नुमालीगढ़ रिफाइनरी लिमिटेड
भारत सरकार का उपक्रम
নুমলীগড় ৰিফাইনেৰী লিমিটেড
ভাৰত চৰকাৰৰ ওপক্ৰম

NUMALIGARH
REFINERY
LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
CIN: U11202AS1993GOI003893

Ref: Ref: NRL/ENV/PCBA/26-27/09

Date: 13 August 2026

To
The Member Secretary,
Pollution Control Board, Assam,
Bamunimaidam,
Guwahati-781021

Sub: Submission of Environmental statement in Form - V for the year 2025-26

Dear Madam,

We are submitting herewith the duly filled-in "Environmental Statement" in Form-V for the year 2025-26 for your kind perusal.

Hope, the same shall meet the requirement.

Thanking you.

Yours faithfully,

(Kothapalli Srinivas)
GM (Environment)
Numaligarh Refinery Limited

Copy: (i) RO, PCBA, Golaghat: For kind information please
(ii) Chief General Manager (Technical Services and R&D): : For kind information please

[FORM – V]

(See rule 14)

Environmental statement for the financial year ending the 31st of March 2026
(For Numaligarh Refinery Limited, Golaghat, Assam)

PART – A

(i) Name and address of the owner/occupier of the industry operation or process	: Mr. Girish Kumar Bora, Director (Technical), Numaligarh Refinery Limited, P.O. Numaligarh Refinery Project, Golaghat -785699, Assam
Co-ordination Office	: Tolstoy House, 6th Floor 15-17 Tolstoy Marg New Delhi-110001
Registered Office	: 122A, G.S. Road Christian Basti Guwahati-781005
(ii) Industry category Primary ----(STC code)	: Primary
Secondary-----(SIC Code)	Large Industry
(iii) Production capacity (Crude Throughput)	: 3.0 MMTPA
(iv) Year of establishment	: 22nd April 1993
(v) Date of the last environmental statement submitted	: 29th September 2025

PART – B

Water and Raw Material Consumption

(i) Water consumption M^3/d

Process water	:	2866
Cooling water	:	5339
Domestic water	:	3404

	Name of Products	Process water consumption per unit of product output	
		During the previous financial year (FY: 24-25)	During the current financial year (FY: 25-26)
		(1)	(2)
(1)	LPG	0.364*	0.336*
(2)	MS EURO VI		
(3)	ATF		
(4)	SKO		
(5)	Wax		
(6)	MTO		
(7)	HSD EURO VI		
(8)	RPC		
(9)	CPC		
(10)	SULPHUR		

*Production: FY-25-26: 3112569 MT & FY-24-25: 3065591 MT

(ii) **Raw Material Consumption**

	Name of Products	Consumption of raw material per unit of output	
		During the previous financial year (FY-24-25)	During the current financial year (FY-25-26)
		(1)	(2)
(1)	LPG	1.003*	1.001*
(2)	MS EURO VI		
(3)	ATF		
(4)	SKO		
(5)	Wax		
(6)	MTO		
(7)	HSD EURO VI		
(8)	RPC		
(9)	CPC		
(10)	SULPHUR		

*Raw material consumption:	2024-2025	2025-2026
(T'put during the year (in MT)((Design Capacity: 30,00,000 MT)	30,65,591	31,12,569

PART - C

Pollution discharged to environment/unit of output (Parameter as specified in the consent issued)

(1) Pollutants	Quantity of Pollutants discharged (mass/day), kg/day	Concentrations of pollutants discharges (Mass/volume) (avg.mg/L) (except pH)	Percentage of variation from prescribed standards with reasons
a) Water: Treated Effluent from ETP			
pH		7.43	All parameters are within prescribed limits/standards
Oil & Grease	2.40	1.63	
BOD3	9.37	6.35	
COD	52.05	35.28	
TSS	13.93	9.44	
Phenol	0.09	0.06	
Sulphides	0.00	<0.1	
CN	0.00	<0.02	
Ammonia as N	15.12	10.25	
Cr (Hexavalent)	0.00	0.00	
Cr (Total)	0.00	0.00	
Pb	0.00	0.00	
Zn	0.03	0.02350	
Ni	0.00	0.00100	
Cu	0.00	0.00000	
Benzene	0.00	<0.1	
Benzo (a)- Pyrene	0.00	<0.2	
Hg	0.00	<0.01	
V	0.00	<0.2	
TKN	16.85	11.42	
P	1.22	0.83	

(1) Pollutants	CPCB Standard (mg/L-(except pH)
pH	6-8.5
OIL & GREASE	5.0
BOD3	15.0
COD	125.0
TSS	20.0
Phenol	0.35
Sulphides	0.5
CN	0.2
Ammonia as N	15.0
Cr (Hexavalent)	0.1
Cr (Total)	2.0
Pb	0.1
Zn	5.0
Ni	1.0
Cu	1.0
Benzene	0.1
Benzo (a)-Pyrene	0.2
Hg	0.01
V	0.2
TKN	40.0
P	3.0

b) Air			
1) Stack Emissions			
SO_2	1477.89*		All parameters are within prescribed limits/standards
NO_x	1662.22		
CO	466.94		
PM	277.92		
2) Ambient air	Ambient air quality data as per NAAQS-2009 standards for 5 Manual Ambient Air Quality Monitoring Stations installed for NRL.		

*(60.73 kg/hr SO_2 emissions against prescribed limit of 256 kg/hr)

PART – D

HAZARDOUS WASTES

(As specified under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 as amended)

S. No.		Generation (MT)	Disposed (MT)	Stock (MT) as on 31-03-2025	Generation (MT)	Disposed (MT)	Stock (MT) as on 31-03-2026
(i)	Schedule-I, Category 4.1: Oily Sludge or emulsion (Tank Bottom Sludge)	265.04	22.580	2127.845	34.560	117.485	2044.920
(ii)	Schedule-I, Category 4.2: Spent Catalyst	Nil	Nil	3.22	28.020	26.490	4.750
(iii)	Schedule-I, Category 4.3: Slop oil (Slop oil of OM&S)	40,377.00	29,421.00 (Processed in CDU) & 3,988.00 (to authorized recycler)	84,311.00	41,662.00	32,919.00 (Processed in CDU) & 1,994.00 (to authorized recycler)	91,060.00
(iv)	Schedule-I, Category-5.1: Used or Spent Oil (Spent Lube Oil)	6.193	Nil	12.591	5.894	Nil	18.485

(v)	Schedule-I, Category- 33.1: Empty barrels/containers contaminated with hazardous chemicals/wastes	Empty drums: 3,060 Nos (Damaged: 0.3 MT)	Empty drums: 2775 Nos (Damaged: 1.2 MT) Internal Reuse = 768 Nos	Empty drums: 3921 Nos (Damaged: Nil)	Empty drums: 2775 Nos (Damaged: 11.3 MT)	Empty drums: 3283 Nos (Damaged: 10.92 MT)	Empty drums: 3313 Nos (Damaged: 0.38 MT)
	From Pollution Control Facilities						
(i)	Schedule -I, Category- 35.1: Exhaust air or gas cleaning residue (CPC dust)	338.17	Nil	2090.25	214.60	1094.85	1210.00
(ii)	Schedule-I, Category-35.3: Chemical Sludge from wastewater treatment (Chemical and Oily Sludge from ETP)	64.50	64.50	Nil	232.02	232.02	Nil
(iii)	Schedule-I, Category-35.4: Oil and grease skimming (Slop Oil of ETP)	17,549.00	Disposed: Nil (to authorized recycler) Internal Reuse: 18,112 MT	6881.00	20,463.00	Disposed: Nil (to authorized recycler) Internal Reuse: 19,965 MT	7378.00

PART – E

Solid Wastes

	During the current financial year (2024-25)	During the current financial year (2025-26)
(a) From Process		
Incinerable non-hazardous substances	Generation 4370 m^3= 920 MT	Generation 4275 m^3= 900 MT
(b)From pollution control facilities- NIL		
(c) (1) Quantity recycled or re-utilized within the unit.	NIL	NIL
(2) Sold	NIL	NIL
(3) Disposed	920 MT	900 MT

PART – F

Please specify the characteristics (in terms of concentration and quantum) of hazardous as well as solid waste and indicate disposal practice adopted for both these categories of wastes.

Sl. No.	Waste type	Characteristics	Quantum (Stock available)	Disposal Method
Hazardous waste				
1.	Tank Bottom Sludge	Oil content: 20-40%	2,044.92 MT	Tank bottom sludge generally is sold to CPCB/SPCB - recognized recyclers. The same is also disposed of through Bioremediation more scientifically and efficiently in the Refinery premises itself. To cater to the requirement, two nos. Bioremediation facilities (1200 m^3 each) are available for bioremediation of Crude Tank cleaning sludge.
2.	Spent Catalyst	Currently SRB spent catalyst (Alumina Claus catalyst) is available in stock.	4.75 MT	Spent catalysts are generally generated after a gap of 3/4 years when the catalyst is required to be replaced in the various units of the Refinery. After generation, the spent catalyst is kept in sealed drums at the demarcated place for onward selling to CPCB/SPCB-approved recyclers with due intimation to PCBA and following the stipulated guidelines/procedures. Spent catalysts are sold to CPCB/SPCB-authorized recyclers by following proper guidelines with intimation to SPCB.
3.	Slop oil	Oil content: 80 %	91,060.00 MT	Slop oil is generated from the process units in the refinery and is stored in the Slop oil tanks under the Oil Movement & Storage Unit. Slop oil is also generated in ETP during the wastewater treatment processes and the same is recovered and transferred to OMS for further treatment and processing. The slop oil generated is treated in a 3-phase decanter system for efficient slop management of the refinery and is reprocessed

				in the CDU. Slop oil is also sold to CPCB/SPCB authorized recyclers.
4.	Used or Spent Oil (Spent Lube Oil)	Oil content: >90 %	18.485 MT	Spent lube oil is usually generated in the refinery during the maintenance activities of the various equipments and machinery operated in the process plants. The spent lube oil generated is kept in drums at demarcated locations and is sold off to CPCB/SPCB-approved recyclers as per guidelines.
5.	Empty barrels/ containers contaminated with hazardous chemicals/wastes	-	3,313 Nos	A lot of barrels/containers/drums are used in the refinery for the intermittent storage of hazardous waste/ chemicals/ oil and lubricants etc. The empty barrels that are generated post respective usages are kept in demarcated locations and are disposed of by selling the same to CPCB/SPCB-authorized recyclers.
6.	ETP Sludge from wastewater treatment	Chemical Sludge: Oil content: 3.94 % Bio-sludge: Oil content: 1- 4 %	0 MT	Chemical & Oily sludge and Bio Sludge which is generated at different sections of the Effluent Treatment Plant (ETP) are collected in a sludge thickener through a sludge collection system. Floating oil with water from the thickener is recycled back to the Inlet Receiving Sump (IRS) of ETP for further processing and oil recovery. The thickened sludge from the bottom of the thickener is taken to the centrifuge feed sump for feeding to the centrifuge for recovering the absorbed oil from it. By using the highly efficient centrifuge, almost total oil is recovered from the sludge and is recycled back to the slop oil system for reprocessing. The cake from the centrifuge is disposed of in the Secured Landfill (SLF) as and when generated. A Secured Landfill (SLF) with a capacity of 6000 m^3 has been constructed inside the Refinery Premises.

Non-Hazardous solid waste				
1.	Incinerable solid waste	Paper waste	900 MT	Non-hazardous solid waste like- paper, hard boards, packing materials/papers, and cartons are collected from various locations of the refinery premises and stored in Solid waste collection yard. The same is then disposed through incineration process in Solid waste Incinerator package.

PART –G

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

NRL has determined the sources of pollution in various activities focusing on pollution load. Company's management is very careful and proactive regarding the environmental impacts of the new initiatives and products. NRL is conducting the Environmental Impact Assessment study of every project to understand the implications of setting up any new project or unit. Significant contribution made by NRL on the specific contribution on innovative clean technology, sustainability, broader user or target groups in the following fields:

a. Environment-friendly technology is adopted for highly polluting industries.
b. Innovativeness/creativity of clean technology.
c. Any significant contribution towards the manufacture of environmentally friendly products.
d. Abatement including reduction reuse, recycling, or any beneficial use of waste generated.
e. Substantial and steady reduction in the effluents and emissions in the year.
f. Success in defining environmental pollution needs meeting pollution prevention goals and overall improvements to the quality of air, water, and land.
g. Reduction of risk to the community living in the vicinity of units handling hazardous chemicals.
h. Sustainability of the developed environmentally friendly technology from financial, social, and ecological aspects.

As higher fuel consumption directly contributes to the higher emission of greenhouse gases affecting natural ecological processes, energy conservation efforts have received continuous focus at NRL since the conceptualization of the refinery by applying optimum consumption of fuel in furnaces thereby reducing the rate of emission of Green House Gases. It has adopted state-of-the-art energy efficient technology, high-efficiency furnaces with glass air pre-heaters, plate-type exchangers, installation of a captive co-generation power plant using a heat recovery system, maximization of waste heat recovery, installation and operation of power recovery turbine in the hydrocracker and other units, etc. NRL has adopted very advanced and comprehensive steps towards controlling pollution. From the very onset, the selection process of technologies and equipment was done with special care for environmental protection.

Details regarding some of the pollution abatement measures of NRL are as follows:

1. WATER

1.1 Effluent Treatment Plant with the latest technology:

A centralized modern Effluent Treatment Plant having tertiary treatment facilities has been installed. Also, ETP includes a three-stage oil recovery system from wastewater and a high-efficiency centrifuge for recovering oil from the oily sludge. To avoid hazardous solid waste generation, a more environmentally friendly hydrogen peroxide treatment process has been introduced. Discharge of Treated Effluent from ETP via dedicated pipeline has been discontinued since October 2000 and discharge of effluents from Sewage Treatment Plant has been discontinued since April 2007. The treated effluent from NRL Township is diverted to the ETP inside the Refinery by implementing suitable modifications in the disposal line in ETP. The treated water from Township STP is received at the aeration tank. The outlet at Numaligarh Jetty in river Dhansiri has been blinded and the discharge from township STP also has been routed to ETP through the same line. About 60-70% of the effluent treated is being reused/recycled in miscellaneous refinery activities and as Firewater makeup and the rest quantity is system/operational losses in ETP due to various constraints. As a part of ETP modernization VOC recovery system has been also implemented.

1.2 Implementation of Hydrogen Peroxide Treatment

H_2O_2 treatment process has been introduced for the chemical treatment of wastewater in the ETP by replacing the conventional $FeCl_3$ process. The introduction of this technique has reduced the solid waste generation drastically.

1.3 Installation of oil catchers in the stormwater drains

Several oil catchers have been installed and hay filters, and oil absorbent booms are placed in the refinery stormwater system as a preventive measure to eliminate any possibility of oil being carried over to the outside environment.

2. AIR:

2.1 Low Nox burners in Furnaces: All the furnaces are provided with ultra-low NOx burners.

2.2 Use of low sulfur fuel for the Refinery furnace: Sweet fuel gas, after removing sulfur in the Amine Treatment Unit of Sulphur Recovery Block (SRB) is used in the refinery furnaces.

2.3 High Stack Height: To reduce the ground-level concentration of pollutants, the height of stacks at different plants in the refinery is kept at 60 meters. Further, the height of the stack at the Coke Calcination Unit is kept at 77 meters.

2.4 Unique Ground Flare System: To avoid any adverse impact of the flare on wild animals in the Kaziranga National Park, a non-illuminating ground flare has been incorporated, which is the first of its kind in the country.

2.5 Sulfur Recovery Plant: Assam crude is sweet crude (only 0.26 % Sulfur content). Despite processing low-sulfur Assam crude, a Sulfur Recovery Unit (SRU) has been installed to remove sulfur from sour water and sour gas generated during the refining process. Subsequently, its capacity has been enhanced from 14.6 Tonnes Per Day to 19.3 Tonnes Per Day in the year 2010 commensurate with the Diesel Quality Upgradation Project. Implementation of a new train of Sulphur Recovery Unit (SRU) has been taken up for parallel execution to meet future environmental requirements along with the implementation of Tail Gas Treating Unit (TGTU). As a remarkable achievement, NRL successfully commissioned the Tail Gas Treating Unit (TGTU) in Feb'24, and sulphur recovery efficiency increased from the existing 96% to 99 %.

2.6 Installation of double mechanical seals in Floating roof tanks: In an effort towards controlling fugitive emission and vapor loss from hydrocarbon storage areas, double mechanical seals are being installed in floating roof tanks in the refinery & marketing terminal adjacent to the refinery.

2.7 Leak Detection and Repair (LDAR) Programme: Leak Detection and Repair (LDAR) Programme has been implemented in the refinery for detection of fugitive emissions.

2.8 Dust mitigation activities: 3 nos. of Mist Cannons are being utilized at project/construction sites as per requirement for control of dust pollution. Water sprinkling using tankers along major haul roads of the refinery is also being carried out. A wheel washing system has been installed for vehicles exiting the Refinery Project gate for the control of dust pollution outside the refinery premises along with regular water sprinkling on the roads by tankers. Permanent water sprinkling arrangement has been installed in the Coke Calcination Unit (CCU) yard, and the installation of 2 mist cannons in the CCU yard has been completed to control fugitive dust emission from CCU.

2.9 Maximum product evacuation through pipeline: About 80% of the product evacuation takes place via NSPL (Numaligarh Siliguri Pipeline) thereby contributing as an initiative towards reducing vehicular traffic for product despatch.

2.10 Diversion of National Highway No. 39: Diversion of National Highway no.39running by the side of the refinery was done to an alternate route thereby reducing congestion and overcrowding of traffic.

2.11 Green Belt development: An ambitious plan of green belt development has been adopted around the refinery to serve as a barrier to air pollutants and noise. A green belt around the refinery and the marketing terminal covering 56 Ha of land has been developed, thereby rendering a perfectly natural barrier to the industrial noise, minor air pollutants from reaching the immediate surroundings, both human population, rich flora & fauna and help in mitigating the effects of fugitive emission in all around Refinery. There are green covers of tea gardens (tea bushes and shed trees) in the northern and southern boundary of the refinery with approx. 260 hectares, contiguous to the refinery Green Belt. The township situated about 5km from the refinery is spread over 250 acres area. Although the township is full of natural green vegetation, large nos. of trees have been planted on both sides of roads and other parts of the township. Initially plantation of around 1,25,000 nos of saplings of various species was carried in the Green Belt around Refinery and 20,000 nos in the Green Belt around NRMT. Massive plantations are being carried out every year in the Green Belt to increase the density of trees. Around 55900 saplings have been planted in the Green Belt area during 2000-2018. Plantation activities inside the Refinery as well as outside the refinery have been carried out in a phased manner considering weather conditions. The meticulously planned and developed green belt all around the refinery has now grown into rich foliage, rendering a perfectly natural barrier to the industrial noise and minor air pollutants from reaching the immediate surroundings, both the human population and the rich flora and fauna. NRL is

aggressively pursuing tree plantation in the refinery area with a plantation of around 7000 saplings during 2018-2021. Plantation drives in nearby areas of the refinery are taken from time to time under various schemes & programmes.

Township environment: Keeping the environment as a prime concern, NRL has envisaged an ambitious experimental project for the first time in the country. This unique project called "Butterfly Eco System" located in the Refinery Township is an effort to give a natural habitat for butterflies to come, stay, and breed in their natural way. Also, a unique herbal garden of rare medicinal plants called "Smritibon" has been developed in the township. In addition, the plantation of various saplings has also been carried out on a wide scale all along the roadsides in the Township & the Butterfly Valley. More than 84% of green cover is maintained in the Township.

3. WASTE

NRL has taken up a lot of advanced & innovative initiatives in the management of Waste generated in the refinery.

Management of various types of waste generated in the refinery is described below:

3.1 Chemical and Oily sludge/Bio-sludge: Chemical and Oily sludge/ Bio-sludge generated at different sections of Effluent Treatment plant are centrifuged in the highly efficient Centrifuge to further remove the oil content. After centrifuge, the cake is kept in sealed drums which are then disposed of in the Secured Landfill.

3.2 Tank Bottom Oily Sludge: Tank bottom sludge generally is sold to CPCB recognized recyclers. The same is also disposed of through Bioremediation more scientifically and efficiently in the Refinery premises itself. Cleaning of Tank bottom has been done by adopting modern tank cleaning methods using a Tricanter centrifuge system for maximum recovery of hydrocarbon from the sludge generated and reduced sludge generation.

3.3 Spent Catalyst: Spent catalysts are generally generated after a gap of 3/4 years and are sold to CPCB/SPCB recognized recyclers by following proper guidelines with intimation to SPCB.

3.4 Slop oil: The slop oil generated is treated in a three-phase decanter system for efficient slop management of the refinery and is reprocessed in the CDU.

3.5 Spent Lube oil: The spent lube oil generated is sold off to CPCB/SPCB approved recyclers as per guidelines.

3.6 Empty Contaminated Barrels: The empty barrels that are generated post respective usages are disposed of by selling the same to CPCB/SPCB authorized recyclers.

3.7 Registration on National Hazardous Waste Tracking System (NHWTS): NRL has also successfully registered in the NHWTS, an online portal developed by CPCB for tracking the generation, transformation, storage, recycling, utilization, and disposal of Hazardous Waste in the country.

3.8 Plastics waste: The plastic packaging waste like stretch films generated in the Wax slabbing unit is collected back by the respective vendors. NRL has received the Registration certificates for Brand Owner and Importer as per the Extended Producers Responsibility (EPR) regime under implementation in Plastic Waste Management Rules, 2016.

3.9 E-waste: The defective components of repaired machines are taken back by the contractors after replacement. Laptops have a buy-back company policy. Desktops are mostly reused in low-priority areas and donated through CSR. The balance minimum nos. are handed over to the warehouse for disposal through auction from time to time.

3.10 Used Batteries: Used batteries are disposed of through the manufacturers/ vendors as buy-back arrangements.

3.11 Non- Hazardous Solid waste management: NRL has installed a 200 kg/hr Solid waste Incinerator with air pollution control equipment for incineration of non- hazardous incinerable waste generated in the refinery

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution:

1. **Biodiversity and Afforestation Initiatives**: NRL has taken up three major flagship initiatives for plantation under Afforestation Drive in degraded areas:

   1.1 Nakkati Chapori, Golaghat: An MoU was signed on 14.09.2020 between NRL and Golaghat Social Forestry Division, Government of Assam, for the plantation of 1 lakh tree saplings (equivalent to 2200 Ton of CO2 absorption per annum), towards compensatory afforestation of 40 Hectares of degraded land in Nakkati Chapori under Khumtai Revenue Circle of Golaghat. 90,000 saplings plantation has been completed as on date.

   1.2 Kandoli Reserve Forest, Nagaon: An MoU was signed on 23rd August 2021 between NRL and Nagaon Forest Division, Govt. of Assam for compensatory afforestation of 35 Hectare land in Kandoli PRF under Nagaon Forest Division with a total budget of ₹1.97 Crore for the plantation of approx. 68000 tree saplings (equivalent to 1496 Ton of CO2 absorption per annum). The progress of the plantation drive is highly satisfactory with the plantation target been already achieved at Kandoli PRF.

   1.3 Abhoypur Village, Dibrugarh: In a significant development, NRL has also taken up its 3rd compensatory afforestation project in 28 Ha. land in Abhoypur Village, Dibrugarh District at a project cost of ₹ 2.2 crore by signing MoU with Dibrugarh Forest Division on 29.05.2024. Plantation target of 3,50,000 saplings (equivalent to approx.7700 Tons of CO2 absorption per annum) has been completed at the site.

   1.4 Establishment of Bamboo Nurseries: As an initiative for mitigation of climate change and environment sustainability, NRL has undertaken a project for the development and construction of three Bamboo Nurseries in the state of Assam to generate 60 lakh saplings to be planted in 15,000 hectares of land area, which will create a carbon sink to fix 2.6 lakh ton CO2 from the air per annum. MoU was signed between NRL and PCCF & HOFF, Assam on 23rd Jan'2023 for the establishment of the 3 nurseries of 5 ha. each at a project cost of ₹ 9 crore for the macro proliferation and nurture of tissue cultured Bamboo saplings

which will be made available to the farmers in Assam and other neighbouring states. The primary hardened bamboo saplings for the nurseries are being supplied by M/s. Chroma Biotech, Dibrugarh.

1.5 Green Credit Programme: Under Green Credit Program (GCP), NRL has acquired a 55-hectare plantation block in Nawada District, Bihar. A total of 60,500 saplings will be planted on this site, contributing to an estimated annual sequestration of 1,300 tonnes of CO_2. The Green Credit Programme (GCP), launched by the Government of India and notified on 13.10.2023 market-based mechanism aimed at incentivizing voluntary environmental actions, with a particular focus initial phase. This initiative of NRL aligns with the objectives of GCP to encourage eco-restoration through the creation of a dynamic land bank accessible to various stakeholders for sustainable land development.

2. **Secured Land Fill Facility:** As per CPCB recommendations with the latest technic/scientific design, a Secured Landfill with capacity of around 6000 m^3 is in operation in the Refinery premises to cater the needs for disposal of Chemical & Oil Sludge.

3. **Bioremediation facility:** Two nos. of Bioremediation facilities (1200 m^3) are available in the refinery for bioremediation of tank bottom oily sludge. 236.67 MT of accumulated Oily sludge generated in the refinery has been sold to CPCB approved recycler.

4. **Decanter System:** A three-phase decanter system has been commissioned for efficient slop management of the Refinery. About 50-70 KL of slop can be processed per day and the resultant processed slop can be directly transferred to the CDU unit for re-processing along with crude.

5. **Phycoremediation of Oily Suldge:** NRL has successfully completed a pilot project for treatment of oily sludge (a hazardous waste generated from refinery) with phycoremediation technology provided by DRIIV (Delhi Science & Technology Cluster) under the O/o Principal Scientific Advisor to the Govt Of India. After success of the pilot project, NRL is planning to implement a scale-up project for the phycoremediation technology which will be the first of its kind for any Indian oil refinery.

6. **Zero Liquid Discharge:** NRL is implementing total Zero Liquid Discharge for existing refinery and NREP for conservation and recycling of water. Feasibility study for installation of a modern ZLD plant has been carried out.

7. **Availing TSDF facilities:** NRL has lined up membership with a Treatment, Storage and Disposal Facility (TSDF) located in Dibrugarh approved by Pollution Control Board, Assam to comply with the environmental regulations for management of the hazardous waste generated in the refinery.

8. **Flare Gas Recovery System:** Numaligarh Refinery was originally designed with a twin flare system i.e., the ground flare and the elevated flare to avoid any adverse impact of the illumination of flare on animals and migratory birds in the surrounding wildlife sanctuaries and protected forest including Kaziranga National Park. In normal operation, the ground flare is in line and only the pilot burner is lit up in the elevated flare. The elevated flare caters to the load during plant emergencies when the flare load is very high or during maintenance of the ground flare system. As a measure for the further protection of the environment & conservation of energy, the Flare Gas Recovery System has been implemented to recover and reuse the excess gas going to the flare. The flare Gas Recovery System (FGRS) supplied by M/s Garo SPA, Italy was successfully commissioned in the year 2018-19. Implementation of the Flare Gas Recovery System has not only reduced specific energy consumption of the refinery but has also reduced Greenhouse gas emissions.

9. **Installation of Ambient Air Quality Monitoring Station (CAAQMS):** To monitor ambient air quality, 5 Nos. manual Ambient air quality monitoring stations (AAQMS) have been installed including one in Kaziranga National Park. 2 Nos. Continuous Ambient air quality monitoring stations (CAAQMS) have also been installed within the refinery premises. Another CAAQMS is being planned to be installed as a part of NREP activities. Initiative has been also taken for the installation of 2 Nos. CAAQMS at outside refinery premises and near Kaziranga National Park.

10. **CDM Projects:** NRL has installed a 12.0 MW Steam Turbine Generator (STG) to utilize and recover waste (thermal/pressure) energy of HP steam. This project has been registered as a CDM Project and NRL has earned Carbon Emission Reductions (CERs) from UNFCCC.

11. **Fuel switch over:** NRL has entered a JV with Oil India Ltd (OIL) and Assam Gas Company Ltd (AGCL) to form the Duliajan Numaligarh Pipeline (DNPL) who laid a 192 KM pipeline from Duliajan to Numaligarh to supply Natural Gas (NG) which is currently used at Captive Power Plant (CPP) and Hydrogen Unit of NRL instead of Naphtha. This has resulted in the reduction of carbon emissions.

12. **Transmission of online real-time data:** Transmission of online real-time data with remote alert facility for SO_2, NO_x, CO, PM, and Ambient Air quality to CPCB server has been implemented. As per directions of CPCB, online transmission of Treated effluent data for four parameters i.e. pH, TSS, BOD, COD, and flow have been implemented.

13. **Estimation of Carbon Footprint and Green House Gas Emission:** NRL is focusing on energy efficiency and building carbon sink to minimize GHG emission and achievement of NET ZERO by 2038.

- NRL continues to monitor its Greenhouse Gas (GHG) emissions and obtains independent validation from an accredited agency with limited assurance covering direct and other indirect emissions (Scope 1 and Scope 3; no Scope 2 emissions at present). The assurance is conducted under the operational control approach in accordance with the API Compendium (2021), ISO 14064, the GHG Protocol, ISAE 3000 (Revised), and ISAE 3410. During FY 2025–26, NRL's GHG emissions (provisional) reduced to 0.761 million tonnes of CO_2 equivalent from 0.768 million tonnes in FY 2024–25 (Assured by M/s TUV India Pvt. Ltd.), while crude processing increased from 3.065 MMTPA to 3.112 MMTPA, demonstrating improved carbon emission intensity.

14. **Despatch of Ethanol Blended Motor Spirit**

NRL has commenced despatch of Ethanol Blended Motor Spirit (EBMS) from its Marketing Terminal in Numaligarh for supply to Retail Outlets located in North-East India. The first tank truck loaded with EBMS was despatched on 03-03-2022 from Numaligarh Refinery Marketing Terminal to be sold through BPCL Retail Outlet. This augurs well with the Govt of India's target to achieve 20% blending of Ethanol with MS (Petrol) by 2025.

India imports 85% of its crude oil requirement. Ethanol, produced domestically, blending in Motor Spirit (Petrol) assumes significance at a time when the Govt. of India is focused on reducing import dependence, thereby saving on foreign exchange while promoting green energy. Also, ethanol is a less polluting fuel and offers equivalent efficiency at a lower cost as compared to MS (Petrol).

NRL has recently commissioned 2 above-ground tanks of capacity 860 KL each, through its subsidiary ABEPL, along with modification of existing truck loading gantry facilities to enable online blending of Ethanol in required proportion before it is dispatched to its customers. NRL's joint venture company, M/s Assam Bio-Ethanol Pvt. Ltd. which is executing the first 2G biorefinery with bamboo mass as feedstock and bioethanol as one of the products is all set to be commissioned in the latter part of this year, which will substantially cater to the ethanol requirement in the Northeast region and beyond.

PART – I

Any other particulars for improving the quality of the environment:

1. As a part of continuous efforts towards reduction of emissions, Numaligarh Refinery produces ultra –low sulphur High Speed Diesel and motor spirit having less than 0.001% (10ppm) sulphur conforming to the Euro-VI Specifications. This contributes to reducing pollution from diesel and petrol vehicles due to the reduction in emission of Sulphur dioxide into the atmosphere.

Numaligarh Refinery Limited (NRL) has upgraded its refinery for production of BS-VI HSD to meet product quality requirements as per the Auto Fuel Policy of the Government of India by the implementation of the Diesel Hydro Treater Project (DHDT), which was commissioned in January 2018. NRL has also increased the capacity of its MS plant by 50% in 2019 and the entire quantity of MS produced meets BS VI standards.

As an advanced step towards environment protection, NRL has installed four mounded Bullets which are more environmentally friendly and safe for the storage of LPG replacing the existing LPG spheres.

2. Energy conservation measures:

Numaligarh Refinery Limited (NRL) continues to prioritize energy conservation and operational efficiency through rigorous monitoring of Energy Performance Indicators (EnPIs) across all process units.

During FY 2025–26, the refinery achieved a Specific Energy Consumption (SEC) of 60.58 MBN against the target of 60.0 MBN. The Energy Intensity Index (EII) for the year stood at 80.28, reflecting NRL's sustained efforts towards energy-efficient operations.

During FY 2025–26, the refinery achieved a Specific water Consumption achieved 143.91 MTN against the target of 144 MTN.

As part of its commitment to sustainable energy adoption, NRL operates a solar photovoltaic (PV) installation with a total capacity of 1.05 MW, contributing approximately 0.4% of the refinery's captive power generation. During FY 2025–26, the solar PV system generated 755.68 MWh of clean energy, resulting in an estimated reduction of 402.71 tonnes of CO_2 equivalent (CO_2e) emissions. To further strengthen its renewable energy portfolio, NRL has engaged M/s NTPC Vidyut Vyapar Nigam Limited (NVVN) as the Project Management Consultant (PMC) under the CAPEX mode for implementation of additional solar power projects. The proposed

installations, with an aggregate generation potential of approximately 1.2 MW, are planned across various identified locations within the refinery premises under the PM Surya Ghar: Muft Bijli Yojana scheme.

2.1 Energy Efficiency Improvement Measures during the year FY'2025-26:

- Steam heat tracing is being replaced by electric heat tracing for VR line from tank R/d to pump suction.
- Rainwater Harvesting system initiated for Annex Building at NRL site.
- Ensuring Steam trap performance rate at >98% in working condition.

Other Highlights

- Recertification audit of EnMS ISO-50001:2018 successfully completed in FY'25-26.
- Joint Steam Leak Survey conducted by CHT nominated refinery experts has been successfully completed in February 2026.
- NRL procured 30,544 nos. of Renewable Energy Certificate (RECs) on PXIL trading platform to fully comply Renewable Consumption Obligation (RCO) for period FY'2024-25 under CPP owner category.
- Mandatory Energy Audit was conducted as per BEE guideline through accredited agency to comply with Energy Conservation Act 2003.
- Comprehensive Water Audit was conducted for the entire refinery

3. Technology Absorption, Adaptation and Innovation measures:

3.1 Numaligarh Refinery Expansion Project (NREP): NRL is in the process of augmenting its refining capacity from 3.0 MMTPA to 9.0 MMTPA, by setting up a new refinery train of 6.0 MMTPA in the existing premises. The project is being executed using a mixed implementation model engaging a combination of PMC, EPC, EPCM, and other supporting consultants. The Hydrogen Generation Unit will be set up in "JOB WORK" mode. Delivery of Process Package, including engineering for all the units are completed. Overall project progress made as on 31.05.2025 is 78%. Noteworthy technologies adopted are PFCC unit for high yield of Propylene and Ebullated Bed Resid Hydrocracker (RPTU) for bottom upgradation. Capacity expansion of NRL from 3.0 MMTPA to 9.0 MMTPA will ensure additional availability of petroleum products primarily LPG, MS and HSD in the NE and Eastern region of India and meet the growing energy demand in the region. Additionally, NRL will also export HSD to Bangladesh through the Indo Bangla Friendship Pipeline (IBFPL) commissioned during March 2023.

3.2 Bio-Ethanol Project : NRL is setting up a 49 TMTPA Bio-Ethanol project as a joint venture company promoted by NRL with 50% equity and a balance of 50% by Fortum 3. B.V Netherland and Chempolis Oy, Finland for producing ethanol from cellulosic feedstock 'Bamboo'. The process to produce bioethanol from bamboobiomass is based on the Formicobio Technology from M/s Chempolis. Overall progress of the project is 99.5% as on 15.05.2025. Bio-Ethanol production from the Bio- Refinery shall be used in blending with Motor Spirit by North-East refineries. Bio Refinery project will help in meeting the 20% Ethanol Blended Petrol (EBP20) programme of GOI's National Biofuel Policy by 2023-24 which will in turn help to strengthen the country's energy security, enable local enterprises and farmers to participate in the energy economy and reduce vehicular emissions.

3.3 Wax Pastillation Unit: NRL has commissioned a new Wax Pastillation Unit (WPU) during March 2023 with a production capacity of 144TPD. M/s IPCO, Germany is the technology provider and process licensor of the WPU. The technology involves an efficient and cost- effective process, in which molten liquid wax is converted into pastille form (5 to 6mm size). Pallet Wax from Wax Pastillation Unit will cater to additional demand from customers and will enhance flexibility in marketing of Paraffin Wax. This plant will also improve capacity utilization of Wax block as existing ASPU is sensitive to maintenance.

3.4 Aq. Ammonia Project: NRL is setting up an Aqueous Ammonia plant to meet 10 TPD Aq. Ammonia requirement in Bio-refinery to maintain pH for proper performance of enzymes. It is noteworthy that NRL is going to produce Aq. NH3(25%) from a waste NH3 rich stream of sour water stripper utilizing technology that is developed jointly by NRL & EIL. Aq. Ammonia 25% (NH_3) production will reduce NO_X generation from refinery. Moreover, this project will convert waste to value added by product.

3.5 Tail Gas Treating Unit (TGTU): TGTU was successfully commissioned on 15th February 2024. TGTU technology with the trade name Eng SulfTG® is developed by EIL to effectively remove sulfur by recycling the unreacted sulfur components like H2S, SO2, COS, & Sulphur by converting to H2S in Hydrogenator & recovering as Sulphur in the Claus section in Sulphur Recovery Unit (SRU). Claus process integrated with Tail gas treating unit (TGTU) is designed based on EngSulfTG® technology and can result in 99.9% removal of sulfur from acid gas & sour gas coming from amine regeneration & Sour water stripper units in refinery. This technology is also adopted in the NREP SRU. With the commissioning of TGTU, SO_2 emission of SRU has significantly decreased from 6000 ppm without TGTU to 100-300 ppm with TGTU. Accordingly, the Sulphur recovery efficiency has improved from 96.0% to 99.9% with additional production of sulphur of around 4 % & it has added to NRL's continuous endeavor towards a safe and clean environment.

3.6 Green Hydrogen: NRL has been playing a pivotal role amongst the Indian PSU to meet the Green Hydrogen Consumption Obligation (GHCO) as per the Govt. of India mandate. Green Hydrogen offers a renewable energy-based alternative for meeting Hydrogen requirements in fertilizer production andpetroleum refining. This has the potential to reduce the country's dependency

on fossil fuels, energy security,and a step towards achieving the Net Zero goal. NRL is setting up a 2.4 KTPA (16 MW)Alkaline Electrolyzer (AEL) to produce 300 Kg per hour of Green Hydrogen. The project is awarded to M/s Greenko ZeroC for implementation with Electrolyzer to be supplied by M/s John Cockril, Belgium. NRL will meet 5% of GHCO by 2026-27 after commissioning of the project. NRL also floated a tender in May'2025 for setting up a 10 KTPA GH2 plant under SIGHT 2B scheme of MNRE & MOPNG. The plant will be set up under Build Own and Operate (BOO) model. Green Hydrogen is a renewable energy alternative for meeting Hydrogen requirements in the refinery. This has the potential to reduce the country's dependency on fossil fuels, energy security and a step towards achieving the Net Zero goal.

3.7 Proposed Polypropylene Unit (PPU): In line with NRL's future petrochemical roadmap, a 360 KTPA Polypropylene Unit(PPU) project is planned to be implemented. It will receive Propylene feedstock from a high severity Petro-FCC unit being set up under NREP. M/s Lummus Novolen GMBH, Germany, is the process licensor for the proposed Polypropylene unit producing 360 KTPA Homopolymer grade Polypropylene. Basic Engineering Design Package for the unit is already completed. Environmental clearance for the Project was obtained in August 2024 and subsequently order was placed with M/S Engineers India Limited (EIL) engaging as EPCM consultant in the of Mar'2025. This proposed PPU project is being implemented inside existing NRL site at Numaligarh and its contractual completion is March'2028 which is36 months from the date of placement of order to M/s. EIL. Considering the impressive growth of polypropylene in the domestic market, the 360 KTPA Polypropylene unit will help NRL to venture into the petrochemical market. Post implementation of the PPU project, NRL's Petrochemical Intensity Index (PII) which is a measure of the proportion of Petrochemical product produced out of the refinery throughput, will elevate from zero to 3.9. Addition of PPU is also expected to enhance NRL's Gross Refinery Margin (GRM) by ~ 1$ per barrel.

Initiative for solar power: As part of its commitment to sustainable energy adoption, NRL operates a solar photovoltaic (PV) installation with a total capacity of 1.05 MW, contributing approximately 0.4% of the refinery's captive power generation. During FY 2025–26, the solar PV system generated 755.68 MWh of clean energy, resulting in an estimated reduction of 402.71 tonnes of CO_2 equivalent (CO_2e) emissions. To further strengthen its renewable energy portfolio, NRL has engaged M/s NTPC Vidyut Vyapar Nigam Limited (NVVN) as the Project Management Consultant (PMC) under the CAPEX mode for implementation of additional solar power projects. The proposed installations, with an aggregate generation potential of approximately 1.2 MW, are planned across various identified locations within the refinery premises under the PM Surya Ghar: Muft Bijli Yojana scheme.

4. Research and Development (R&D) Activities:

NRL has been actively pursuing targeted R&D initiatives through collaborations with premier academic and research institutions. These partnerships aim to advance technological excellence across refinery operations, develop innovative value-added products, and enhance the quality of existing petroleum offerings in line with NRL's strategic and sustainability objectives. Below is a summary of key research collaborations and ongoing R&D initiatives:

4.1 NRL Centre of Excellence for Sustainable Materials at IIT Guwahati

4.1.1 Development of Sustainable Materials

- Biodegradable Packaging: A project titled "Development of Biodegradable Plastics from Oil and Bio-Ethanol Plant Streams" is underway to convert furfural (a bio-refinery by-product) into Polycaprolactone for moulding into eco-friendly packaging materials.

- Green Activated Carbon Production: Aimed at circular economy solutions, a demonstration scale project for converting 5 MT/batch of waste bamboo dust into marketable grade green activated carbon is in progress.

4.1.2 Carbon Neutrality

- "H_2 Separation and CO_2 Capture from PSA Off- Gas": This project seeks to integrate Liquid Piston Compression, Metal Hydride, and Membrane Technologies for hydrogen recovery and CO_2 capture, aligning with NRL's decarbonization roadmap.

4.1.3 Business Process Automation

- "AI-Based Procurement RFx Automation": In collaboration with IIT Guwahati, this initiative aims to digitize and streamline procurement workflows while ensuring compliance with Government of India procurement norms.

4.2 Wind Energy Resource Assessment: In partnership with Assam Kaziranga University and the Institute of Frontier Science and Application, NRL is supporting a study on "Assessment of Wind Energy Potential in Northeast India." Two LIDAR units have been deployed across riverine sites in the Brahmaputra Valley to collect high-frequency wind data at turbine height. This bankable data will support future wind energy project feasibility in the region.

4.3 Waste to Wealth – Phenol Recovery: In collaboration with CSIR-NEIST, a project titled "Removal of Phenol from Sour and Stripped Water for Reuse and Value Addition" is in progress. Lab-scale studies with 50L batches using hollow fiber membrane modules were successfully conducted. A 1 m^3/hr pilot unit is now under development for installation at NRL to reduce water footprint and recover value-added chemicals.

4.4 Refinery Waste Management Using Cyanobacteria: A project in collaboration with St. Edmund's College, Shillong, focuses on bioremediation of refinery waste using cyanobacteria. It targets crude oil, tank bottom sludge, and ETP hydrocarbon sludge. After 28-day treatment cycles, the Total Petroleum Hydrocarbon (TPH) content was reduced to near zero in test samples, demonstrating significant potential for sustainable waste treatment.

4.5 R&D PROJECTS

- **Green Hydrogen production at NRL**: NRL is setting up a 2.4 KTPA green hydrogen plant on EPC basis, which is targeted to be commissioned by October 2026. At present about 42% of job has been completed. NRL has awarded LoA to M/s Neuen Green Energy Pvt. Ltd. on 23rd March 2026 to set up a 10 KTPA Green hydrogen on BOO (Build, Own and Operate) basis and to supply Green Hydrogen for use in refinery, under SIGHT 2B scheme of MNRE. The contractual period of the BOO contract is 25 years. Total 0.124 MMTPA of CO_2 emission will be reduced post commissioning of these plants.

- **SAF initiative by co processing in existing DHDT**: It is proposed to re-purpose the existing DHDT for production of SAF blended ATF by 5% co-processing of UCO with kerosene, as feedstock. The DFR of the project is completed.

- **200 KTPA SAF production in Paradip**: NRL is planning to produce 200 KTPA SAF through a green field project using palm oil or UCO as feed stock. PFR of the project is completed.

- **Repurposing of Grey H2:** NRL is planning to implement a 270 TPD CO recovery plant from SMR (Steam Methane Reformer) gas of HGU and 190 TPD of CO_2 liquefaction plant for EOR activities in Oil India Limited. DFR has been

completed by M/s Topsoe. The CO produced shall be used downstream valuable chemicals, e.g Acetic acid, acetic anhydride, formic acid etc. This repurposing will reduce 0.2 MMTPA CO_2 emission from existing Hydrogen plant.

4.6 R&D Projects with Rajiv Gandhi Institute of Petroleum Technology (RGIPT), Amethi: A Memorandum of Agreement was signed on 13.11.2024 for the following projects:

- **Electrocatalytic conversion** of H_2S and NH_3 in sour water into Sulfur, Hydrogen, and Ammonium Sulphate
- **Methanol-diesel blending** for fuel stability
- **Lignin-based bio-adhesives** and process optimization
- **Electrochemical conversion** of ethanol-water into acetic acid and hydrogen
- **Development of corrosion inhibitors** for methanol-blended diesel systems. These strategic R&D engagements reflect NRL's commitment to innovation, sustainability, and process excellence. They play a crucial role in driving long-term.

4.7 R&D Collaboration

(i) WITH CSIR-IIP : For development of indigenous technology for production of SAF through HEFA (Hydrogenated Ester and Fatty Acids).

(ii) WITH CSIR-NPL: For development of technology for production of Graphite from Refinery Pet Coke.

Research themes include:

- Development of **nanocomposite membrane** for CO_2 capture
- **Hybrid nano-catalysts** for green hydrogen production
- **Graphene-like nanomaterials** from petroleum waste
- **Multienzyme production** for bamboo-based bio-refinery applications

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