



# Petronet LNG Limited

GIDC Industrial Estate, Plot No. 7/A, Dahej,  
Taluka : Vagra, Dist. Bharuch (Gujarat) - 392130 (India)  
Tel. : 02641 - 670200 / 257  
www.petronetlng.com  
CIN: L74899DL 1998PLCO93073  
GST No. : 24AAACP8148D1ZM

REF: PLL/DHJ/HSE/MoEF/2023/05

Date: 27<sup>th</sup> July, 2023

To,

The Director (Environment)  
Forests & Environment Department,  
Government of Gujarat,  
Block No. 14, 8<sup>th</sup> Floor, Sachivalaya,  
Gandhinagar – 382 010  
(Fax No.: 079-23252156)

**Subject:** Half-yearly Compliance Report with respect to conditions stipulated by Ministry of Environment & Forests, Govt. of India and Department of Forests, Govt. of Gujarat for Installation of Terminal facilities to handle additional 10 MMTPA of LNG (Phase IIIA & Phase IIIB) at PLL Dahej, Gujarat by Petronet LNG Limited, Gujarat as on 30<sup>th</sup> June, 2023.

**Ref :** (a) F. No. 11-63/2011-IA-III Dated 26<sup>th</sup> February, 2014  
(b) ENV-10-2013-71-E Dated 13<sup>th</sup> January, 2014  
(c) F. No. 11-63/2011-IA-III Dated 04<sup>th</sup> Dec, 2020

Dear Sir,

The half yearly compliance report as on 30<sup>th</sup> June, 2023 with respect to conditions stipulated by Ministry of Environment & Forests, Govt. of India and Department of Forests, Govt. of Gujarat for Installation of Terminal facilities to handle additional 10 MMTPA of LNG (Phase IIIA & Phase IIIB) at Petronet LNG Limited, Gujarat is enclosed.

Thanking you,  
Yours faithfully,  
For Petronet LNG Limited

  
S B Singh  
ED(Plant Head)

Encl.: As above

Copy to:-

Director,  
Ministry of Env., Forest and Climate Change  
Indira Paryavaran Bhawan,  
Jorbagh Road,  
New Delhi – 110 003

MoEF & CC  
Integrated Regional Office  
Room No 407 & 409  
Sector 10A  
A Wing Aranya Bhawan  
Gandhinagar-382010

Unit Head - Bharuch Division  
Gujarat Pollution Control Board  
Paryavaran Bhavan, Sector-10 A  
GANDHINAGAR – 382 010 (Gujarat)

Regional Officer  
Gujarat Pollution Control Board  
C-1\119\3, GIDC, Phase – 2 , Narmadanagar  
Bharuch – 392015 (Gujarat)

**Regd. Off.:**

World Trade Centre, First Floor, Babar Road,  
Barakhamba Lane, New Delhi-110 001 (INDIA)  
Tel.: 011 - 23472525, 23411411 Fax : +91-11-23709114

**Kochi Site :**

Survey No. 347, Puthuvypu  
P.O. 682508, Kochi (INDIA)  
Tel.: 0484-2502268

**HALF YEARLY COMPLIANCE REPORT TO (FOR THE PERIOD JANUARY 23 TO JUNE 23) THE CONDITION MENTIONED IN MOE&F LETTER NO. F.No.11-63/2011-IA-III, DATED: 26th February, 2014**

**&**

**LETTER NO. F.No.11-63/2011-IA-III DATED 04<sup>TH</sup> December 2020**

**(For Phase III Expansion) AS ON 30.06.2023**

Point-wise compliance statement for the subject environmental clearance is as below:

	<b><u>CONDITIONS</u></b>	<b><u>STATUS</u></b>
<b>7.</b>	<b><u>Special Conditions:</u></b>	
i)	"Consent for Establishment" shall be obtained from State Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.	Complied. "Consent for Establishment" was obtained from GPCB vide their letter no. GPCB/BRCH/B-CCA611(2)/ ID-15479/222771 Dated 21.08.2014 and provisional order obtained for validity extension.
ii)	All the recommendations and conditions stipulated by the Gujarat Coastal Zone Management Authority vide letter no. ENV-10-2013-71-E dated 13.01.2014, shall be strictly complied with.	Complied and detail of compliance attached as Annexure-I.
iii)	The facility shall be constructed in accordance with the NFPA 59 A- Standard for the Production, storage and handling of liquefied Natural gas, OISD-194- Standard for Storage and handling of LNG, EN 1473 - Installation and equipment for LNG - Design of onshore installations and M.B.Lal Committee report.	Complied. The facilities designed and constructed as per NFPA59A, OISD 194,EN1473 and M B Lal committee recommendation are incorporated. Attached Annexure IV Engineering design basis document for your reference.  The construction and commissioning of the Phase-IIIA facilities at Dahej completed and is operational since October, 2016 and Phase-IIIB1 Regasification facility at Dahej completed and is operational since June, 2019.
iv)	Precautionary measures shall be put in place to prevent leakage of LNG due to any disasters including tidal/ tsunami wave, seismic and other natural calamities. Disaster Management Plan shall put in place to manage emergencies.	Complied. The terminal is designed considering all the specified factors for safe operations. ERDMP plan is approved from M/s Bosai safety and valid up to 11/10/2025. Please Refer Annexure – V for valid ERDMP certificate.



v)	Oil Spill Contingency Management Plan shall be put in place.	Complied Oil spill contingency plan, is available.
vi)	Online sensor for load monitoring shall be provided, as committed.	Complied. Online stack monitoring instrument are installed for gas turbine stacks.
vii)	Temperature sensors, gas detectors, spill detectors shall be installed to take care of any type of spillage or leakage of the gas from the plant and the trucks.	Complied. These sensors placed as per design and as per F & G Mapping study for instant detection of any leakage in Phase-IIIA & Phase-IIIB1 Regasification Project. Attached Annexure VI F&G Study report Index page for your reference.
viii)	Project proponent shall explore training the local population with the help of training institutes like ITI etc, to make them suitable for employment in the facility.	Complied Petronet is working continuously for skill development of local people. PLL has recruited fair number of local people. For ancillary and support functions as security services, fire fighting and green belt maintenance etc. PLL is giving preference to local people.
ix)	All the recommendation of the EMP, Risk Assessment and Disaster Management Plan shall be complied within letter and spirit. All the mitigation measures submitted in the EMP/DMP report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MOEF along with half yearly compliance report to MoEF-RO.	Complied.  ERDMP plan updated and recertify on 12/10/2022 by PNGRB approved agency M/s Bosai Safety and valid up to 11/10/2025.  Attached Annexure V for ERDMP certificate for your refercncc.
x)	A separate Environment Monitoring Cell shall be set up especially for this plant and details shall be submitted to the Ministry prior to the commencement of operation.	Complied. Environment Monitoring Cell is already set up in the existing plant and is being used for Environment Monitoring of expansion project and a brief report is being submitted to MoEF on half yearly basis. Detailed organogram of EMC is attached as Annexure-XII for your reference.
xi)	Construction activity shall be carried out strictly as per the provisions of CRZ Notification, 2011. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.	Complied. Construction activities was done as per CRZ Notification 2011. The construction and commissioning of the Phase-IIIA facilities at Dahej completed and is operational since October 2016 and Phase-IIIB1

*Tomay*

		Regasification facility at Dahej completed and is operational since June, 2019.
xii)	No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.	Complied. CRZ Notification followed during construction phase however the construction and commissioning of the Phase-IIIA facilities at Dahej completed and is operational since October, 2016 and Phase-IIIB1 Regasification facility at Dahej completed and is operational since June, 2019.
xiii)	The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.	Complied. EMC is already setup in the company, and it will be used for Environment Monitoring of expansion project. Detailed organogram of EMC is attached as Annexure-XII for your reference.
xiv)	The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.	Noted for compliance. Funds earmarked for environment management plan is included in budget and being monitored regularly.
<b>8.</b>	<b><u>General conditions:</u></b>	
i)	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	Complied. No digging activity effected the ground water quality during the construction. Ground water samples are taken and being monitors regularly. Ground water monitor data and report are attached in Annexure II
ii)	Full support shall be extended to the officers of this Ministry/Regional Office at Bhopal by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.	Complied. Entry of GPCB and all government bodies are taken care for any inspection and all required information submitted as and when visited.
iii)	A Six-Monthly monitoring report shall need to be submitted by the project proponents to the Regional Office of this Ministry at Bhopal regarding the implementation of the stipulated conditions.	Complied. MoEF & CRZ Half yearly compliance report submitted regularly. Last half yearly compliance report for period July 22 to December 2022 was

		submitted on 27.01.2023.
iv)	Ministry of Environment & Forests 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.
v)	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.	Agreed. No Such case till date.
vi)	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment and Forests.	Complied Wherever there is change in project profile or change in implantation agency, we had taken new TOR and Environment clearance. i.e. Project wise Environment Clearance received as follows. <ul style="list-style-type: none"> <li>• MoEF&amp;CC LETTER NO. J-17011/11/2000-1A-III DATED 27<sup>TH</sup> DECEMBER, 2000 fro Phase I proejct</li> <li>• MoEF&amp;CC LETTER NO. J-17011/11/2000-IA-III DATED 23<sup>rd</sup> NOVEMBER 2005 for Phase II project</li> <li>• MoEF&amp;CC LETTER NO. J-17011/11/2000-IA-III, DATED: 14<sup>th</sup> NOVEMBER, 2008 for STAND BY JETTY project</li> </ul> MoEF&CC LETTER NO. F.No.11-63/2011-IA-III, DATED: 26th February, 2014 and amended vide letter no LETTER NO. F.No.11-63/2011-IA-III DATED 04 <sup>TH</sup> December 2020 for Phase III project
vii)	The project proponents 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 land development work.	Complied. Regional Office as well as the Ministry has been informed about the start of land development works vide our letter no. PLL/DHJ/MoEF/010 Dtd.12 <sup>th</sup> May, 2014.

viii)	A copy of the clearance letter shall be marked to concerned Panchayat/local NGO, if any, from whom any suggestion/ representation has been made received while processing the proposal.	Complied. The environment clearance was forwarded to concerned offices. A copy of inwards from such offices was submitted vide our letter no. PLL/DHJ/MoEF/011 Dt.13 <sup>th</sup> May, 2014.
ix)	State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Center and Collector's Office/Tehsildar's office for 30 days.	Complied. Copy of environment clearance was already forwarded to concerned offices.
9.	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.	Complied. Mention Environment act and Rules are followed. PLI Policy renewed for one year w.e.f 02.06.2023. Attached Annexure VIII for PLI policy.
10.	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 proponents from the respective competent authorities.	Complied. Applicable clearances from following authorities obtained, a copy of same was submitted vide our letter no. PLL/DHJ/MoEF/011 Dt.13 <sup>th</sup> May, 2014: 1. PESO in principle approval obtained vide letter dated 10/10/2012 [PV(WC)S-784/GJ-II] and letter Dt 19/03/2014[PV(WC)S-784/GJ-II]. 2. Forest Dept. Approval obtained vide letter dated 30/10/2013, No.FCA-1013/10-13/11/SF-31-F.
11.	The project proponent shall 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 Environmental and CRZ Clearance and copies of clearance letters are available with the State Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forests at <a href="http://www.envfor.nic.in">http://www.envfor.nic.in</a> . The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bhopal.	Complied. A Public Notice was advertized in the local newspapers in English and Gujarati languages. A copy of same was submitted vide our letter no. PLL/DHJ/MoEF/011 Dtd.13 <sup>th</sup> May 2014. Sandesh Gujarati newspaper dated 07.03.2014 and Times of India English Newspaper dated 07.03.2014. A copy of this notice is already forwarded to RO, Bhopal vide letter PLL/DHJ/MoEF/2014/007 dated 07.03.2014.

12.	This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.	Agreed.
13.	Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Agreed. No Such case till date.
14.	Status of compliance to the various stipulated environmental conditions and environmental safeguards will be uploaded by the project proponent in its website.	Complied. Six monthly compliance are uploaded at company website <a href="http://www.petronetlng.com">www.petronetlng.com</a> Attached Annexure IX for screen shot of website.
15.	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. The clearance letter shall also be put on the website of the company by the proponent.	Complied.  Refer reply to 8 (viii).  The Environment and CRZ Clearance is already uploaded at company website <a href="http://www.petronetlng.com">www.petronetlng.com</a> .
16.	The proponent shall upload the status of compliance of the stipulated 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 MoEF, the respective Zonal Office of CPCB and the SPCB	Complied. The Environment and CRZ Clearance compliance status is already uploaded at company website <a href="http://www.petronetlng.com">www.petronetlng.com</a> . The monitored reports are regularly sent to MoEF RO, Bhopal with copy to GPCB & CPCB.
17.	The environmental statement for each financial year ending 31st 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 company along with the status of compliance of Clearance conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.	Complied. The Form-V is being updated on company website and sent to MoEF Regional Office by e-mail. Attached Annexure VII for Environment statement.
<b>Condition Mention in LETTER NO. F.No.11-63/2011-IA-III dated 04<sup>TH</sup> December 2020</b>		
6i	Marine ecological monitoring and its mitigation measures for protection of phytoplankton, zooplanktons, macrobenthos, estuaries, sea grass,	Complied Marine ecological monitoring study conducted in June,2023 by GPCB



	algae, sea, weeds, crustacean, fishes mangroves and migratory birds etc. shall be undertaken through a reputed university/institute with financial support as desired. Six monthly report of the studies to be provided to the regional office of MoEFCC.	authorized vendor M/s Unistar Environment and Research Labs Pvt. Ltd. Attached Annexure XI for Marine ecological monitoring report.
7	The MoEFCC has considered the proposal based on the recommendation of the Expert Appraisal Committee and hereby decided to accord extension of validity of EC of aforementioned project issued by the Ministry vide letter No -11-63/2011-IA-III dated 26 <sup>th</sup> February 2014 for period of three years i.e up to 25 <sup>th</sup> February 2024 under the EIA Notification 2006 as amended subject to strict compliance of all conditions specified in the EC letter and in addition to additional condition prescribed by the EAC.	Complied. All previous EC conditions are Complied. Half yearly compliance report submitted regularly.



ANNEXURE-I

Compliance to conditions as conveyed by Department of Forests & Environment, Govt. of Gujarat, Letter No. ENV-10-2013-71-E dated 13<sup>th</sup> January, 2014 as on 30.06.2023

Point-wise compliance statement for the subject environmental clearance is as below:

<u>SR. NO.</u>	<u>CONDITIONS</u>	<u>STATUS</u>
1	The provisions of the CRZ notification of 2011 shall be strictly adhered to by the PLL	Complied CRZ Notification 2011 followed strictly.
2	PLL shall have to comply with all the Standards/norms prescribed by the Central Pollution Control Board for this project	Noted for compliance. CPCB and GPCB norms are followed. Monthly Environment monitoring done through GPCB approved agency and all measured parameters are under the limit. <b>Attached Annexure II for Environment monitoring data.</b>
3	PLL shall have to revise the Emergency Preparedness plan in close coordination with District Authority prior to Commissioning of expansion project.	Complied. ERDMP plan updated on 12/10/2022 and approved by PNGRB approved agency M/s Bosai Safety and valid up to 11/10/2025. <b>Attached Annexure V for ERDMP certificate for your reference.</b>
4	All the recommendations and suggestions given by the VIMTA LABS in their Comprehensive Environment Management Plan shall be implemented strictly by the PLL	Complied. Company has adopted and followed best Environment Management practices to minimizing the impact on environment. Company has ISO 14001/9001/45001 certificate.

5	The construction debris and sewage generated during the construction phase shall not be discharged into the creek, sea, estuary or into the CRZ area. The debris shall be removed from the construction site immediately after the construction is over and shall be disposed off as per the guidance of the GPCB.	Complied. No debris discharged into the creek, sea or into CRZ area during construction phase.
6	The construction camps shall be located outside the CRZ area and the construction labours shall be provided with the necessary amenities, including sanitation, water supply and fuel and it shall be ensured that the environmental conditions are not deteriorated by the construction labours	Complied. Construction camp set outside the CRZ area and all required welfare services are provided.
7	The groundwater shall not be tapped to meet with the water requirements during construction or operation phase in any case.	Complied. Ground water was not used during the construction phase as well as operation phase.
8	A Disaster Management Plan to meet with any eventualities that may arise during construction and/or operation phase shall be prepared implemented.	Complied. ERDMP plan updated and recertify on 12/10/2022 by PNGRB approved agency M/s Bosai Safety and valid up to 11/10/2025. <b>Attached Annexure V for ERDMP certificate for your reference.</b>
9	Necessary permissions/Clearances from different departments/ agencies under different laws/ acts shall be obtained before commencing any enabling activities.	Complied. Applicable clearances from following authorities obtained, a copy of same was submitted vide our letter no. PLL/DHJ/MoEF/011 Dt.13 <sup>th</sup> May, 2014: 1. PESO in principle approval obtained vide letter dated 10/10/2012 [PV(WC)S-784/GJ-II] and letter Dt 19/03/2014[PV(WC)S-784/GJ-II]. Forest Dept. Approval obtained vide letter dated 30/10/2013, No.FCA-1013/10-13/11/SF-31-F.



10	A separate Environmental Cell with qualified personnel shall be created to implement the Environmental Management Plan and a separate budget shall be provided for this purpose.	Complied. EMC is already setup in the company, and it will be used for Environment Monitoring of expansion project. Detailed organogram of EMC is attached as Annexure-XII for your reference.
11	The cost of the external agency that may be appointed by this department for supervision / monitoring of the project activities during construction/ operational phases shall be borne by the PLL.	Agreed. PLL agree to born cost of external agency appointed by this department
12	Massive greenbelt development program including the mangrove plantation in 100 ha. shall be carried out in consultation with the Gujarat Ecology Commission/ Forest Department by PLL.	Complied. PLL has completed 100 ha. Mangrove Plantation in consultation with Forest Department.
13	A large scale socio-economic upliftment program in consultation with the District Collector/ DDO shall be carried out. A separate budget shall be provided for this purpose and details be furnished to this Department from time to time.	Complied. Please Refer Attached <b>Annexure III</b> for detail.
14	Environmental Audit report shall be submitted every year. The report shall also cover the change in the coastal and marine environment enroute the proposed rerouted pipeline and due to commissioning of the proposed activities.	<b>Complied</b>  PLL is ISO 14001(Environment Management System) certified company. Procedure is adopted and followed strictly to protect the environment. Annual external environmental audit for ISO 14001 certification is carried out.  Pls refer <b>Annexure XIII</b> for ISO14001 certificate.  Also, Monthly Environmental monitoring done through GPCB approved agency and all

		<p>parameters are under prescribed limit.</p> <p>Pls refer <b>Annexure II</b> for Environment monitoring data.</p> <p>Six Monthly Marine ecological monitoring is also carried out for monitoring marine ecological condition. Last Marine ecological monitoring was conducted on 9<sup>th</sup> June ,2023 by authorized vendor M/s Unistar Environment and Research Labs Pvt. Ltd.</p> <p>Latest marine ecological monitoring report is attached as <b>Annexure – XI</b>.</p>
15	A six monthly progress reports regarding the compliance of the conditions shall be submitted to this department.	<p>Complied</p> <p>Half yearly compliance report submitted regularly</p>
16	Any additional condition that may be imposed by the Ministry of Environment and Forests, Government of India/This department from time to time shall have to be complied with by the PLL.	<p>Noted for compliance.</p> <p>No such case till date.</p>



## ANNEXURE - II - ENVIROMENT DATA

### AMBIENT AIR QUALITY STATUS REPORT

All units are in  $\mu\text{g}/\text{m}^3$ .

Sr.no.	Month	PM10		PM2.5		SOx		NOx		HC as Methane CH <sub>4</sub>	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	NAAQ norms	100 $\mu\text{g}/\text{m}^3$		60 $\mu\text{g}/\text{m}^3$		80 $\mu\text{g}/\text{m}^3$		80 $\mu\text{g}/\text{m}^3$		Absent	
1	Jan-23	72.00	89.00	20.00	28.00	12.40	20.30	15.10	26.30	BDL	BDL
2	Feb-23	71.00	88.00	20.00	33.00	12.10	20.30	15.20	24.60	BDL	BDL
3	Mar-23	71.00	88.00	20.00	31.00	12.60	20.30	17.40	24.60	BDL	BDL
4	Apr-23	74.00	88.00	18.00	32.00	12.30	19.60	17.10	22.80	BDL	BDL
5	May-23	71.00	88.00	18.00	32.00	11.40	20.30	14.70	24.80	BDL	BDL
6	Jun-23	71.00	88.00	20.00	32.00	12.10	18.60	15.20	26.80	BDL	BDL
7	Jul-23									BDL	BDL
8	Aug-23									BDL	BDL
9	Sep-23									BDL	BDL
10	Oct-23									BDL	BDL
11	Nov-23									BDL	BDL
12	Dec-23									BDL	BDL
	Range (Jan-23 to July 23)	71-89		18-33		11.4-20.3		14.7-26.8		BDL	

*Boncus*

### STACK EMISSION AIR QUALITY STATUS REPORT

Sr.no.	Month	GTG		
		SPM	SO <sub>x</sub>	NO <sub>x</sub>
GPCB norms		150 mg/NM <sup>3</sup>	100 ppm	50 ppm
1	Jan-23	BDL	BDL	17.10
2	Feb-23	BDL	BDL	16.30
3	Mar-23	BDL	BDL	17.20
4	Apr-23	Not monitored due to non operational GTGs		
5	May-23	Not monitored due to non operational GTGs		
6	Jun-23	BDL	BDL	16.80
7	Jul-23			
8	Aug-23			
9	Sep-23			
10	Oct-23			
11	Nov-23			
12	Dec-23			
	Range (Jan-23 to Dec-23)	BDL	BDL	16.3-17.2

BDL: Below Detection Level.



### NOISE LEVEL REPORT

Sr.no.	Location	Unit	Limit	Jan-23		Feb-23		Mar-23		Apr-23		May-23		Jun-23		Jul-23		Aug-23		Sep-23		Oct-23		Nov-23		Dec-23		
				L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>	L <sub>night</sub>	L <sub>day</sub>
1	North	decibel	Day-75 db Night-70db	52.6	43.6	51.3	44.6	52.3	46.3	54.6	48.4	55.2	48.5	54.1	47.6													
2	East	decibel	Day-75 db Night-70db	51.1	41.8	52.3	41.6	55.4	42.8	56.7	43.6	54.5	43.8	55.1	44.1													
3	West	decibel	Day-75 db Night-70db	52.6	42.5	55.4	42.8	56.3	44.1	58.1	46.1	57.2	45.7	56.9	46.8													
4	South	decibel	Day-75 db Night-70db	51.8	42.7	52.6	41.8	51.8	42.7	52.3	44.2	51.6	42.6	52.3	44.3													

*Bonars*

**GROUND WATER QUALITY STATUS REPORT**

Sr.no.	Parameter	Unit	Mar-23		Jun-23		Sep-23		Dec-23	
			GW1	GW2	GW1	GW2	GW1	GW2	GW1	GW2
1	Temperature	*C	30	29	31	30				
2	PH	-	8.76	8.31	8.87	8.58				
3	Total Dissolved Solids (TDS)	mg/L	2040	2290	3206	3012				
4	Chlorides as CL	mg/L	589.4	570.5	906.1	553.3				
5	Sulphate as SO4	mg/L	134.2	392.6	210.5	350.5				
6	BOD (5 days @ 20°C)	mg/L	BDL	BDL	3	4				
7	COD	mg/L	BDL	BDL	13.3	16.4				
8	Oil & Grease	mg/L	BDL	BDL	BDL	BDL				
9	Phenolic Compound	mg/L	BDL	BDL	BDL	BDL				
10	Zinc as Zn	mg/L	BDL	BDL	BDL	BDL				
11	Total Chromium as Cr+3	mg/L	BDL	BDL	BDL	BDL				
12	Lead as Pb	mg/L	BDL	BDL	BDL	BDL				
13	Cyanide as CN	mg/L	BDL	BDL	BDL	BDL				
14	Flouride as F	mg/L	1.6	0.94	1.9	1.9				
15	Copper as Cu	mg/L	BDL	BDL	BDL	BDL				
16	Insecticide	mg/L	Absent	Absent	Absent	Absent				
17	Pesticide	mg/L	BDL	BDL	BDL	BDL				
18	Mercury as Hg	mg/L	BDL	BDL	BDL	BDL				
ND*: Not detected										



**MARINE WATER QUALITY STATUS REPORT**

Sr.no.	Parameter	Unit	Mar-23	Jun-23	Sep-23	Dec-23
			MW	MW	MW	MW
1	Temperature	*C	29	30		
2	PH	-	7.86	8.05		
3	Color	Co-pt	40	60		
4	Total Suspended Solids	mg/L	620	>1000		
5	Total Dissolved Solids (TDS)	mg/L	>10000	>10000		
6	Chlorides as CL	mg/L	>5000	>5000		
7	Sulphate as SO4	mg/L	>2000	>2000		
8	BOD (5 days @ 20°C)	mg/L	110	44		
9	COD	mg/L	461.9	122.7		
10	Oil & Grease	mg/L	BDL	BDL		
11	Phenolic Compound	mg/L	BDL	BDL		
12	Zinc as Zn	mg/L	0.168	0.177		
13	Total Chromium as Cr+3	mg/L	0.084	0.096		
14	Lead as Pb	mg/L	BDL	BDL		
15	Cyanide as CN	mg/L	BDL	BDL		
16	Flouride as F	mg/L	BDL	4.95		
17	Copper as Cu	mg/L	0.066	0.082		
18	Insecticide	mg/L	Absent	Absent		
19	Pesticide	mg/L	BDL	BDL		
20	Mercury as Hg	mg/L	BDL	BDL		
21	Hexavalent Chromium as Cr+6	mg/L	BDL	BDL		
22	Nickel as Ni	mg/L				
	<b>ND*: Not detected</b>					

## **ANNEXURE –III**

### **CSR DETAILS**

PLL has constructed a temple at the site for the local people and has contributed towards infrastructure in the area for roads and drinking water.

Community development and welfare measures are taken. Village Luwara has been jointly adopted along with another nearby industry, as directed by PCPIR Welfare Society. Separate fund allocated for CSR.

Some of the schemes completed/under progress are Health Center (construction & operation), drainage and provision of street lights at Village Luwara. Rupees 75 lakh contributed to PCPIR Welfare Society. Two ladies from Luwara village sponsored for nursing course at Vidhyadeep Community college, Bharuch. Sponsored construction of Sanitation scheme at village Muller. Active participation in other Government initiated community development programs.

Installed 10 nos. Emergency solar lighting at prominent places in village Luwara. Donated Rs.1 lac for Bharuch District Civic centre development. Participated in Govt. scheme on KanyaKelvani. Installation of drainage crossings to remove accumulated water at 4 locations within the village Luwara at a cost of Rs. 0.8 lacs. Construction of approach road in village Lakhigaon, Dahej.

PLL has sponsored 'Mataria Talav drinking water project' of the Bharuch Municipality Corporation. This project is for the supply of sweet drinking water from the Narmada River to the residents of Bharuch city. MD&CEO handed over cheque for Rs. 25 Lacs to the Collector, Bharuch on 13/06/2011 and further, PLL added Rs. 20 Lacs for the 'Mataria Talav drinking water project'

PLL installed 50 nos. Emergency solar lighting at prominent places in village Luwara & 10 nos. Emergency solar lighting at prominent places in village Lakhigam of Vagra Taluka in Bharuch District. Provided School Bus to Primary School at Lakhigam Village and also running Primary Health Center at Luwara Village. PLL constructed Bus-stand and extended Gram Panchayat Bhavan building at Luwara Village.

PLL installed 25 Nos. of Solar lights at prominent places in village Lakhigam and Luwara. Contributed Rs. 20 Lakhs in Akshay Patra mid-day meal scheme at villages in and around Dahej location. Also, contributed Rs. 10.00 Lakhs in Gujarat Lion Conservation Society towards procurement of Vehicle.



Primary health services to Luvara village, Gynec health and Pulse Polio campaign (Pakhajan PHC). PLL supported noble cause of Construction of Storm water drainage at Shravan Chokdi to Jambusar by pass (over bridge) in Bharuch. This project is executed under District Collector office.

Request from CDHO (Chief District Health Officer) was received to participate in various health initiatives. PLL agreed during meeting with DM to provide the ambulance for PHC, Pakhajan Village of Vagra Taluka. PLL is supporting Luvara School for reference books, uniform, school picnic and creating awareness on environment, health, safety and security aspects through various programs regularly, rewarding bright students etc. PLL celebrated Shala Pravesh Utsav at Luvara School and distributed tool box to children.

Bharuch has problem of solid waste management and garbage disposal. To improve on cleanliness of the town, PLL is supporting initiative of GREEN BHARUCH CLEAN BHARUCH by donating two dumper placer worth Rs. 23.94 Lakh.

Due to delay in recruitment of teachers, primary schools in and around Dahej has 40% teaching staff. To support education by deploying young educated teachers, PLL sponsored 14 teachers in 4 schools of villages of Dahej, Lakhigam and Luvara.

PLL constructed 11hosues of homeless tribes in Luvara village at a cost of 25 Lakh. PLL initiated drive to make Luvara open defecation free by sponsoring toilets for 172 houses at a cost of Rs. 17.2 Lakh.

As a part of initiate for Swachh Bharat Abhiyan, PLL constructed five toilet blocks for school at Lakhigam, Luvara, Ambetha, Jageshwar & Dahej. Also, PLL has constructed 91 Toilet blocks at an estimated expenditure of Rs. 172 Lakhs for various schools in fifteen district of Assam in co-ordination with Rashtriya Madhiyamik Siksha Abhiyan (RMSA).

Cancer screening done (Pep and Breast) for female above 18 years at Luvara village. Establishment of equipment for Ultra Sonography Ward done at General/Civil Hospital, Bharuch. Motivational Awards (Academics and punctuality), School kit and reference books given for Luvara School students. Nutrition and clothing kit (105 nos.) was given to under nourished baby and mother.

PLL has sponsored Drawing competition, Educational tour and uniform distribution at Primary School Luvara. PLL sponsored Medical Equipment such as Eye sight testing, ECG Machine, Spirometer, Pulse Oxymeter etc. to Luvara Primary Health Centre. PLL also celebrated Swatch Bharat Pakhwada during 16th June, 2016 to 30th June, 2016 in co-ordination and consultation with neighboring villages, communities, schools etc.

*Tomal*

The launch of Project Vidhyagam was organized in Luwara Primary School wherein a classroom library for std. 7 & 8 students is setup. About 130 books (syllabus and general reading including comics, biographies, story books, general knowledge, science fiction in Gujarati, Hindi and English language) has been kept in the library. The idea behind this project is that students develop interest in reading and thus studying. The PLL Disha Ladies Club organized for food and distribution of educational kits for 65 girls in the Orphanage in Bharuch on 11th Sept 2016. A focused group discussion on importance of hygiene and cleanliness was organized by Ladies club members as well.

Roofing item worth Rs. 2 Lacs was provided to the Gram Panchayat Office of Luwara Village for construction of house for 10 tribal families living below the poverty line. This material consisted of cement roof, channel, and hooks. It is expected that the construction of houses will be done by mid-January 2017.

Petronet LNG Limited celebrated the World Sight Day on 13th October 2016 by organizing the Eye Screening Camp for contractual labor at the company premises. The camp was organized in association with Wockhardt Foundation and about 200 labor and 60 employees participated in the same. During the camp; 125 specs and 60 unit of drops were distributed to beneficiaries based on assessment by Doctors.

On the occasion of 147th birth anniversary of Father of Nation Shri Mahatma Gandhi Health and Hygiene talk, Swachhta Selfie Campaign, Drawing Competition at Govt. High School, Lakhigam and other activities were organized as part of Swachh Bharat Abhiyaan.

It is observed that there is a shortage of regular teachers in local schools and severely hampering the quality of education of poor children in schools. To mitigate this problem, PLL has started supporting para teachers in local school and ensuring improvement in quality of education in local schools.

PLL CSR team participated in world school day celebration on 23 March, 2017. As a part of celebration PLL has distributed Uniforms to Std. 8th Students. It was decided to provide two pair of uniforms to all students in school. The uniforms were prepared by Sardar Mahila Vikas Mandal a group of tribal women for employment generation and livelihood opportunity. PLL provided work order worth of Rs. 2,23,980/-

As the students studying in primary schools are coming from BPL and poor families, most of the families are not able to afford educational tours for their children. Every year school is organizing such tour sponsored by PLL. Students will get exposures to various places and gain experience. About 150 students get benefit of this tour and



places covered like Dwarka, Somnath, Porbandar, Smruti Mandir, Naheru Planetorium, Sasan Gir etc.

PLL had sponsored community mass marriage of weaker community, participated in Shala Pravesh Utsav 2017, planted 150 of trees in nearby villages, distributed food packages during water logging observed at nearby villages, supported empowerment of Special children, engaged contractor for repair and maintenance of Toilets in nearby School, arranged sessions for awareness on solid waste management at school.

PLL supported 10th Special Olympics, Bharuch in January, 2018, sponsored project "Kaushal Setu" Skill Development Program with CIPET, Ahmedabad and trained 100 underprivileged youth, supported educational tour for Primary School of Luvara Village, provided para-teachers at school of nearby villages, sponsored community mass marriage of weaker community, supported "Startup Village" project towards Rural Youth Entrepreneurship Development Program, Supporting Swachh Bharat Abhiyan by District Administration Bharuch (Heritage Walk).

PLL signed MoA with Samagra Shiksha Abhiyan, Department of Education, Govt. of Gujarat on 23rd Jan. 2019 at Govt. Primary School, Luvara village for the Development of Primary School at Luvara Village. PLL supported District Level Special Olympics Games which was organized on 23rd February 2019. Around 250 special children, 150 volunteers including PLL volunteers and coaches participated during the event.

*(July, 2019 to Dec. 2019)*

PLL has signed MoU with ALIMCO to provide Aids and Equipment to disables of Bharuch District. PLL has signed MoU with Wockhardt Foundation to run Mobile Medical Unit (MMU) in nearby villages of PLL plant area. PLL has signed MoU with NHFDC to provide skill training to disable youth of Bharuch District. PLL has supported relief camp for affected community near Lakhigam during monsoon season.

*(Jan.2020 to June 2020)*

PLL has conducted assessment camps at Jambusar and Vagra Taluka of Bharuch Distrcit to Aids and Equipment to disables. Kaushal Setu Skill Training with CIPET Ahmedabad 78 candidates have completed the training and 90% of them got job with the salary range of Rs. 9000 to Rs. 12000. PLL has conducted District Level Special Olympics in partnership with Kalrav Trusy Bharuch and Special Olympics, Gujarat. As a part of COVID-19 pandemic response, PLL has contributed Rs. 34.00 lakhs to

*Toral*

District Health Office, Bharuch to procure PPE Kits, Masks and Sanitise materials for COVID-19 workers. PLL has provided 4300 nos. of Ration kits worth of Rs. 25.00 lakhs to Migrant Labours, and Poor Families of nearby villages. Petronet LNG Limited (PLL) under its CSR initiatives aims at distributing 1,00,000 face masks to the migrant labor communities, slum dwellers, nearby hospitals, local police authorities & Government Offices to combat COVID-19 in the Bharuch District of Gujarat.

(July 2020 to December 2020)

PLL has supported Construction of Primary School, at Luvara village worth of Rs. 1.71 Crore. Construction is about to complete by March, 2021. PLL has distributed aids and equipment to about 250 disabled beneficiaries at Jambusar and Vagra Taluka of Bharuch District. As a part of COVID-19 pandemic response, in addition to supporting District Health Office (CDHO) and Distributing Ration Kits to Migrant Labours, and Poor Families of nearby villages, PLL has prepared 1,00,000 cotton masks through Women SHGs of Bharuch District. About 80 women got indirect employment during pandemic through this initiative. These masks were distributed among local communities of nearby villages, health workers, labour community, Nagarpalika Sawachhta Karmchhari, Special Children and their families, Vegetable vendors, Local Police authorities, Government Offices, Security Guards, PLL employees also participated in mask distribution initiative. These masks were made of Cotton considering its environment aspect for reusable and bio-degradable properties.

(January, 2021 to June, 2021)

PLL/PLF has signed agreement with Wockhardt Foundation to run Mobile Medical Unit (MMU) in nearby villages of PLL plant area. This MMU is providing its services to nearby villages like Lakhigam, Navi Nagari, Luvara, Jageshwar, Ambetha. More than 5500 patients have been benefited during last six months. PLL/PLF has signed agreement with NHFDC to provide skill training to disabled youth of Bharuch District. First batch of 30 candidates started from April, 2021. PLL/PLF has signed agreement with MOKSHDA to install environment friendly green crematorium system to reduce excessive use of wood. The works are under progress, Construction of Govt. Primary School at Luvara village with 12 classrooms and modern amenities worth of Rs. 1.71 Crs. and Construction of 24 Nos. of widow quarters for BSF worth of Rs. 5.87 Crs. are going to be completed by end of July, 2021. PLL/PLF skill training partner CIPET, Ahmedabad has completed skill training of 75 candidates and remaining 25 candidates are under progress. Candidates have secured job of Rs. 10,000 per month to Rs. 15,000 per month post completion of training programme. Most of the CSR projects got delayed due to COVID-19 restrictions.

**(July, 2021 to December, 2021)**

PLL/PLF has signed agreement with Wockhardt Foundation to run Mobile Medical Unit (MMU) in nearby villages of PLL plant area. This MMU is providing its services to nearby villages like Lakhigam, Navi Nagari, Luvara, Jageshwar, Ambetha. More than 8500 patients have been benefited during last six months. PLL/PLF has signed agreement with NHFDC to provide skill training to disable youth of Bharuch District. First batch of 30 candidate started from April, 2021 and second batch of 20 candidates started in August, 2021 and both batches have been completed during December, 2021. PLL/PLF has signed agreement with MOKSHDA to install environment friendly green crematorium system to reduce excessive use of wood. The works are under progress, Construction of Govt. Primary School at Luvara village with 12 classrooms and modern amenities worth of Rs .1.71 Crs. and Construction of 24 Nos. of widow quarters for BSF widow's worth of Rs. 5.87 Crs. are completed. PLL/PLF skill training partner CIPET, Ahmedabad has completed skill training of 93/100 candidates. Candidate have secured job of Rs. 10,000 per month to Rs. 15,000 per month post completion of training programme. PLL has signed agreement with Bharuch Nagarpalika to provide support for Disaster Management and Swachh Bharat Abhiyan, Bharuch Nagarpalika would procure one fire tender and Road sweeping machine with the financial support of Rs. 1.93 Cr. under PLL CSR Initiatives. PLL has signed an agreement with Gujarat CSR Authority (GCSRA) for construction of Panchayat Bhavan at Lakhigam village. PLL has supported Development of Green Zone beneath newly constructed flyover bridge at Bharuch City.

**(January, 2022- June, 2022)**

PLL/PLF has signed agreement with Wockhardt Foundation to run Mobile Medical Unit (MMU) in nearby villages of PLL plant area. This MMU-1 is providing its services to nearby villages like Lakhigam, Navi Nagari, Luvara, Jageshwar, Ambetha. More than 15000 patients have been benefited during last six months. PLL/PLF has signed agreement with NHFDC to provide skill training to disable youth of Bharuch District. First batch of 30 candidate started from April, 2021 and second batch of 20 candidates started in August, 2021 and both batches have been completed during December, 2021. This project benefited 50 disable persons with computer skill, Certificate distribution held during June, 2022. PLL/PLF has signed agreement with MOKSHDA to install environment friendly green crematorium system to reduce excessive use of wood. The works are under progress, Construction of Govt. Primary School at Luvara village with 12 classrooms and modern amenities worth of Rs .1.71 Crs. and Construction of 24 Nos. of widow quarters for BSF widow's worth of Rs. 5.87 Crs. are completed. PLL/PLF skill training partner CIPET, Ahmedabad has completed skill training of 93/100 candidates. Candidate have secured job of Rs. 10,000 per month to Rs. 15,000 per month post completion of training programme.



PLL has signed a new agreement with CIPET, Ahmedabad to train 400 candidates in CNC Machine and Plastic Product Manufacturing. First batch of 50 candidate enrolled and initiated. PLL has signed agreement with Bharuch Nagarpalika to provide support for Disaster Management and Swachh Bharat Abhiyan, Bharuch Nagarpalika would procure one fire tender and Road sweeping machine with the financial support of Rs. 1.93 Cr. under PLL CSR Initiatives. PLL has signed an agreement with Gujarat CSR Authority (GCSRA) for construction of Panchayat Bhavan at Lakhigam village with financial support of Rs. 1.13 Crs.. PLL has supported Development of Green Zone beneath newly constructed flyover bridge at Bharuch City with financial support of Rs. 5.00 lakhs. PLL has supported development of Sports facility by Police Department, Bharuch with financial support of Rs. 5.00 lakh. PLL has supported Medical Equipments to Kasturba Hospital, Seva Rural Jhagadia with financial support of Rs. 5.00 lakh. PLL has provided support to Seva Yagaya Samiti for Strengthening of Facilities for Orphan/destitute Old Age Patients at Civil Hospital, Bharuch for Rs. 5.00 lakh. PLL has partnered with National Youth Foundation to Support for School Health Check-Up Program' at 48 Schools of Vagra Taluka, Dist. Bharuch Gujarat for Rs. 19.92 lakh.

(July, 2022- December, 2022)

PLL/PLF has signed agreement with Wockhardt Foundation to run Two Mobile Medical Unit (MMU) in nearby villages of PLL plant area. This MMU-1 is providing its services to nearby villages like Lakhigam, Navi Nagari, Luvara, Jageshwar, Ambetha. MMU-2 is providing services to Dahej, Suva, Rahiyad, Vav, Vadadla, Kadodar and Sambheti More than 30000 patients have been benefited during last six months. PLL has signed a new agreement with CIPET, Ahmedabad to train 400 candidates in CNC Machine and Plastic Product Manufacturing. First batch of 50 candidates and second batch of 45 candidates enrolled and initiated. PLL skill training partner CIPET, Ahmedabad has completed skill training of 39 candidates. Candidate have secured job of Rs. 10,000 per month to Rs. 15,000 per month post completion of training programme. PLL has signed an agreement with Gujarat CSR Authority (GCSRA) for construction of Panchayat Bhavan at Lakhigam village with financial support of Rs. 1.13 Crs. The Construction works are under progress. PLL has partnered with National Youth Foundation to Support for School Health Check-Up Program' at 48 Schools of Vagra Taluka, Dist. Bharuch Gujarat for Rs. 19.92 lakh. This programme successfully completed about 6500 students benefited from this initiative. PLL had partner with Blind People's Association and Torch It to distribute 1000 assistive devises to Divyang Jans of Gujarat State, The Project successfully completed with distribution in various interior districts of Gujarat State.

PLL has celebrated Swachhta Pakhwada 2022 with Say no to Plastic theme, distributed about 20,000 cotton bags prepared by SHGs and various awareness initiatives in local villages. PLL has celebrated Har Ghar Tiranga 2022 Abhiyan, and distributed about 10,000





**National Flags prepared by SHGs in local villages. PLL has supported Installation of Dishwasher Machine at Asmita Vikas Kendra, Tralsa (Bharuch) worth of Rs. 4.75 Lakhs.**

**(January, 2023- June, 2023)**

**PLL has signed agreement with Wockhardt Foundation to run Two Mobile Medical Unit (MMU) in nearby villages of PLL plant area. This MMU-1 is providing its services to nearby villages like Lakhigam, Navi Nagari, Luvara, Jageshwar, Ambetha. MMU-2 is providing services to Dahej, Suva, Rahiyad, Vav, Vadadla, Kadodar and Sambheti More than 60000 patients have been benefited during last six months.**

**PLL has signed a new agreement with CIPET, Ahmedabad to train 400 candidates in CNC Machine and Plastic Product Manufacturing. PLL skill training partner CIPET, Ahmedabad has completed skill training of 110 candidates. 90% Candidates have secured job of Rs. 10,000 per month to Rs. 15,000 per month post completion of training programme.**

**PLL has signed an agreement with Gujarat CSR Authority (GCSRA) for construction of Panchayat Bhavan at Lakhigam village with financial support of Rs. 1.13 Crs. The Construction works are under progress.**

**PLL has signed an agreement with Gujarat CSR Authority (GCSRA) for construction of Govt. Primary School Building at Lakhigam village with financial support of Rs.2.41 Crs. The building plan, design and estimates preparation under progress.**

**PLL has signed an agreement with Vikas Centre for Development for Pond Redevelopment at Luvara village with project cost of Rs. 95.00 lakh. This project would ensure preservation of natural resources, ground water recharged and reduce salinity in this area.**

**PLL has signed an Agreement with Ekal Gramothan Foundation to Support Basic Computer Education in Interior Tribal Villages of Narmada and Bharuch District. About 300 youth gets trained on basic computer education.**

**PLL has signed an MoU with District TB Office, Bharuch and Seva Yagya Samiti for Pradhan Matri TB Mukta Bharat Abhiyan. PLL is supporting nutrition kit for 300 TB patients of Bharuch Taluka for six month with project cost of Rs. 18.00 lakh.**

**PLL has supported District Level Special Olympics for Special Children in Bharuch District. Every Year about 250 special children participate in 25 different sports games. Winners gets chance to represent at State and Nation event.**

**PLL has supported Development of Sports Ground at Govt. High School, Lakhigam. PLL has supported women empowerment through livelihood support for Papad making Gruh udhyog. PLL has supported development of Garden and Recreation area at Luvara village.**

PLL has supported fisherman community in local area through distribution of Fishing Kit which is useful for seasonal fishing activities for local community.

PLL CSR & HSE Team has conducted Community Awareness Program on Industrial Safety, and Fire Safety in local Schools and Villages.

CSR Activities Glimps of July, 2022-December, 2022.

**Widow Quarters 24 Nos. at BSF, Gandhinagar**



**Construction of Primary School Luvara Village**



**Kaushal Setu Skill Training – CIPET Ahmedabad, MOA Signed (P-III)**

*Romney*



**Mobile Health Unit (MHU) (Wockhardt Foundation)**



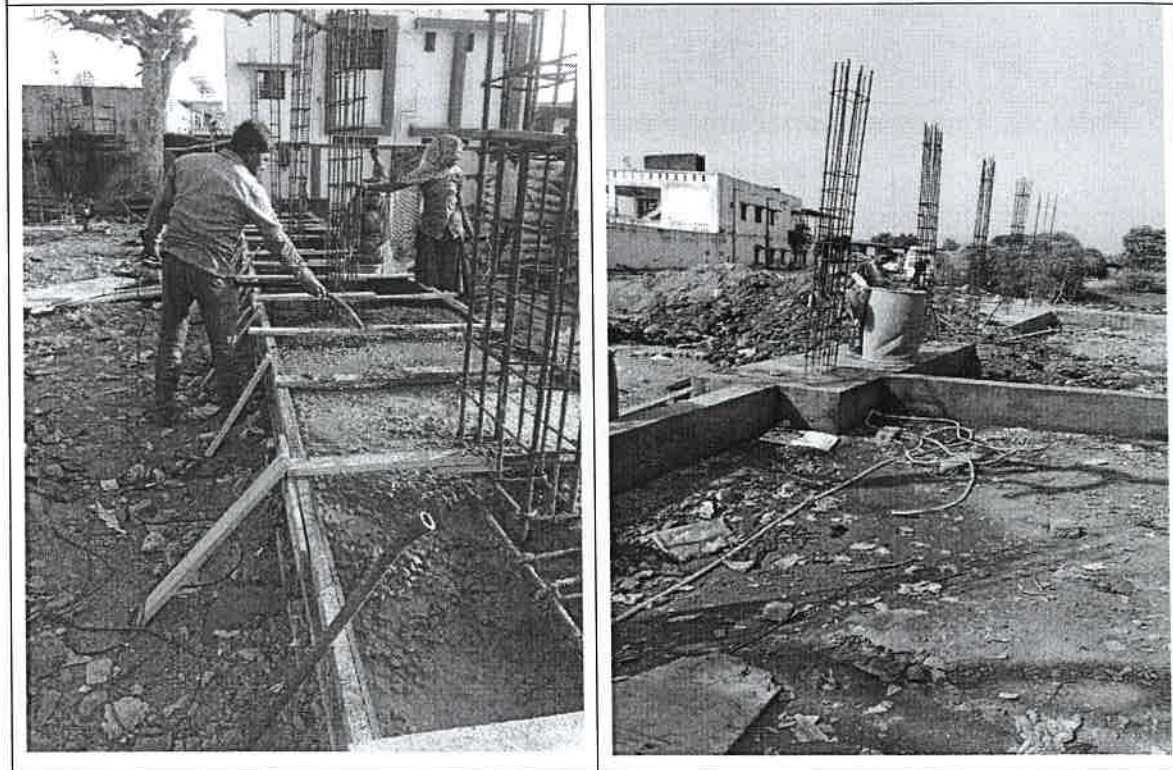


**Promote fitness and encouragement of sports activities by Police Department, Bharuch**



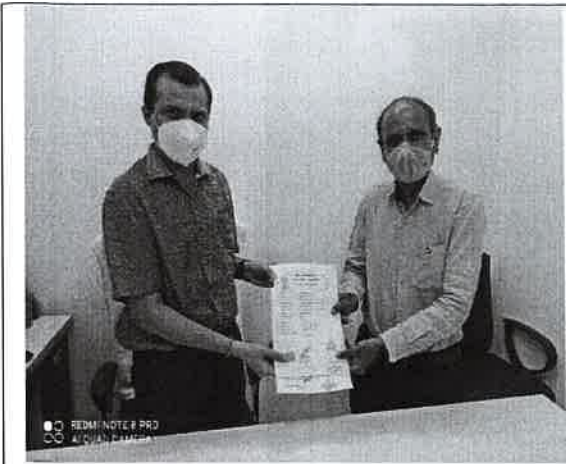
**Agreement Signed with GCSRA for Construction of Panchayat Bhavan at Lakhigam village**

*Handwritten signature in blue ink.*



**Swachh Bharat with Bharuch Nagarpalika**

*Samal*



10X5

## ભરૂચ નગરપાલિકા, ભરૂચ

“સ્વચ્છ ભારત મિશન” અંતર્ગત PETRONET LNG LTD. દ્વારા  
ભરૂચ નગરપાલિકાને CSR અંતર્ગત ફાળવેલ  
ટ્રક માઉન્ટેડ રોડ સ્વીપીંગ મશીનનું  
**લોકાર્પણ**

સ્વચ્છ ભારત  
કો દુલ્હનને કાગડ પોતે  
મારુદ સુધી લઈ જુવરાલ સ્વચ્છ ભારત  
બાલકોની, ભરૂચ નગર દેશે

સ્થાપક : મુખ્ય અધિકારી તથા તમામ સ્ટાફશ્રીઓ

તા. ૧૯/૦૩/૨૦૨૨ ને શનિવાર સાંજે ૫:૦૦ કલાકે સ્થળ : ભરૂચ નગરપાલિકા, પટાંગલ

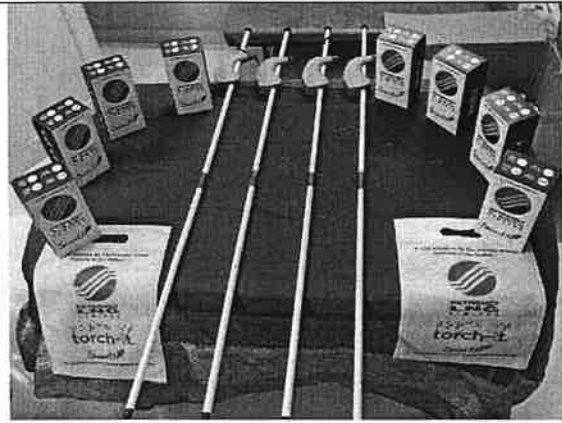


**Visit of Seva Rural Jhagadiya**

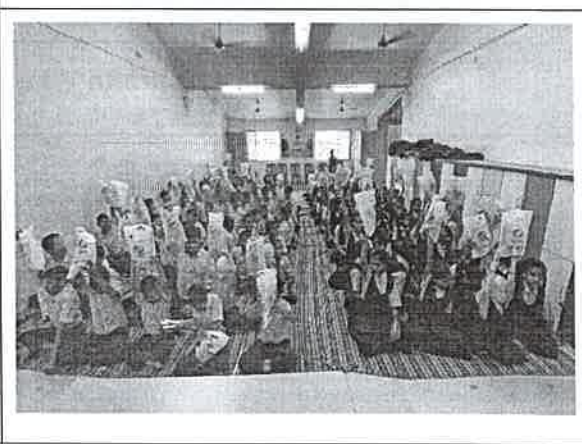
*Handwritten signature*



**Distribution of 1000 Saarthi Assistive Devices to 1000 Blind persons in Gujarat State**



*Saarthi*



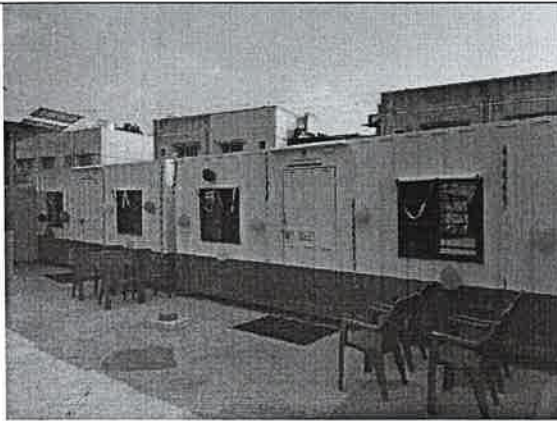
*Ismael*



**Certificate Distribution for NHFDC Skill Training for Disables**



**Handover Old age care facility to Seva Yagya Samiti**

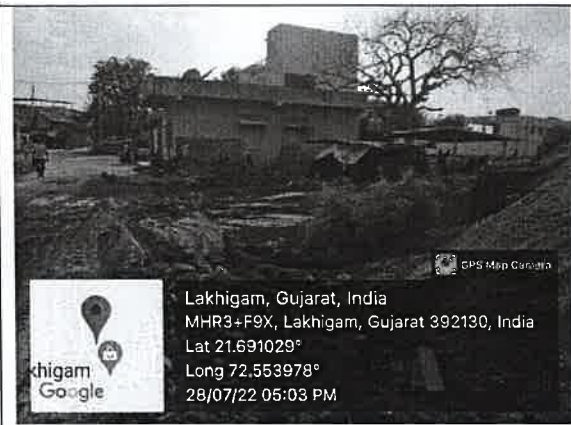
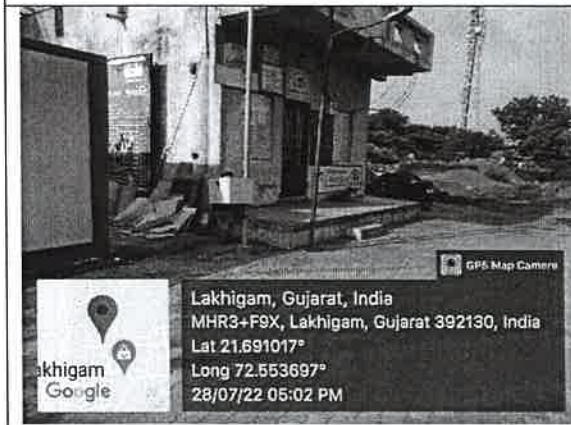


**Visit of Ashmita Vikas Kendra, Tralasa**

*Amay*



**Construction of Panchayat Bhavan, Lakhigam**



**Visit of IIT-Gandhinagar**

*Omaj*



**Skill Development Workshop on for promotion of Art & Culture**



**Har Ghar Tiranga Celebrations**

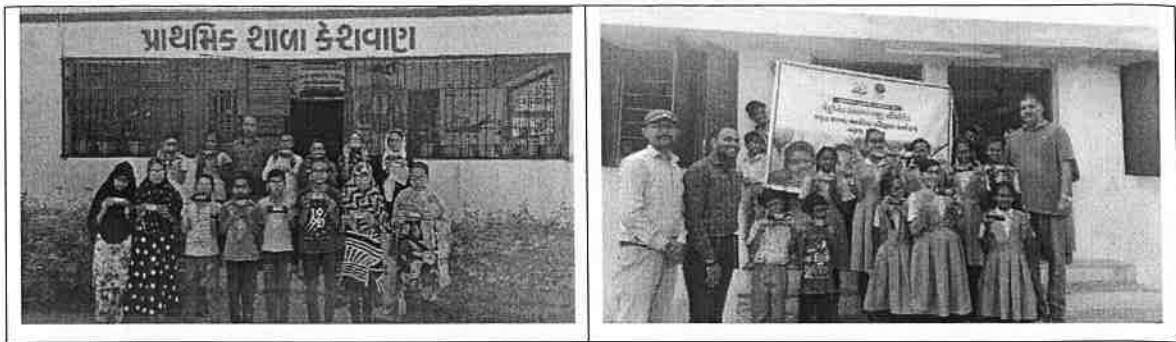
*tomel*



**Free School Health Care Camps at 48 Govt. Schools of Vagra Taluka**

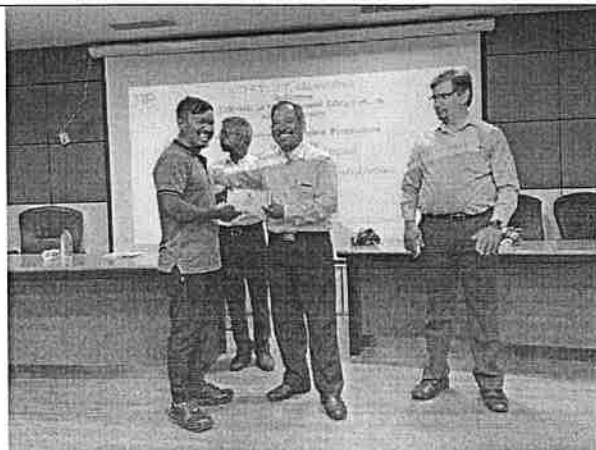


*Omceel*



**CSR Activities Glimpse from January 2023, to June, 2023.**

**Kaushal Setu Skill Training – CIPET Ahmedabad, MOA Signed (P-III)**





**Mobile Health Unit (MHU) (Wockhardt Foundation)**

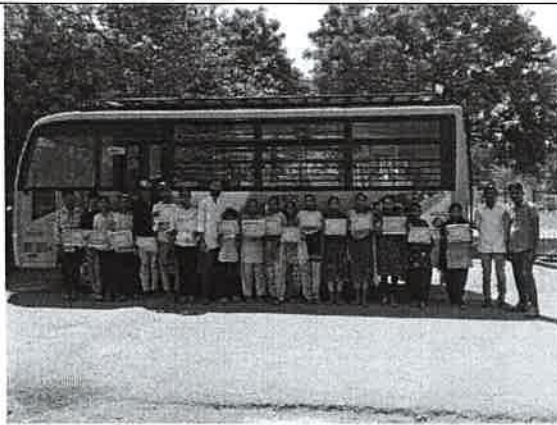
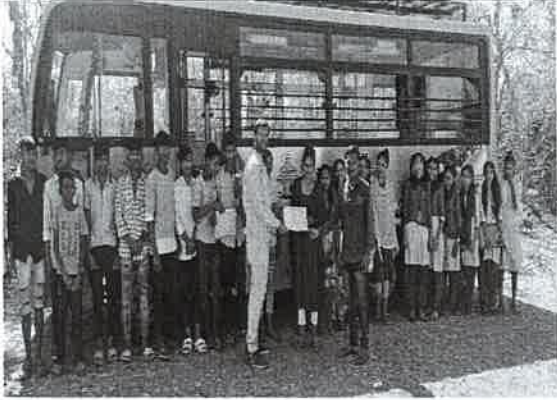




**Agreement Signed with GCSRA for Construction of Panchayat Bhavan at Lakhigam village**



**Ekal on Wheel, Ekal Gramothan Foundation**

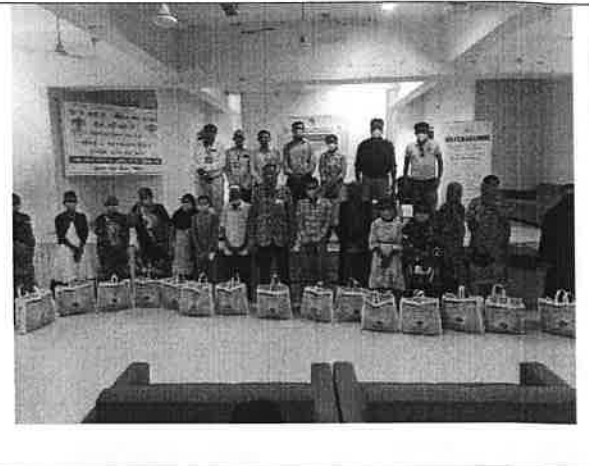


**TB MukT Bharat Abhiyan**



*Bomach*





**Distribution of Fishing Kits at Luvara Village**



**MoA for Construction of Govt. Primary School, Lakhigam Village**



### Safety Awareness at Luvara Village



*smash*

## ENGINEERING DESIGN BASIS (STATIC EQUIPMENT)

**PROJECT: LNG TERMINAL AT DAHEJ**

**CLIENT: M/s PLL**

**JOB NO.: A324**

**(EIL)**

**(PLL)**

0	07.09.2012	ISSUED AFTER CLIENT COMMENTS INCORPORATED	RS	TG	RKT
A	25-05-2012	ISSUED FOR CLIENT'S COMMENTS/APPROVAL	RS	TG	RKT
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Checked by</b>	<b>Approved by</b>



---

**CONTENTS**

<b>DESCRIPTION</b>	<b>PAGE NO.</b>
FOREWORD	3
PART – 1 (OWNER'S REQUIREMENTS)	4
PART – 2 (DESIGN PHILOSOPHY)	6

*Small*

## 1.0 REFERENCED PUBLICATIONS

### a) Codes and Standards:

The following codes and standards in their latest edition including latest addenda as on the date of first issue of this design basis shall be followed unless otherwise specified in the requisition for the design, fabrication, inspection and testing of Vessels, Double Wall Storage Tanks, Air coolers & heat exchangers:

ASME SEC. VIII DIV.1	For Pressure Vessels, Heat Exchangers
ASME SEC. II	For material specification
ASTM	For material specification
ASME SEC. V	Non Destructive Examination
ASME SEC. IX	For welding
ASME B31.3	Process piping
BS EN 14620 PART I TO V	Flat bottom, vertical, cylindrical tanks for storage of refrigerated, liquefied gases with operating temperatures between 0° C and (-) 165° C
BS 8110 + Amendements	Structural use of concrete
BS EN 1473	Installation and equipment for LNG-design of onshore installations
API 620	For Low Pressure Storage Tanks
API 2000	Venting atmospheric and low pressure storage tanks, Non refrigerated and refrigerated
API 2003	Protection against ignitions arising out of static, lightning & stray currents
API 678	Accelerometer Based Vibration Monitoring System – Reaffirmed (1987)
API 2550	Standard Methods for Measurements and calibration of upright cylindrical tanks
ACI 373	Design & construction of circular prestressed concrete structures

ACI 305R	Hot weather concrete
ASTM 549 NFPA 59A	Perlite loose fill insulation Production, storage & handling of LNG
NFPA 70	National Electric Code
NFPA 780	Standard for Installation of Lightning protection system
FIP recommendations	Acceptance and application of post tensioning system
PI-201-77	Compacted density
OISD 194	Standard for the storage and handling of LNG
IS: 875/SITE DATA	For wind load consideration
IS: 1893/SITE DATA	For seismic design consideration
ASME B 16.5	Steel Pipe flanges and pipe fittings
ASME B 16.47	For large diameter flanges
ASME B 16.20/ B 16.21	For gaskets
TEMA Class R	For shell and tube Exchanger
API 661	For Air Cooled Exchanger
IS 800	For Air Cooled Exchanger Structural Design

**b) Statutory Provisions:**

National laws and statutory provisions together with any local by-laws for the state shall be complied with. Static and Mobile Pressure Vessel (SMPV) rules and OISD norms as applicable shall also be complied with.

**2.0 DESIGN PHILOSOPHY / GENERAL CRITERIA**

Equipment shall be designed in compliance with the latest design code requirements and applicable standards/ specifications. All design calculations shall be performed considering all applicable loads for erection, operating and hydro test conditions.

**2.1 Full Containment with Prestressed Concrete Outer Tank Wall**

The storage tanks are to be above ground, flat bottom, and vertical full containment Prestressed cylindrical type. The under face of the concrete slab shall be minimum two meter above the ground, contractor for Storage Tank during detail engineering shall work out the actual height of the concrete slab.

A concrete outer tank and a roof constructed of reinforced concrete with carbon steel vapor barriers on the inside of the wall & base slab.

*Tony*



## Certificate of Conformity

Standard: Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP) Regulations, 2010 and 2020.

Certificate Number: **BOSAI/0157**

Certificate Holder: Petronet LNG Ltd., Dahej LNG Terminal.

Scope: **Review and implementation of ERDMP as per the PNGRB Regulations**

This is to certify that **BOSAI SAFETY PRIVATE LIMITED**, approved TPIA by PNGRB vide Registration No. PNGRB/Tech/11-TPIA/(3)/2021(P-3506) dated 09.11.2021 have reviewed and assessed the **ERDMP document prepared by Petronet LNG Ltd., Plot No 7/A, GIDC Industrial Estate, Dahej - 392130** and found the same in conformity with the **Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP) Regulations, 2010 and 2020.**

The audit team conducted site assessment visit on 29.09.2022 & 30.09.2022 at **Petronet LNG Ltd., Dahej LNG Terminal** to review implementation of ERDMP as per the requirement and found the same to be compliant.

This certificate is being issued to **Petronet LNG Ltd., Dahej LNG Terminal** for their compliance of ERDMP documents as per PNGRB Regulations. 2010 and 2020.

**Issued on:12/10/2022, Valid till:11/10/2025**

Dinesh  
Kumar  
Singh

Digitally signed by  
Dinesh Kumar  
Singh  
Date: 2022.10.12  
16:48:57 +05'30'

(D.K. SINGH)  
Chief Executive Officer



(Note: This Certificate is valid for maximum 3 years from the date of issue or till any major Modification/ Revamp in the facility or as per directives of PNGRB whichever is earlier.)

G-405, C58/23, INDIAN OIL APARTMENT, NOIDA-201309, Mob: 9868920846, bosaisafety@gmail.com

ANNEXURE IV



Dahej Expansion Phase IIIA  
LNG Regasification Facilities  
FLD341F





### F&G Mapping Study

PROJECT NAME : DAHEJ EXPANSION PHASE – IIIA  
LNG REGASIFICATION FACILITIES  
OWNER : PETRONET LNG LTD

			AP
			AP

*Handwritten signature*



	<b>Dahej Expansion Phase IIIA LNG Regasification Facilities PLD3A/R</b>	
ISSUE DATE: 17.04.2015	<b><i>F&amp;G Mapping Study Report</i></b>	Page 2 of 104 Rev.: 1

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>4</b>
<b>2</b>	<b>STUDY OBJECTIVES AND SCOPE.....</b>	<b>4</b>
2.1	OBJECTIVE .....	4
2.2	SCOPE OF WORK .....	4
2.3	APPLICABLE CODES AND STANDARDS .....	5
<b>3</b>	<b>TERMINOLOGY.....</b>	<b>6</b>
3.1	DEFINITIONS .....	6
3.2	ABBREVIATIONS .....	6
<b>4</b>	<b>STUDY APPROACH.....</b>	<b>6</b>
4.1	OVERVIEW OF F&G MAPPING METHODOLOGY .....	6
4.2	3D MODEL IMPORT .....	7
4.3	FLAME MAPPING ASSESSMENT .....	9
4.4	FLAMMABLE GAS MAPPING ASSESSMENT .....	16
<b>5</b>	<b>MAPPING ANALYSIS.....</b>	<b>23</b>
<b>6</b>	<b>LNG TANK AREA.....</b>	<b>25</b>
6.1	FLAME MAPPING .....	25
6.2	FLAMMABLE GAS MAPPING .....	33
<b>7</b>	<b>HP PUMP AND RECONDENSER AREA.....</b>	<b>40</b>
7.1	FLAME MAPPING .....	41
7.2	FLAMMABLE GAS MAPPING .....	46
<b>8</b>	<b>BOG COMPRESSOR AREA.....</b>	<b>52</b>
8.1	FLAME MAPPING .....	53
8.2	FLAMMABLE GAS MAPPING .....	57
<b>9</b>	<b>STV AREA .....</b>	<b>62</b>
9.1	FLAME MAPPING .....	63
9.2	FLAMMABLE GAS MAPPING .....	66
<b>10</b>	<b>LNG DRAIN DRUM (TLF) AREA .....</b>	<b>70</b>
10.1	FLAME MAPPING .....	70
10.2	FLAMMABLE GAS MAPPING .....	73
<b>11</b>	<b>LNG DRAIN DRUM (PROCESS) AREA .....</b>	<b>75</b>
11.1	FLAME MAPPING .....	75
11.2	FLAMMABLE GAS MAPPING .....	79
<b>12</b>	<b>TRUCK LOADING FACILITY (TLF) AREA.....</b>	<b>81</b>
12.1	FLAME MAPPING .....	81



	<b>Dahej Expansion Phase IIIA LNG Regasification Facilities PLD3A/R</b>	
ISSUE DATE: 17.04.2015	<i>F&amp;G Mapping Study Report</i>	Page 3 of 104 Rev.: 1

12.2	FLAMMABLE GAS MAPPING.....	87
13	<b>GAS METERING STATION AREA .....</b>	<b>92</b>
13.1	FLAME MAPPING .....	92
13.2	FLAMMABLE GAS MAPPING.....	96
14	<b>TIE-IN POINTS IN INTERCONNECTING AREA .....</b>	<b>99</b>
14.1	FLAME MAPPING .....	99
15	<b>CONCLUSIONS.....</b>	<b>103</b>



**PETRONET  
LNG  
LIMITED**

# Petronet LNG Limited

GIDC Industrial Estate, Plot No. 7/A, Dahej,  
Taluka : Vagra, Dist. Bharuch (Gujarat) - 392130 (India)  
Tel. : 02641 - 670200 / 257  
www.petronetlng.com  
CIN: L74899DL 1998PLCO93073  
GST No. : 24AAACP8148D1ZM

Ref.: PLL/DHJ/HSE/GPCB/2023/02

Date: April 12, 2023

GPCB XGN ID: 15479

To,

Gujarat Pollution Control Board  
Paryavaran Bhavan  
Sector-10 A  
GANDHINAGAR – 382 010

**Sub: Environmental Statement for the financial year April 2022 to March 2023**

Dear Sir,

Enclosed Please find Environmental Statement (FORM – V) for the financial year April 2022 to March 2023 for your kind perusal.

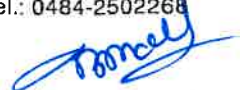
Thanking you,

Yours faithfully,  
For Petronet LNG Limited

  
S B Singh  
ED (Plant Head)  
Petronet LNG Limited,  
Dahej Terminal-392130

Encl: As above

Copy to:  
Gujarat Pollution Control Board, Bharuch



**FORM-V**  
**ENVIRONMENTAL STATEMENT**  
(See rule 14)

Environmental Statement for the financial year ending with **31<sup>st</sup> March 2023**

**PART - A**

i. Name and address of the owner/occupier of the industry operation or process:

Mr. S B Singh  
ED (Plant Head)  
M/s Petronet LNG Limited  
Plot.7/A, GIDC Industrial Estate  
Dahej, Taluka Vagra  
Dist. Bharuch – 392130  
Ph. 02641-670299/201

ii. Industry category Primary-(STC Code) Secondary-(STC Code)

Not Applicable.

iii. Production capacity – Dahej Unit.

20 MMTPA (Million Metric Tons per Annum) Regasification Capacity

Receipt of LNG through Ship, storage, Regasification and Dispatch of RLNG and LNG

iv. Year of establishment: **2<sup>nd</sup> April, 1998**

v. Date of the last environmental statement submitted: 30<sup>th</sup> May 2022

**PART - B**

**Water and Raw Material Consumption:**

i. Water consumption in m<sup>3</sup>/d:

Process	: Nil
Cooling	: Nil
Domestic	: Nil water intake from GIDC. Avg.118 m3/day water reused for domestic water from condensate water generation.



Name of Products	Process water consumption per unit of product output	
	During the previous financial year	During the current financial year
1. Regasified Liquefied Natural gas (RLNG)	Nil	Nil

**ii. Raw material consumption:**

Name of raw materials*	Name of Products	Consumption of raw material per unit of output	
		During the previous financial year (F.Y. 2021-22)	During the current financial year (F.Y. 2022-23)
1. Liquefied Natural Gas (LNG)	RLNG	14.4135 MMTPA  19873.68 MMSCM of send out RLNG	12.9335 MMTPA  17616.56 MMSCM of send out RLNG
MMSCM = Million Metric Standard Cubic Meter MMTPA = Million Metric Ton per Annum			

\* Industry may use codes if disclosing details of raw material would violate contractual Obligations, otherwise all industries have to name the raw materials used.

**PART – C**

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

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	No process effluents generated	Not Applicable	Not Applicable
(b) Air • Stack emissions from Gas Turbine Generator • EDG Stacks	----  ----	PM : BDL** SO <sub>2</sub> : BDL NOx : 17.3 ppm  PM : 88 mg/Nm <sup>3</sup> SO <sub>2</sub> : 37 ppm NOx : 46 ppm	Concentration of pollutants discharged is well within the GPCB norms.

\*\* BDL= Below detection limit

**PART - D  
HAZARDOUS WASTES**

(as specified under Hazardous and Other Wastes (Management & Trans boundary Rules, 2016)

Hazardous Wastes (Disposed)	Total Quantity (Kg)	
	During the previous financial year (F.Y. 2021-22)	During the current financial year (F.Y. 2022-23)
1. From Process	Nil	Nil
2. From Pollution Control Facilities	Nil	Nil
3. Used oil	2725 Liters	2124 Liters
4. Waste Residue containing Oil	967 Kgs	1101 Kgs
5. Insulation Waste	Nil	Nil
6. Paint Waste	Nil	Nil
7. Contaminated Empty barrels and drums	73 Nos (400 Kgs)	310 Nos(795 Kgs)

**PART- E**

**SOLID WASTES**

Solid Wastes	Total Quantity (Kg)	
	During the previous financial year (F.Y. 2021-22)	During the current financial year (F.Y. 2022-23)
a. From process	Nil	Nil
b. From Pollution Control Facility	Nil	Nil
c. (1) Quantity recycled or re- utilized within the unit.	Nil	Nil
(2) Sold :	Nil	Nil
(3) Disposed: a) E Waste	2370 Kg	1930 Kg



## PART – F

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

**Hazardous waste :** 1. Used oil 2124 Liters (Disposal through GPCB approved Recycler/ Preprocessor, M/s R.K. steel, Bharuch)

**Solid Waste :** 1. Waste residue containing oil (Cotton waste) of 1101 Kgs disposed to approved incineration site of M/s Bharuch Enviro Infrastructure (BEIL), Dahej for incineration process.  
2. 310 Nos (795Kg) Contaminated Empty barrels, drums, carboys are sent to approved decontamination facility of M/s Vikas Enterprise.

**E-Waste :** Total 1930 Kg E - waste disposed to GPCB approved agency, M/s Earth E Waste Management Pvt. Ltd., Surat

**Used Batteries:** Total 18 nos batteries are disposed off as per Batteries Waste Management Rules, 2022.

## PART – G

**Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.**

Regular Environmental monitoring is carried out through GPCB approved agency. (M/s. Unistar Environment & Research Labs Pvt. Ltd, Vapi) and monitored results are well within the consent limit

*Handwritten signature*

## PART – H

### Additional measures/investment proposal for environmental protection including abatement of pollution.

The total Green Belt area approximately 1,66,000 Sq. meters has been allocated in and around periphery wall. Whereas, PH-I & PH-II green belt has been developed and maintained and the PH-III green belt (57,000 Sqm) area development has been initiated. In addition to this, the total lawns/ green cover developed & maintained till date is 30000 Sq.m.

S.No	Financial Year	Amount Spent (Rs. In Lacs)	Purpose of Investment
1	2009-10	33.22	Development & maintenance of Green belt and Mangrove Plantation during the year.
2	2010-11	55.00	Development & maintenance of Green belt and Mangrove Plantation during the year.
3	2011-12	93.31	Development & maintenance of Green belt and Mangrove Plantation during the year.
4	2012-13	109.57	Development & maintenance of Green belt and Mangrove Plantation during the year.
5	2013-14	95.20	Development & maintenance of Green belt and Mangrove Plantation during the year.
6	2014-15	88.83	Development & maintenance of Green belt and Mangrove Plantation during the year.
7	2015-16	42.20	Development & maintenance of Green belt and Mangrove Plantation during the year.
8	2016-17	77.96	Development & maintenance of Green belt and Mangrove Plantation during the year.
9	2017-18	71.08	Development & maintenance of Green belt during the year.
10	2018-19	60.93	Development & maintenance of Green belt during the year.
11	2019-20	51.11	Development & maintenance of Green belt during the year.
12	2020-21	78.96	Development, maintenance of Green belt & related to STP project during the year.
13	2021-22	76.26	Development & maintenance of Green belt during the year.
		155.34	STP Installation
14	2022-23	74.65	Development & maintenance of Green belt during the year
		7.76	STP Operation and Maintenance cost
<b>Total</b>		<b>1171.38 Lakh</b>	

*Bimal*



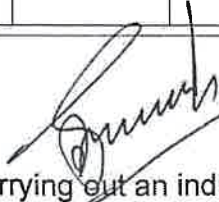
**PART- I**

**Any other particulars for improving the quality of the environment.**

Total 1150 ha. Mangrove Plantation undertaken along the Gujarat Coast till date as furnished below:

S.No	Financial Year	Covered Area	Location	Consultation with Forest Department/ GEC
1	2009-10	50 ha.	NadaVillage, Jambusar, Bharuch	Gujarat Ecology Commission (GEC), Govt. of Gujarat
2	2010-11	100 ha.	AnkalvaVillage, Hansot, Bharuch	Gujarat Ecology Commission (GEC) , Govt. of Gujarat
3	2011-12	200 ha.	AnkalvaVillage, Hansot, Bharuch	Gujarat Ecology Commission (GEC) , Govt. of Gujarat
4	2012-13	200 ha.  100 ha.	AnkalvaVillage, Hansot, Bharuch  RoniyaBhatha, Nr. Nirma, Bhavanagar	Gujarat Ecology Commission (GEC) , Govt. of Gujarat  Bhavnagar Forest Division, Govt. of Gujarat
5	2013-14	200 ha.	RoniyaBhatha, Nr.Lock Gate, Bhavanagar	Bhavnagar Forest Division, Govt. of Gujarat
6	2014-15	200 ha.	RoniyaBhatha, Nr.Lock Gate, Bhavanagar	Bhavnagar Forest Division, Govt. of Gujarat
7	2014-15	50 ha.	Kentiyajal, Hansot Bharuch	Bharuch Forest Sub-Division, Govt. of Gujarat
8	2016-17	50 ha.	Gadula Village, Talaja Taluka, Mahuva, Bhavnagar	Bhavnagar Forest Division, Govt. of Gujarat
<b>Total</b>		<b>1150 ha.</b>		

(Signature of person carrying out an industry – operation or process)



**S B Singh**  
ED ( Plant Head )  
Petronet LNG Limited,  
Dahej Terminal-392130

Name: Mr. S B Singh  
Designation: ED (Plant Head)  
Address: M/s Petronet LNG Limited  
Plot.7/A, GIDC Industrial Estate  
Dahej, Taluka Vagra  
Bharuch – 392130  
Ph. 02641-670299/201





**M/S PETRONET LNG LIMITED**

1st Floor, world Trade Center Babar Road,  
Barakhambha Lane, New Delhi - 110001.

Contact No. - 011-23472543

Email [debabrata.satpathy@petroneting.in](mailto:debabrata.satpathy@petroneting.in)

**Subject: Public Liability Act Insurance Policy No. : 130132327120000005**

Dear Sir,

**Welcome to the Reliance General Insurance Family!**

We are honored to have you as our valuable customer and are truly thankful that you have chosen Reliance General Insurance for your Insurance requirements.

We are pleased to inform you that you have been insured under Policy No. **130132327120000005** . Attached herewith your policy document, with all the details which have been prepared based on the details furnished to us. We request you to kindly go through the same.

Should you find any discrepancy in the document, kindly write to us immediately for necessary rectification. In the absence of any communication from your end, the contents and coverage of the policy shall stand accepted by you.

To enable us to serve you better, you are requested to mention your Policy Number in all your further Correspondences.

With Reliance General Insurance, you get nothing less than excellent and unparalleled services. Thanking you once again for choosing us. Look forward to a long lasting and delightful relationship.

For Reliance General Insurance Company Limited

Authorised Signatory

**PUBLIC LIABILITY (ACT) INSURANCE POLICY**

(Under Public Liability Insurance Act 1991)

**POLICY SCHEDULE**

1	Intermediary Details	Agent/Broker Name	Direct
		Agent/Broker License Code	Direct
		Agent/Broker Contact No	NA
2	Proposal Details	Tax Invoice No. & Date:	P060623100291 & 08/06/2023
		GSTIN/UIN of the Insured:	07AAACP8148D1ZI
	Details of previous policy (if renewal)	Previous policy No	NA
		Date of expiry	NA
3	Policy Number	130132327120000005	
4	Territory & Jurisdiction	India Only	
5	Name of Insured	M/S PETRONET LNG LIMITED	
6	Communication address & Place of Supply	1st Floor, world Trade Center Babar Road, Barakhambha Lane, New Delhi - 110001.	
7	Risk Location	Dahej, state of Gujarat. Kochi, state Of Kerala.	
8	Business	LNG Receipt, Storage & Regasification	
9	Policy Period	From : 02/06/2023 (00.01 hrs) To : 01/06/2024 (23.59 hrs) Both days local standard Time at the address stated above	
10	Turnover for the Policy Period	INR 55,098 Crore	
11	Indemnity Limit	Any One Accident : INR 50,000,000 Any One Year : INR 150,000,000	
12	Deductible	Nil	
13	Conditions and Exclusion	<ul style="list-style-type: none"> <li>Radioactive Ingredients Exclusion</li> <li>Nuclear Energy Risk Exclusion</li> <li>Arising out of wilful or intentional noncompliance of any Statutory provisions Exclusion.</li> <li>In respect of fines, penalties, punitive and/or exemplary damages</li> <li>In respect of damage to property owned, leased or hired or under hire purchase or on loan to the Insured or otherwise in the Insured Owner's control, care or custody.</li> <li>Ionising radiation or contamination by radioactivity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel.</li> <li>The radioactive, toxic, explosive or other hazardous properties of</li> </ul>	

		<p>any explosive nuclear assembly or nuclear component thereof.</p> <ul style="list-style-type: none"> <li>• Dry docks, wharves, offshore platforms and rigs, offshore oil and gas operations.</li> <li>• Communicable Disease Exclusion Clause</li> <li>• Pandemics/Epidemics as declared by the WHO and / or the Government India will be an exclusion</li> <li>• Excluding any claims as a result of stipulation/ violation under Disaster Management Act and the Epidemics Diseases Act/ Epidemics Disease Amendment Act.</li> <li>• Subject Otherwise To Terms And Conditions, Exclusion Of Public Liability (Act) Insurance Policy Wording</li> </ul>										
14	Premium Details	<table> <tr> <td>Net Premium</td> <td>INR 9,174/-</td> </tr> <tr> <td>Add:CGST (09%)</td> <td>INR 825.50/-</td> </tr> <tr> <td>Add:SGST (09%)</td> <td>INR 825.50/-</td> </tr> <tr> <td>Add :ERF Contribution</td> <td>INR 9,174/-</td> </tr> <tr> <td>Total Premium</td> <td>INR 19,999/-</td> </tr> </table>	Net Premium	INR 9,174/-	Add:CGST (09%)	INR 825.50/-	Add:SGST (09%)	INR 825.50/-	Add :ERF Contribution	INR 9,174/-	Total Premium	INR 19,999/-
Net Premium	INR 9,174/-											
Add:CGST (09%)	INR 825.50/-											
Add:SGST (09%)	INR 825.50/-											
Add :ERF Contribution	INR 9,174/-											
Total Premium	INR 19,999/-											
15	Claims Notification address	<p>Reliance General Insurance Co. Ltd.                  Claims Department - 2nd Floor, G Block, Reliance General Insurance Co., DAKC, Thane – Belapur Road, Near Koperkhairane Railway Station, Koperkhairane , Navi Mumbai, Maharashtra</p>										
16	Address Of Servicing Office	<p>Reliance General Insurance Company Limited                  10-15, 14th Floor , Vijaya Building                  17, Barakhamba Road , Connaught Place , New Delhi – 110001.</p>										
17	Address Of Issuing Office	<p>Reliance General Insurance Co. Ltd. Reliance Centre, 4<sup>th</sup> Floor, South Wing, Near Prabhat Colony, Santacruz (East), Mumbai, Maharashtra – 400055.</p>										

Note : In the event of dishonor of cheque, this Policy document automatically stands cancelled from inception, irrespective of whether a separate communication is sent or not and the Policy shall in such event be deemed to be void ab initio without any liability whatsoever accruing on the Insurer.

This document shall be treated as a Tax Invoice as per Rule 46 of the Central Goods and Services Tax Rules 2017"

GSTIN: 07AABCR6747B1ZI; SAC: 997139; Description of services: Other non-life insurance services (excluding reinsurance services)

As per the GST regulations, the amount of GST will not be refunded if the policy / endorsement is cancelled after 30th September of the next financial year

Consolidated Stamp duty Paid vide Letter of Authorization "NO.LOA/CSD/662/2023/(Validity Period Dt.27/03/2023 to Dt.01/12/2023)/1156 DT.27 MAR 2023" at General Stamp Office, Mumbai.

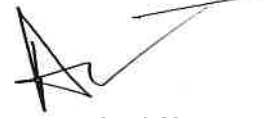
\*\* Not Applicable for the State of Jammu & Kashmir.

For any assistance on claims, please contact us on 022-48903009 (toll free) or email us at [services.rgicl@rcap.co.in](mailto:services.rgicl@rcap.co.in)

In witness whereof this policy has been signed at on New Delhi on 08/06/2023

Reliance General Insurance Company Limited. IRDAI Registration No. 103. An ISO 9001:2015 Certified Company  
 The Registered Office & Corporate Office/Policy Issuing Office: Reliance General Insurance Company Limited, 6th Floor, Oberoi Commerz, International Business Park, Oberoi Garden City, Off Western Express Highway, Goregaon (East), Mumbai – 400 063. Corporate Identity No.U66603MH2000PLC128300. UIN:IRDAN103CP0002V01200102. Trade Logo displayed above belongs to Anil Dhirubhai Ambani Ventures Private Limited and used by Reliance General Insurance Company Limited under License. RGI/MCOM/CO/HIIP/POLICY-SCHEDULE/Ver. 1.0/121219

For Reliance General Insurance Company Limited



Authorised Signatory

**Fund Transfer - NEFT PFT060523101971 Date 01/06/2023 Amount 19999.00**

Attached with this Policy schedule, are the Policy wording along with terms and condition, Endorsement, and Annexure. If you (Policyholder) have not received any of these, please E-mail/write to the company at [rgicl.services@relianceada.com](mailto:rgicl.services@relianceada.com) or contact us on 1800 3009 (toll free) within 15 days of receipt of this policy Schedule

This policy Schedule in original must be surrender to the company. In case of cancellation of the policy. In the event of any incorrect representation, the liability shall be upon the policy holder.

"The policy wording with detailed terms, conditions and exclusions are available on our website [www.reliancegeneral.co.in](http://www.reliancegeneral.co.in)"

(Policy wordings link: <https://www.reliancegeneral.co.in/Insurance/About-Us/Downloads.aspx>)



## Annexure IX Upload of Half Yearly Returns on Company Website



Company Natural Gas Terminals CSR Media Centre Investor Centre Careers Tender Customers

### DAHEJ LNG TERMINAL



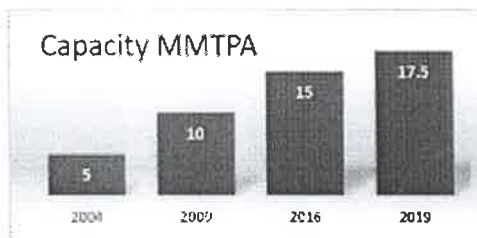
The Company had set up South East Asia's first LNG Receiving and Regasification Terminal with an original nameplate capacity of 5 MMTPA at Dahej, Gujarat. The infrastructure was developed in the shortest possible time and at a benchmark cost. The capacity of the terminal has been expanded in phases which is currently 17.5 MMTPA and the same is under expansion to 22.5 MMTPA in two phases. The terminal has 8 LNG storage tanks and other vaporization facilities. The terminal is meeting around 40% of the total gas demand of the country.

The terminal has two LNG Jetties at Dahej. While the first jetty can handle berthing of up to Q-Flex vessels, the second jetty can handle berthing of up to Q-Max vessels.



Dahej terminal is the largest single location LNG storage and regasification terminal in the country and has recently achieved the milestone of handling 3000<sup>th</sup> LNG cargo on 7<sup>th</sup> July 2022. The terminal is also offering tolling services to Offtakers & Bulk customers. To cater the small customers who are not having gas pipeline connectivity, Dahej is supplying LNG to such customers which is transported through cryogenic trucks.

PLL Dahej is first terminal to start loading of LNG in trucks for supply of LNG to the areas where pipelines have not reached and today has 04 truck loading bays and hub for development of Small Scale LNG business. It has handled 4340 LNG cryogenic trucks fillings in FY 2021-22



- Environment statement (Form-V) for the FY 2022-23
- Environment statement (Form-V) for the FY 2021-22

- Annual Report (Form - IV) as per Bio Medical Waste Management Rules 2016 for CY 2022
- Annual Report (Form - IV) as per Bio Medical Waste Management Rules 2016 for CY 2021

- Annual Report (Form - IV) as per Bio Medical Waste Management Rules 2016
- Environmental Statement (Form - V) for the FY 2020-21

- Environmental and CRZ clearance for Installation of Terminal facilities to handle 10 MMTPA of additional LNG at PLL, Dahej
- Environmental Statement (Form - V) for the FY 2018-19

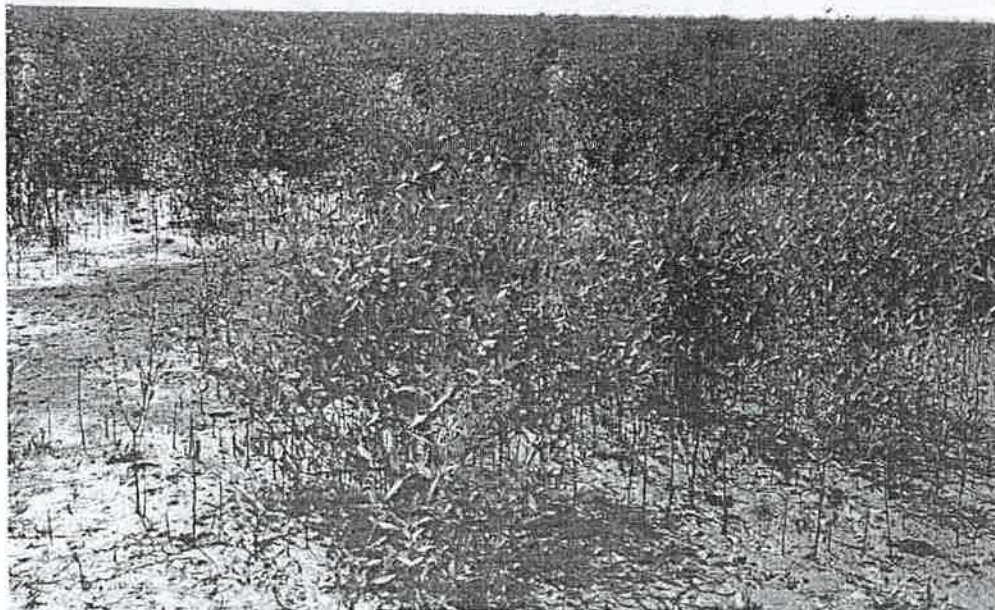
#### MoEF & CRZ Compliance Report

Description	Status Report
Half yearly MoEF & CRZ compliance report for Standby Jetty	31.12.2022
Half yearly MoEF & CRZ compliance report for Phase III	31.12.2022
Half yearly MoEF & CRZ compliance report for Phase II	31.12.2022
Half yearly MoEF & CRZ compliance report for Phase I	31.12.2022

*Handwritten signature*

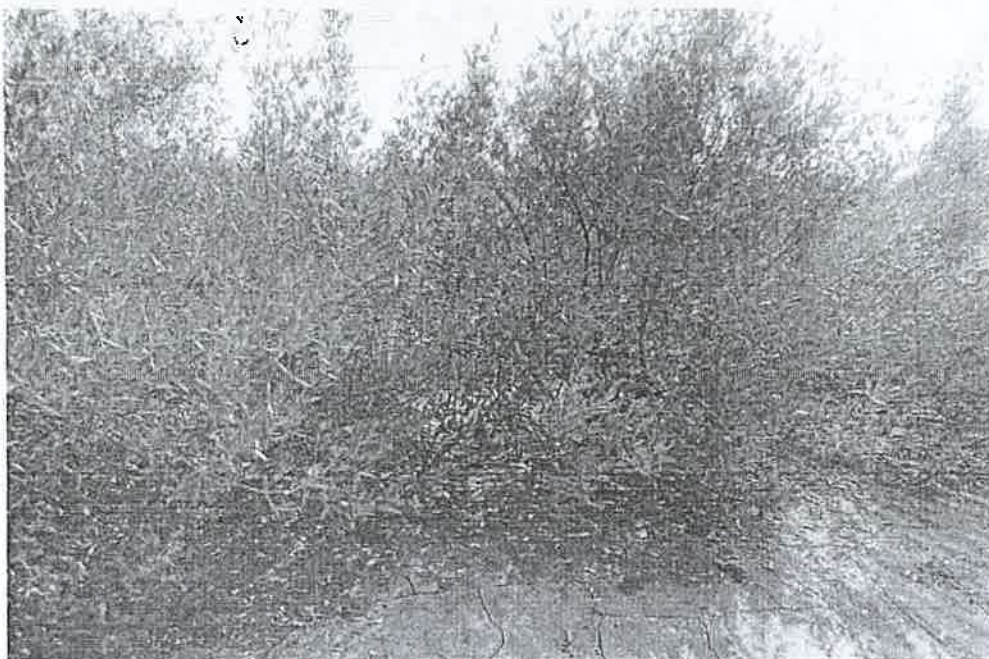
ANNEXURE II

**Mangroves planted in 50 ha. area at NADA Coast during 2009-10**



*Tommy*

**Mangroves planted in 100 ha. area at Ankalva Coast during 2010-11**



*Tomay*



**Mangroves planted in 200 ha. area at Ankalva Coast during 2011-12**



*Tommy*

**Mangroves planted in 200 ha. area at Ankalva Coast during 2012-13**



**Mangroves planted in 100 ha. area at Bhavnagar Coast during 2012-13**



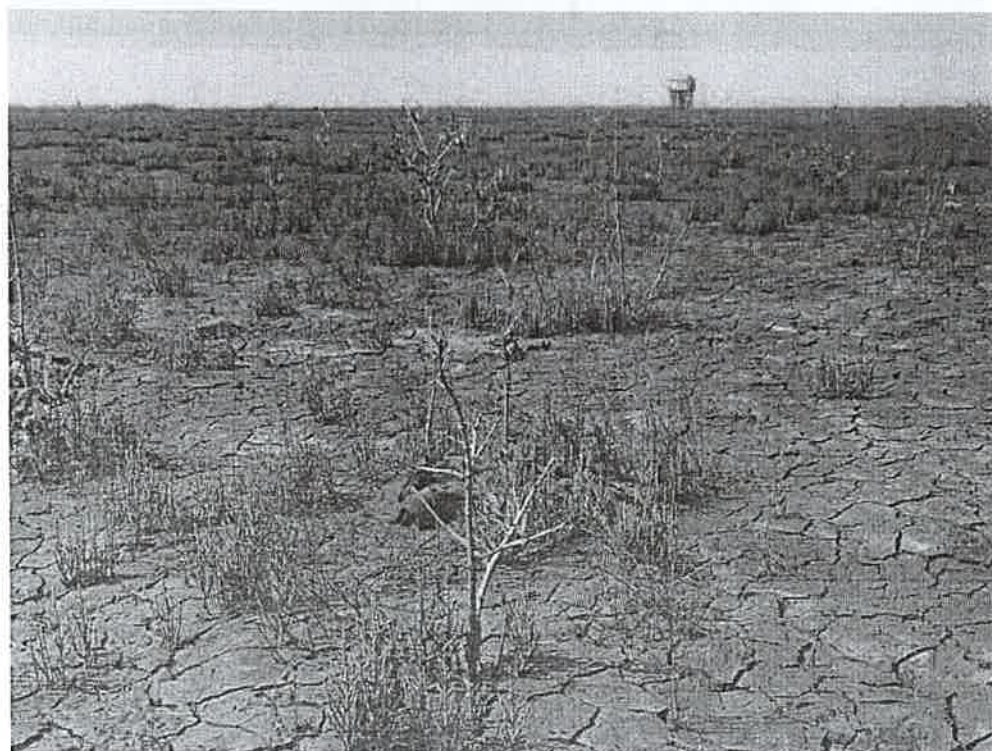
*toomay*

**Mangroves planted in 200 ha. area at Bhavnagar Coast during 2013-14**



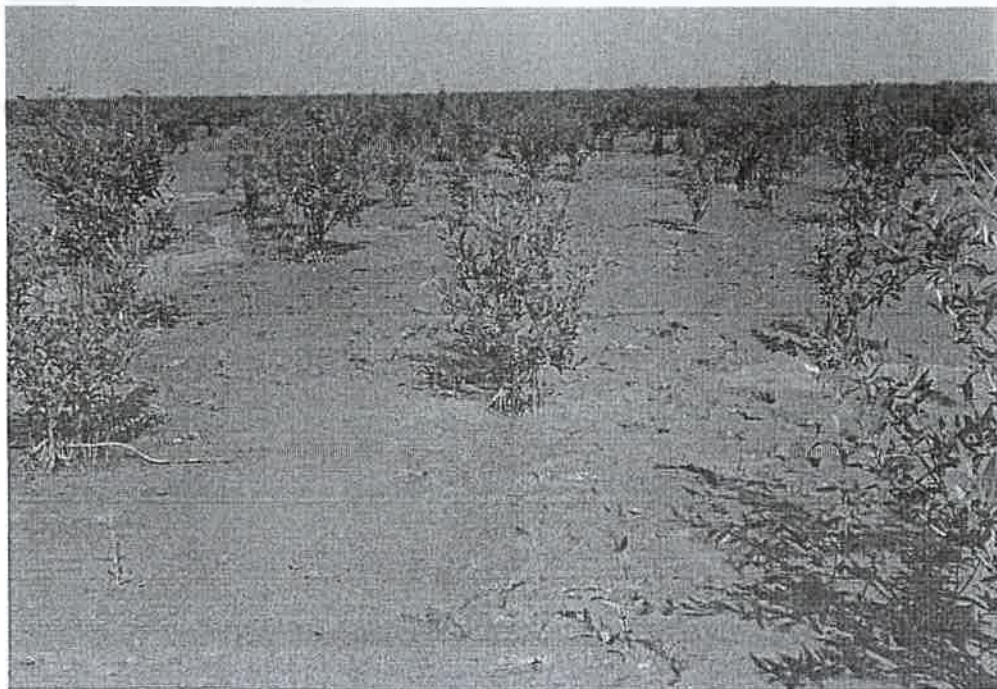
*Smay*

**Mangroves planted in 200 ha. area at Bhavnagar Coast during 2014-15**



*Omaw*

**Mangroves planted in 50 ha. area at at Kentiyajal Coast during 2014-15**



*Sanjay*

**Mangroves planted in 50 ha. area at Gadhula, Talaja Coast during 2016-17**



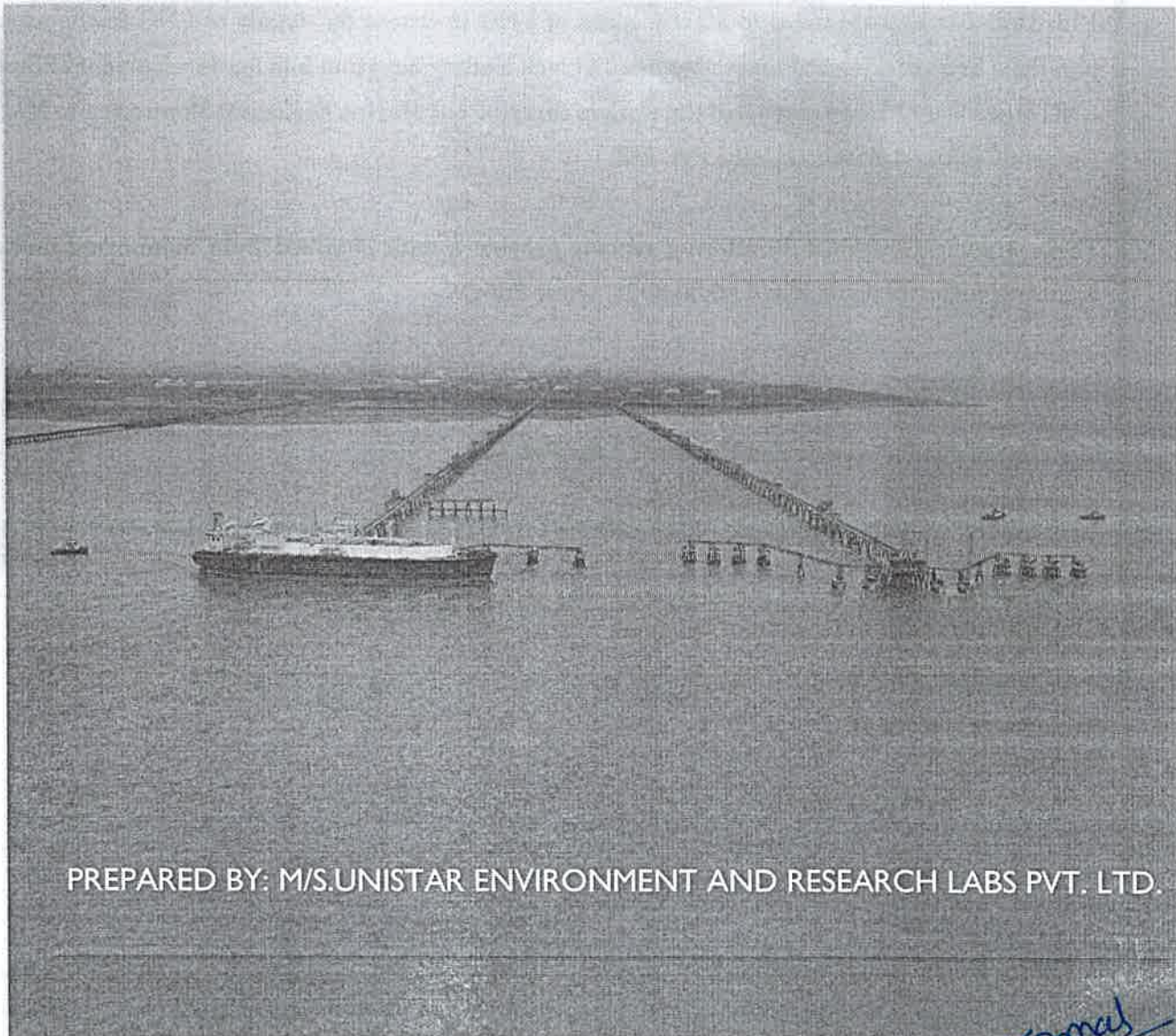
*Tammy*

# MARINE ECOLOGICAL MONITORING REPORT

FOR

**M/s.PETRONET LNG LIMITED., DAHEJ**

JUNE 2023



PREPARED BY: M/S.UNISTAR ENVIRONMENT AND RESEARCH LABS PVT. LTD.

*Unistar*





Marine Ecological Monitoring at  
M/s.Petronet LNG Limited., Dahej Terminals



Prepared by: M/s UniStar Environment and Research Labs Pvt. Ltd.

PREFACE

The Company had set up South East Asia's first LNG Receiving and Regasification Terminal with an original nameplate capacity of 5 MMTPA at Dahej, Gujarat. The infrastructure was developed in the shortest possible time and at a benchmark cost. The capacity of the terminal has been expanded in phases which is currently 17.5 MMTPA and the same is under expansion to 22.5 MMTPA in two phases. The terminal has 6 LNG storage tanks and other vaporization facilities. The terminal is meeting around 40% of the total gas demand of the country.

The terminal has two LNG Jetties at Dahej. While the first jetty can handle berthing of up to Q-Flex vessels, the second jetty can handle berthing of up to Q-Max vessels.

Dahej terminal is the largest single location LNG storage and regasification terminal in the country and has recently achieved the milestone of handling 3000th LNG cargo on 7th July 2022. The terminal is also offering tolling services to Off takers & Bulk customers. To cater the small customers who are not having gas pipeline connectivity, Dahej is supplying LNG to such customers which is transported through cryogenic trucks.

PLL Dahej is first terminal to start loading of LNG in trucks for supply of LNG to the areas where pipelines have not reached and today has 04 truck loading bays and hub for development of Small-Scale LNG business. PPL has entrusted the work of carrying out Marine Ecological Monitoring to **M/s.UniStar Environment and Research Labs Pvt. Ltd.**

These Marine Ecological Monitoring reports provide a data obtained from monitoring and analysis activities undertaken on dated.09.06.2023. (June 2023)

Date: 06/07/2023

**M/s.UniStar Environment and Research Labs Pvt. Ltd.**

White house, Char Rasta, Vapi-396 191

Approved by

Manager - Operations  
(Jaivik Tandel)

**TABLE OF CONTENTS**

NO.	Contents	Page No.
<b>Introduction to Project</b>		4
1.1	Background	4
1.2	Objectives	4
1.3	Scope of Work	4
1.4	Sampling Strategy	5
1.5	Team Members	7
<b>Water Quality</b>		8
2.1	Marine Water quality	8
2.2	Physico-chemical Water analysis result	9
<b>Biological Characteristics (Biodiversity Studies)</b>		11
3.1	Planktonic forms	11
3.2	Zooplankton Diversity	13
3.3	Macro-Benthic Fauna	17
3.4	Benthic Diversity	18
3.5	Avifaunal Diversity	22
3.6	Mangroves	23
3.7	Phytoplankton Diversity	24
3.8	Phytoplankton Pigments (Chlorophyll A and Pheophytin)	31
3.9	Chlorophyll A and Pheophytin Concentrations	32
4.0	Conclusion	34
<b>Map / Photos / Images/Graph</b>		
1	Sampling locations of Subtidal and intertidal Zone at M/s. PLL., Dahej Terminals	6
2	Zooplankton population (nos./100 m <sup>3</sup> ) recorded in the sub-tidal waters.	15
3	Zooplankton population (nos./100 m <sup>3</sup> ) recorded in the inter-tidal waters.	15
4	Dominant groups of Zooplankton reported from study area.	16
5	Microphotographs of zooplanktons reported in the coastal waters.	16
6	Subtidal macrobenthos abundance (nos./m <sup>2</sup> ) during high tide and low tide.	19
7	Inter-tidal macro benthos abundance (nos./m <sup>2</sup> ) at different sampling stations.	21
8	Percent composition of Subtidal benthic taxa from the marine waters	21
9	Microphotographs of microbenthic organisms observed in the sediment samples collected in the vicinity.	21

NO.	Contents	Page No.
10	High Tidal Level (HTL) phytoplankton abundance (no. $\times 10^2$ / L)	26
11	Low Tidal Level (LTL) phytoplankton abundance (no. $\times 10^2$ / L)	28
12	Inter-tidal phytoplankton abundance (no. $\times 10^2$ / L) at different sampling stations.	30
13	Microphotographs of phytoplankton reported in the coastal waters.	30
14	Different Types of Sampling Photographs	36
<b>Tables</b>		
1	Co-ordinates of subtidal and intertidal sampling stations	5
2	Methodology of Physico chemical Water Analysis	8
3	Physico-Chemical Water Analysis Results	9-10
4	Test methods for phytoplankton, Zooplankton, Chlorophyll a and Pheophytin, Macro benthos analysis	12
5	Population (nos./100 m <sup>3</sup> ) and biomass (ml/100 m <sup>3</sup> ) of various zooplankton groups in the sub-tidal area	14
6	Population (nos./100 m <sup>3</sup> ) and biomass (ml/100 m <sup>3</sup> ) of various zooplankton groups in the inter-tidal area	14
7	Faunal composition, density (nos./m <sup>2</sup> ) and biomass (g/m <sup>2</sup> ) of the macro benthos community in the sub-tidal region	18
8	Faunal composition, density (nos./m <sup>2</sup> ) and biomass (g/m <sup>2</sup> ) of the macrobenthos community in the inter-tidal region	20
9	List of bird species observed in the study area.	22
10	Phytoplankton abundance (cells $\times 10^2$ /L) at different sampling stations during High Tide Level (HTL) in the coastal waters	25
11	Phytoplankton abundance (cells $\times 10^2$ /L) at different sampling stations during Low Tide Level (LTL) in the coastal waters	27
12	Phytoplankton abundance (cells $\times 10^2$ /L) at different sampling stations during Intertidal zone	29
13	Chlorophyll a, Pheophytin concentrations in the surface marine water at High Tide level (HTL) and Inert-tidal zone (IT)	32
14	Chlorophyll a, Pheophytin concentrations in the middle marine water at High Tide level (HTL)	32
15	Chlorophyll a, Pheophytin concentrations in the bottom marine water at High Tide level (HTL)	33
16	Chlorophyll a, Pheophytin concentrations in the surface marine water at Low Tide level (LTL)	33
17	Chlorophyll a, Pheophytin concentrations in the middle marine water at Low Tide level (LTL)	33
18	Chlorophyll a, Pheophytin concentrations in the bottom marine water at Low Tide level (LTL)	33

## ❖ INTRODUCTION

### 1.1 Background:

The Marine Ecological Monitoring involves Physico-chemical and biological analysis of Marine water. Marine water quality of Sub-tidal and Intertidal regions, Flora and Fauna analysis in marine water area and Benthos in inter-tidal and sub-tidal analysis for the Petronet LNG Ltd. (Dahej LNG Terminal). Water sample are collected from different location (station) and Benthos sample are collected from High water and low water transect area. Samples are brought to the laboratory by field sampling team and the analysis was carried out in our laboratory and the results are presented in this report.

### 1.2 Objectives:

The primary objectives of this study are,

- a) To evaluate the physico-chemical parameters of seawater for better understanding of water quality in study region.
- b) To assess the marine biological status of the study region with quantitative and qualitative data of marine organisms (phytoplankton, zooplankton, and macrobenthos).
- c) To recommend adequate marine environmental management measures.

### 1.3 Scope of work

Sample collection on spatial basis for the Petronet LNG Ltd. (Dahej LNG Terminal) to evaluate the following parameters:

#### a) Marine Biological Water quality sample analysis from subtidal region

Water quality will be assessed for Temperature, pH, Turbidity, Total suspended solids, salinity, Oil & grease, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Calcium Carbonate, Alkanity, Petroleum Hydrocarbons (PHc), Total Phosphate, Nitrate, Ammonical nitrogen, Total nitrogen and Total coliform.

#### b) Biological Analysis of collected sample with respect to phytoplankton, zooplankton, Chlorophyll from subtidal region

#### c) Sampling of benthic communities from subtidal region between Low tide and high tide

d) Intertidal flora/fauna Qualitative and quantitative estimations: phytoplankton, pollution and generic diversity, primary productivity, zooplankton standing stock, micobenthic standing stock subtidal region, sea grass, algae, sea weeds, crustaceans, fishes mangroves and migratory birds etc.

#### 1.4 Sampling strategy

To evaluate the influence of activity at the Petronet LNG Ltd. (Dahej LNG Terminal), sedimentary parameters and marine biota present sampling was carried out on dated.09.06.2023

Table 1: Co-ordinates of subtidal and intertidal sampling stations

Stations		Co-ordinates		
Sub-tidal (ST)	ST-1	HTL	21°40.880'N	72°29.807'E
		LTL	21°40.887'N	72°29.948'E
	ST-2	HTL	21°39.867'N	72°29.799'E
		LTL	21°39.880'N	72°29.790'E
	ST-3	HTL	21°39.100'N	72°29.800'E
		LTL	21°39.055'N	72°29.801'E
	ST-4	HTL	21°38.130'N	72°30.432'E
		LTL	21°38.020'N	72°30.587'E
Intertidal (IT)	IT-01		21°40.572'N	72°30.921'E
	IT-02		21°40.559'N	72°30.586'E
	IT-03		21°40.128'N	72°30.950'E
	IT-04		21°39.896'N	72°30.629'E

#### a) Sampling frequency:

All Sampling subtidal stations were monitored during flood to ebb. Water samples were collected in Triplicate (surface, Middle and bottom) for assessing water quality and marine biological characteristics. Intertidal sampling was completed during low tide, for assessed Macro benthic fauna samples were collect in duplicate from each transects.

*Handwritten signature*

Figure 1. Sampling locations of Subtidal and intertidal at M/s.Petronet LNG Limited., Dahej Terminals



**b) Sampling methodology:**

- **Water quality:** Surface water samples were collected using the clean polyethylene bucket. Niskin water sampler (5-liter capacity) with a mechanism for closing at a desired depth using messenger was used for collecting sub-surface (bottom) water samples (~1m above the sea floor).
- **Sediment sampling:** For estimation of sedimentary parameters samples were collected from subtidal stations using Van-Veen type grab (area of 0.1 m<sup>2</sup>), while intertidal samples were collected using metal quadrant (0.25 m<sup>2</sup> area).
- **Biological characteristics:** Samples for chlorophyll and phytoplanktons were collected using clean plastic bucket and Niskin water samples. The samples for chlorophyll were immediately preserved with ice and kept in ice box till further analysis whereas the phytoplankton samples were fixed with Lugol's iodine and few drops of 3% buffered formaldehyde solutions, while for zooplankton oblique hauls were made at water surface using Heron Tranter net (mesh size 0.33 mm, mouth area 0.25 m<sup>2</sup>) attached with calibrated flow meter (General Oceanic). The samples were preserved in 5% buffered formaldehyde solutions. Samples for macrobenthos were collected using Van-Veen type of grab covering an area of 0.1 m<sup>2</sup> and sieving through 500 um mesh size. The samples were preserved with 5% formaldehyde Rose Bengal solutions.

### 1.5 Team Members

This Marine Ecological Monitoring work presented in this report is done by M/s. UniStar Environment and Research Labs Pvt. Ltd. With active co-operation from M/s. Petronet LNG Ltd. for this Marine Ecological Sampling and Analysis UERL team members as follows.

#### ➤ Sampling team members:

1. Dr. Sushant Vilas Sanaye (Marine Scientist)
2. Mr. Jaivik S. Tandel (Manager-Operations)
3. Mr. Bhavin Patel (Environmental Engineer)
4. Mr. Pravin Singh (Environmental Engineer)
5. Mr. Vijay Thanki (Environment Chemist)

#### ➤ Laboratory members

1. Dr. Ashwini Pawar-Sanaye, (Marine Scientist)
2. Dr. Sushant Vilas Sanaye (Marine Scientist)
3. Ms. Shweta A. Rana (Sr. Microbiologist)
4. Mr. Nilesh Patel (Sr. Chemist)



Marine Ecological Monitoring at  
M/s.Petronet LNG Limited., Dahej Terminals



Prepared by: M/s UniStar Environment and Research Labs Pvt. Ltd.

❖ WATER QUALITY

2.1 Marine Water quality:

Seawater samples have been collected during June 2023.

2.2 Physico chemical Water analysis result:

All the water sampled, which is collected by sampling team is brought to the lab for Physico chemical analysis. The marine water quality at different collected stations are measured during this investigation is presented in Table No.2.1 and its method of analysis is present in Table No.2.0

Table: 2.0 Methodology of Physico chemical Water Analysis

Sr.No.	Parameters	Test Method
1	pH @ 25 °C	IS 3025 (Part 11)1983
2	Temperature (°C)	IS 3025 (Part 9)1984
3	Turbidity	IS 3025 (Part 10)1984
4	Total Suspended Solids	APHA 23 <sup>rd</sup> Ed.,2017,2540- D
<b>CHEMICAL QUALITY</b>		
1	Biochemical Oxygen Demand (BOD)	IS 3025 (Part 44)1993
2	Oil & Grease	IS 3025 (Part 39) 2021
3	Ammonical Nitrogen	APHA 23 <sup>rd</sup> Ed.,2017,4500- NH3 B
4	Salinity	By Calculation
5	Dissolved Oxygen	APHA 23 <sup>rd</sup> Ed.,2017,4500-O, B
6	Total Alkalinity as CaCO <sub>3</sub>	IS 3025 (Part 23)1986
7	Phosphate	APHA 23 <sup>rd</sup> Ed.,2017,4500-P, D
8	Nitrate	APHA 23 <sup>rd</sup> Ed.,2017,4500 NO3-B
9	Calcium Carbonate	APHA 23 <sup>rd</sup> Ed.,2017,3500 Ca. B
10	Petroleum Hydrocarbon (PHc)	GC Method
<b>MICROBIOLOGY QUALITY</b>		
1	Total Coliform	APHA 23 <sup>rd</sup> Ed.2017,9222-B



Table: 2.1 Physico chemical Water Analysis Result

Sr.No.	Parameters	Unit	Station 1			Station 2		
			Surface	Middle	Bottom	Surface	Middle	Bottom
<b>PHYSICAL QUALITY</b>								
1.	pH @ 25 °C	--	8.01	7.82	7.81	7.90	7.97	8.04
2.	Temperature	(°C)	29	29	28	29	30	29
3.	Turbidity	NTU	50	10	50	50	10	10
4.	Total Suspended Solids	(mg/l)	784	624	521	740	724	536
<b>CHEMICAL QUALITY</b>								
1.	Biochemical Oxygen Demand	mg/L	4.4	4.8	3.8	4.1	3.6	3.4
2.	Oil & Grease	mg/L	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)
3.	Ammonical Nitrogen	mg/L	1.02	1.1	1.08	1.17	1.13	1.31
4.	Salinity	ppt	31.0	30.6	29.8	30.2	29.8	29.8
5.	Dissolved Oxygen	mg/L	5.8	5.9	5.4	5.7	5.8	5.9
6.	Total Alkalinity as CaCO <sub>3</sub>	mg/L	131.3	126.3	131.3	136.4	136.4	141.4
7.	Phosphate	mg/L	0.19	0.28	0.18	0.19	0.24	0.36
8.	Nitrate	mg/L	1.0	1.0	0.9	1.0	1.0	0.7
9.	Calcium Carbonate	mg/L	989.4	999.6	969	918	989.4	958.8
10.	Petroleum Hydrocarbon (PHc)	ppb	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
<b>MICROBIOLOGY QUALITY</b>								
1.	Total Coliform	CFU/ 100ml	46	20	Absent	44	18	Absent

Note: MDL = Minimum Detection Limit (MDL: 0.01) and N.D. = Not detectable

**Table: 2.2 Physico chemical Water Analysis Result**

Sr.No.	Parameters	Unit	Station 3			Station 4		
			Surface	Middle	Bottom	Surface	Middle	Bottom
<b>PHYSICAL QUALITY</b>								
1.	pH @ 25 °C	--	7.90	8.00	7.87	7.87	7.78	7.82
2.	Temperature	(°C)	29	28	28	29	29	28
3.	Turbidity	NTU	50	50	10	50	50	50
4.	Total Suspended Solids	(mg/l)	902	836	632	840	864	538.6
<b>CHEMICAL QUALITY</b>								
1.	Biochemical Oxygen Demand	mg/L	4.6	2.2	4.8	4.1	3.8	3.5
2.	Oil & Grease	mg/L	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)	BDL (MDL:5.0)
3.	Ammonical Nitrogen	mg/L	1.24	0.82	1.66	1.26	1.17	1.29
4.	Salinity	ppt	30.6	31.0	29.4	31.0	31.5	30.6
5.	Dissolved Oxygen	mg/L	5.9	6.0	5.9	6.0	5.7	6.0
6.	Total Alkalinity as CaCO <sub>3</sub>	mg/L	141.4	131.3	136.4	131.3	126.3	131.3
7.	Phosphate	mg/L	0.21	0.30	0.35	0.25	0.34	0.48
8.	Nitrate	mg/L	0.9	0.7	0.8	1.2	0.6	0.8
9.	Calcium Carbonate	mg/L	958.8	938.4	989.4	999.6	948.6	979.2
10.	Petroleum Hydrocarbon (PHc)	ppb	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
<b>MICROBIOLOGY QUALITY</b>								
1.	Total Coliform	CFU/100ml	56	36	Absent	41	24	Absent

**Note:** MDL = Minimum Detection Limit (MDL: 0.01) and N.D. = Not detectable

#### ❖ BIOLOGICAL CHARACTERISTICS (BIODIVERSITY STUDIES):

Marine ecosystems are subject to a multitude of direct human pressures, such as overexploitation, eutrophication, pollution, and species introductions. These stressors can have synergistic effects on marine ecosystems, altering its functioning. Anthropogenic involvements constantly compromise the health of the marine ecosystem by disturbing the ecological balance. Hence the assessment of the biotic components along with abiotic factors is an integral part of environmental assessment and monitoring study. During the present investigation at Petronet LNG, Dahej, the abundance and distribution of marine organisms (Plankton and benthos) were studied as part of routine environmental monitoring.

#### 3.1 Planktonic Forms:

The name plankton is derived from the Greek word “planktons”, meaning “wanderer” or “drifter”. While some forms of plankton are capable of independent movement and can swim up to several hundred meters in a single day, their position is primarily determined by currents in the body of water they inhabit. As per definition, organisms classified as “plankton” are unable to resist ocean currents. Plankton is primarily divided into two broad functional groups i.e., Phytoplankton and Zooplankton.

##### 3.1.1 Phytoplankton

Phytoplankton are microscopic, single-celled photosynthetic organisms that live suspended in all water niches, including oceans, freshwater, and marine niche. Like the terrestrial ecosystem where plants are an integral part of the ecosystem, phytoplankton play key role in the biogeochemistry of the oceans. As they are dependent on sunlight for energy, they mostly inhabit the euphotic zone. Therefore, they are responsible for production of half of the atmosphere’s oxygen and more than half of the primary production in the oceans. There are many species of phytoplankton, each of which has a characteristic shape, size, and function. Marine species of phytoplankton grow abundantly in oceans around the world and are the foundation of the marine food chain. Marine phytoplankton are the producing (autotrophic) component in the ocean. There are fourteen classes of phytoplankton. Each class of phytoplankton contains unique attributes in size, cell structure, nutrients, and function.

##### 3.1.2 Zooplankton:

Zooplankton occupies second position in the food web of the marine niche. They are the primary consumer’s organisms and generally feed on phytoplankton or small, microscopic group of organisms for they are nutritional needs. They are incapable of making their own food from sun-light or inorganic compounds, and feed on organisms or the remains of other organisms to get the energy necessary for survival.

• **SIGNIFICANCE OF PHYTO- AND ZOOPLANKTONS**

Phytoplankton are vital to marine ecosystems. They are producers, or autotrophs, that form the foundation of most marine food webs. As photosynthetic organisms, they can convert solar energy into chemical energy and store it in form of sugars. They are responsible for half of the photosynthetic activity on the planet. The significance of zooplanktons is found in their role of transferring biological production from phytoplankton to large organisms in the marine food web and the seafloor. The microscopic protozoan, tunicates, copepods, and other crustaceans graze upon many phytoplankton species. These in turn become food for other animals further linking the food web. Therefore, variability in reproduction of copepods would affect the survival of young fish that feeds on them.

**Table 3: Test methods for phytoplankton, Zooplankton, Chlorophyll a and Pheophytin, Macro benthos analysis**

Sr. no.	Test performed	Method
1	Phytoplankton	APHA, Edition 23, Part 10000, 10200 F
2	Chlorophyll <i>a</i> and Pheophytin	APHA, Edition 23, Part 10000, 10200 H (with some modification)
3	Zooplankton	APHA, Edition 23, Part 10000, 10200 G
4	Macro benthos	APHA, Edition 23, Part 10000, 10500 A-10500 D

### 3.2 ZOOPLANKTON DIVERSITY

Zooplankton includes arrays of organisms, varying in size from the microscopic protozoans of a few microns to some jellyfish-like organisms with tentacles several meters long. By virtue of sheer abundance and intermediate role between phytoplankton and fish, zooplankton is considered as the chief index of the utilization of aquatic biotopes at the second trophic level.

Zooplankton standing stock in terms of population and biomass revealed substantial variation within all Subtidal (4 stations) and inter-tidal (4 stations) stations (Table 4 and Table 5) in the study area of Petronet LNG jetty, Dahej during June 2023. In the sub-tidal area, the maximum zooplankton population density (19209 nos./100 m<sup>3</sup>) and biomass (3.16 ml/ 100 m<sup>3</sup>) was recorded at Station 1 during high tide level and minimum zooplankton population density (9352 nos./100 m<sup>3</sup>) and biomass (1.03 ml/100 m<sup>3</sup>) were recorded at Station 3 during low tide level (Figure 1). In the inter-tidal area, the maximum zooplankton population density (12807 nos./100 m<sup>3</sup>) and biomass (1.51 ml/100 m<sup>3</sup>) were recorded at Station IT-4 and the minimum zooplankton population (9851 nos./100 m<sup>3</sup>) and biomass (1.10 ml/100 m<sup>3</sup>) were recorded at Station IT-2 (Figure 2). A total of 12 groups of zooplankton including Copepods, Copepod nauplii, crab larvae, Chaetognaths, Decapod larvae, fish and shellfish eggs, fish larvae, gastropod larvae, Polychaetae larvae, Siphonophora, Ostracods and Oikopleura were identified during this study (Table 4 and 5). Among these identified groups Copepods (72.89%) and Copepod nauplii (9.32%) were most dominant (Figure 3). Chaetognaths (3.61%) and Crab larvae (2.97%) were also the dominant groups in the zooplankton population (Figure 3). As well as fish and shell eggs, polychaetae larvae also were another observed group during the present study.

**Table 4: Population (nos./100 m<sup>3</sup>) and biomass (ml/100 m<sup>3</sup>) of various zooplankton groups in the sub-tidal area at the Petronet LNG, Dahej during June 2023.**

Zooplankton Groups	High Tide level				Low Tide level			
	St-1	St-2	St-3	St-4	St-1	St-2	St-3	St-4
Copepods	13563	13281	12826	13943	8869	7363	6948	10991
Copepod nauplii	2667	2792	1837	2073	1322	936	722	653
Crab larvae	784	698	696	617	261	349	186	392
Chaetognaths	1063	736	553	514	452	386	392	467
Decapod (shrimps)	70	57	71	51	17	37	21	19
Fish and shell fish eggs	209	396	321	343	87	129	144	112
Fish larvae	0	19	36	0	17	18	0	0
Gastropod larvae	70	19	54	34	35	0	41	19
Polychaete larvae	174	264	214	240	70	73	474	56
Siphonophora	70	94	54	86	70	55	21	56
Ostracods	35	19	36	51	17	18	41	19
Oikopleura	17	0	18	51	17	0	0	0
<b>Population (nos./100 m<sup>3</sup>)</b>	<b>19209</b>	<b>18839</b>	<b>17677</b>	<b>17782</b>	<b>11524</b>	<b>9865</b>	<b>9352</b>	<b>12137</b>
<b>Biomass (ml/100 m<sup>3</sup>)</b>	<b>3.16</b>	<b>2.24</b>	<b>1.67</b>	<b>2.68</b>	<b>1.74</b>	<b>1.03</b>	<b>1.03</b>	<b>1.63</b>

**Table 5: Population (nos./100 m<sup>3</sup>) and biomass (ml/100 m<sup>3</sup>) of various zooplankton groups in the inter-tidal area at the Petronet LNG, Dahej during June 2023.**

Zooplankton Groups	Inter tidal stations			
	IT-1	IT-2	IT-3	IT-4
Copepods	10262	8793	9044	10433
Copepod nauplii	886	865	720	657
Crab larvae	318	335	233	277
Chaetognaths	351	441	447	467
Decapod (shrimps)	0	35	19	17
Fish and shell fish eggs	117	194	136	156
Fish larvae	17	0	0	17
Gastropod larvae	17	0	19	17
Polychaete larvae	150	194	97	52
Siphonophora	50	35	58	52
Ostracods	17	0	39	17
Oikopleura	0	18	19	0
<b>Population (nos./100 m<sup>3</sup>)</b>	<b>10501</b>	<b>9851</b>	<b>10774</b>	<b>12807</b>
<b>Biomass (ml/100 m<sup>3</sup>)</b>	<b>1.57</b>	<b>1.10</b>	<b>1.58</b>	<b>1.51</b>

*Done*

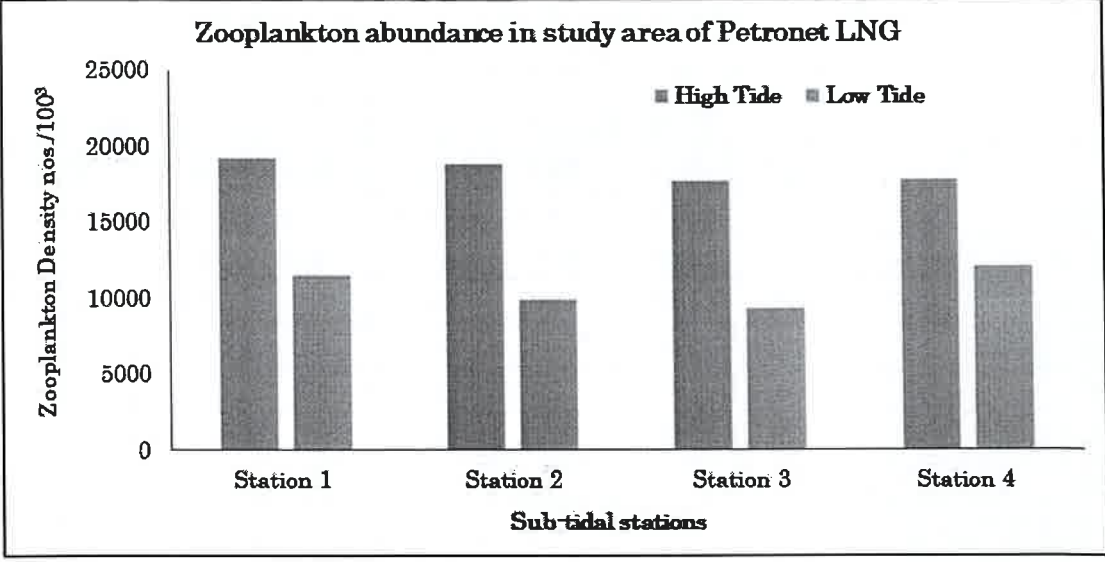


Figure 2: Zooplankton population (nos./100 m<sup>3</sup>) recorded in the sub-tidal waters along the Petronet LNG, Dahej during June 2023.

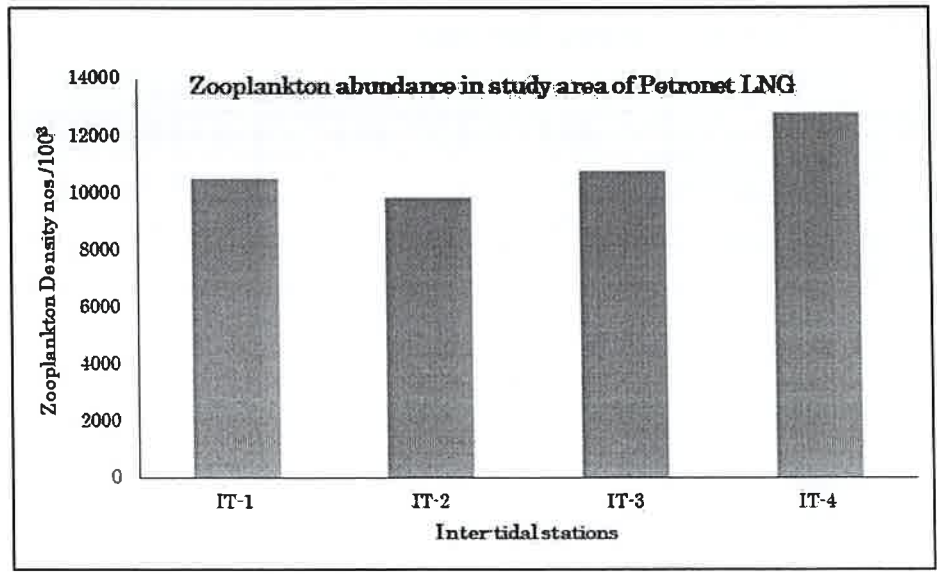
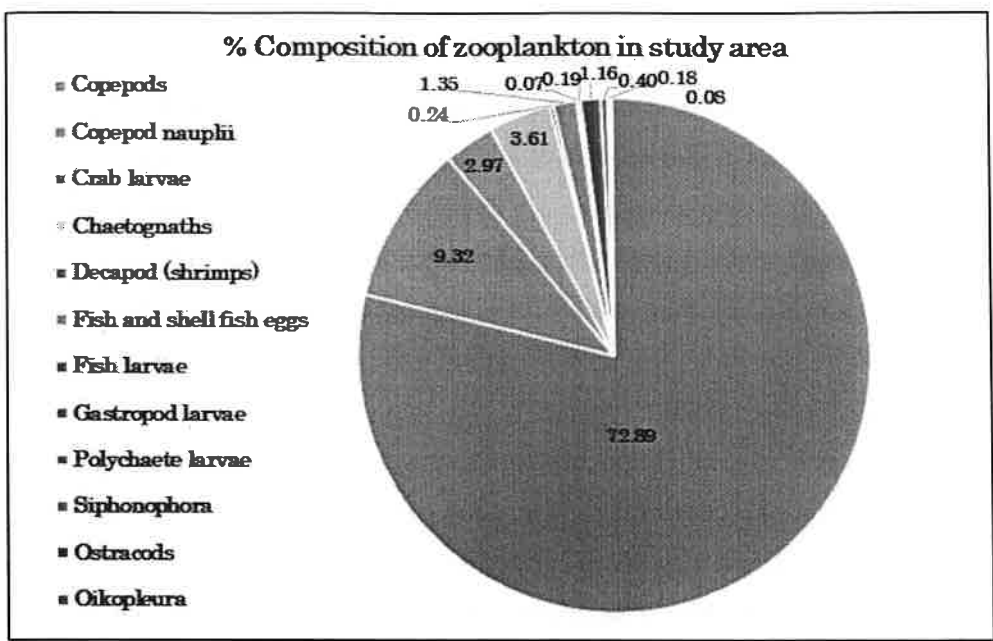
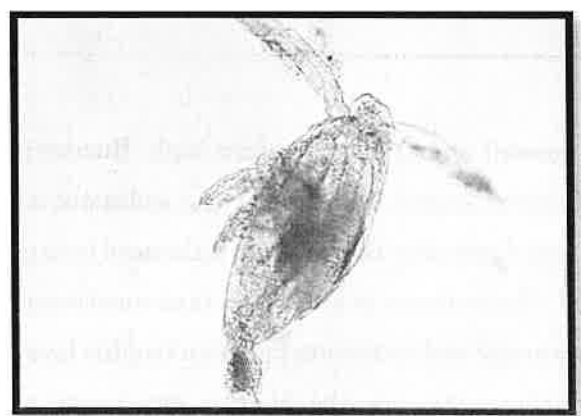


Figure 3: Zooplankton population (nos./100 m<sup>3</sup>) recorded in the inter-tidal waters along the Petronet LNG, Dahej during June 2023.



**Figure 3: Dominant groups of Zooplankton reported from study area of Petronet LNG, Dahej during June 2023.**



**Copepod**



**Copepod Nauplius**

**Figure 4: Microphotographs of zooplanktons reported in the coastal waters of Petronet LNG, Dahej during June 2023**



### 3.3 MACRO-BENTHIC FAUNA

The benthic zone is the lowest ecological zone of a water body which usually involves the sediments on the seafloor. The number of phyla and species of benthic animals exceeds those of pelagic species, at least partly because of the greater physical variety of benthic habitats. Benthic animals are separated into in faunal and epifaunal species, depending upon whether they live within sediments or on the surface of the seafloor, respectively. Size categories of the zoobenthos consist of the larger macrofauna (>1.0 mm), the small meiofauna which is characteristically found in sand and mud, and the microfauna which is made up mostly of protozoans.

Benthic organisms are morphologically different from those planktonic organisms. Many are adapted to live on the substrate (bottom). In benthic habitats, they can be considered dominant creatures. These organisms adapted to deep-water pressure so cannot survive in the upper parts of the water column. Since light does not penetrate very deep ocean water, the benthic organisms often depend on the organic matter falling from the upper water column as their main energy source. This dead and decaying matter sustains the benthic food chain. The most benthic organisms are scavengers or detritivores. These organisms under being relatively stationary, are constantly exposed to changes undergoing in overlying water, and hence, respond very well to aquatic pollution. The macro benthos population is very sensitive to environmental perturbation and is highly influenced by the physicochemical characteristics of water, the nature of the substratum, food, predation, and other factors. The density of benthic invertebrates also fluctuates widely with the changes in the season.

- **Significance of macrobenthic organisms**

The biomass of microbenthic organisms in estuaries and coastal embayment is often high. Burrowing and tube-building by deposit-feeding benthic organisms (bioturbations) help to mix the sediment and enhance the decomposition of organic matter. Nitrification and denitrification are also enhanced because a range of oxygenated and anoxic micro-habitats are created. Macro fauna is also important constituents of fish diets and thus are an important link for transferring energy and nutrients between trophic levels, also driving pelagic fish and crustacean production. For these reasons, the benthic organisms are extremely important indicators of environmental change.



**Marine Ecological Monitoring at  
M/s.Petronet LNG Limited., Dahej Terminals**



Prepared by: M/s UniStar Environment and Research Labs Pvt. Ltd.

### 3.4 BENTHIC DIVERSITY

#### 3.4.1 Subtidal region:

During the present study, macrobenthos abundance and biomass were recorded at sub-tidal stations during high and low tide levels at Petronet LNG, Dahej (Table 6). The macrobenthos density ranged from 340 nos./m<sup>2</sup> to 460 nos./m<sup>2</sup> at sampling stations (Table 6; Figure 5) and comprising of 4 different groups (mollusks, Sipuncula, annelids and foraminifera). The biomass of the macrobenthic community in the study region ranged from 1.37 g/m<sup>2</sup> to 1.82 g/m<sup>2</sup>. The maximum abundance of benthic microorganisms was reported at Station 3 (460 nos./m<sup>2</sup>) during high tide levels and mainly contributed by the dominance of polychaete worms. The highest biomass of macrobenthic species was observed at Station 3 (1.82 g/ m<sup>2</sup>) during high tide levels with the dominance of Polychaetas. The least density (340 no/m<sup>2</sup>) and biomass (1.4 g/m<sup>2</sup>) was observed at Station 4 during high tide tide level. In species composition, Annelida is the first largest group observed at all the stations during the present study where Polychaete species (Phylum Annelida) belonging to the family Paraonidae, Pilargidae, Capitillidae, Cossuridae, Spionidae, Nereidae, Eunicidae, were abundant. Secondly, bivalves & gastropods, foraminifera and sipunculids were present at all the sampled stations.

**Table 6: Faunal composition, density (nos./m<sup>2</sup>) and biomass (g/m<sup>2</sup>) of the macrobenthos community in the sub-tidal region at Petronet LNG, Dahej during June 2023.**

Benthos Faunal Groups	High tide Level				Low tide Level			
	St-1	St- 2	St- 3	St- 4	St- 1	St- 2	St- 3	St- 4
<b>Phylum Mollusca</b>								
Bivalves and gastropods	20	20	10	20	20	20	30	20
<b>Phylum Sipuncula</b>								
Sipunculids	10	10	10	10	20	20	20	10
Nemertine	40	30	20	10	0	20	10	10
<b>Phylum Annelida</b>								
Polychaetes	210	150	230	140	140	140	180	150
<b>Phylum Retaria</b>								
Foraminifera	160	150	190	160	180	200	160	150
<b>Density (nos./ m<sup>2</sup>)</b>	<b>440</b>	<b>360</b>	<b>460</b>	<b>340</b>	<b>360</b>	<b>400</b>	<b>400</b>	<b>344</b>
<b>Biomass (gm/m<sup>2</sup>)</b>	<b>1.75</b>	<b>1.55</b>	<b>1.82</b>	<b>1.4</b>	<b>1.47</b>	<b>1.7</b>	<b>1.68</b>	<b>1.37</b>

*Tommy*

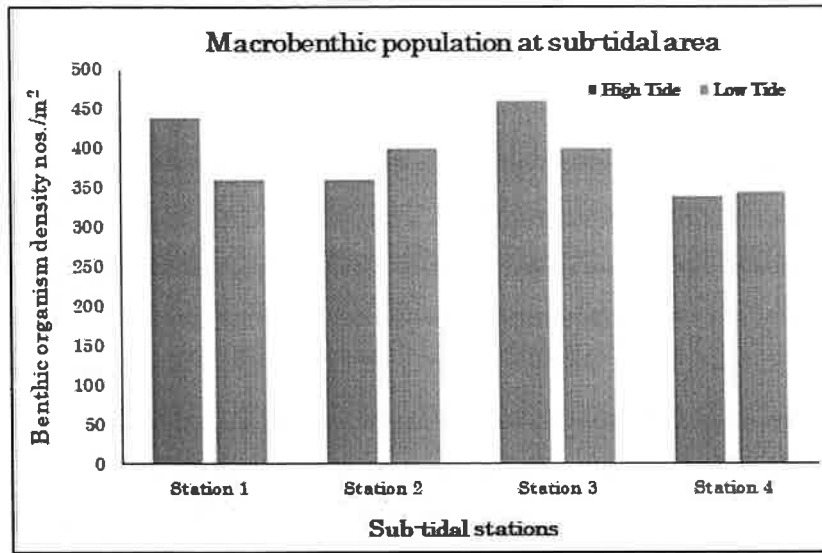


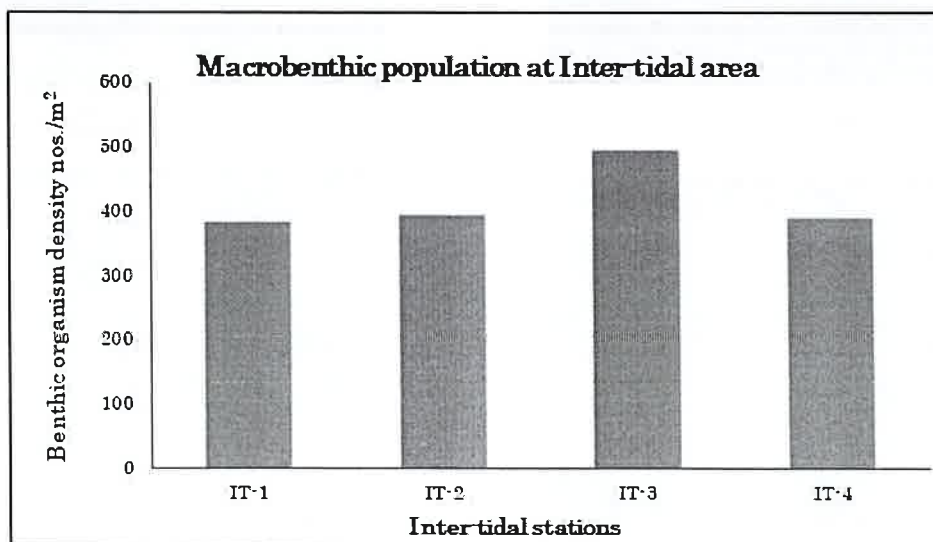
Figure 5: Subtidal macrobenthos abundance (nos./m<sup>2</sup>) during high tide and low tide at different sampling stations at Petronet LNG, Dahej during June 2023.

### 3.4.2 Intertidal region:

The muddy and sandy substratum with moderate organic matter supports the occurrence of the microbenthic community in the intertidal region. The macrobenthos biomass was measured in between 1.48 g/m<sup>2</sup> to 2.15 g/m<sup>2</sup> in the intertidal region at the Petronet LNG, Dahej (Table 7). The lowest density and biomass of macrobenthic organisms were reported at station IT-1 (384 nos./m<sup>2</sup> and 1.48 g/m<sup>2</sup>, respectively), whereas the highest density was reported at Station IT-3 (494 nos./m<sup>2</sup> and 2.15 g/m<sup>2</sup>, respectively) (Table 7 and Figure 6). In the intertidal area, Foraminifera (47%) and Polychaete (43%) species were contributed to the total macrobenthic abundance at these stations followed by bivalves and gastropods (4.81%). Some photographs of benthic fauna are shown in Figure 8.

**Table 7: Faunal composition, density (nos./m<sup>2</sup>) and biomass (g/m<sup>2</sup>) of the macrobenthos community in the inter-tidal region at Petronet LNG, Dahej during June 2023.**

Benthos Faunal Groups	Inter-tidal stations			
	IT-1	IT- 2	IT- 3	IT- 4
<b>Phylum Mollusca</b>				
Bivalves and gastropods	20	20	20	10
<b>Phylum Sipuncula</b>				
Sipunculids	0	10	10	10
Nemertine	20	10	10	10
<b>Phylum Annelida</b>				
Polychaetes	160	160	220	180
<b>Phylum Arthropoda</b>				
Decapod larvae (crab)	4	4	4	0
<b>Phylum Retaria</b>				
Foraminifera	180	190	230	180
<b>Density (nos./ m<sup>2</sup>)</b>	<b>384</b>	<b>394</b>	<b>494</b>	<b>390</b>
<b>Biomass (gm/m<sup>2</sup>)</b>	<b>1.48</b>	<b>1.7</b>	<b>2.15</b>	<b>1.65</b>



**Figure 6: Inter-tidal macro benthos abundance (nos./m<sup>2</sup>) at different sampling stations at Petronet LNG, Dahej during June 2023.**

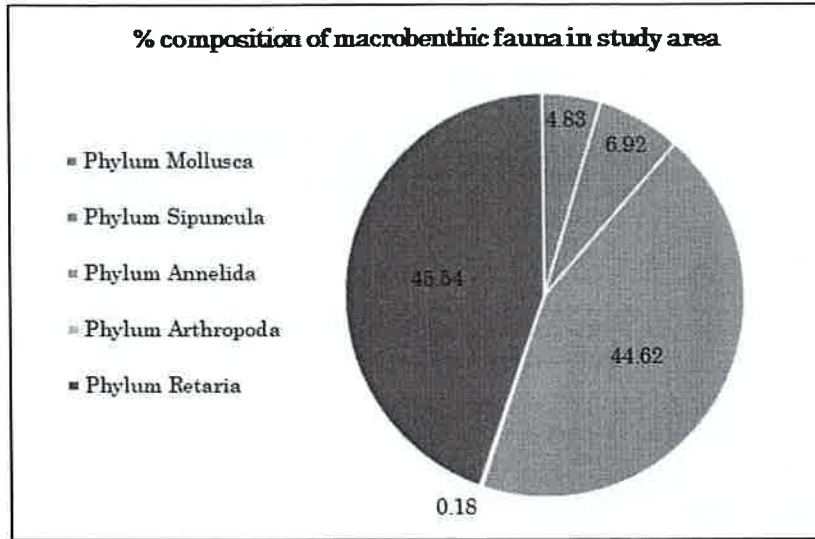
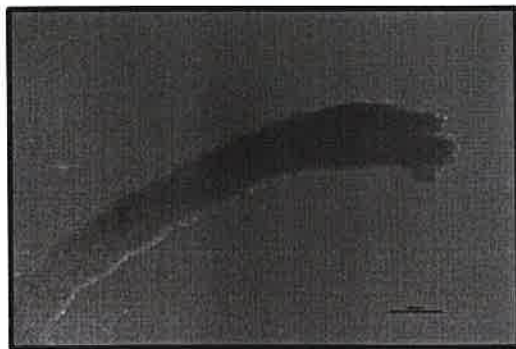
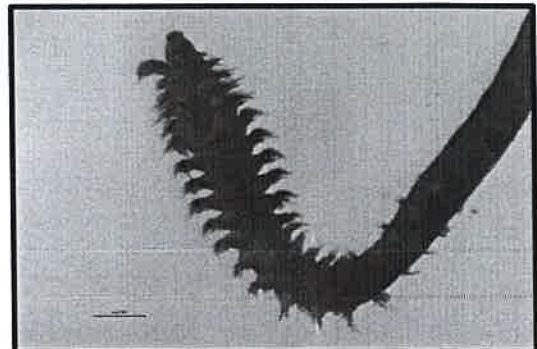


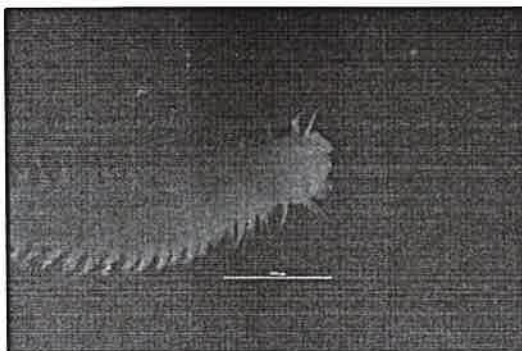
Figure 7: Percent composition of Subtidal benthic taxa from the marine waters of Petronet LNG, Dahej during June 2023



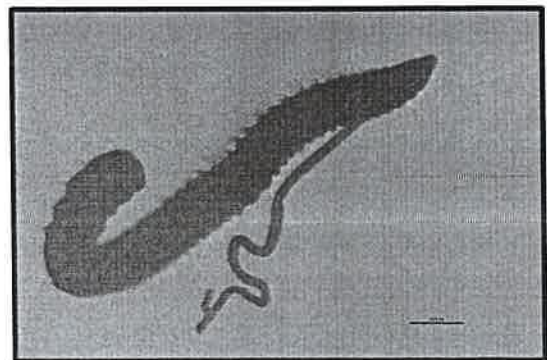
Capitallidae



Spoynidae



Pilargidae



Cossuridae

Figure 8: Microphotographs of microbenthic organisms observed in the sediment samples collected in the vicinity of Petronet LNG, Dahej during June 2023

### 3.5 AVIFAUNAL DIVERSITY

Due to their importance in the ecosystem for various roles such as scavengers, pollinators for crops, seeds dispersal agents and also predators of insect pests, the avifaunal diversity study of a given region is a major indicator to evaluate habitats both qualitatively and quantitatively. Due to anthropogenic activities along with climate changes, the global diversity of birds is rapidly decreasing. IUCN Red List of endangered birds has already recognized 1226 bird species as threatened globally and whereas, 88 bird species are found in India.

Coastal and estuarine waters are always been important habitats for many bird species, including many migratory birds. Mudflats and sandy beaches are important feeding grounds for coastal birds and nearby mangrove forests and land trees provide shelter and breeding habitats. During the present study, an overview of the avifaunal diversity present in the study area has been taken. Due to the restricted approach to mudflats and shores directly for security reasons, only available bird species are listed in Table 8.

**Table 8: List of bird species observed in the study area.**

Sr. No.	Scientific name	Common name	IUCN category
1.	<i>Actitis hypoleucos</i>	Common sandpiper	Least concern (LC)
2.	<i>Ardeola grayii</i>	Indian pond Heron	Least concern (LC)
3.	<i>Bubulcus ibis</i>	Cattle egret	Least concern (LC)
4.	<i>Casmerodius albus</i>	Great egret	Least concern (LC)
5.	<i>Columba livia</i>	Rock dove	Least concern (LC)
6.	<i>Charadrius leschenaultii</i>	Sand plover	Least concern (LC)
7.	<i>Egretta gularis</i>	Western reef egret	Least concern (LC)
8.	<i>Milvus migrans</i>	Black kite	Least concern (LC)
9.	<i>Vanellus indicus</i>	Red-wattled Lapwing	Least concern (LC)

Most of the bird species were observed foraging in the inter-tidal mud flats during low tide. Rock doves were observed to make nests in jetties and building structures. All the avifaunal species found in the study area are common in appearance and in the least concern (LC) category of the IUCN red list of threatened species. All species are observed to be resident species in Indian region.

### 3.6 MANGROVES

Mangroves are a very specialised group of plants found only in the transitional zone between land and the sea. The mangrove species are adapted to the salty water, less oxygen in sediments as well as daily tidal variation. The mangrove species developed a special kind of roots called 'Pneumatophores' which enables them for intake of air for plants in the water filled muddy soil. These breathing roots help mangrove trees to absorb oxygen from air and therefore thrive them into oxygen less muddy soil.

Mangrove plants generate a variety of natural resources and ecosystem services that are vital to subsistence economies and sustain local and national economies. During many natural calamities like cyclones, storm surges, heavy flooding and tsunamis they act as barriers and protect the land from erosion and reduce the effect on living resources. The value of mangroves as a carbon sink and the efficiency with which they can remove carbon from the atmosphere put them center stage in the context of increasing global concerns about climate change and sea level rise. They also maintain the stability of the shoreline and prevent the release of toxic wastes into the coastal waters. The mangrove ecosystem is also a rich of nutrients in the coastal waters. The falling leaves from the mangrove area become the primary source of a food chain, which goes on to feed microorganisms, larvae and the adults of many invertebrates and fishes. These roots also harbor the number of fish species which use this area as their breeding grounds. It is estimated that over 70% of commercially important fishes depend on mangroves for their nutrient cycle and nursery breeding. This fish reach habitat attracts the number of birds and animals in the area thus making the mangroves a biodiversity reach habitat.

During the present study, scattered patches of mangroves mainly *Avicennia* species were found towards the northwest side of Petronet LNG jetties. All observed patches are shrub type and may be because of the high tidal amplitude in the Gulf of Khambhat.



### 3.7 PHYTOPLANKTON DIVERSITY:

The phytoplankton are vast array of minute and microscopic plants passively drifting in natural waters and mostly confined to the illuminated zone. In an ecosystem these organisms constitute primary producers forming the first link in the food chain. The phytoplankton have long been used as indicators of water quality. Some species flourish in highly eutrophic waters, while others are very sensitive to organic and/or chemical wastes. Because of their short life cycles, plankton responds quickly to environmental changes. Hence, their standing crop in terms of biomass, cell counts and species composition are more likely to indicate the quality of the water mass in which they are found. Phytoplankton composition also varies considerably. Thus, a very few species may be overwhelmingly common during blooms, while a large number of species may occur without clear dominance under normal conditions.

Phytoplankton sampling was carried out at 4 stations from three levels i.e., Surface, Middle and Bottom at HTL (High Tide Level), LTL (Low Tide Level) and IT (Intertidal zone). During the sampling period (June 2023) the phytoplankton population in the coastal waters of Petronet LNG, Dahej was diverse and represented with a total of 33 phytoplankton genera (Table 9) belonging to diatoms (29 genera) and dinoflagellates (4 genera). Diatoms Species belonged to *Amphora* sp., *Amphorprora* sp., *Asterionella* sp., *Bacillaria* sp., *Chaetoceros* sp. *Corethron* sp., *Coscinodiscus* sp., *Cyclotella* sp., *Cylindrotheca* sp., *Cymbella* sp., *Diploneis* sp., *Ditylum* sp., *Guinardia* sp., *Gyrosigma* sp., *Lauderia* sp., *Leptocylindrus* sp., *Licmophora* sp., *Lithodesmium* sp., *Navicula* sp., *Nitzschia* sp., *Odontocella* sp., *Paralia* sp., *Pinnularia* sp., *Pleurosigma* sp., *Pseudo-nitzschia* sp., *Rhizosolenia* sp., *Synedra* sp., *Thalassiosira* sp. and *Thalassionema* sp.

The phytoplankton abundance in the study region was ranged from 78 to 198 cells $\times 10^2/L$  (Table 9, Figure 9) at HTL. The highest phytoplankton abundance was observed at Station 4 in the surface (198 nos. $\times 10^2/L$ ) and lowest at Station 1 in bottom water (78 nos. $\times 10^2/L$ ). The phytoplankton abundance was ranged from 72 to 173 nos. $\times 10^2/L$  (Table 9, Figure 9) at LTL. The highest phytoplankton abundance at LTL was (173 nos. $\times 10^2/L$ ) was observed at Station 4 in surface water and lowest was at station 3 bottom water (72 nos. $\times 10^2/L$ ). The phytoplankton abundance was ranged from 98 to 116 nos. $\times 10^2/L$  (Table 9, Figure 9) at Intertidal zone. The highest phytoplankton abundance at IT was (116 nos. $\times 10^2/L$ ) was observed at Station 1 and lowest was at station 2 (98 nos. $\times 10^2/L$ ). The study shows that the marine water around was enriched with the diverse phytoplankton population.



**Table 9: Phytoplankton abundance (cells×10<sup>2</sup>/L) at different sampling stations during High Tide Level (HTL) in the coastal waters of Petronet LNG, Dahej during June 2023.**

Note: S=surface; M= Middle; B=bottom; HTL= High Tide Level; St=station

Phytoplankton Genera	Sampling Stations (HTL)											
	St-1			St-2			St-3			St-4		
	S	M	B	B	M	B	S	M	B	S	M	B
<b>Diatoms</b>												
<i>Amphora</i> sp.	1	0	0	4	2	1	4	0	0	4	2	1
<i>Amphorprora</i> sp.	0	0	0	2	1	2	1	1	0	1	0	1
<i>Asterionella</i> sp.	22	18	15	16	14	12	21	19	15	26	18	14
<i>Bacillaria</i> sp.	2	1	1	3	3	2	2	0	4	9	4	4
<i>Chaetoceros</i> sp.	1	1	1	1	1	0	2	1	1	5	2	1
<i>Corethron</i> sp.	1	0	0	0	2	0	2	1	0	2	1	0
<i>Coscinodiscus</i> sp.	22	18	12	21	18	10	25	15	10	22	16	12
<i>Cyclotella</i> sp.	0	0	0	1	0	4	2	2	1	5	4	2
<i>Cylindrotheca</i> sp.	1	0	0	1	3	1	0	4	0	2	0	2
<i>Cymbella</i> sp.	0	0	0	1	1	0	0	0	1	2	1	1
<i>Diploneis</i> sp.	0	1	1	1	1	1	1	0	0	4	2	0
<i>Ditylum</i> sp.	5	2	2	1	0	1	5	3	1	1	1	0
<i>Guinardia</i> sp.	4	2	2	8	6	3	7	8	6	6	4	4
<i>Gyrosigma</i> sp.	5	3	0	0	2	0	0	0	0	0	0	0
<i>Lauderia</i> sp.	0	2	1	0	0	1	0	0	0	2	1	1
<i>Leptocylindrus</i> sp.	3	0	1	2	1	2	1	1	0	4	0	3
<i>Licmophora</i> sp.	1	0	0	0	0	1	0	2	3	1	3	0
<i>Lithodesmium</i> sp.	5	0	0	1	2	1	2	1	4	3	2	0
<i>Navicula</i> spp.	15	11	10	16	14	12	16	11	6	14	11	6
<i>Nitzschia</i> spp.	9	6	4	8	4	1	8	7	5	10	8	5
<i>Odontella</i> sp.	6	5	2	1	1	4	7	5	3	9	8	7
<i>Paralia</i> sp.	4	1	0	5	8	6	10	5	3	11	8	4
<i>Pinnularia</i> sp.	5	0	2	1	0	0	5	0	2	6	4	1
<i>Pleurosigma</i> spp	8	6	4	5	2	2	11	8	5	12	6	2
<i>Pseudo-nitzschia</i> sp.	4	1	2	2	0	1	3	4	2	0	0	0
<i>Rhizosolenia</i> sp.	5	2	2	6	3	3	8	5	2	10	6	3
<i>Synedra</i> sp.	2	1	0	0	0	1	2	0	2	3	1	0
<i>Thalassionema</i> sp.	10	9	7	8	8	7	5	3	1	11	4	2
<i>Thalassiosira</i> sp.	8	4	3	7	2	0	6	6	5	8	0	1
<b>Dinoflagellates</b>												
<i>Alexandrium</i> sp.	1	0	1	1	0	1	1	0	2	1	0	1
<i>Gymnodinium</i> sp.	1	2	2	1	1	2	0	2	4	1	0	1
<i>Prorocentrum</i> sp.	2	0	2	0	4	1	1	0	1	2	1	1
<i>Protoperidinium</i> sp.	1	2	1	1	1	1	1	0	1	1	1	0
<b>Total Phytoplankton (nos. x 10<sup>2</sup>/L)</b>	<b>154</b>	<b>98</b>	<b>78</b>	<b>125</b>	<b>105</b>	<b>84</b>	<b>159</b>	<b>114</b>	<b>90</b>	<b>198</b>	<b>119</b>	<b>80</b>

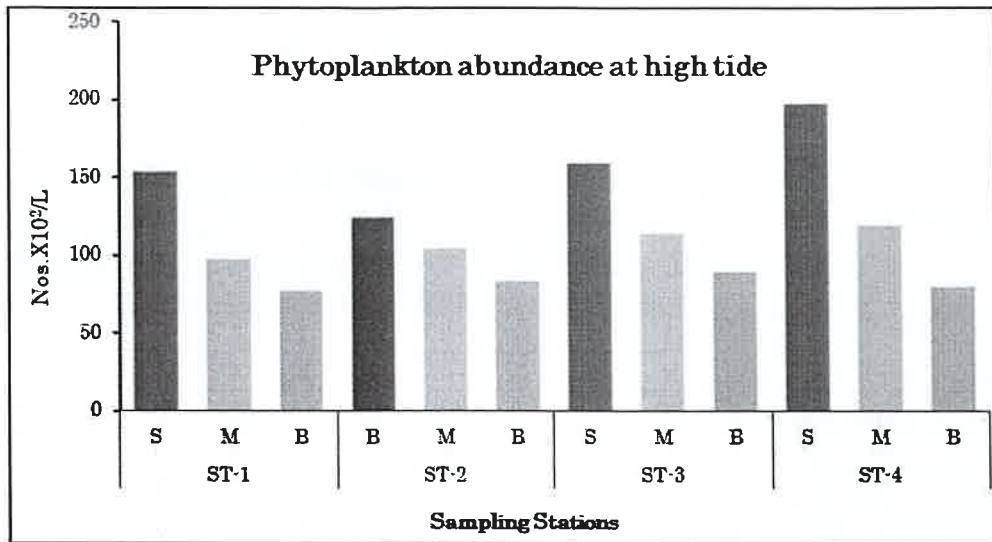


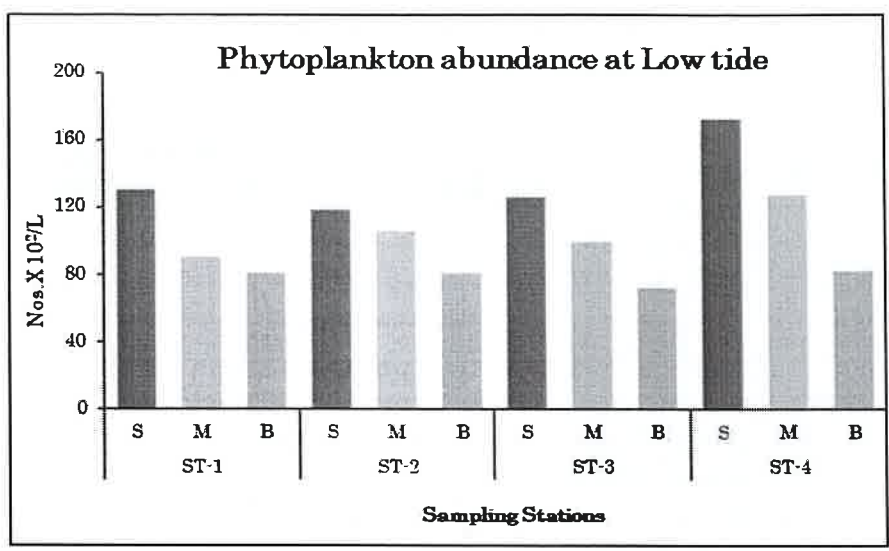
Figure 9: High Tidal Level (HTL) phytoplankton abundance (no. x10<sup>2</sup>/ L) at different sampling stations at Petronet LNG, Dahej during June 2023

*Handwritten signature*

**Table 10: Phytoplankton abundance (cells×10<sup>2</sup>/L) at different sampling stations during Low Tide Level (LTL) in the coastal waters of Petronet LNG, Dahej during June 2023.**

Note: S=surface; M= Middle; B=bottom; LTL= Low Tide Level; St=station

Phytoplankton Genera	Sampling Stations (LTL)											
	St-1			St-2			St-3			St-4		
	S	M	B	B	M	B	S	M	B	S	M	B
<b>Diatoms</b>												
<i>Amphora</i> sp.	1	0	0	3	2	1	1	0	1	8	7	0
<i>Amphorprora</i> sp.	0	1	0	0	1	2	4	1	1	1	0	0
<i>Asterionella</i> sp.	19	17	15	12	12	11	11	8	7	21	19	11
<i>Bacillaria</i> sp.	1	0	0	4	3	1	2	0	4	9	4	4
<i>Chaetoceros</i> sp.	1	1	3	6	4	2	2	2	1	7	6	4
<i>Corethron</i> sp.	1	0	0	1	2	1	0	0	0	1	0	1
<i>Coscinodiscus</i> sp.	20	18	17	14	13	7	11	8	7	25	19	13
<i>Cyclotella</i> sp.	1	2	3	2	2	2	0	0	1	5	0	1
<i>Cylindrotheca</i> sp.	1	1	1	0	3	1	0	4	0	2	0	2
<i>Cymbella</i> sp.	1	0	0	2	1	1	0	0	0	0	0	0
<i>Diploneis</i> sp.	1	0	0	0	1	0	0	0	0	4	0	1
<i>Ditylum</i> sp.	5	2	2	1	1	1	11	6	1	1	1	1
<i>Guinardia</i> sp.	3	2	1	7	5	4	8	7	6	0	0	0
<i>Gyrosigma</i> sp.	1	1	1	0	2	0	0	0	0	0	0	0
<i>Lauderia</i> sp.	0	1	0	0	0	0	0	0	0	2	0	0
<i>Leptocylindrus</i> sp.	2	0	1	5	4	3	0	1	0	5	0	0
<i>Licmophora</i> sp.	0	1	1	0	0	1	0	2	3	1	3	0
<i>Lithodesmium</i> sp.	3	0	0	1	1	1	3	3	2	1	4	1
<i>Navicula</i> spp.	16	12	10	14	9	7	8	5	2	13	11	9
<i>Nitzschia</i> spp.	10	8	7	12	10	8	6	4	2	15	13	8
<i>Odontella</i> sp.	5	4	2	4	2	1	15	8	4	15	14	7
<i>Paralia</i> sp.	3	0	0	6	3	2	11	6	2	2	2	2
<i>Pinnularia</i> sp.	4	0	1	2	0	0	7	5	4	3	2	2
<i>Pleurosigma</i> spp	6	3	2	2	2	2	9	9	7	7	4	2
<i>Pseudo-nitzschia</i> sp.	1	0	1	1	0	1	3	4	1	0	0	0
<i>Rhizosolenia</i> sp.	2	1	2	8	5	4	1	8	3	11	7	6
<i>Synedra</i> sp.	1	1	0	0	0	1	2	0	1	3	2	1
<i>Thalassionema</i> sp.	8	5	4	1	6	5	5	5	5	7	5	4
<i>Thalassiosira</i> sp.	7	6	5	10	7	4	3	0	2	1	0	0
<b>Dinoflagellates</b>												
<i>Alexandrium</i> sp.	2	1	1	0	0	0	1	0	1	0	0	1
<i>Gymnodinium</i> sp.	1	2	0	1	3	4	1	4	2	1	4	2
<i>Prorocentrum</i> sp.	2	0	0	0	1	2	1	0	1	1	0	0
<i>Protoperidinium</i> sp.	2	1	1	0	1	1	0	0	1	1	1	0
<b>Total Phytoplankton (nos. x 10<sup>2</sup>/L)</b>	<b>131</b>	<b>91</b>	<b>81</b>	<b>119</b>	<b>106</b>	<b>81</b>	<b>126</b>	<b>100</b>	<b>72</b>	<b>173</b>	<b>128</b>	<b>83</b>



**Figure 10: Low Tidal Level (LTL) phytoplankton abundance (no. x10<sup>2</sup>/ L) at different sampling stations at Petronet LNG, Dahej during June 2023**

**Table 11: Phytoplankton abundance (cells×10<sup>2</sup>/L) at different sampling stations during Intertidal zone of Petronet LNG, Dahej during June 2023.**

Phytoplankton Genera	Sampling stations			
	IT1	IT2	IT3	IT4
<b>Diatoms</b>				
<i>Amphora</i> sp.	1	0	1	3
<i>Amphorprora</i> sp.	1	0	0	0
<i>Asterionella</i> sp.	12	15	19	13
<i>Bacillaria</i> sp.	2	1	0	4
<i>Chaetoceros</i> sp.	2	1	1	1
<i>Corethron</i> sp.	0	0	0	0
<i>Coscinodiscus</i> sp.	14	24	22	17
<i>Cyclotella</i> sp.	1	2	2	0
<i>Cylindrotheca</i> sp.	1	0	0	0
<i>Cymbella</i> sp.	1	1	1	1
<i>Diploneis</i> sp.	0	1	0	0
<i>Ditylum</i> sp.	4	5	1	1
<i>Guinardia</i> sp.	5	5	9	20
<i>Gyrosigma</i> sp.	2	1	3	0
<i>Lauderia</i> sp.	0	2	1	0
<i>Leptocylindrus</i> sp.	4	0	0	3
<i>Licmophora</i> sp.	0	3	2	0
<i>Lithodesmium</i> sp.	0	0	2	1
<i>Navicula</i> spp.	11	1	0	1
<i>Nitzschia</i> spp.	4	7	6	8
<i>Odontocella</i> sp.	8	8	1	1
<i>Paralia</i> sp.	1	0	4	10
<i>Pinnularia</i> sp.	8	0	0	2
<i>Pleurosigma</i> spp	2	8	0	2
<i>Pseudo-nitzschia</i> sp.	5	0	1	1
<i>Rhizosolenia</i> sp.	1	1	11	9
<i>Synedra</i> sp.	1	0	0	0
<i>Thalassionema</i> sp.	18	8	2	1
<i>Thalassiosira</i> sp.	1	1	15	10
<b>Dinoflagellates</b>				
<i>Alexandrium</i> sp.	1	1	1	0
<i>Gymnodinium</i> sp.	1	0	1	1
<i>Prorocentrum</i> sp.	0	1	0	0
<i>Proto-peridinium</i> sp.	4	1	1	1
<b>Total Phytoplankton (nos. x 10<sup>2</sup>/L)</b>	<b>116</b>	<b>98</b>	<b>107</b>	<b>111</b>

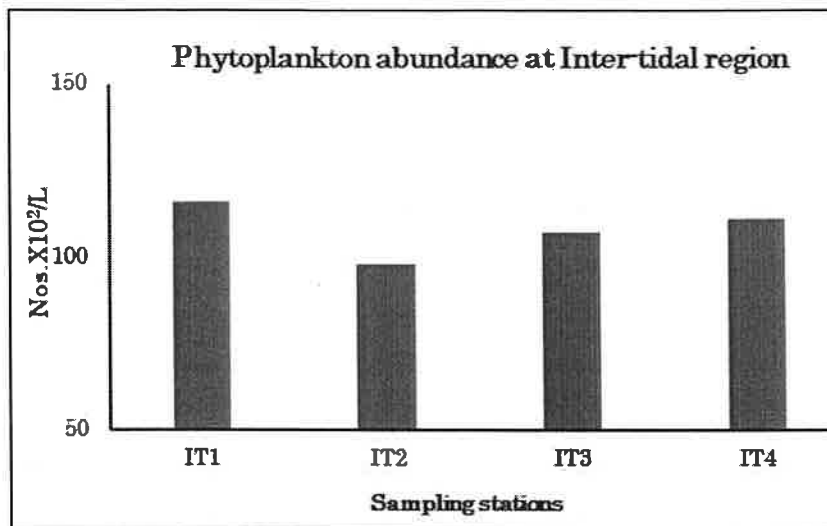
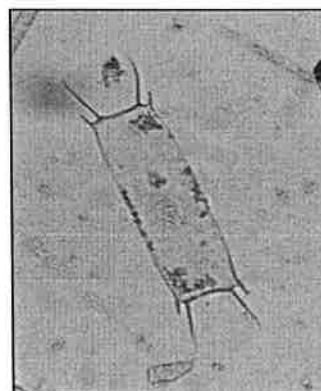


Figure 11: Inter-tidal phytoplankton abundance (no. x10<sup>2</sup>/ L) at different sampling stations at Petronet LNG, Dahej during June 2023.



*Navicula sp.*



*Odontella sp.*

Fig. 12- Microphotographs of phytoplankton reported in the coastal waters of Petronet LNG, Dahej during June 2023.

### 3.8 PHYTOPLANKTON PIGMENTS (CHLOROPHYLL *a* AND PHEOPHYTIN):

Marine phytoplankton contains essential as well as accessory pigments like that of terrestrial plants. Phytoplankton pigments capture sunlight. The resulting photosynthesis and its products, especially the oxygen and organic compounds, all rely on the light energy captured by the different phytoplankton pigments. Chlorophyll *a* is the major pigment for light harvesting, and plays a significant role in photosynthesis and photoprotection, by extending the light collection window and protecting the cell from the damage of high irradiance levels or high ultraviolet light exposure.

Algal chlorophyll forms a series of degradation products upon degradation. In addition to Chlorophyll the naturally occurring pigments in algal cells. The nature of these degradation products depends on which part of the chlorophyll molecule is affected. As chlorophyll degrades, the initial step is either the loss of the magnesium from the center of the molecule or the loss of the phytol tail. This results in the formation of the molecule, phaeophytin. Depending on the parent molecule several distinct molecules like phaeophytins, chlorophyllides, and pheophorbides can be produced. Thus, in addition to Chlorophyll *a* filtered seawater contains color degradation products of phytoplankton pigments.



### 3.9 CHLOROPHYLL *a* AND PHAEOPHYTIN CONCENTRATIONS

The phytoplankton biomass distribution expressed in terms of Chlorophyll *a* (Chl-*a*) and Pheophytin at selected stations in the coastal region of Petronet LNG, Dahej during June 2023. The samples for chlorophyll *a* and pheophytin is analysed for High Tide Level (HTL), Low tide level (LTL) and Inter-tidal zone (IT). For HTL and LTL samples collected from surface, middle and bottom and for IT samples collected only form surface water. The Chl-*a* concentrations in the HTL surface water were ranged from 1.16 mg/m<sup>3</sup> to 1.57 mg/m<sup>3</sup>. The Pheophytin content was ranged from 0.44 mg/m<sup>3</sup> to 0.54 mg/m<sup>3</sup>. The Chl-*a* concentrations in the HTL middle water were ranged from 1.05 mg/m<sup>3</sup> to 1.20 mg/m<sup>3</sup>. The Pheophytin content was ranged from 0.30 mg/m<sup>3</sup> to 0.38 mg/m<sup>3</sup>. The Chl-*a* concentrations in the HTL bottom water were ranged from 1.00 mg/m<sup>3</sup> to 1.10 mg/m<sup>3</sup>. The Pheophytin content was ranged from 0.21 mg/m<sup>3</sup> to 0.32 mg/m<sup>3</sup>. The Chl-*a* concentrations in the IT water were ranged from 0.87 mg/m<sup>3</sup> to 1.11 mg/m<sup>3</sup>. The Pheophytin content was ranged from 0.29 mg/m<sup>3</sup> to 0.42 mg/m<sup>3</sup>.

The Chl-*a* concentrations in the LTL surface water were ranged from 1.20 mg/m<sup>3</sup> to 1.35 mg/m<sup>3</sup>. The Pheophytin content was ranged from 0.31 mg/m<sup>3</sup> to 0.42 mg/m<sup>3</sup>. The Chl-*a* concentrations in the LTL middle water were ranged from 1.00 mg/m<sup>3</sup> to 1.26 mg/m<sup>3</sup>. The Pheophytin content was ranged from 0.24 mg/m<sup>3</sup> to 0.32 mg/m<sup>3</sup>. The Chl-*a* concentrations in the LTL bottom water were ranged from 1.01 mg/m<sup>3</sup> to 1.11 mg/m<sup>3</sup>. The Pheophytin content was ranged from 0.21 mg/m<sup>3</sup> to 0.30 mg/m<sup>3</sup>.

**Table 12: Chlorophyll *a*, Pheophytin concentrations in the surface marine water of Petronet LNG, Dahej at High Tide level (HTL) and Inert-tidal zone (IT) during June 2023.**

Sr. No	Parameters	Unit	High Tide Level (HTL)							
			Surface Water							
			St.1	St.2	St.3	St.4	IT1	IT2	IT3	IT4
1.	Chlorophyll <i>a</i>	mg/m <sup>3</sup>	1.43	1.57	1.16	1.32	1.11	1.03	0.87	0.94
2	Pheophytin	mg/m <sup>3</sup>	0.49	0.54	0.44	0.47	0.41	0.42	0.32	0.29

**Table 13: Chlorophyll *a*, Pheophytin concentrations in the middle marine water of Petronet LNG, Dahej at High Tide level (HTL) during June 2023.**

Sr. No.	Parameters	Unit	High Tide Level (HTL)							
			Middle Water							
			St.1	St.2	St.3	St.4	IT1	IT2	IT3	IT4
1.	Chlorophyll <i>a</i>	mg/m <sup>3</sup>	1.10	1.20	1.05	1.11	-	-	-	-
2	Pheophytin	mg/m <sup>3</sup>	0.32	0.38	0.30	0.35	-	-	-	-



**Table 14: Chlorophyll *a*, Pheophytin concentrations in the bottom marine water of Petronet LNG, Dahej at High Tide level (HTL) during June 2023.**

Sr. No.	Parameters	Unit	High Tide Level (HTL)							
			Bottom Water							
			St.1	St.2	St.3	St.4	IT1	IT2	IT3	IT4
1.	Chlorophyll <i>a</i>	mg/m <sup>3</sup>	1.00	1.10	1.00	1.08	-	-	-	-
2	Pheophytin	mg/m <sup>3</sup>	0.21	0.32	0.31	0.30	-	-	-	-

**Table 15: Chlorophyll *a*, Pheophytin concentrations in the surface marine water of Petronet LNG, Dahej at Low Tide level (LTL) and Inert-tidal zone (IT) during June 2023.**

Sr. No.	Parameters	Unit	Low Tide Level (LTL)			
			Surface Water			
			St.1	St.2	St.3	St.4
1.	Chlorophyll <i>a</i>	mg/m <sup>3</sup>	1.20	1.35	1.21	1.34
2	Pheophytin	mg/m <sup>3</sup>	0.31	0.42	0.38	0.40

**Table 16: Chlorophyll *a*, Pheophytin concentrations in the middle marine water of Petronet LNG, Dahej at Low Tide level (LTL) during June 2023.**

Sr. No.	Parameters	Unit	Low Tide Level (LTL)			
			Middle Water			
			St.1	St.2	St.3	St.4
1.	Chlorophyll <i>a</i>	mg/m <sup>3</sup>	1.06	1.26	1.00	1.00
2	Pheophytin	mg/m <sup>3</sup>	0.24	0.32	0.26	0.27

**Table 17: Chlorophyll *a*, Pheophytin concentrations in the bottom marine water of Petronet LNG, Dahej at Low Tide level (LTL) during June 2023.**

Sr. No.	Parameters	Unit	Low Tide Level (LTL)			
			Bottom Water			
			St.1	St.2	St.3	St.4
1.	Chlorophyll <i>a</i>	mg/m <sup>3</sup>	1.01	1.11	1.02	1.07
2	Pheophytin	mg/m <sup>3</sup>	0.21	0.30	0.25	0.30

### 3.9 SEA GRASS AND MACRO ALAGE (SEA WEEDS)

During the present study, no occurrence of sea grasses and sea weeds in the inter-tidal area was observed.

#### 4.0 CONCLUSION

##### 4.1 Chemical Analysis of Water Sample

- pH at all Subtidal region Sampling Station was observe between rang in 7.78 to 8.04
- Temperature at all Subtidal region Sampling Station was observed around 28.8°C
- Turbidity at all Subtidal region Sampling Station was observed between 10 to 50 NTU
- Total Suspended Solids at all Subtidal region Sampling Station was observed between 521 to 902 mg/L
- Biochemical Oxygen Demand (BOD) Solids at all Subtidal region Sampling Station was observed between 2.2 to 4.8 mg/L
- Oil & Grease at all Subtidal region Sampling Station was observed under below detection limit.
- Ammonical Nitrogen at all Subtidal region Sampling Station was observed between 0.8 to 1.7 mg/L
- Salinity at all Subtidal region Sampling Station was observed between 29.4 to 31.5 ppt
- Dissolved Oxygen at all Subtidal region Sampling Station was observed between 5.4 to 6.0 mg/L
- Total Alkalinity as CaCO<sub>3</sub> at all Subtidal region Sampling Station was observed between 126.3 to 141.4 mg/L
- Phosphate at all Subtidal region Sampling Station was observed between 0.20 to 0.50 mg/L
- Nitrate at all Subtidal region Sampling Station was observed between 0.6 to 1.2 mg/L
- Calcium Carbonate at all Subtidal region Sampling Station was observed between 918 to 999.6 mg/L
- Petroleum Hydrocarbon (PHc) at all Subtidal region Sampling Station was Not detected.
- In microbiological parameter Total Coliform at all Subtidal region Sampling Station was observed between Absent to 56 CFU/100ml

##### 4.2 Biological parameters of water samples

- The Chl-*a* and Pheophytin concentrations were more in the surface water as compared to the bottom water. The variations observed between the surface and bottom waters could be due to several natural biological variability.
- During the sampling period (Junc 2023) the phytoplankton population in the coastal waters of Petronet LNG, Dahej was diverse and represented with a total of 33 phytoplankton genera (Table 9) belonging to diatoms (29 genera) and dinoflagellates (4 genera).
- In the sub-tidal area, more density and species were reported in the surface water than middle and bottom waters. This difference could be attributed to the depth of water as surface water are more productive due to more penetration of light which decreases as increase in depth of water.
- The occurrence of copepods and their nauplii together with decapods and fish larvae/eggs in zooplankton samples highlights the fair production potential of live food resources (organisms) to support the fish and crustacean population in the study region.

- Difference in zooplankton abundance during high tide level and low tide level in the sub-tidal area was observed during the present study. Increased levels of suspended solids and the apparent increase in turbidity of water as well as high current during low tide will be considered as a possible reason for low zooplankton abundance during low tide levels.
- Compared to sub-tidal stations, in inter-tidal region zooplankton abundance was observed to be less and higher turbidity and current caused by the lower depth of water in inter-tidal areas also possible reasons for the same.
- During present study, two groups of organisms i.e. Foraminifera contributed to the 45% and Polychaete worms contributed to the 43% of total benthic organisms. Overall, the presence of Polychaete and Sipuncula worms suggests the availability of food organisms for benthic predators in the area. Due to presence of sand in the study area, foraminiferans are more abundant.
- Mangrove species *Avicennia* sp. is very sparse.
- Avifauna present in the study area is most common type.
- Overall, considering biological parameters of the study area, the study area is showed healthy environment contributing good production of phytoplankton, zooplankton and benthic organisms.

- Different Types of Sampling Photographs



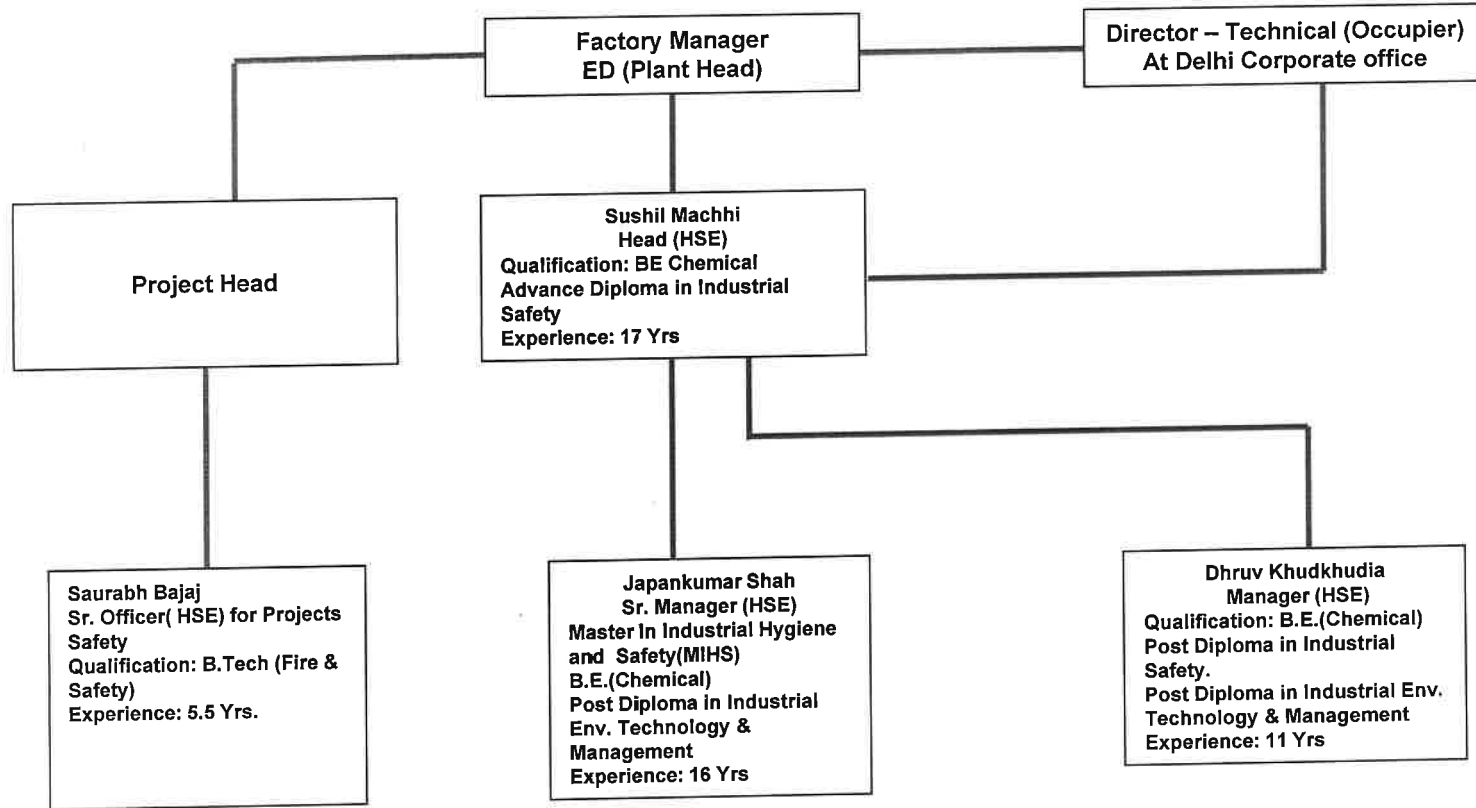
\*\*\*\*\*

*Handwritten signature*



# Annexure-XII

## EMC Organogram – PLL, Dahej



*Moored*