Within a month
69	Lots of loose cables are lying near SS#16, should be shifted to a proper location.	TPS, GT and Hospital, Area.	Medium	C- 19.4,6 as per IS 14489:2018	Shift the loose cables near SS#16 to a designated cable management area or tray to prevent tripping hazards, electrical risks, and maintain a tidy workspace.	Within a month



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC RULE (2025-



70	Near MCP-262A in STG ground floor one cross over bridge is there while crossing the crossover the pipelines are installed at low height, chance of getting hurt while crossing.	TPS, GT and Hospital, Area.	Medium	C-25.1 as per IS 14489:2018	Install "Mind Your Head" warning signs near the crossover bridge at STG ground floor, MCP-262A, to alert personnel of the low-hanging pipelines and prevent head injuries.	Within a week
71	In Electrical temporary connection record list in the system, lot of jobs are not closed in the system after expiry of permit validity date.	TPS, GT and Hospital, Area.	Low	C-6 as per IS 14489:2018	Ensure timely closure of electrical temporary connections in the system after permit expiry dates to maintain accurate records, prevent potential safety hazards, and optimize resource allocation. Review and update the system regularly to reflect completed jobs.	Immediate
72	Checked the normal work permits system also in the system, there also at least 50no of permits are yet to close in the system though the timeline have expired.	TPS, GT and Hospital, Area.	Low	C-6 as per IS 14489:2018	Close outstanding permits in the system to maintain accurate records and prevent safety risks. Assign personnel to review and update permit statuses.	Within a week



HALDIA REFINERY
INDIAN OIL CORPORATION LIMITED
EXTERNAL SAFETY AUDIT AS PER MSIHC
RULE (2025-26)



END OF REPORT
THANK YOU

TEST REPORT

Name & Address of the Customer :
INDIAN OIL CORPORATION LIMITED
 P.O.- Haldia Oil Refinery,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/001202
Date : 25.06.2025
Sample No. : MSKGL/ED/2025-26/06/01450
Sample Description : VOC Monitoring

Ref. No. & Date : 29376997, Date - 08/11/2023

VOC MONITORING REPORT

Sampling Date : 21-03-25
Sampling Location : HGU-2 (OHCU BLOCK)
Unit : - 92

Instrument No	Functional Loc	Description	Reading (ppm)
9040-092-P-01A	Pump Sale	SOUR NAPHTHA FEED PUMP	8
9040-092-P-01A	Suction I/V Flange	SOUR NAPHTHA FEED PUMP	5
9040-092-P-01A	Discharge Valve Flange	SOUR NAPHTHA FEED PUMP	5
9040-092-P-01A	PG Flange	SOUR NAPHTHA FEED PUMP	4
9040-092-P-01B	Pump Sale	SOUR NAPHTHA FEED PUMP	NR
9040-092-P-01B	Suction I/V Flange	SOUR NAPHTHA FEED PUMP	NR
9040-092-P-01B	Discharge Valve Flange	SOUR NAPHTHA FEED PUMP	NR
9040-092-P-01B	PG Flange	SOUR NAPHTHA FEED PUMP	NR
9040-092-P-02A	Pump Sale	REFLUX PUMP	NR
9040-092-P-02A	Suction I/V Flange	REFLUX PUMP	NR
9040-092-P-02A	Discharge Valve Flange	REFLUX PUMP	NR
9040-092-P-02A	PG Flange	REFLUX PUMP	NR
9040-092-P-02B	Pump Sale	REFLUX PUMP	2
9040-092-P-02B	Suction I/V Flange	REFLUX PUMP	1
9040-092-P-02B	Discharge Valve Flange	REFLUX PUMP	1
9040-092-P-02B	PG Flange	REFLUX PUMP	2
9040-092-P-14A	Pump Sale	FULE NAPHTHA PUMP	NR
9040-092-P-14A	Suction I/V Flange	FULE NAPHTHA PUMP	NR
9040-092-P-14A	Discharge Valve Flange	FULE NAPHTHA PUMP	NR
9040-092-P-14A	PG Flange	FULE NAPHTHA PUMP	NR
9040-092-P-14B	Pump Sale	FULE NAPHTHA PUMP	1
9040-092-P-14B	Suction I/V Flange	FULE NAPHTHA PUMP	1
9040-092-P-14B	Discharge Valve Flange	FULE NAPHTHA PUMP	1
9040-092-P-14B	PG Flange	FULE NAPHTHA PUMP	1

For Mitra S. K. Private Limited

Report Prepared By 


Authorised Signatory

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

TEST REPORT

Name & Address of the Customer :
INDIAN OIL CORPORATION LIMITED
 P.O.- Haldia Oil Refinery,
 Pin - 721606

Report No. : MSKGL/ED/2025-26/001203
Date : 25.06.2025
Sample No. : MSKGL/ED/2025-26/06/01451
Sample Description : VOC Monitoring

Ref. No. & Date : 29376997, Date - 08/11/2023

VOC MONITORING REPORT

Sampling Date : 21/22-03-25
Sampling Location : OHC(U)OHC(U) BLOCK)
Unit - 91

Instrument No	Functional Loc	Description	Reading (ppm)
9040-091-K-01A	Pump Sale	MAKE UP COMPRESSOR	0
9040-091-K-01A	Suction I/V Flange	MAKE UP COMPRESSOR	0
9040-091-K-01A	Discharge Valve Flange	MAKE UP COMPRESSOR	0
9040-091-K-01A	PG Flange	MAKE UP COMPRESSOR	1
9040-091-K-01B	Pump Sale	MAKE UP COMPRESSOR	1
9040-091-K-01B	Suction I/V Flange	MAKE UP COMPRESSOR	1
9040-091-K-01B	Discharge Valve Flange	MAKE UP COMPRESSOR	2
9040-091-K-01B	PG Flange	MAKE UP COMPRESSOR	1
9040-091-K-01C	Pump Sale	MAKE UP COMPRESSOR	0
9040-091-K-01C	Suction I/V Flange	MAKE UP COMPRESSOR	1
9040-091-K-01C	Discharge Valve Flange	MAKE UP COMPRESSOR	0
9040-091-K-01C	PG Flange	MAKE UP COMPRESSOR	0
9040-091-K-02	Pump Sale	RECYCLE GAS COMPRESSOR	0
9040-091-K-02	Suction I/V Flange	RECYCLE GAS COMPRESSOR	0
9040-091-K-02	Discharge Valve Flange	RECYCLE GAS COMPRESSOR	0
9040-091-K-02	PG Flange	RECYCLE GAS COMPRESSOR	0
9040-091-P-01A	Pump Sale	MAIN FEED PUMP	0
9040-091-P-01A	Suction I/V Flange	MAIN FEED PUMP	0
9040-091-P-01A	Discharge Valve Flange	MAIN FEED PUMP	0
9040-091-P-01A	PG Flange	MAIN FEED PUMP	0
9040-091-P-01B	Pump Sale	MAIN FEED PUMP	0
9040-091-P-01B	Suction I/V Flange	MAIN FEED PUMP	3
9040-091-P-01B	Discharge Valve Flange	MAIN FEED PUMP	12
9040-091-P-01B	PG Flange	MAIN FEED PUMP	0
9040-091-P-03A	Pump Sale	WILD NAPHTHA PUMP	NR



Contd to page-2

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

Instrument No	Functional Loc	Description	Reading (ppm)
9040-091-P-03A	Suction I/V Flange	WILD NAPHTHA PUMP	NR
9040-091-P-03A	Discharge Valve Flange	WILD NAPHTHA PUMP	NR
9040-091-P-03A	PG Flange	WILD NAPHTHA PUMP	NR
9040-091-P-03B	Pump Sale	WILD NAPHTHA PUMP	1
9040-091-P-03B	Suction I/V Flange	WILD NAPHTHA PUMP	1
9040-091-P-03B	Discharge Valve Flange	WILD NAPHTHA PUMP	1
9040-091-P-03B	PG Flange	WILD NAPHTHA PUMP	0
9040-091-P-04A	Pump Sale	H2S STRIPPER REFLUX PUMP	0
9040-091-P-04A	Suction I/V Flange	H2S STRIPPER REFLUX PUMP	0
9040-091-P-04A	Discharge Valve Flange	H2S STRIPPER REFLUX PUMP	0
9040-091-P-04A	PG Flange	H2S STRIPPER REFLUX PUMP	0
9040-091-P-04B	Pump Sale	H2S STRIPPER REFLUX PUMP	NR
9040-091-P-04B	Suction I/V Flange	H2S STRIPPER REFLUX PUMP	NR
9040-091-P-04B	Discharge Valve Flange	H2S STRIPPER REFLUX PUMP	NR
9040-091-P-04B	PG Flange	H2S STRIPPER REFLUX PUMP	NR
9040-091-P-05A	Pump Sale	H2S STRIPPER BOTTOM PUMP	214
9040-091-P-05A	Suction I/V Flange	H2S STRIPPER BOTTOM PUMP	1
9040-091-P-05A	Discharge Valve Flange	H2S STRIPPER BOTTOM PUMP	1
9040-091-P-05A	PG Flange	H2S STRIPPER BOTTOM PUMP	1
9040-091-P-05B	Pump Sale	H2S STRIPPER BOTTOM PUMP	NR
9040-091-P-05B	Suction I/V Flange	H2S STRIPPER BOTTOM PUMP	NR
9040-091-P-05B	Discharge Valve Flange	H2S STRIPPER BOTTOM PUMP	NR
9040-091-P-05B	PG Flange	H2S STRIPPER BOTTOM PUMP	NR
9040-091-P-06A	Pump Sale	NAPHTHA STRIPPER REFLUX PUMP	NR
9040-091-P-06A	Suction I/V Flange	NAPHTHA STRIPPER REFLUX PUMP	NR
9040-091-P-06A	Discharge Valve Flange	NAPHTHA STRIPPER REFLUX PUMP	NR
9040-091-P-06A	PG Flange	NAPHTHA STRIPPER REFLUX PUMP	NR

Contd to page-3



- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

Instrument No	Functional Loc	Description	Reading (ppm)
9040-091-P-06B	Pump Sale	NAPHTHA STRIPPER REFLUX PUMP	0
9040-091-P-06B	Suction I/V Flange	NAPHTHA STRIPPER REFLUX PUMP	0
9040-091-P-06B	Discharge Valve Flange	NAPHTHA STRIPPER REFLUX PUMP	0
9040-091-P-06B	PG Flange	NAPHTHA STRIPPER REFLUX PUMP	0
9040-091-P-07A	Pump Sale	NAPHTHA STRIPPER BOTTOM PUMP	NR
9040-091-P-07A	Suction I/V Flange	NAPHTHA STRIPPER BOTTOM PUMP	NR
9040-091-P-07A	Discharge Valve Flange	NAPHTHA STRIPPER BOTTOM PUMP	NR
9040-091-P-07A	PG Flange	NAPHTHA STRIPPER BOTTOM PUMP	NR
9040-091-P-07B	Pump Sale	NAPHTHA STRIPPER BOTTOM PUMP	0
9040-091-P-07B	Suction I/V Flange	NAPHTHA STRIPPER BOTTOM PUMP	0
9040-091-P-07B	Discharge Valve Flange	NAPHTHA STRIPPER BOTTOM PUMP	0
9040-091-P-07B	PG Flange	NAPHTHA STRIPPER BOTTOM PUMP	0
9040-091-P-08A	Pump Sale	FEED PUMP	0
9040-091-P-08A	Suction I/V Flange	FEED PUMP	1
9040-091-P-08A	Discharge Valve Flange	FEED PUMP	0
9040-091-P-08A	PG Flange	FEED PUMP	0
9040-091-P-08B	Pump Sale	FEED PUMP	NR
9040-091-P-08B	Suction I/V Flange	FEED PUMP	NR
9040-091-P-08B	Discharge Valve Flange	FEED PUMP	NR
9040-091-P-08B	PG Flange	FEED PUMP	NR
9040-091-P-09A	Pump Sale	KEROSENE PUMP AROUND PUMP	0
9040-091-P-09A	Suction I/V Flange	KEROSENE PUMP AROUND PUMP	2
9040-091-P-09A	Discharge Valve Flange	KEROSENE PUMP AROUND PUMP	0
9040-091-P-09A	PG Flange	KEROSENE PUMP AROUND PUMP	0
9040-091-P-09B	Pump Sale	KEROSENE PUMP AROUND PUMP	NR
9040-091-P-09B	Suction I/V Flange	KEROSENE PUMP AROUND PUMP	NR
9040-091-P-09B	Discharge Valve Flange	KEROSENE PUMP AROUND PUMP	NR
9040-091-P-09B	PG Flange	KEROSENE PUMP AROUND PUMP	NR
9040-091-P-10A	Pump Sale	KEROSENE PRODUCT PUMP	1
9040-091-P-10A	Suction I/V Flange	KEROSENE PRODUCT PUMP	1



Contd to page-4

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.

Instrument No	Functional Loc	Description	Reading (ppm)
9040-091-P-10A	Discharge Valve Flange	KEROSENE PRODUCT PUMP	1
9040-091-P-10A	PG Flange	KEROSENE PRODUCT PUMP	1
9040-091-P-10B	Pump Sale	KEROSENE PRODUCT PUMP	NR
9040-091-P-10B	Suction I/V Flange	KEROSENE PRODUCT PUMP	NR
9040-091-P-10B	Discharge Valve Flange	KEROSENE PRODUCT PUMP	NR
9040-091-P-10B	PG Flange	KEROSENE PRODUCT PUMP	NR
9040-091-P-11A	Pump Sale	GAS OIL PUMP AROUND PUMP	0
9040-091-P-11A	Suction I/V Flange	GAS OIL PUMP AROUND PUMP	1
9040-091-P-11A	Discharge Valve Flange	GAS OIL PUMP AROUND PUMP	0
9040-091-P-11A	PG Flange	GAS OIL PUMP AROUND PUMP	0
9040-091-P-11B	Pump Sale	GAS OIL PUMP AROUND PUMP	NR
9040-091-P-11B	Suction I/V Flange	GAS OIL PUMP AROUND PUMP	NR
9040-091-P-11B	Discharge Valve Flange	GAS OIL PUMP AROUND PUMP	NR
9040-091-P-11B	PG Flange	GAS OIL PUMP AROUND PUMP	NR
9040-091-P-12A	Pump Sale	GAS OIL PRODUCT PUMP	NR
9040-091-P-12A	Suction I/V Flange	GAS OIL PRODUCT PUMP	NR
9040-091-P-12A	Discharge Valve Flange	GAS OIL PRODUCT PUMP	NR
9040-091-P-12A	PG Flange	GAS OIL PRODUCT PUMP	NR
9040-091-P-12B	Pump Sale	GAS OIL PRODUCT PUMP	0
9040-091-P-12B	Suction I/V Flange	GAS OIL PRODUCT PUMP	0
9040-091-P-12B	Discharge Valve Flange	GAS OIL PRODUCT PUMP	0
9040-091-P-12B	PG Flange	GAS OIL PRODUCT PUMP	0
9040-091-P-13A	Pump Sale	COLUMN RESIDUE PUMP	0
9040-091-P-13A	Suction I/V Flange	COLUMN RESIDUE PUMP	0
9040-091-P-13A	Discharge Valve Flange	COLUMN RESIDUE PUMP	0
9040-091-P-13A	PG Flange	COLUMN RESIDUE PUMP	0
9040-091-P-13B	Pump Sale	COLUMN RESIDUE PUMP	NR
9040-091-P-13B	Suction I/V Flange	COLUMN RESIDUE PUMP	NR
9040-091-P-13B	Discharge Valve Flange	COLUMN RESIDUE PUMP	NR



Contd to page-5

- The results relate only to the item(s) tested.
- This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.