



HETERO INFRASTRUCTURE SEZ LTD.
Ch. Lakshmiapuram (Vill)
N.Narasapuram (Village), Rajayyapeta (Vill),
Nakkapalli (Mandal),
Anakapalli (Dist) - 531 081, A.P., INDIA.
Tel : +91 8931 227307, Fax: +91 8931 227200

Letter NO: HIS/EHS/MoEF&CC/2023-24/02

1st December 2023

Joint Director (S)
Integrated Regional Office (IRO),
Ministry of Environment, Forest & Climate Change,
Green House complex, Gopala Reddy Road,
Vijayawada - 520010,
Andhra Pradesh.

Dear Sir,

Sub : Submission of six-monthly compliance report of Environmental Clearance issued to M/s Hetero Infrastructure SEZ Ltd, Nakkapalli, Visakhapatnam Audited by the third party approved by MoEF&CC— Regarding

Ref : Environmental Clearance No: 21-641/2007-IA, III (I) Dated 25/10/2010

With reference to the above, please find enclosed six-monthly compliance report of Environmental clearance of M/s Hetero Infrastructure SEZ Ltd, for the period 1st April 2023 to 30th September 2023 Audited and certified by the third Party M/s S.V. Enviro Labs & Consultants (NABL Accredited and Approved by MoEF&CC) with all necessary enclosures for your kind information and perusal.

Kindly acknowledge the receipt.

Thanking you,

Yours faithfully,
For Hetero Infrastructure SEZ Ltd

S. Kullayi Reddy
Associate Vice President -EHS

Enclosures : As above

Corporate

7-2-A2, Industrial Estates, Sanath Nagar, Hyderabad-500 018, Telangana, India
T: +91 40 23704923 / 24 / 25, Fax : +91 40 23704926, 23714119

www.hetero.com



SV ENVIRO LABS & CONSULTANTS

(ENVIRONMENTAL ENGINEERS & CONSULTANTS IN POLLUTION CONTROL)

Corporate Office & Laboratory : Enviro House, B-1, Block-B, IDA, Autonagar, Visakhapatnam-530012.
Hyderabad: Flat No. 302, H.No. 7-1-396/B/12, Sai Ram Residency, Balkampet Road, S.R.Nagar, Hyderabad-500038.
C +91-9440338628, +91-7207664444 • svenviro_labs@yahoo.co.in, info@svenvirolabs.com • www.svenvirolabs.com
Recognized by Govt. of India-MoEF & CC, New Delhi, Accredited by : NABL & NABET



Date:

To

Sr. General Manager -EHS,

M/s. Hetero Infrastructures SEZ Ltd

N. Narasapuram Village, Nallamattipalem Village,

Nakkapalli Mandal,

Visakhapatnam.

Sir,

Sub: Certified Compliance report for Environmental Clearance and CRZ Clearance of M/s.

Hetero Infrastructures SEZ Ltd Audited by SV Enviro Labs & Consultants, NABL.

Accredited third party- Reg

Ref: 1) EC & CRZ Clearance F. No. 21-641/2007-IA.III, Date: 25.10.2010

We wish to inform you that, we SV Enviro Labs & Consultants, accredited by NABET/NABL located at Enviro House, B1, Block 'B'-IDA, Auto Nagar, Visakhapatnam herewith submit audited report for M/s. Hetero Infrastructures SEZ Ltd at Sy. No. 215, 286/1, 286/2, 283/1, in Ch. Lakshmi Puram, 312/1 to 312/5, 312/10 to 312/12, 313/1 to 313/7 of Rajaiahpet, 19(qart) in Pedda Teermala, 117/1 to 117/3, 119/1, 119/2, 120/1, 120/2, 125, 126, 129/1 to 129/9, 138, 142, 150, 215, N. Narasaraopuram Village, Nakkapally Mandal, Visakhapatnam for Environmental Clearance obtained from Ministry of Environment and Forests for the period of 01st April 2023 to 30th September 2023 (as on December 2023) after completing site visit.

With reference cited above, we have prepared certified compliance report for Environmental Clearance for the orders mentioned above vide reference numbers (1).

Thanks and Regards,

SV Enviro Labs & Consultants


Authorized Signatory



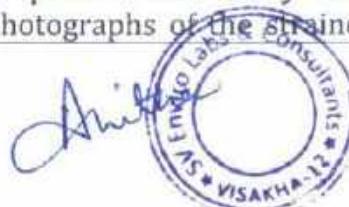
HETERO INFRASTRUCTURE SEZ LTD

COMPLIANCE REPORT TO CONDITIONS OF ENVIRONMENTAL & CRZ CLEARANCE

F.NO: 21-641/2007-IA, III Dated. 25th October 2010

PERIOD OF COMPLIANCE: 1st April 2023 to 30th September 2023

S.No.	Condition	Compliance										
Part-A, Specific Conditions												
Construction Phase												
(i)	Consent for Establishment" shall be obtained from Andhra Pradesh Pollution Control Board under Air and Water Act and a shall be submitted to the Ministry before start of any construction work at the site.	<p>Complied.</p> <p>The industry has obtained Consent for Establishment from AP Pollution Control Board vide Order No: 219/PCB/CFE/RO-VSP/HO/2010-2355, date:13/12/2010 and is being updated/Amended from time to time.</p> <p>The details of the CFE's are as below:</p> <table border="1"> <thead> <tr> <th>CTE Order No</th> <th>Date of issue</th> </tr> </thead> <tbody> <tr> <td>219 /APPCB/CFE/RO-VSP/HO/ 2010</td> <td>13/12/2010</td> </tr> <tr> <td>CFE Amendment Order</td> <td>14/09/2018</td> </tr> <tr> <td>CFE Amendment Order</td> <td>13/11/2018</td> </tr> <tr> <td>CFE (Expansion) Order</td> <td>15/07/2020</td> </tr> </tbody> </table>	CTE Order No	Date of issue	219 /APPCB/CFE/RO-VSP/HO/ 2010	13/12/2010	CFE Amendment Order	14/09/2018	CFE Amendment Order	13/11/2018	CFE (Expansion) Order	15/07/2020
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CFE Amendment Order	14/09/2018											
CFE Amendment Order	13/11/2018											
CFE (Expansion) Order	15/07/2020											
(ii)	Sufficient dilution shall be ensured to meet the ambient parameters within 50 m distance from outfall.	<p>Complied by the industry.</p> <p>Out fall pipeline has been laid as per NIO recommendations for having sufficient dilution at the point of outfall. .</p>										
(iii)	Regular Independent monitoring of marine water quality including temperature and salinity at the outfall shall be undertaken through an authorized agency and submitted along with six monthly monitoring report to the ministry.	<p>Complying.</p> <p>The industry is taking expertise of NIO for conducting the studies and conducting the studies on yearly basis. The report is being submitted to APPCB (RO & ZO) and IRO, MoEF&CC, Vijayawada. Copy of the latest report submitted by NIO in Feb 2023 has been submitted to MoEF&CC along with previous compliance report and Issued Work Order on National Institute of Oceanography for study during 2023-24 and expecting the report in 6 months' time. Copy of work order issued to NIO is enclosed as <i>Annexure-I</i></p>										
(iv)	Filters in the way of extruders shall be provided at the intake point to prevent fishes entering in the system.	<p>Complied by the industry.</p> <p>Strainers are provided at the intake point to prevent fish entry into the system. Photographs of the strainers installed at</p>										



		the sea water intake point are enclosed as <i>Annexure-II.</i>
(v)	The recommendations of EIA and DMP shall be strictly complied with.	<p>Complied.</p> <p>The industry has followed all recommendation of EIA & DMP. The detailed report on the EIA recommendations is enclosed as <i>Annexure-III.</i></p>
(vi)	Lighted buoys shall be provided at intake and out fall location as indicators.	<p>Complied.</p> <p>Marker Buoys which were installed at the intake & Outfall points as indicators have been damaged due to various reasons like fishing activities, Boats Movement and intentional damage by the fisherman. Now the industry has installed new marker buoys during annual maintenance in March 2023.</p> <p>Photographs of the marker buoys installations is enclosed as <i>Annexure-IV.</i></p>
(vii)	The pipeline shall be buried at least 2 m depth in onshore area and 4 mts in the offshore area. Necessary permission with regard to the pipeline burial and laying shall be obtained from maritime Board to ensure that the pipeline route does not fall in the navigation channel. Accordingly, the details of the laying of the pipeline shall be provided.	<p>Complied by the industry.</p> <p>Pipeline has been laid as per the recommendations made by NIO.</p> <p>The industry is paying annual charges for pipelines to Maritime Board regularly. The payment made to maritime Board is enclosed as <i>Annexure-V.</i></p> <p>The pipeline route is not falling in the navigation channel and the routing of the pipeline is enclosed as <i>Annexure-VI.</i></p>
(viii)	The pipeline shall not pass through any sand dunes/mangroves. The project shall be implemented in such a manner that there is not damage whatsoever to the mangroves/other sensitive coastal ecosystem. If any damage to mangroves is anticipated/envisaged as a result of project activates then the clearance shall stand cancelled, and the proponents shall seek fresh approval from the Ministry.	<p>Not applicable.</p> <p>There are no mangroves and sand dunes in the area where pipeline has been laid. The industry is taking all precautions to avoid damage to the marine environment.</p>
(ix)	The reject shall meet the standards prescribed by Andhra Pradesh Pollution Control Board before disposal.	<p>There are no specific CPCB/APPCB standards for Desalination rejects. Copy of latest analysis report of Rejects is enclosed as <i>Annexure -VII.</i></p>



(x)	A continuous and comprehensive post project marine quality monitoring programmed shall be taken up. This shall include monitoring of water quality sediments quality and biological characteristics and report submitted every 6 months to Ministry's Regional Office at Bangalore.	Being followed. The industry is conducting post project marine monitoring through NIO regularly for water quality, sediments quality and biological characteristics. Copy of the latest report is enclosed as Annexure-VIII and the same has been submitted to IRO, Vijayawada
(xi)	It shall be ensured that there is no displacement of people, houses or fishing activity as a result of the project.	Complied by the industry. The Land of the project used to be a vacant land & used for aquaculture in the past. There is no displacement of people, houses or fishing activity as a result of the project. The details of the fish catch data given by the Joint Director-Fisheries, Govt. of AP in Visakhapatnam has been submitted to IRO, MoEF&CC in the last Compliance report.
(xii)	There shall be display boards at critical locations along the pipeline viz. road / rail/ river crossing giving emergency instructions. This will ensure prompt information regarding locations of accident during any Emergency. Emergency information Board shall contain emergency instruction in addition to contact details. Proper lighting shall be provided all along the road.	Complied by the industry. The pipeline is completely laid in M/s Hetero Infrastructure SEZ Ltd area and only one crossing is there (Creek & Village Road) along the pipeline. Display Boards have been installed at the crossing and the photographs of the Display Board is enclosed as Annexure-IX . Industry has taken all necessary precautions at the crossing. 24x7 security surveillance is in place all along the pipeline and Emergency contact details are available in the ECC & also at Security. Lighting has been provided all along the roads.
(xiii)	There shall be no withdrawal of ground water in CRZ area for this project.	Complied by the industry. The total water requirement of the facility is being met through Sea water Desalination plants and not drawing ground water for any purposes of the industry.
(xiv)	No other activities except the permissible actions under CRZ Notification 1991 shall be carried out with CRZ areas.	Complied by the industry. The industry has installed Desalination plant in the existing buildings of Ex. Vijaya Marines due to lack of awareness & clarity



		<p>on CRZ notifications as the plant was installed before CRZ Notification 2011.</p> <p>The industry is in the process of getting the Desalination plant regularized in CRZ area as this is the permissible activity as per CRZ Notification 2011 & 2019 and accordingly applied to APCZMA for regularization of Desalination plant in CRZ area as per Office Memorandum of MoEF&CC vide F.No:19-27/2015.IA.III dated 19th February 2021 and obtained recommendations of APCZMA for Regularization of Desalination plant in CRZ area. Copy of Recommendations obtained from APCZMA are enclosed as Annexure-X.</p> <p>Now the industry applied to MoEF & CC for the same on 16/11/2023 vide single window No: SW/151124/2023.</p>
(xv)	Soil and ground water samples will be tested to ascertain that there is no threat to ground water quality by leaching of heavy metals and other toxic contamination.	<p>Complied.</p> <p>The industry is conducting the analysis of soil & ground water periodically to check the contamination (if any).</p> <p>Copy of analysis report is enclosed as Annexure - XI.</p>
(xvi)	Construction spoils, including bituminous material and other hazardous materials must not be allowed to contaminate water courses and the dump sites for such material must be secured so that they should not leach into the ground water.	<p>Complied.</p> <p>The industry is not using any bitumen for construction of roads as all the roads are made of concrete only.</p> <p>There are no dump sites for waste material around the factory premises.</p>
(xvii)	Any hazardous waste generated during construction phase should be disposed off as per applicable rules and norms with necessary approval of the Andhra Pradesh state Pollution Control Board.	<p>Complying.</p> <p>The industry has disposed waste generated during construction phase as per applicable rules and norms of APPCB. At present there are no major construction activities at site.</p>
(xviii)	The diesel generator sets to be used during construction phase should be low Sulphur diesel type and should conform to Environment (Protection) Rules prescribed for air and noise emission standards.	<p>Complied.</p> <p>The industry is using only low Sulphur diesel for operation of DG sets and all DG sets are provided with acoustic enclosures to control noise.</p>



(xix)	The diesel required for operation DG sets shall be stored in underground tanks and required clearance from Chief Control of Explosives shall be taken.	As such there is no diesel storage in the premises of Hetero Infrastructure SEZ Ltd and the units which are located in SEZ area are storing the diesel in above ground storage tanks as approved by the Chief Controller of Explosives Copies of Explosive Licenses of SEZ units are enclosed as <i>Annexure-XII</i> .
(xx)	Vehicles hired for bringing construction material to the site should be in good condition and should have a pollution check certificate and should conform to applicable air and noise emission standards and should be operated only during non-peak hours	Complied by the industry. All vehicles hired by the company are in good condition and having pollution check certificates. The vehicle movement in the premises is restricted to daytime only. <i>At present are no major construction activities at site.</i>
(xxi)	Ambient noise levels should conform to residential standards both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during construction phase. Adequate measures should be made to reduce ambient air and noise level during construction phase, so as to conform to the stipulated standards by CPCB/SPCB	Complied. At present there are no major construction activities at site The industry is monitoring the noise levels in house and through third party regularly and the records are being maintained. As per records noise levels found to be within limits. Copy of the latest report is enclosed as <i>Annexure-XIII</i> .
(xxii)	Fly ash should be used as building material in the construction as per the provision of Fly ash Notification of september,1999 and amended as on 27th August,2003	Complied. The industry utilized & using fly ash Bricks & also using fly ash in Ready Mix concrete for the construction purposes. At present fly ash is being disposed to Brick Manufacturing units.
(xxiii)	Ready mixed concrete must be used in building construction	Complied. Ready mix concrete was used for the construction of buildings during construction phase. At present there are no major construction activities at site.
(xxiv)	Storm water control and its re-use as per CGWB and BIS standards for various applications.	The industry has approached CGWB, Irrigation Department, Govt. Of AP and APWALTA (Department of Rural Development) etc. for technical suggestions & permissions (if any) for



		<p>storm water control & its reuse. But no department is giving clarity on the same and finally APWALTA informed us to approach irrigation department for necessary approvals.</p> <p>Irrigation Department, Govt. of Andhra Pradesh has issued permission to store the rainwater in the pond within the premises of the industry. Copy of the letter issued by Irrigation department, Govt. of AP is enclosed as Annexure- XIV.</p>
xxv	Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other best practices referred	Complied. <p>The industry used Ready mix concrete for the construction and used curing chemicals for curing purpose. At present there are no major construction activities at site.</p>
xxvi	Permission to draw ground water shall be obtained from the competent Authority prior to construction/operation of the project.	NOT APPLICABLE <p>The industry is not drawing ground water for any purpose of the industry as the total water requirement of the plant is being met through Sea water desalination plant.</p>
xxvii	Regular supervision of the above and other measure for monitoring should be in place all through the construction phase, so as to avoid disturbance to the surroundings.	Complied. <p>There are no villages adjacent to the project site (within 1 Km Radius). However, regular supervision is being done by the Environment Department head to avoid disturbance to the surroundings.</p>
xxviii	Under the provisions of Environment (protection) Act,1986, legal action shall be initiated against the project proponent if it was found that construction of the project has started without obtaining environmental clearance	Agreed and accepted. <p>The industry has started construction activities after getting Environmental Clearance only.</p>

II. Operation Phase

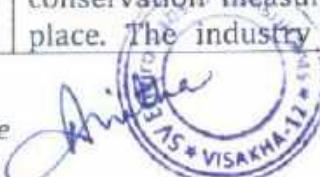
I	The installation of the Effluent Treatment Plant (ETP) should be certified by an independent expert and a report in this regard should be submitted to the Ministry before the project is commissioned for operation. Treated effluent emanating from ETP	Complied. <p>The industry has constructed full-fledged ETP for the treatment of Effluents at a cost of Rs.80.00 Cores. The ETP design was certified by the third party at the time of installation. ETP performance evaluation has been done through the third party</p>
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	shall be Recycled/ Reused to the maximum extent possible.	MoEF&CC approved Laboratory and the copy of ETP performance evaluation report has been submitted to the IRO, Vijayawada along with previous compliance reports. Now the industry is installing 1 MLD new ETP in addition to the existing ETP after obtaining CTE from APPCB. The designs of the plant have been verified by the Third party and submitted feasibility report. Copy of the feasibility report is enclosed as <i>Annexure-XV</i> .
ii	The solid waste generated should be properly collected and segregated. Wet garbage should be composted and dry/inert solid waste should be disposed off to the approved sites for land filling after recovering recyclable material	Complied. Dedicated places have been provided for storing solid waste. Installed Organic Waste Converter & Vermi-compost plant for disposing wet garbage and canteen waste. Photograph of the Vermi Compost plant and its design capacity is enclosed as <i>Annexure-XVI</i> . Inorganic salts are being disposed to TSDF Visakhapatnam whereas the organic wastes are being disposed to cement plants for co-incineration (Alternate Fuel) as per the conditions stipulated by the APPCB in CTO. Types of hazardous waste and its mode of disposal is enclosed as <i>Annexure-XVII</i> .
iii	Diesel power generating sets proposed as sources of backup power for elevators and common area illumination during operation phase should be of enclosed type and conform to rules made under the environment (protection) Act,1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use low sulphur diesel. The location of the DG sets may be decided with in consultation with Andhra Pradesh State Pollution Control Board.	Complied by the industry. The Diesel generators are provided with acoustic enclosures and adequate stack height as per the norms prescribed by the Board. Using only low Sulphur diesel for operation of the DG sets.
Iv	Noise should be controlled to ensure that it does not exceed the prescribed standards. During nighttime the noise levels measured at the boundary of	Complied. The industry is regularly monitoring the noise levels around the factory



	the periphery of the plot shall be restricted to the permissible levels to comply with the prevalent regulations.	premises and found values are well within the norms. The industry is taking all possible measures to control the noise pollution. Noise levels monitored by the industry are enclosed as Annexure-XVIII .
V	The green belt of adequate width and density preferably with local species along the periphery of the plot shall be raised so as to provide protection against particulates and noise.	Complied. The industry has planted more than 500000 saplings in and around the premises. Photographs of the Green belt is enclosed as Annexure-XIX .
vi	Weep holes in the compound walls shall be provided to ensure natural drainage of rain water in the catchment area during the monsoon period	Complied by the industry. Weep holes are provided in the compound walls to ensure natural drainage of rainwater in the catchment area during the monsoon period. In addition to that Well-designed drainage system is in place for the entire premises.
vii	Rainwater harvesting for roof run-off, as plan submitted should be implemented. Before recharging the surface run off, pre-treatment must done to remove suspended matter,	The rainwater of the entire premises is being collected in a pond within the industry for naturally recharging the ground water and the same is being reused for utilities (if requirement arises).
viii	The ground water level and its quality should be monitored regularly in consultation with Central ground water authority	Complied by the industry. Industry has provided 04 piezo wells within the factory premises for monitoring the Ground water Levels and quality. These wells are being monitored on quarterly basis through third party (MoEF&CC approved Laboratory). Copy of ground water report is enclosed as Annexure -XX .
ix	Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided. Parking should be fully internalized and no public space should be utilized	Complied. There is no traffic congestion near entry & exist points as the industry has constructed its own Road from the National Highway and is using the same Road for transportation purposes. Also provided adequate parking area to park vehicles and no public spaces are being utilized.
x	A report on the energy conservation measures confirming to energy conservation norms finalized by Bureau of Energy should be prepared incorporating details about building	Complied. The study has been done on energy conservation measures and report is in place. The industry has appointed one



	xi	<p>materials & technology & Factors etc and submit to the Ministry in three months' time.</p>	<p>expert energy auditor on permanent roles of the Company for Energy management & auditing. Regular reports are being generated on Energy conservation and will be produced to inspecting officers of the MoEF&CC and APPCB.</p>
		<p>Energy conservation measure like installation of CFLs/TFLs for the lighting the areas outside the building should be integral part of the project design and should in place before project commissioning. Use CFL and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/rules of the regulatory authority to avoided mercury contamination. Use of solar panels may be done to the extent possible.</p>	<p>Complied.</p> <p>CFLs/TFLs for the lighting area was an integral part of the project and the industry has replaced all CFL/TFL's with LED lights for lighting purpose in and around the premises.</p> <p>Electrical and electronic waste is being disposed to Recyclers Authorized by APPCB. Copy of recent disposal of Electrical & electronic waste is enclosed as Annexure-XXI.</p>

PART-B, GENERAL CONDITIONS

i	The environmental safeguards contained in the EIA report should be implemented in letter and spirit.	Complied. The industry has implemented the environmental safeguards contained in the EIA report. Copy of compliance report is enclosed as Annexure -III .
ii	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	Complied. The industry is regularly submitting the condition wise EC compliance reports to Regional Office to MoEF & CC. The same report is being submitted to APPCB.
iii	Officials from the Regional Office of MoEF, Bangalore who would be monitoring the implementation of environment safeguards should be given full cooperation, facilities and documents /data by the project proponents during their inspection. A complete set of all the documents submitted to MoEF should be forwarded to the CCF, Regional Office of MoEF, Bangalore.	Noted and is being followed.
iv	In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by this Ministry	Agreed to comply.



		There are no changes in the project. The industry will approach the Ministry in case of any changes in the scope of the project.
v	The ministry reserves the right to added additional safeguard measures subsequently if found necessary, and to take action including revoking of the environment clearance under provisions of the environmental (protection) Act,1986, ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.	Noted and agreed to comply.
vi	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of explosive, 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. The industry obtained the approval for storage of Diesel in the individual units of SEZ and Fire NOC from AP State Disaster Response and Fire Services Department for Hetero Infrastructure SEZ Ltd & also individual units of Hetero SEZ. Copies of PESO Licenses of SEZ units are and Fire NOC of Hetero Infrastructure have already submitted to IRO, Vijayawada.
vii	These stipulation would be enforced among others under the provisions of Water (prevention and Control of pollution) Act 1974, the Air(Prevention and control)act1981 the Environment (protection) Act 1986 ,the public Liability insurance)Act 1981 and EIA Notification,2006	Noted and will be followed. The industry is having public liability insurance policy and the details are as under: Policy No: 96000036233300000024 Validity: 10/11/2024. Copy of PLI policy is enclosed as Annexure-XXII.
viii	The project proponent should advertise in at least two local Newspapers widely circulated in the region one of which shall be in the vernacular language informing that the project has been accorded Environmental Clearance and copies of clearance letters are available with the Kerala Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forest at http:// www.envfor.nic.in The advertisement should be within	Noted and complied. The industry has advertised about Environmental clearance in in two local newspapers and the copies already submitted to the Regional Office. As informed earlier, we couldn't find/ misplaced the advertisement published in English paper due to shifting of the office several times since 2010.





HETERO INFRASTRUCTURE SEZ LTD

	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 Bangalore.	Copy of the Paper advertisement has already submitted to IRO, Vijayawada along with earlier compliances.
ix	Environmental clearance is subject to final order of the Hon'ble supreme court of India in the matter of Goa Foundation V/s Union of India in Writ petition (Civil) No.460 of 2004 as may be applicable to this project.	Noted and agreed.
x	Any appeal against this Environmental Clearance shall lie with the National Environment Appellate Authority, if preferred, with a period of 30 days as prescribed under section 11 of the National Environment Appellate Act,19987	Noted and accepted
xi	A copy of the clearance letter shall be sent by the proponent to concerned panchayat, Zilla parishad/Municipal Corporation, Urban Local Body and the Local NGO, if any from whom suggestions/representation, 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. The industry has submitted Copy of Environmental Clearance letter to the concerned Village Panchayat.
xii	The proponent shall upload the status of compliance of the stipulated EC 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. The criteria pollutant levels namely; SPM, RSPM, SO ₂ , NO _x (ambient levels as well as stack emissions) or critical sect oral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.	Complied. EC Letter & Its compliance status is available in the Company website www.hetero.com . Compliance of EC conditions are being sent to Regional Office, MoEF & CC regularly. Monitoring data is being submitted regularly to SPCB on monthly basis. The industry has Installed 03 No CAAQM stations in the premises and the data is being displayed at the Main Gate through Digital/LED display.
xiii	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	Complying. The industry is regularly submitting Environmental statement to APPCB before



	<p>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 EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail</p>	<p>30th September of every year and is uploaded in Company website www.hetero.com.</p> <p>Copy of latest Environmental statement is enclosed as <i>Annexure-XXIII</i>.</p>
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SERVICE PURCHASE ORDER

Vendor Name & Address 900386 NATIONAL INSTITUTE OF OCEANOGRAPHY REGIONAL CENTRE, 176, LAWSONS BAY C VISAKHAPATNAM, 530017 GSTIN Number:	PO NO. : 4900228061
	PO Date : 12.10.2023 Amendment Date : Quotation No & Date :
With reference to your above quotation, we request you to supply the following materials / services subject to terms and conditions mentioned	Payment Terms : 50% ADV , 50% AFTER COMPLETION OF Insurance : Delivery Terms : DAPAT THE SITE
	GSTIN NUMBER : 37AABCH6897E3Z6 CIN No. : U24239TG2005PTC047265

S.No.	Service Code	Service Description	Qty (UOM)	Unit Rate (INR)	Total Value (INR)
1	POST PROJECT MARINE MONITORING STUDIES 3000033	GENERAL SERVICE FOR R/M JOB WORKS Post project monitoring of likely affected physico_chemical, biological, microbiological and sedimentological parameters at and around the MOP in the coastal waters off Nallamattipalem, near Nakkapalli during the post SW monsoon of 2023 SAC CODE : 998711 Subtotal -----> Delivery Date:31.12.2023	1.000 AU	1,950,000.00	1,950,000.00
		GrandTotal ----->			1,950,000.00

Other Terms & Conditions

Special Instructions:

1.COA, MOA,MSDS,Validation Documents & Duplicate for Transporter Invoice must be accompany with the Consignment

	Delivery Address: HETERO INFRASTRUCTURE SEZ LIMITED SY.No.150,286,312 N. NARASAPURAM NAKKAPALLY (M) RAJAYAPETA (VILL) VISAKHAPATNAM-531081	For HETERO INFRASTRUCTURE SEZ LTD This Document is Electronically Apporoved. Hence, Signature is not Necessary
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HETERO INFRASTRUCTURE SEZ LTD

Regd.Office: "Hetero Corporate", 7-2-A2, Industrial Estates, Sanath Nagar, Hyderabad-500018, Telangana, India.

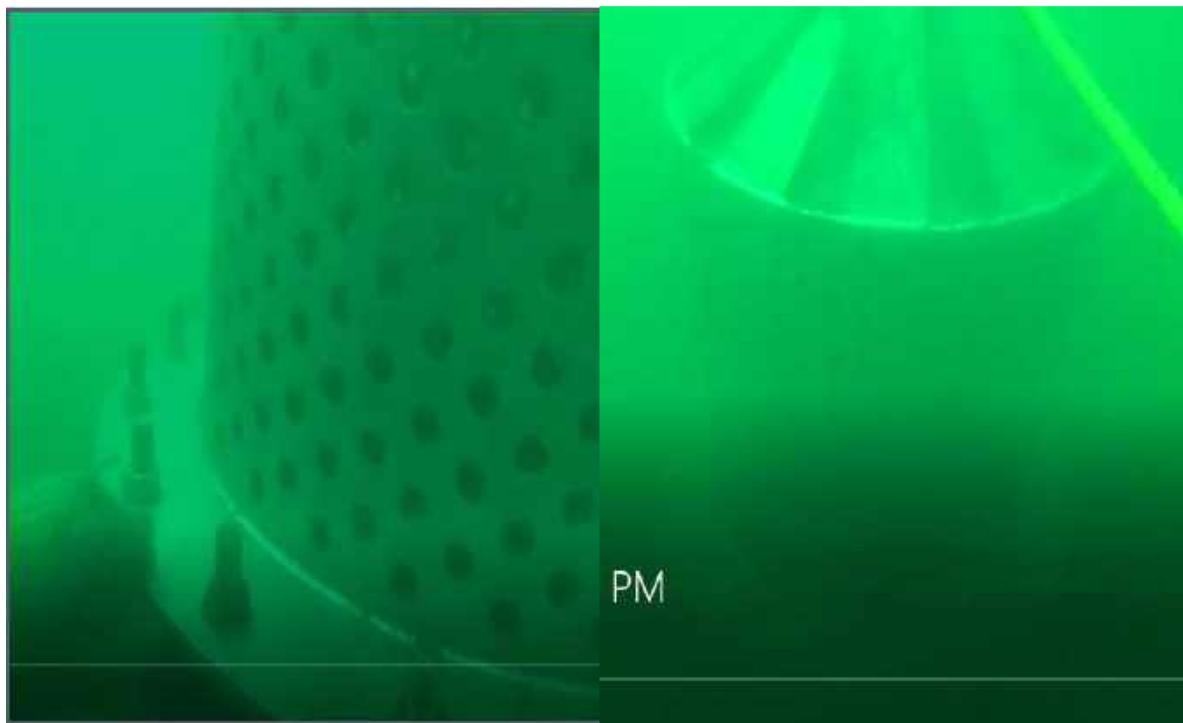
Phone Nos: +91 040 23704923/24/25, Fax: +91 040 23714250/23704926, E Mail: contact@heterodrugs.com

*Terms and Conditions as per attached sheet

TERMS AND CONDITIONS

- ACCEPTANCE:** IF NO FORMAL ACCEPTANCE IS RECEIVED WITHIN 7 DAYS FROM THE DATE OF THIS PURCHASE ORDER , THE SAME SHALL BE DEEMED TO HAVE BEEN ACCEPTED BY YOU.
- QUALITY:** THE MATERIAL SUPPLIED AGAINST THIS PURCHASE ORDER MUST IN ALL RESPECTS CONFIRM TO THE SPECIFICATIONS STATED THEREIN OR AS PER SAMPLES APPROVED BY US.EACH CONSIGNMENTS OF THE MATERIAL DESPATCHED BY YOU SHOULD BE ACCCOMPANIED BY A CERTIFICATE OF ANALYSIS.THE MATERIALS SUPPLIED WILL BE EXAMINED AT OUR LABORATORY AND THE REPORT WILL BE FINAL AND BINDING ON THE PARTIES. THE MATERIAL NOT CONFIRMING TO THE SPECIFICATIONS / APPROVED SAMPLES WILL BE REJECTED. THE MATERIALS REJECTED SHOULD BE IMMEDIATELY REMOVED BY YOU OR BY YOUR NOMINEES FROM OUR WORKS. IN CASE THE REJECTED MATERIAL REMAINS LYING AT OUR WORKS FOR ANY REASONS THE SAME WILL BE ENTIRELY AT YOUR RISK AND RESPONSIBILITY.IF SO DESIRED BY YOU THE REJECTED MATERIAL WILL BE DESPATCHED BY US TO YOU ON 'FREIGHT TO PAY BASIS' AND THE TRANSIT INSURANCE FOR SUCH RETURNS HAS TO BE ARRANGED BY YOU.WE WILL ALSO RAISE DEBIT NOTE FOR INCOMING FREIGHT CHARGES, IF ANY PAID BY US.
- WEIGHT:** UNLESS OTHERWISE STIPULATED WEIGHT / VOLUME RECORDED AT OUR PREMISES SHALL BE DEEMED AS FINAL.
- VALIDITY:** THE MATERIAL MUST BE AIR FREIGHTED / SHIPPED AS PER INSTRUCTIONS STIPULATED IN THE PURCHASE ORDER. TIME IS ESSENCE OF THIS PURCHASE ORDER. IN CASE THERE IS DELAY IN DESPATCH OF THE MATERIAL BY YOU, YOU WILL BE RESPONSIBLE FOR ALL DAMAGES AND LOSSES AS MAY ARISE AS A CONSEQUENCE THEREOF.
- LIQUIDATED DAMAGES:** IN CASE OF DELAYED SUPPLIES LIQUIDATED DAMAGES @ 2% PER MONTH OR PART THEREOF FOR THE VALUE OF DELAYED SUPPLIES SHALL BE PAYABLE.
- DELIVERY SCHEDULE:** SUPPLIES SHOULD BE ACCOMPANIED BY DELIVERY CHALLAN , BEARING THE REFERENCE OF THE PURCHASE ORDER.
- SUSPENSION:** IN THE EVENT OF STRIKES , ACCIDENTS OR ANY OTHER DISABLING CIRCUMSTANCES BEYOND OUR CONTROL , DELIVERIES AGAINST THE ORDER SHALL BE LIABLE FOR SUSPENSION AT OUR REQUEST.
- PRICE:** SUPPLIES IS EFFECTED AT A PRICE HIGHER THAN THOSE GIVEN IN THE PURCHASE ORDER WITHOUT OUR CONFIRMATION IN WRITTEN BEING FIRST OBTAINED, WILL BE LIABLE FOR REJECTION. WHERE THE ORDER IS PLACED ON FOR-OUR-FACTORY OR FREE DELIVERY AT WORKS BASIS, BOTH FREIGHT AND INSURANCE CHARGES SHALL BE PRESUMED TO HAVE BEEN INCLUDED IN SUCH PRICE, AND THE LOSS, BREAKAGE OR ANY DAMAGE DURING TRANSIT DUE TO ANY CAUSE WHATSOEVER SHALL BE BORNE BY THE SUPPLIER. WE WILL BE ENTITLED TO DEDUCT SUCH SUMS OF MONEY AS MAY BE REMAINING OUTSTANDING ON ANY ACCOUNT OUT OF THE SUMS AS MAY BE REMAINING OUTSTANDING ON ANY ACCOUNT OUT OF THE SUMS AS MAY BE PAYABLE BY US TO YOU.
- PAYMENT:** UNLESS OTHERWISE STIPULATED PAYMENT WILL BE MADE WITHIN 30 DAYS OR SUCH OTHER LONGER PERIOD AS MAY BE AGREED TO FROM THE DATE OF RECEIPT OF GOODS AND BILLS IN DUPLICATED COMPLETE IN ALL RESPECT, BEARING THE REFERENCE TO THE ORDER, YOUR CHALLAN REFERENCE AND ACCOMPANIED BY REQUISITE DOCUMENTS. HOWEVER, NO INTEREST WILL BE PAYABLE BY US ON OVERDUE ACCOUNT. DESPATCH MUST REACH US IN TIME TO TAKE DELIVERY OF THE GOODS FREE OF DAMAGE AND ANY SUCH CHARGES IF INCURRED SHALL BE TO YOUR ACCOUNT.
- FREIGHT & INSURANCE:** UNLESS AND OTHERWISE EXPLICITLY STATED FREIGHT & INSURANCE CHARGES SHALL BE BORNE BY YOU.
- INSPECTION:** ALL GOODS SUPPLIED AGAINST THE ORDER SHALL BE SUBJECT TO OUR INSPECTION AND APPROVAL AT ANY TIME WITHIN THIRTY DAYS OF THE DATE OF THE RECEIPT AND / OR USE WHICHEVER IS LATER , ANY REJECTION, SHORTAGE, DAMAGE, BREAKAGE ETC SHALL BE TO YOUR ACCOUNT. ALL GOODS REJECTED FOR ANY REASON WHATSOEVER SHALL BE RETURNED OR REPLACED FREE OF COST AT OUR OPTION. IN THE EVENT OF REJECTION OR REPLACEMENTS THE INWARD / OUTWARD FREIGHT AND OTHER INCIDENTAL CHARGES SHALL ALSO BE BORNE BY YOU. YOU KEEP US INDEMNIFIED AGAINST ANY ACTION, LOSS PENALTIES AND DAMAGES IF GOODS SUPPLIED AGAINST THE PURCHASE ORDER INFRINGES ANY DESIGN, PATENT OR TRADE MARK.
- SPARES & ACCESSORIES:** MACHINERY DESPATCHES / RECEIVED WITHOUT ALL THE REQUISITE SPARES AND ACCESSORIES SPECIFIED BY US ARE LIABLE FOR REJECTION AND RETURN AT YOUR RISK AND COST.
- CONSIGNMENT:** OUT-STATION SUPPLIER SHOULD MENTION LR-RR-PWB-AW-BILL-POST PARCEL NUMBER ETC . ON REFERENCE THEIR INVOICE.
- FORCE MAJEURE:** THE COMPANY WILL NOT BE IN ANY WAY LIABLE FOR NON - PERFORMANCE EITHER IN WHOLE OR IN PART OF ANY CONTRACT OR FOR ANY DELAY IN PERFORMANCE THEREOF AS A CONSEQUENCE OF STRIKE, SHORTAGE OF LABOUR OR COMBINATION OF WORKMEN OR LOCK-OUT BREAKDOWN OR ACCIDENT TO MACHINERY OR OTHER ACCIDENT TO MACHINERY OR OTHER ACCIDENT OF WHATEVER NATURE OR FAILURE ON THE PART OF THE RAILWAYS TO SUPPLY SUFFICIENT WAGONS TO CARRY ESSENTIAL MATERIALS TO AND THE FINISHED PRODUCTS FROM THE WORKS AND ALL CAUSE OF WHATEVER NATURE BEYOND THE COMPANY'S CONTROL.
- ARBITRATION:** ANY DISPUTES ARISING OUT OF THIS CONTRACT SHALL BE WITHIN THE JURISDICTION OF COURT IN HYDERABAD.

STRAINERS INSTALLED AT INTAKE POINT



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COMPLIANCE REPORT ON THE RECOMMENDATIONS/ MITIGATION MEASURES MENTIONED IN THE EIA REPORT

ENVIRONMENTAL ISSUES/ IMPACTS (As per EIA)	ENHANCEMENT/ MITIGATION MEASURES (As per EIA)	MANAGEMENT ACTION/COMPLIANCE
Reduction of trees in the site: cutting of 25 trees	<ul style="list-style-type: none"> • Initiate and complete the process of compensatory trees plantation. Number of trees to be planted 25000. 	<p>This is to bring to your kind notice that, the total site was used for aquaculture farms in the past and hence there was no greenery/trees in the site while starting the project.</p> <p>However, the industry has planted more than 5.0 Lac plants in & around the industry site. The species used are as below:</p> <ul style="list-style-type: none"> ➢ Ganuga ➢ Neem ➢ Acacia ➢ Pinto farm ➢ Kona Carpus ➢ Coconut and ➢ Medicinal plants <p>The photographs of the green belt in and around the industry premises are enclosed as Annexure-I for your information.</p>
Soil Erosion during construction and sediment load on the Storm water drains	<ul style="list-style-type: none"> • Earth works specifications to include provision for silt fence. • Construction during non-monsoon season 	<p>The industry has ensured that there is no soil erosion during the construction of industry and ensuring there is no sediment load on the storm water drains.</p> <p>The industry is cleaning/desilting the storm water drains regularly to avoid sediment deposition in the storm water drains.</p> <p>The natural drain which is passing adjacent to the industry premises is being cleaned regularly to avoid stagnations in the catchment area.</p>
Sanitation facilities during construction	<ul style="list-style-type: none"> • Proper availability of drinking water and Sanitation facilities 	<p>During construction phase, the industry has provided labour sheds for the construction labour, adequate drinking water points and sanitation facilities.</p> <p>Photographs of the labour sheds and drinking water points are enclosed as Annexure-II for your information.</p>

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Fire Prevention during construction	<ul style="list-style-type: none"> • Adopt safe work practise and have adequate firefighting facilities. 	<p>The industry has adopted and being adopted the safe work practices during the construction. Some of the safety practices followed are as below:</p> <ul style="list-style-type: none"> ➢ Provisioning of Personal Protective Equipment ➢ Provisioning of fall protection equipment ➢ Regular Medical check-ups etc. <p>The industry has provided adequate firefighting facilities in the industry.</p> <p>Details of firefighting facilities provided in the industry are enclosed as Annexure-III.</p>
Pollution of land, ground water and surface water arising from sanitary and other wastes and Spillages	<ul style="list-style-type: none"> • During Construction it will be ensured that contractor does not dispose off debris in water bodies. 	<p>This is to bring to your notice that, all the contractors are advised to dispose the debris in such a way that, it should not enter the water bodies.</p> <p>There are no water bodies in and around the project site.</p>
	<ul style="list-style-type: none"> • Soil laden run off will not be diverted to water bodies. 	<p>Not Applicable.</p> <p>There are no water bodies to divert overloaded soil into the water bodies.</p>
	<ul style="list-style-type: none"> • Vehicle maintenance and refuelling will be confines to areas under construction yard to trap discarded lubricant and fuel spills. 	<p>Regular vehicle maintenance and refuelling is being done outside the site in an authorised workshops and petrol pumps.</p> <p>In case of emergency maintenance of vehicles, the waste is disposed to Incineration along with other wastes.</p>
	<ul style="list-style-type: none"> • Sanitation waste from will not be diverted to construction water bodies. 	<p>Sanitation waste is being collected separately and disposed to either incineration or to the treatment as applicable.</p>
	<ul style="list-style-type: none"> • Contractor's to prepare, for the works sites, which make adequate provision for safe disposal of all wastes and prevention of spillages, leakage of polluting materials etc. 	<p>The contractors are advised to dispose the waste properly to avoid nuisance to the surroundings and also advised to not to use polluting materials like Bitumen, Waste oils etc in the construction.</p>
	<ul style="list-style-type: none"> • Contractor to be required to pay all costs associated with cleaning up any pollution caused by their activities and to pay full compensation to those affected. 	<p>Major construction works have been completed and only few modifications works & repair works are going on at site. Till now there are issue associated with pollution caused due to the activities of contractors.</p>



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Groundwater abstraction for construction activities.	<ul style="list-style-type: none"> Contractor to ensure optimisation of water abstraction. 	<p>During major construction, the industry has used curing chemical, ready mix concrete etc. for optimum usage of water in construction. Photograph of the Ready-mix concrete plant working in the factory premises is enclosed as Annexure-IV for your information.</p>
Construction traffic causing pavement and structure damage due to overloading, increasing congestion and increased road safety hazards on the Nakkapalli-Rajayyapeta road.	<ul style="list-style-type: none"> Contractors to use appropriate vehicles and to comply with legal gross vehicle and axle load limits. Contractors to repair damage at own expense. Contractors to minimise road safety hazards and inconvenience to other road users by taking appropriate measures. 	<p>The industry has laid own road to the factory from National Highway and hence there is no traffic congestion, inconvenience to the other public and road safety issues.</p> <p>Drawing and Photographs of the Road are enclosed as Annexure-V.</p>
Air Pollution from batch mix plants, construction yard due to movement of mechanical compactor and other vehicles.	<ul style="list-style-type: none"> Trucks carrying construction material will be covered with tarpaulin to avoid spilling. 	Instructed all truck owners to cover the trucks with tarpaulins and is being followed strictly.
	<ul style="list-style-type: none"> Water Sprinkling will be carried out in mornings and evenings on haul roads and compact surface. 	Industry used to sprinkle water on the roads during initial stages of construction and at present all roads are either concreted or black top,
	<ul style="list-style-type: none"> Vehicles and construction machinery will be maintained to conform emission standards specified by SPCB. 	Maintaining Vehicles and construction machinery in good working condition so that it will meet the emission standards specified by APPCB
	<ul style="list-style-type: none"> Stock piled sand and stone will be wetted before loading. Construction debris shall be disposed only at designated sites. 	<ul style="list-style-type: none"> There is no sand stocks at the site. Construction debris is being disposed at designated places only.
Noise Levels	<ul style="list-style-type: none"> Construction yard will be located at 500m away from habitation. 	There is no construction yard near to the habitation.
	<ul style="list-style-type: none"> All equipment will be maintained in good working order, properly designed engine enclosures and intake silencers. 	All vehicles are provided with silencers and maintaining in good working condition. All DG sets are provided with acoustic enclosures. Photographs of the DG sets are enclosed as Annexure -VI .
Water Logging and cross Drainage.	<ul style="list-style-type: none"> Storm water drain on the North Eastern side of the site connecting to the 	Storm water drain on the eastern side of the factory is being maintained in good condition so that



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	creek and drains within the site.	there will not be any water logging in the catchment area. Drawings of the storm water drain on the eastern side of the factory is enclosed as Annexure-VII.
Negative impact on flora due to Flora due to cutting of trees.	• To compensate for 25 number of trees to be cut, 25000 number of trees will be planted.	Industry has planted more than 500000 plants in the premises. Photographs of the green belt are enclosed as Annexure-VIII.
Occupational Safety and Health	• Construction workers be provided with personal protective equipment (PPE) such as earplugs, helmets, safety shoes, gloves, etc.	All workers are being provided with suitable PPE like Shoes, Helmet, Goggles Gloves, Ear plugs etc. depending on the work. The PPE Matrix and protocols are enclosed as Annexure-IX for your information
Environmental monitoring during construction phase	• Ambient Air Quality to be measured once in a season (except monsoon) at location specified in monitoring plan	Ambient air quality monitoring is done continuously through 03 Nos of CAAQM stations. Conducting ambient air quality monitoring through third party once in a month and reports are being submitted to RO, APPCB, Visakhapatnam.
	• Water Quality (ground and surface) to be monitored once in a season (except monsoon season) at locations specified in monitoring plan.	The industry has provided 04 nos of piezo wells in the factory premises for monitoring the ground water quality and is being monitored once in 03 months. Reports are being submitted to MoEF&CC along with compliance reports. Layout of piezo wells installed in the plant is enclosed as Annexure-X.
	• Noise levels to be monitored once in a season at locations specified in monitoring plan.	Regular noise monitoring is being done internally and records are being maintained,
	• Soil quality to be monitored once a year .	Soil quality is being monitored once in six months and the reports are being submitted to MoEF&CC along with compliance reports,
	• Monitoring of Construction sites for arrangements made for protection measures at storage areas, and drainage.	Regularly monitoring the construction sites for arrangements made.
Occupation Phase		
Air Pollution From Boilers	• Effective stack heights and bag filters.	The industry is having 04 nos of boilers and the details are as below:



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		Capacity of Boiler	Stack Height	APCD
		45 TPH	53 m	Electrostatic Precipitator (ESP)
		20 TPH	33 m	Dust collector followed by Bag filter
		12 TPH	30 m	Bag filters
		10 TPH	30 m	Bag filters
Air Pollution From DG sets	<ul style="list-style-type: none"> Effective stack heights as per CPCB Formula 	All DG sets are provided with adequate stack height as per the CPCB formula.		
Air Pollution from Incinerator	<ul style="list-style-type: none"> Provision of Scrubbers. 	No Hazardous waste Incinerator is installed at site.		
Diffuse emissions from, reactors, multiple effect evaporators, strippers etc.	<ul style="list-style-type: none"> Provision of vent condensers. 		<ul style="list-style-type: none"> All reactors are provided with dual stage condensers to avoid process emissions entry into the atmosphere All reactor vents in which acidic reactions are being carried are connected to scrubbers. Stripper vent is connected to dual stage condensers. 	
Fugitive Emissions from accidental spills	<ul style="list-style-type: none"> Containment measures like dykes for bulk solvent storage, periodic maintenance. 		<p>All solvent storage tanks are provided with sufficient dykes (110% of tank capacity) and provided Dump tanks in all solvent storage yards to control the spills.</p> <p>Photographs of the solvent yard is enclosed as Annexure-XI.</p>	
Water Resources	<ul style="list-style-type: none"> Source: YLB Canal supply. 		As per EC, the industry has installed Sea water Desalination plant for meeting the water requirements of the industry.	
Effluents from Process:				
Organic Wastes	<ul style="list-style-type: none"> Incinerator Stripper followed by distillation or incineration. 		Sending to cement Industries, pre-processing units for incineration purpose as directed by the Board.	
High TDS Effluents	<ul style="list-style-type: none"> Evaporator followed by Filter Press condensate From Evaporator for Biological treatment followed by tertiary treatment and marine disposal . 		HTDS effluents are being treated in Multiple Effect Evaporator (MEE) followed by biological treatment and tertiary treatment before disposing into the Sea.	
Low COD and Low TDS Effluents	<ul style="list-style-type: none"> Activated Sludge process followed by tertiary treatment and marine disposal. 		<p>All LTDS effluents along with MEE Condensate is being treated in Bio-tower followed by Dual stage activated sludge process and then to RO plant before disposing into the Sea.</p> <p>Details and photographs of the Stripper/MEE/ATFD & Biological Treatment are enclosed as Annexure -XII.</p>	



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Effluents from utilities	<ul style="list-style-type: none"> Primary treatment followed by marine disposal. 	Effluents from utilities is being treated along with LTDS effluents.
Domestic Effluents	<ul style="list-style-type: none"> Sewage treatment plant and treated water for on Land Irrigation. 	Domestic effluents are being treated in sewage treatment plant of 300 KLD capacity and treated sewage is recused for gardening purpose. Details of STP and photograph are enclosed as Annexure-XIII.
Solid Wastes		
Coal ash from Boiler	<ul style="list-style-type: none"> Supply to manufacturers Brick and Cement Manufacturers 	Sending to Brick manufacturing units.
Garbage	<ul style="list-style-type: none"> a) Biodegradable for vermicomposting and Reuse for horticulture development b) Recyclable Wastes Like Paper, plastic to recyclers. c) Non-Biodegradable for disposal to local authorities. d) STP Sludge for compost and reuse as manure. 	<p>a) Installed organic waste converter for converting the biodegradable waste into manure.</p> <p>b) LDPE paper and plastic waste is being sent to recyclers.</p> <p>c) Non-Biodegradable waste is being disposed as per the guidelines.</p> <p>d) Using STP sludge in Vermi compost plant to maintain moisture and then for gardening purpose as manure.</p> <p>Photograph of the vermi-compost plant is enclosed as Annexure-XIV.</p>
Hazardous wastes		
a) Forced Evaporation salts b) Solvent Residues c) Process residues d) ETP sludge e) Waste Oils f) Used Batteries g) Waste Containers	<ul style="list-style-type: none"> Temporary Storage Facility with 3 Months storage capacity And Sent To TSDF, Visakhapatnam sent to authorized recyclers Detoxification resultant effluent to ETP and sold to authorised vendor. 	<p>Hazardous wastes are being disposed as per the conditions stipulated by APPCB in the CTO. Minimum stocks are being maintained in the Hazardous waste storage yard.</p> <p>Detoxification of containers/Liners is being done in Detoxification yard and wash water is being routed to ETP for treatment.</p> <p>Hazardous waste and mode of disposal specified by the APPCB in CTO is enclosed as Annexure-XV.</p>
Noise Pollution from DG Sets, Motors, Compressors etc.	<ul style="list-style-type: none"> Provision of Acoustic enclosures for DG Sets provision of noise absorption pads at the foundation levels Green Belt. 	All DG sets are provided with Acoustic enclosures and thick green belt is being maintained in & around the factory premises for minimising the noise.



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Green Belt	<ul style="list-style-type: none"> • Provision of Avenue plantation and 50 m wide green belt all around the estate 	Thick green belt is being maintained in & around the factory premises.
Occupational safety	<ul style="list-style-type: none"> • Provision of PPE, and Health centre. • Periodic Health Check-ups. • Occupational Safety training. 	<ul style="list-style-type: none"> • The industry has provided 02 no's of Occupational health centres with ambulances (mini trauma) within the industry premises. Full time doctors are deployed in the OHC and Round the clock male nurses/ paramedical staff are available in the factory for taking care of health issues of employees/emergencies. • Periodical medical examination of the employees is being carried as per the Factories Act. • Occupational safety training is the part of Safety induction training and also during regular trainings.
Community Development	<ul style="list-style-type: none"> • Extension of Medical facilities by way of health camps, Improvement of educational facilities, Empowerment of Women in Surrounding villages. 	<p>The industry is extending medical support to the nearby villagers by way of:</p> <ul style="list-style-type: none"> ➢ Conducting medical camps in the nearby villages regularly through mobile medical van of the Company and giving free medicines. ➢ Established Eye hospital at Nakkapalli for the eye care of the nearby villagers. This includes free testing, providing goggles, medicines, Cataract surgeries etc. ➢ Financial assistance to the people suffering with health ailments. ➢ Sanitation facilities during calamities. <p>For education, the industry is carrying following activities:</p> <ul style="list-style-type: none"> ➢ Providing the infrastructure to all nearby Govt. schools like construction of toilets, Compound walls, classrooms etc. ➢ Providing furniture to the Govt Schools. ➢ Providing Study material for school going children ➢ Drinking water facilities (RO Plants) in the schools. ➢ Rewards for the meritorious students.



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		<ul style="list-style-type: none">➤ Celebration of national events in schools➤ Providing lighting & sport kits to the schools etc. <p>For women empowerment, the industry is providing jobs to the women and promoting them to take self-decisions both at home and workplace by way of providing training to the women employees.</p> <p>The details are enclosed as Annexure-XVI</p>
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Submitted to the IRO, MoEF&CC, Vijayawada for information and perusal.

Date :23/12/2022



Annexure-I

GREEN BELT PHOTOS



ANNEXURE-II

LABOUR SHED & DRINKING WATER



Drinking Water

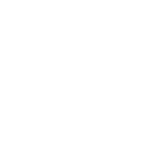


ANNEXURE-III

Hetero Complex Safety Equipment's				
S. No	Name of the Equipment	Capacity / UoM	Total Quantity	Photograph
1	Fire Extinguishers	Nos	2238	
2	ARFFF (Foam)	Lts	47960	
3	Fire hydrant points	Nos	462	
4	Fire hose cabinet	Nos	436	
5	First aid hose reel	Nos	176	
6	Fire hydrant monitors	Nos	74	
7	Fire hydrant gate valves	Nos	314	
8	Fire blanket	Nos	148	
9	Eye & Body wash unit	Nos	105	

10	Personal protective Equipment in Blocks	Nos	74	
11	Eye wash bottle	Nos	327	
12	SCBA	Nos	38	

TYPE OF FIRE EXTINGUISHER

1	CO2	2 kg	96	
2		4.5 kg	567	
3		5 kg	10	
4		22.5 kg	275	
5	Foam	45 kg	91	
6		9Lts	112	
7	DCP	50Lts	373	
8		9Kg	78	
9		10Kg	120	
10		25Kg	282	
11		50Kg	81	

12	D-Type	9Kg	4	
13		10 Kg	27	
14		25 Kg	15	
15		50 Kg	11	
16	ABC	2Kg	80	
17	DCP / Clean Agent Modular	10 Kg	672	

HETERO COMPLEX FIRE HYDRANT PUMP HOUSE DETAILS



<u>PUMP HOUSE NO</u>	PUMP HOUSE -I			PUMP HOUSE-II			PUMP HOUSE-III		
PUMP DESCRIPTION	JOCKEY PUMP	MAIN PUMP	DIESEL PUMP	JOCKEY PUMP	MAIN PUMP	DIESEL PUMP	JOCKEY PUMP	MAIN PUMP	DIESEL PUMP
PUMP HEAD (Mt)	88	88	88	88	88	88	95.1	88	88
PUMP FLOW (m ³ /hr)	25	410	410	25	410	410	61	273	273
PUMP HP	25	215	231	25	215	231	20	150	133
PUMP RPM	2900	2900	1800	2900	1480	1800	2920	1480	1800
PUMP LPM	416	6833	6833	416	6833	6833	1000	4550	4550
AUTO START (Kg/cm ²)	5	5	5	5	4	2	5	4	Manual shut off
AUTO SHUT OFF (Kg/cm ²)	7	Manual shut off	Manual shut off	7	Manual shut off	Manual shut off	7	Manual shut off	Manual shut off
Water Storage Capacity	600 KL			1200 KL			1000 KL		

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HIGH PRESSURE WATER MIST FIRE TENDER		
UNIT	Fire Engine -1	Fire Engine-2
Engine model	EICHER 10.95	EICHER 10.95
Water tank capacity	3500ltrs	2000ltrs
Foam Tank capacity	350L	400L
Foam Water monitor capacity	2000Lpm@100bar	1000Gpm@7kG/cm2
DCP Tank capacity	250 Kgs
High pressure pump	150Lpm @ 100bar	150Lpm @ 100bar
High pressure hose pipe (60mtrs length)	02 no's	02 no's
Type	Advances water mist and Foam type	Advanced water Mist, Foam and Dry Chemical Powder



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ANNEXURE-IV

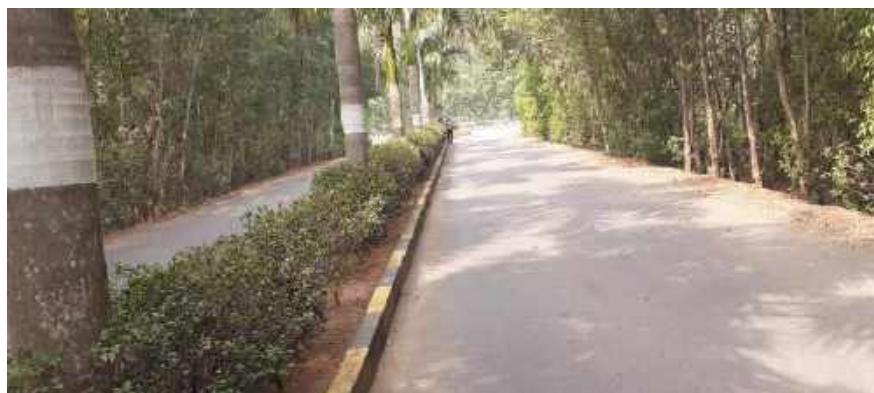
READY-MIX CONCRETE PLANT



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ANNEXURE – V

HETERO COMPLEX ROAD



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ANNEXURE – VI

DG SETS



using triple camera
with my Galaxy M30



using triple camera
with my Galaxy M30



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ANNEXURE – VII

STORM WATER DRAIN POINT



HETERO INFRASTRUCTURE SEZ LTD

ANNEXURE – VIII

GREEN BELT PHOTOS



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ANNEXURE – IX

PPE MATRIX

Area/Activity	PPEs REQUIRED BEFORE STARTING ACTIVITY			Area/Activity	PPEs REQUIRED BEFORE STARTING ACTIVITY		
PPE mandatory before entering in to any work Areas.	Safety Shoes		Nose Mask	Flammable Gas handling like Hydrogen etc.	Safety Shoes		FR Suit with Hood
	Safety Goggles				Safety Goggles		Nitrile Hand glove
	Safety Helmet				Safety Helmet		SCBA
Handling of Flammable Solvents with Proper Earthing and bonding	Safety Shoes		FR Suit with Hood	Boiler house	Safety Shoes		FR Suit with Hood
	Safety Goggles		Nitrile Gloves		Safety Goggles		Heat Resistant glove
	Safety Helmet		PAPR		Safety Helmet		Ear Plug/Muff
	Full Face Mask				Dust Masks		
Toxic Material Handling (Like NH3, bromine etc)	Safety Shoes		PVC Air Line Suit	Opening of Pipe lines	Safety Shoes		FR Suit with Hood
	Safety Helmet		PVC Hand Gloves		Safety Goggles		Hand Gloves
	Full Face Mask		PAPR		Safety Helmet		Nose Mask
Charging/ Handling of corrosive chemical (NaOH, H ₂ SO ₄)	Safety Shoes		PVC Apron	Utility and DG Set areas	Safety Shoes		Hand gloves
	Safety Goggles		PVC Hand Gloves		Safety Goggles		Ear Plug/Mug
	Safety Helmet		PAPR		Safety Helmet		FR Suit
	Full Face Mask		Other		Nose Mask		
Charging/Handling powder (powder Milling, sifting, dispensing and charging in to reactor Etc)	Safety Shoes		FR Suit with Hood	Working at effluent sumps, water, sumps, cooling towers, aeration tanks, etc.	Safety Shoes		FR Suit with Hood
	Safety Goggles		Nitrile Gloves		Safety Goggles		Safety Belts
	Safety Helmet		PAPR		Safety Helmet		Hand gloves
	Dust Mask				Nose Mask		Life Buoys
Hot material handling, Abrasive material handling	Safety Shoes		FR Suit /Apron	Working at heights, painting, and Civil constructions.	Safety Shoes		Life Lines
	Safety Goggles		Heat Resistant glove		Safety Goggles		Safety Belts
	Safety Helmet				Safety Helmet		Hand gloves
	Nose Mask				Nose Mask		
Rescue operation in Fire	Safety Shoes		Fire Proximity Suit	Hot Works like welding, cutting , grinding , heating , chipping etc.	Safety Shoes		FR Suit with Hood
	Safety Goggles		Fire Proximity Glove		Safety Goggles		Safety Belts
	Safety Helmet				Safety Helmet		Hand gloves
	Full Face Mask		SCBA		Nose Mask		
Rescue operation in toxic, corrosive atmosphere.	SCBA		PVC hand Gloves	Confined Space Entry	Safety Shoes		Safety Belt/Ladder
	PVC Suit/Apron		Safety Helmet		Safety Goggles		
	Safety Gum Shoe				Safety Helmet		
Laboratory works	Safety Shoes		FR Suit with Hood	Working on MCC, SFU, Isolator, capacitors underground cable	Insulative Shoe		Arc Suit
	Safety Goggles		Lab Apron		Safety Goggles		Electrical Resistance Gloves
	Nose Mask				Safety Helmet		
Detoxification Works	Safety Shoes		PVC Suit	Excavation work	Safety Shoes		FR Suit with Hood
	Safety Goggles		Hand Gloves		Safety Goggles		Hand Gloves
	Safety Helmet		PAPR		Safety Helmet		
Monitoring activities in plant and warehouse	Safety Shoes		FR Suit with Hood	Gas cylinder Handling	Safety Shoes		FR Suit with Hood
	Safety Goggles		Nose Mask		Safety Goggles		Hand Gloves
	Safety Helmet				Safety Helmet		Face Shield
Road Tanker Sampling and Unloading	Safety Shoes		FR Suit with Hood	Powder Handling	Safety Shoes		FR Suit with Hood
	Safety Goggles		Safety Belts		Safety Goggles		Nitrile Hand gloves
	Safety Helmet		Nitrile Hand glove		Safety Helmet		PAPR
	Full Face Mask				Nose Mask		

HETERO INFRASTRUCTURE SEZ LTD

ANNEXURE – X

LAYOUT OF PIEZO WELLS

GROUND WATER MONITORING WELL LOCATIONS



HETERO INFRASTRUCTURE SEZ LTD

FIRST FORERUN COLLECTION SUMPS LOCATIONS



HETERO INFRASTRUCTURE SEZ LTD

ANNEXURE – XI

SOLVENT YARD



HETERO INFRASTRUCTURE SEZ LTD

ANNEXURE – XII

STRIPPER/MEE/ATFD & BIOLOGICAL TREATMENT



Multiple effect evaporator



Stripper

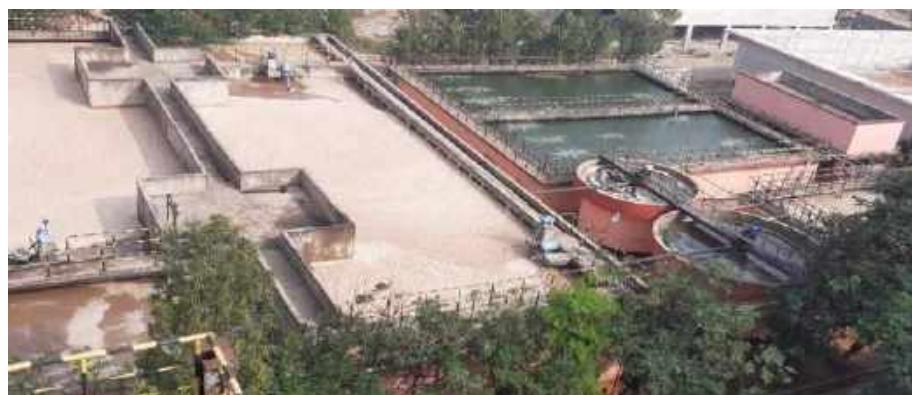


ATFD

HETERO INFRASTRUCTURE SEZ LTD



Biological treatment



HETERO INFRASTRUCTURE SEZ LTD

ANNEXURE – XIII

SEWAGE TREATMENT PLANT



HETERO INFRASTRUCTURE SEZ LTD

ANNEXURE – XIV

VERMI COMPOST PLANT



HETERO INFRASTRUCTURE SEZ LTD

Annexure-XV

HAZARDOUS WASTE AND MODE OF DISPOSAL

Hazardous wastes are being disposed as per the conditions stipulated by APPCB in the CTO.

Minimum stocks are being maintained in the Hazardous waste storage yard.

Hazardous waste and mode of disposal specified by the APPCB in CTO is mentioned below:

S.No	Details of waste	Mode of Disposal
1	Process Solid waste	To TSDF, Parawada, Anakapalli Dist. for secured Land filling
2	MEE/ Forced Evaporation Salt	
3	Incineration Ash	
4	ETP Sludge	
5	Solvent Residue/Organic Residue	Shall be incinerated to sent to Cement industries for Co-incineration/Co-processing/ Pre-processing units
6	Spent Carbon	
7	Damage or Rejected APIs/products	
8	Damaged or Expired Raw materials	
9	Used PPEs	Shall be incinerated in in-house incinerator or sent to Cement industries for incineration.
10	Used Oils	To Re-processing units authorized by APPCB
11	Used Batteries	Shall be sent to suppliers on buy back basis
12	e-Waste/ electrical waste	Sent to Authorized Recyclers approved by APPCB/CPCB.
13	Empty Drums/ Containers/ Liners contaminated with Hazardous chemicals/waste	To outside agencies after complete detoxification.
14	Empty barrels / containers / liners contaminated with hazardous chemicals / wastes	
15	LDPE Paper	To authorized Recyclers/ outside agencies
16	Coal Ash from Boilers	To Brick manufacturing units
17	Spent Solvents	Shall be recycled within the units of Hetero Infrastructure SEZ Ltd or sold to outside agencies
18	Recovered Solvents	

HETERO INFRASTRUCTURE SEZ LTD



A Brief Report of CSR activities in Nakkapalli plant areas

December 2022

About Hetero

Hetero is one of India's leading generic pharmaceutical companies and is one of the world's largest producers of anti-retroviral drugs for the treatment of HIV/AIDS. With more than 20 years of expertise in the pharmaceutical industry, Hetero's strategic business areas include APIs, generics and biosimilars. Hetero also offers custom pharmaceutical services to its partners around the world. The company is recognized for its strengths in Research and Development, manufacturing, and commercialization of a wide range of products.

Hetero is the first company in India to launch the generic version of Remdesivir injection, COVIFOR, in India, which is used to treat hospitalization cases of COVID-19.

Corporate Social Responsibility

At Hetero, we value health and prosperity for all. Our passion for improving quality of life extends beyond our business and transcends everything we do. While we work towards making medicines affordable and accessible to society at large, we also continuously seek opportunities to help the society through our corporate social responsibility initiatives. Since its inception, Hetero has been directly supporting with healthcare programmes, drinking water & sanitation, educational and welfare activities in communities surrounding the company's factories. The company also extends its support beyond its operational vicinities depending on the community needs and emergencies.

As a Hetero group we will focus on the following thematic areas to implement CSR activities in Nakkapally Region. Following activities have been implemented in 26 number of villages with an outreach of 16,800 households, 32 schools 31 Anganwadi centers etc.

1. Quality Education
2. Health Care Services
3. Village Infrastructure.
4. Drinking Water & Sanitation

1. Quality Education

Quality Education is one of the flagship programs for Hetero Company. We are working in 32 Schools & 31 Anganwadi Centers. Goal is to address the root causes of education quality challenges. We identified several challenges among the marginalised students studying especially in govt schools.



To provide quality education:

- Supported **32 vidya volunteers** in schools to balance the student teacher ratio. Purpose of vidya volunteers is to address the root causes of lack of required teaching staff in select schools. Vidya volunteers are well trained on various participatory didactic learning/teaching methods. Vidya volunteers help the school students through language and numeracy improvement. Also helps in various behavioural change trainings to students.
- Provided **uniforms, bags, stationery, notebooks & furniture** to schools to bring the uniformity among the students (till the year 2019). The intent of providing the above is to enable children studying in the schools to have a better access to learning materials.
- Provided **outdoor playing equipment** to Anganwadi schools to encourage the children to attend regularly. In several Anganwadi centers, it was observed that the children do not have access to required outdoor playing equipment.
- Constructed **RO Water Plant** in Schools to address the clean and safe drinking water.
- Provided **Cooking Wessels** to Schools.
- **Merit Awards** to students to encourage higher education.
- Provided **Reading Material** to 10th class students
- Constructed **25 toilets in Schools for Boys & Girls** to prevent the transmission of communicable diseases.



2. Health Care Services:

Health is the other flag ship program for Hetero Company, under health, we are working in following segments:



2.1 Vision Health Care Centre:

To Address the eyesight issues of marginalised communities, Hetero opened a Vision centre at Nakapally Village in collaboration with Sankurathri Foundation. The Vision centre equips latest technologies, well trained staff. Communities from neighbouring villages visits the Vision center, get the eye tests done, and for needed patients, undertake surgeries by specialist Surgeons.



Objective of the Centre:

To Support the needy villagers, who are having vision problem and not able to bare the expenses for eye surgeries.

So far, served **42,958 members**, distributed **17,983 spectacles** & conducted **1,806 eye surgeries**.



2.2 Mobile Medical Van:

The main purpose of this activity is to serve the underprivileged society and especially focus on seasonal diseases like fever, cold, allergies etc, blood pressure & sugar/diabetes.

Through this project, so far, we conducted **1,973 camps** and reached **1,04,612 members** & distributed medicines. A qualified medical doctor provides required medical support to the patients in the village itself. Once the testing is done, required medicines are provided to the patients free of cost. Interactions with few patients inferred that, on an average each patient save around Rs. 1000 per visit if they go and get the same medical support from nearby town.





2.3 Covid 19 response:

During Covid, every **15 days** we have done sanitation in the whole village to stop the spread of virus in the villages.

During lock down we have distributed groceries to the people in and around Nakkapally Region. We have organized special vaccination drive to the villagers.

Under this project we covered 27 villages and distributed **16,000 Grocery kit** (Dal, Rice, Sugar, oil packet etc) to the Villagers.



3. Village Infrastructure:

Under this project 27 villages are adopted by Hetero Group and constructed the following infrastructure in the villages.

- Constructed 6 Community Halls.
- Laying of CC Roads & Gravel roads
- Construction of Toilets
- Laying of Electrical Lines.
- Provided Solar lamps to the fisherman community
- Provided streetlights
- Construction of compound walls to Graveyards.
- Planted trees in the community.



4. Drinking Water & Sanitation:

Under this project following activities are completed.

- 14 RO Plants are installed in various villages to provide clean and neat drinking water.
- Provided running water to the whole community.
- Constructed Overhead tanks.
- Drilled 12 bore wells
- Constructed drainages in the community
- Created awareness on Swachh Bharath



ANNEXURE-IV



TAX INVOICE

INVOICE # **10070/2022-2023**
 INVOICE DATE **2022-12-19**

ANDHRA PRADESH MARITIME BOARD
 BEACH ROAD, KAKINADA, AP-533007
 GSTIN **37AAAGA2316N1ZJ**
 PAN **AAAGA2316N**

AGENCY **Hetero Infrastructure SEZ Ltd** PAN **AABCH6897E**
 GSTIN No **37AABCH6897E3Z6**
 PORT **Kakinada**
 DEPARTMENT **PO KKD**

S.no	Description of Services	Type of Services	SAC Code	Service Amt
1	<p>As per the G.O.Ms.No.21, E, I&I (Ports.II) Dept., Dt.29.06.2018 and based on the previous inspection conducted by the Port Officials and previous measurements submitted by the Executive Engineer, Marine Division, Kakinada vide his letter Dt. 08.01.2020 and request made by the firm by phone, Fee towards way leave charges calculated as follows : A) 200 MM dia effluent pipeline. 1) Port Land for laying pipeline on land side area L46XW1.00 = 46.00@Rs.788x46/10 = Rs.3625/- for one year i.e., from 29.06.2022 to 28.06.2023 = Rs.3,625/- 2) Port Land for laying pipeline in the Sea Side area L986 X W100 = 986 Sq.m@473x986/10 = Rs.46,638/- X one year i.e., from 29.06.2022 to 28.06.2023 = Rs.46,638/- Total A (1+2) = 50,263/- B) 500 MM dia pipeline 1) Port Land for laying pipeline on land side area L45.72 XW1.20 = 54.86@Rs.788x54.86/10 = Rs.4,323/- for 1 (one) year i.e., from 29.06.2022 to 28.06.2023 = Rs.4,323/- 2) Port Land for laying pipeline in the Sea Side area L1100 X W1.20 = 1320 Sq.m@473x1320/10 = Rs.62,436/- X 1 (one) year i.e., from 29.06.2022 to 28.06.2023 = Rs.62,436/- Total B (1+2) = 4,323 + 62,436 = 66,759/- Total Way Leave Charges (A+B) = Rs.1,17,022/- (Rs.50,263/- +Rs.66,759/-) Note : 1) Invoice prepared based on the previous information furnished by your Firm. 2) Our Departmental Engineers will visit the site and after verification of the actual utilization facilities of your firm, if any due amount will be initiated at later stage pending amount should be cleared after raising revised final invoice. 3) Payment will be done within a 15 days from date of invoice raised by this office, if failed making payment within due date penalty will be levied as per the rules in force.</p>	Way Leave Charges	996759	117022
				117022

Note: This is a system generated invoice, it doesn't require any signatures

Andhra Pradesh Maritime Board
PAYMENT RECEIPT

Transaction ID	4qj6fuixlch3tsu5
Bank Ref No	YSBI1655150276
Invoice Type	miscellaneous
Invoice Number	10070/2022-2023
Transaction Date	Jan 4, 2023 9:03:13 AM
Payment Status	Success
Success Info	Pending Authorization
Service Head	81
Total Payment Amount	Rs: 117022
Service Amount	Rs: 117022

PORT OFFICER

Andhra Pradesh Maritime Board

system generated receipt 05/01/2023 at 2:24PM

TAX INVOICE

INVOICE # **10071/2022-2023**
INVOICE DATE **2022-12-19**

ANDHRA PRADESH MARITIME BOARD
BEACH ROAD, KAKINADA, AP-533007
GSTIN **37AAAGA2316N1ZJ**
PAN **AAAGA2316N**

AGENCY **Hetero Infrastructure SEZ Ltd**
GSTIN No **37AABCH6897E3Z6**
PORT **Kakinada**
DEPARTMENT **PO KKD**

PAN **AABCH6897E**

S.no	Description of Services	Type of Services	SAC Code	Service Amt
1	Towards Collection of GST to the Invoice No. 10070/2022-2023, Dt. 19-12-2022	GST	997212	21064
				21064

Note: This is a system generated invoice, it doesn't require any signatures

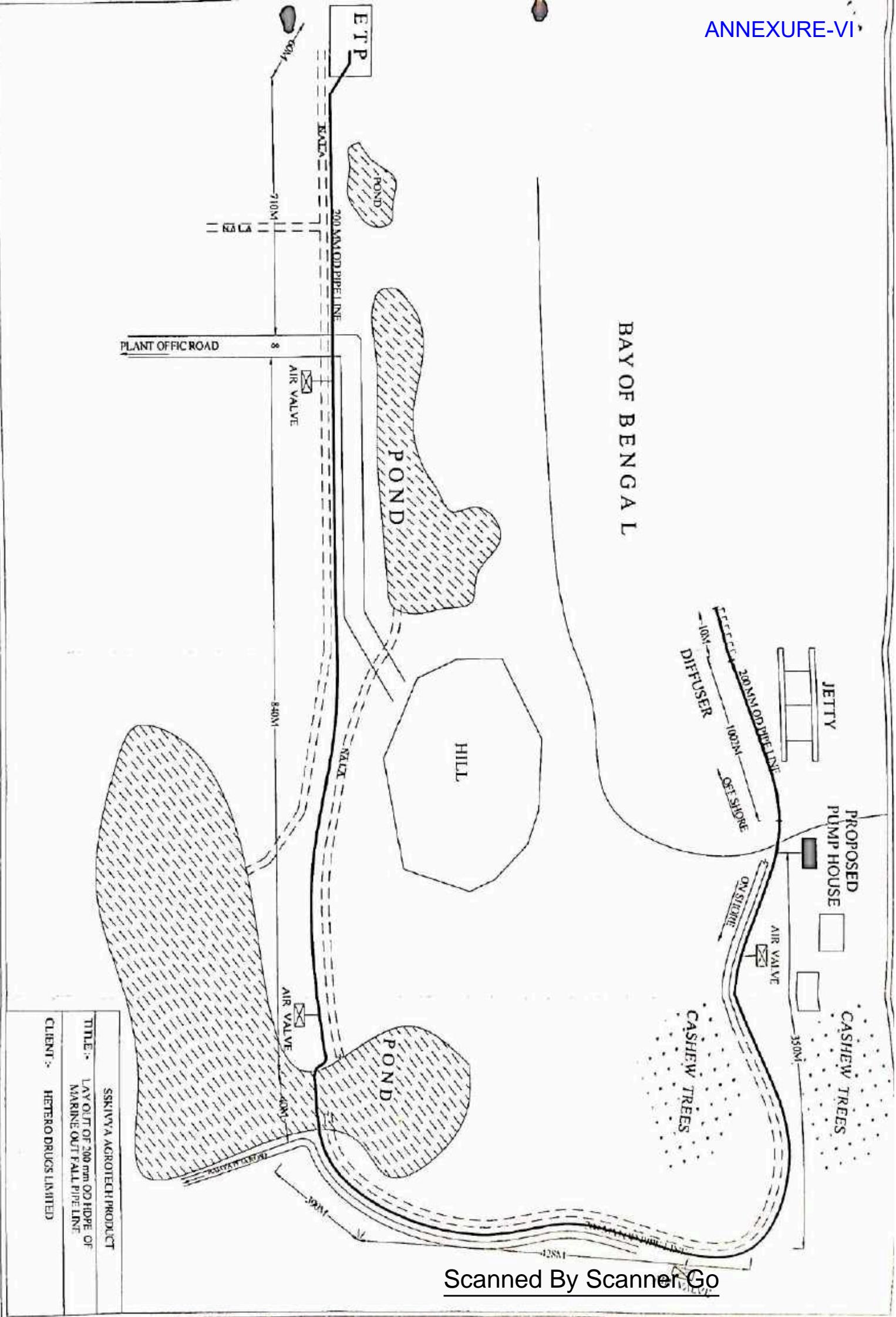
Andhra Pradesh Maritime Board
PAYMENT RECEIPT

Transaction ID	4qj6fuinlch3r3r5
Bank Ref No	YSBI1655148082
Invoice Type	miscellaneous
Invoice Number	10071/2022-2023
Transaction Date	Jan 4, 2023 9:01:07 AM
Payment Status	Success
Success Info	Pending Authorization
Service Head	GST
Total Payment Amount	Rs: 21064
Service Amount	Rs: 21064

PORT OFFICER

Andhra Pradesh Maritime Board

system generated receipt 05/01/2023 at 2:23PM

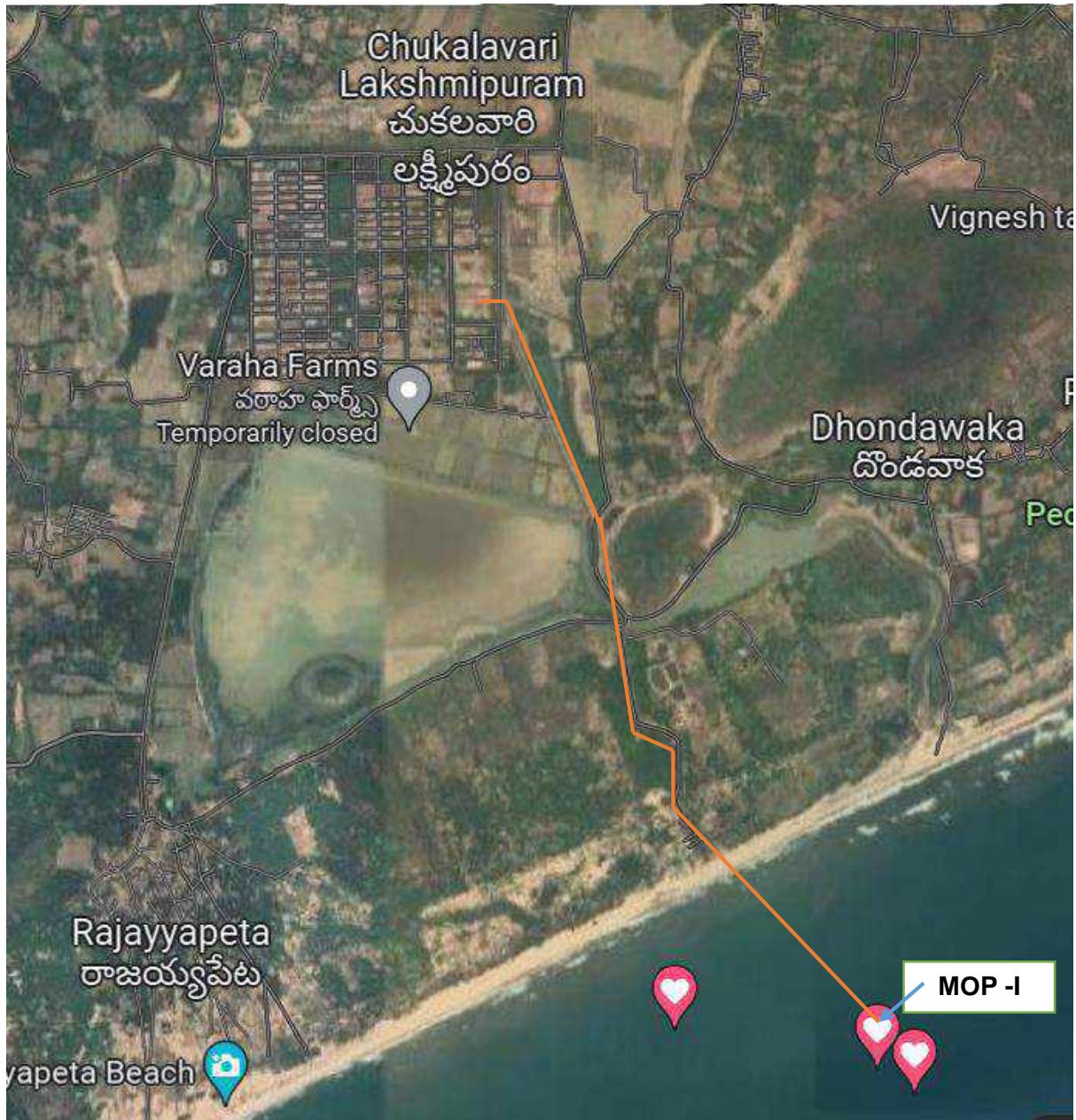


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HETERO INFRASTRUCTURE SEZ LTD

N.Narasapuram(V), Nakkapalli (M), Anakapalli Dist

MARINE DISPOSAL PIPELINE ROUTING FROM PLANT TO SEA





SV ENVIRO LABS & CONSULTANTS

(ENVIRONMENTAL ENGINEERS & CONSULTANTS IN POLLUTION CONTROL)

Corporate Office & Laboratory : Enviro House, B-1, Block-B, IDA, Autonagar, Visakhapatnam-530012.
 Hyderabad: Flat No. 302, H.No. 7-1-398/B/12, Sai Ram Residency, Balkampet Road, S.R.Nagar, Hyderabad-500038.
 ☎ +91-9440338628, +91-7207664444 | senviro_labs@yahoo.co.in, info@senvirolabs.com | www.senvirolabs.com
 Recognized by Govt. of India-MoEF & CC, New Delhi, Accredited by : NABL & NABET



Ref: SVELC/HLL/23-11/03

Date: 20-11-2023

NAME AND ADDRESS : M/s. HETERO LABS LIMITED (UNIT-III),
 NALLAMATIPALEM (V),
 NAKKAPALLI (M),
 VISAKHAPATNAM (Dist).

SAMPLE PARTICULARS : WATER

SOURCE OF COLLECTION : DESALINATION REJECT WATER

DATE OF COLLECTION : 11-11-2023

DATE OF RECEIPT : 11-11-2023

TEST REPORT

S.NO	PARAMETER	UNIT	RESULT	METHODS
1.	Turbidity	NTU	<0.01	APHA,2130-B, 24 th Edition
2.	pH	-	7.46	APHA 4500-H+B, 24 th Edition
3.	Total Dissolved Solids	mg/l	49820	APHA,2540-C, 24 th Edition
4.	Total Alkalinity as CaCO ₃	mg/l	163	APHA,2320-B, 24 th Edition
5.	Total Hardness as CaCO ₃	mg/l	10627	APHA,2340-C, 24 th Edition
6.	Calcium as Ca	mg/l	768	APHA,3500-Ca B, 24 th Edition
7.	Magnesium as Mg	mg/l	2116	APHA,3500-Mg B, 24 th Edition
8.	Chlorides as Cl ⁻	mg/l	27650	APHA,4500-Cl B, 24 th Edition
9.	Fluoride as F	mg/l	3.21	APHA,4500-FD, 24 th Edition
10.	Nitrate as NO ₃ ⁻	mg/l	2.96	APHA,4500-NO ₃ ⁻ B & C, 24 th Edition
11.	Sulphates as SO ₄ ²⁻	mg/l	3860	APHA,4500-SO ₄ ²⁻ E, 24 th Edition

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SV ENVIRO LABS & CONSULTANTS



Restricted distribution

NIO/SP- 04/2023
(SSP-3462)

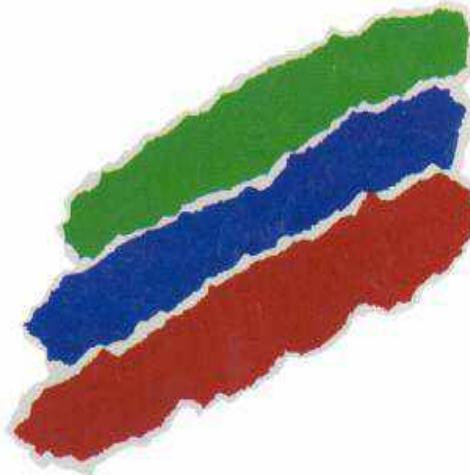
Monitoring Study around the marine outfall point of Hetero Infrastructure SEZ Ltd. in the coastal waters off Nallamattipalem

Sponsored by



Hetero Infrastructure SEZ Ltd.

February 2023



 A graphic showing a blue wave line with a small orange sun-like circle above it, positioned against a white background.	<p>सीएसआईआर – राष्ट्रीयसमुद्रविज्ञानसंस्थान CSIR-NATIONAL INSTITUTE OF OCEANOGRAPHY (वैज्ञानिकतथा औद्योगिक अनुसंधान परिषद) (COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH) दोना पावला, गोवा भारत / DONA PAULA, GOA - 403004 India फोन/Tel : 91(0)832-2450450/ 2450327 फैक्स /Fax: 91(0)832-2450602 इ-मेल/e-mail : ocean@nio.org http:// www.nio.org</p>	 The official logo of CSIR-National Institute of Oceanography, featuring a stylized gear design with a central emblem and the text "सीएसआईआर" and "CSIR-NIO" around it.
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DISTRIBUTION RESTRICTED

Monitoring Study around the marine outfall point of Hetero Infrastructure SEZ Ltd. in the coastal waters off Nallamattipalem

Sponsored by



Hetero Infrastructure SEZ Ltd.



CSIR - NATIONAL INSTITUTE OF OCEANOGRAPHY
(Council of Scientific & Industrial Research)
Regional Centre, Visakhapatnam – 530 017

February 2023

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P R E F A C E

M/s. Hetero Infrastructure SEZ limited, Rajayyapeta village, Nakkapalli Mandal, Visakhapatnam district approached CSIR-National Institute of Oceanography (CSIR-NIO), Regional Centre at Visakhapatnam to carry out the post project monitoring of marine environment at its marine outfall point (MOP) to know the impacts, if any on the ecology, water and sediment quality due to the release of treated effluent from Hetero chemical complex. In this connection, CSIR-NIO received a service order (No. 4900198745) from Hetero Infrastructure SEZ Limited on 29th April 2022. CSIR-NIO conducted a field campaign on 7th May 2022 in the marine outfall region of M/s Hetero Chemical Complex for *in-situ* observations and sample collection for the comprehensive study on water quality, biological, microbiological and sediment characteristics of the region. The following studies were carried out:

- ❖ Monitoring of physico-chemical, biological, micro-biological and sedimentological parameters in the marine environment to assess the present status of marine ecology.
- ❖ Toxicological studies to know the survival rate of the test species with the treated effluent from the guard pond of M/s Hetero Infrastructure SEZ Limited.

This report describes the results of the above studies and provides recommendations to M/s Hetero Infrastructure SEZ limited to maintain the sea water quality and health of the ecosystem in the coastal waters off Rajayyapeta.

Station: Visakhapatnam
Date: 06.02.2023

(M S KRISHNA)
(Project Leader)

List of Contributors to the project

Scientist-In-Charge

Shri. G. P. S. Murty

Project Leader

Dr. M. Sri Rama Krishna

Data Collection, Processing & Analysis

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Mr. I Dhanunjaya Rao
Mr. Dipin Ghosh
Mr. Shirish Varshishth
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Biological studies

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Dr. L. Jagadeesan
Ms. M. Sravani
Mr. Joseph Ignitius

Acknowledgements

This work was sponsored by M/s. Hetero Infrastructure SEZ Limited, Rajayyapeta, Visakhapatnam. CSIR-National Institute of Oceanography (NIO), Regional Centre, Visakhapatnam acknowledges **Shri Kullayi Reddy Sane**, Associate Vice President, EHS, Hetero Infrastructure SEZ Limited for his keen interest, involvement, support and continuous interaction throughout the project tenure. We are thankful to **Dr. Sunil Kumar Singh**, Director, CSIR-NIO for his support and encouragement to carry out this study.

Executive Summary

CSIR-National Institute of Oceanography (CSIR-NIO) received a work order from M/s Hetero Infrastructure SEZ Limited to conduct post project monitoring study of the marine environment around its marine outfall point (MOP) in the coastal waters of Rajayyapeta. Accordingly, CSIR-NIO carried out a field campaign in the coastal waters off Rajayyapeta on 7th May 2022 for *in-situ* observations and sample collection for physico-chemical, biological, microbiological and sedimentological parameters. Eco-toxicology (bioassay) test was conducted for four days on the treated effluent collected directly from the guard pond of M/s Hetero Infrastructure SEZ Limited using zebra fish following CPCB norms. The salient features of our investigations in this study are given below.

- ✓ The range of values observed for temperatures and salinities of the study region is normal and consistent with coastal waters of east coast of India.
- ✓ The range of concentrations observed for chemical parameters such as dissolved inorganic nutrients (nitrite, nitrate, phosphate and silicate) is normal and is concurrent with the coastal waters along the east coast of India.
- ✓ The range of values observed for pH and total suspended matter in the study region is normal and are well within the values reported for coastal waters of east coast of India. However, the range of total petroleum hydrocarbons (TPHC) found in the surface and bottom waters of this study (10.0-22.1 µg/L and 2.1-37.4 µg/L, respectively) are relatively higher than those found in the previous monitoring study conducted in this region in 2017 (1.3-10.5 µg/L and 1.7-4.7 µg/L, respectively), indicating that there is a slight increase in recent years in the TPHC input from local sources into the coastal waters of Rajayyapeta.

- ✓ Mean dissolved oxygen (DO) concentrations in the surface (6.1 ± 0.2 mg/L) and bottom (5.8 ± 0.5 mg/L) waters of the study region are well above the threshold limit of DO concentrations for good quality of seawater (5.0 mg/L), indicating that coastal waters of this region are healthy with respect to DO concentrations.
- ✓ Mean values of biochemical oxygen demand for three days (BOD_3) in the surface and bottom waters of this study (1.9 ± 0.7 mg/L and 2.1 ± 1.0 mg/L, respectively) are well within the reported BOD_3 values for east Indian coastal waters. The BOD_3 values found in this study indicate that there is no significant pollution of labile organic matter from external sources in this region during the study period.
- ✓ Phytoplankton biomass, in terms of Chlorophyll-a (chl-a), varied from 0.23 to 0.56 mg/m³ (mean: 0.37 mg/m³) and it is considerably lower than those found in this region in 2017 monitoring study (1.2 to 7.44 mg/m³). Mean phytoplankton abundances found in the surface and bottom waters of this study (4646 Nos./L and 5675 Nos./L, respectively) are considerably lower than those reported in the previous monitoring study conducted in this region in 2017 (10860 Nos./L and 10698 Nos./L, respectively), indicating that decreased primary production in the study region when compared to 2017. However, phytoplankton diversity increased as the range of number of phytoplankton genera recorded in surface waters of this study (15-27) is considerably higher than those reported in 2017 (12-19). Though the diatoms are the most predominant contributors to the total phytoplankton abundance, their mean contribution to the total phytoplankton decreased to ~60% in this study compared to ~97% in 2017. On other hand, dinoflagellate contribution increased from ~4% in 2017 to ~23% in the present study. Cynobacterial contribution to the total phytoplankton abundance is 4.2% only. Dominant and consistently occurring species were *Chaetoceros sp.*, *Skeletonema sp.*, *Rhizosolenia sp.*, *Cyclotella sp.*, *Nitschia sp.*,

Navicula sp., Ceratium sp., Gymnodinium sp., Trichodesmium sp., Cyanobacteria, Thalassiothrix sp., etc.

✓ Meso-zooplankton abundance in the present study (mean: 395 Nos./m³) is less than one-fourth of the zooplankton abundance reported in previous monitoring study (1776 Nos./m³) conducted in this region in 2017. Copepods are predominant in the total zooplankton abundance, with a mean contribution of 89.2% (range: 79.5-94.3%). Chaetognatha contributes from 0.7% to 9.4% (mean: 3.4%) to the total zooplankton abundance. Decapod larve are the third dominant groups in the total zooplankton abundance, with a mean contribution of 1.8% (range: 0.4-4.9%). The lowest abundant groups that contribute <1% to the total zooplankton abundance are Bivalve larvae (mean: 0.8%), Cladocerans (mean: 0.6%) and Thaliacea (0.4%).

✓ The range of macro faunal density found in this study (2650 to 3200 ind/m²) is comparable to those found in surface sediments of east coast of India. A total of 20 fauna was found and is dominated by families of Polychaeta, with a mean contribution of ~68.3% to the total abundance. In particular *Nephtyidae*, *Orbinidae*, *Eunicidae*, *Tereellidae*, *Opheliidae*, *Nereidae* and *Spionidae* families are common in all stations. The second largest group was Arthropoda and it was dominated by Amphipoda and Isopoda. Sipuncula and Nematoda were present at all the stations. The wet weight of biomass was in the range of 4.05 to 11.27 g/m². The meiofauna represent the intermediate size group among the benthos. A total of 7 taxa were identified in the study area and the meio fauna was dominated by nematode, harpacticoid copepod, polychaeta, turbellaria, foraminifera, ostracoda and nauplii of crustacean group.

✓ The range of TVC found in the surface ($2.9\text{-}24.6 \times 10^3$ CFU/mL) and bottom ($0.9\text{-}34.8 \times 10^3$ CFU/mL) waters of this study are comparable with those

reported in the previous monitoring study conducted in this region in 2017 ($5.6\text{-}13.6 \times 10^3$ CFU/mL and $3.2\text{-}33.0 \times 10^3$ CFU/mL, respectively). However, total coliform counts in this study ($1.4\text{-}8.4 \times 10^3$ CFU/mL in surface and $0.01\text{-}10.0 \times 10^3$ CFU/ mL in bottom water) are considerably higher than those reported in the previous monitoring study conducted in 2017 ($0.3\text{-}0.8 \times 10^3$ CFU/ mL and $0.2\text{-}1.2 \times 10^3$ CFU/ mL, respectively). The range of *Escherichia coli* like organisms (ECLO) found in this study (NG to 3.2×10^3 CFU/ mL and NG to 3.1×10^3 CFU/ mL, respectively) is comparable with those found in the previous monitoring study conducted in 2017 ($1.5\text{-}3.7 \times 10^3$ CFU/ mL and $0.7\text{-}7.4 \times 10^3$ CFU/ mL, respectively). The *Enterococcus faecalis* like organism counts were NG to 22.9×10^3 CFU/ mL in surface water and NG to 1.6×10^3 CFU mL in bottom water. The *Vibrio* like organism (VLO) counts were NG to 3.0×10^1 CFU/ mL in surface water and NG to 1.0×10^1 CFU/ mL in bottom water. *Vibrio cholerae* like organism (VCLO) counts were NG to 3.0×10^1 CFU/ mL in surface water and NG to 1.0×10^1 CFU/ mL in bottom water. There is no growth of *Vibrio parahaemolyticus* like organism (VPLO) in both surface and bottom waters.

- ✓ ECLO and EFLO counts were observed in most of the stations which showed the influence of anthropogenic activities such as domestic and industrial discharge, recreational activities, open defecation in coastal (beach) regions (in villages), fisherman activities etc. The counts were higher than the reported from the coastal waters and as per standards of coastal recreational waters. VLO and VCLO counts were observed only in two stations out of the 12 stations sampled in the coastal waters off Rajayyapeta.
- ✓ Eco-toxicology (bioassay) test was conducted for four days (96 hrs) on the treated effluent collected from M/s Hetero Infrastructure SEZ Limited using zebra

fish. During the test period of 96 hours, no mortality was observed in the control treatment and the effluent concentrations of 10%, 20% and 30%. The effluent of 50% concentrations recorded 5% mortality during the last 24 hours. Whereas, 60% effluent concentration recorded 5% mortality during the last 48 hours. The 90% effluent recorded 10% mortality while the 100% effluent recorded 25% mortality during the test time of 96 hours. These results indicate that the treated effluent collected from the guard pond of M/s Hetero Infrastructure SEZ Limited did not fulfill the CPCB norms for the bio-assay test, i.e., 90% of survival of zebra fish in 100% of treated effluent after the test time of 96 hours.

✓ Based on the median lethal concentrations (LC₅₀), the acute toxicity unit (TU_a) of the treated effluent of M/s Hetero Infrastructure SEZ Limited was determined as 0.56 (range: 0.35 to 0.71) for zebra fish. Therefore, the quality of the treated effluent from M/s Hetero Infrastructure SEZ Limited is graded as Limited Toxic (TU_a: <1).

✓ Based on the results of investigations carried out in the coastal waters of Rajayyapeta (large variability in the abundances of phytoplankton and zooplankton), it is recommended to carry out yearly monitoring study in the coastal waters of Rajayyapeta for next couple of years

✓ Based on the observations and eco-toxicology test results, it is recommended to prevent the extensive growth of algae in guard ponds of the industry in eco-friendly manner to improve the quality of treated effluent in order to comply with the CPCB norms of bioassay test for the treated effluent.

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Chapter 1 **INTRODUCTION**

1.1 Background information

M/s. Hetero Infrastructure SEZ Limited is a bulk drugs manufacturing company situated at Rajayyapeta village in Nakkapalli Mandal of Visakhapatnam District, Andhra Pradesh (Fig. 1.1). This plant is producing bulk drugs and their intermediates for the past few years. The industry is discharging the treated effluents into the sea through a marine disposal pipeline at a distance of 980 m from the coast, a safe disposal point for quick dispersion, as recommended by the National Institute of Oceanography in their Rapid Marine Environmental Impact Assessment report of 2006. As per the conditions of Environmental Clearance (EC) issued by MoEF&CC, Govt. of India and consent for operation issued by APPCB, the industry is carrying regular post-project monitoring studies in the marine environment and bioassay tests for the treated effluents as a mandatory for a coastal based industry. Accordingly, CSIR-National Institute of Oceanography (CSIR-NIO), Regional Centre, Visakhapatnam has carried out post project monitoring studies in 2010, 2012, 2014 and 2017 to know the impacts if any due to the discharge of treated effluents on the seawater quality and health of the ecosystem. As part of the post project monitoring of the marine environment, once again M/s Hetero Infrastructure SEZ Limited approached CSIR-NIO, Regional Centre, Visakhapatnam for these studies to know the cumulative effects, if any, on the ecology, water quality and sediment quality due to the discharge of treated effluents into the marine environment in April 2022. After examining the proposal, CSIR-NIO agreed to carry out the study to generate one time site-specific data on oceanographic parameters and bioassay studies on the treated effluents as part of the post project monitoring.



Fig. 1.1.: Hetero chemical complex

1.2 Objectives and scope of the Study

The generation of site-specific environmental data base is a prerequisite for the assessment of probable impact of any coastal based industry. The main objective of the study is to understand the cumulative impact, if any, on the ecosystem in the coastal waters off Rajayyapeta due to the release of treated effluent from M/s Hetero Infrastructure SEZ Limited. Hence, the scope of the present study includes the generation of reliable data, at least one time, in respect of physico-chemical, biological, micro biological and sedimentological parameters to understand the water quality and sediment quality at and around the marine out fall point (MOP; discharge point) covering 12 stations. Since the toxicological studies are important to assess the survival rate of test species in the treated effluent, the scope of the work also includes to carry out the bioassay test for four days (96 hours) on the treated effluent collected from the guard pond of M/s Hetero Infrastructure SEZ Limited using pink zebra fish as test species. The results of the monitoring study

conducted in the coastal waters off Rajayyapeta on 7th May 2022 and the toxicological studies conducted on the treated effluent are given in this report.

1.3 Company Profile

M/s Hetero Infrastructure SEZ Limited is a Bulk Drug Manufacturing Complex with four units situated at N. Narasapuram, Nakkapalli Mandal, Visakhapatnam district of Andhra Pradesh. Out of four units, one unit is in the non-Special Economic Zone (SEZ) and the other three units are in the SEZ. M/s Hetero-Infrastructure SEZ Ltd is providing utilities & common facilities like Water, Steam, Effluent Treatment, Sewage Treatment, Scrap Yard, Hazardous waste handling etc. to all the manufacturing units located in this area.

The industrial estate is situated in Sy. Nos: 215, 286/1, 286/2, 283/1 in Ch. Laxmipuram village, 312/1 to 312/5, 312/10 to 312/12, 313/1 to 313/7 of Rajayyapeta village, 19(part) in Peda Teenarla village, 117/1 to 117/3, 119/1, 119/2, 120/1, 120/2, 125, 126, 129/1 to 129/9, 138, 142, 150, 215, N. Narsapuram village, Nakkapalli Mandal, Visakhapatnam District spread over an area of 139.856 ha. The various units which are working at present are as below:

- Hetero Labs Limited, Unit-III (Non SEZ)
- Hetero Drugs Limited, Unit-IX (SEZ)
- Hetero Labs Limited, Unit-IX (SEZ)
- Honour Lab Ltd, Unit-III
- Hetero Infrastructure SEZ Ltd (common facilities)

The Hetero complex (Fig. 1.2) is surrounded by open lands & salt lake in the south direction, open lands in the east direction, open lands in north direction and road connecting Upamaka village with Rajayyapeta village in the West direction, The NH 16 is in the north direction at a distance of 4 km, the nearest railway station is located at

Narsipatnam at a distance of 9 km in the north direction. The nearest airport is located at a distance of 70 km in the north east direction at Visakhapatnam. The Bay of Bengal is in the south eastern direction of the site at a distance of 1.2km. The area is drained by the Varaha River in the northern direction up to a distance of 13km, and the Tandava River in the south west direction at a distance of 14km.



Fig. 1.2: Synoptic view of the Hetero Complex

The capital cost of the project is Rs 1500 Crores. The SEZ is designed on the basis of required infrastructure for pharmaceutical manufacturing facilities like, road, storm water network, common utilities, storage facilities for raw materials, solvents, parking areas, pollution control facilities etc.

The water requirement of the project is being met with the sea water desalination plants (Fig. 1.3) installed in the premises of Hetero Infrastructure SEZ Ltd. Vermi Compost and sewage treatment plants (Figs. 1.4 and 1.5) are provided to treat the waste water and effluent treatment plant, containing different stages of treatment (Figs. 1.6 to

1.11) for industrial waste water. Water conservation measures were incorporated in the plumbing designs. Water recycling / reuse were adopted by way of using treated sewage for green belt development. The storm water from the site is collected in a storage tank and the same is reused for various purposes (as and when required), while the over flow is let out into the natural drain adjacent to the site. The required power is drawn from the AP TRANSCO and adopted energy efficient design for lighting and utility systems to optimize the energy requirement. Construction material was drawn from local sources. The industry installed a 6.1 MW Captive power plant for the generation of power and uses power from Hetero Wind Power.

Amenities and utilities:

A number of amenities and utilities were implemented during the operation phase to provide common infrastructure and pollution control facilities.



Fig. 1.3: Desalination plant in the Hetero Premises



Fig. 1.4: Vermi Compost Plant



Fig. 1.5: Sewage Treatment Plant (STP)



Fig. 1.6: Stripper and MEE (I & II)



Fig. 1.7: ATFD Connected to MEE I & II



Fig. 1.8: HTDS Tanks covered with Hoods and connected to Scrubbers



Fig. 1.9: Biological system for LTDS & Condensate of MEE & ATFD



Fig. 1.10: Guard ponds for storage of treated Effluent



Fig. 1.11: Aeration tanks

Baseline environment:

The baseline environment of the project impact areas (PIA) spread over 25km radius from the site was studied for air, water, soil, noise, ecological and social economic status. The baseline status is found to be within the prescribed limits in all respects except the noise levels which are found to be above the prescribed limits during day time in the PIA.

1.4 Major Products:

Table 1.1: Hetero Labs Limited (UNIT – III) – regular products

S. No	Name of the Product	Quantity (Kg/Day)
1	Abacavir sulphate	166.67
2	Capecitabine	133.33
3	Cefidinir	166.67
4	Cefixime Trihydrate	1000
5	Cefoxitin Sodium	333.33
6	Cefpodoxime Proxetil	666.67
7	Cefuroxime Axetil	666.67
8	Citicoline Sodium	100
9	Darunavir	250
10	Dolutegravir Sodium	167
11	Domperidone	166.67
12	Efavirenz	333.33
13	Fluconazole	166.67
14	Folic acid	100
15	Gliclazide	166.67
16	Hydralazine Hydrochloride	200
17	Irbesartan	166.67
18	Lamivudine	2333.33
19	Levetiracetam	1500
20	Losartan Potassium	866.67
21	Nevirapine	1000
22	Omeprazole	166.67
23	Pamidronate sodium	166.67
24	Phenylephrine.HCl	166.67
25	Pioglitazone Hydrochloride	166.67
26	Quetiapine fumarate	333.33
27	Ritonavir	100
28	Rosiglitazone maleate	166.67

29	Rosuvastatin calcium	100
30	Telmisartan	100
31	Tenofovir Disproxil fumerate	666.67
32	Terbinafine HCl	166.67
33	Tranexamic acid	100
34	Valsartan	500
35	Zidovudine	1166.67
Total Production capacity worst case scenario		11816.67 Kg/day

Table 1.2: Hetero Labs Limited (UNIT – III) – Campaign Products

S.No	Name of the Product	Quantity (Kg/Day)
1	Acyclovir	33.33
2	Alendronate Sodium Trihydrate	3.33
3	Alfuzosin Hydrochloride	26.67
4	Aliskiren Hemifumarate	6.67
5	Amlodipine Besylate	25
6	Anastrozole	1
7	Aripiprazole	33.33
8	Atazanavir Sulphate	33.33
9	Atomoxetine HCl	33.33
10	Atorvastatin Calcium Trihydrate	33.33
11	Benazepril HCl	3.33
12	Benfotiamine	66.67
13	Bicalutamide	66.67
14	Butenafine Hydrochloride	0.67
15	candesartan cilexetil	16.67
16	Cefditoren pivoxil	66.67
17	Cilazapril Monohydrate	3.33
18	Cilostazol	25
19	Citalopram Hydrobromide	66.67
20	Clopidogrel Hydrogen Sulfate	26.67
21	Daclatasvir	13.33
22	Deflazacort	1.67
23	Desloratadine	1.67
24	Didanosine	3.33
25	Dorzolamide HCl	5
26	Duloxetine HCl	25
27	Eletripton	16.67
28	Emtricitabine	33.33
29	Eplerenone	1.67
30	Eprosartan Mesylate	16.67
31	Erlotinib Hydrochloride	16.67

32	Escitalopram Oxalate	16.67
33	Esomeprazole Megnesium	33.33
34	Etoricoxib	25
35	Ezetimibe	16.67
36	Famiclovir	26.67
37	Febuxostat	16.67
38	Fosamprenavir Calcium	66.67
39	Fosinopril Sodium	33.33
40	Glimpiride	26.67
41	Indinavir	16.67
42	Itraconazole	25
43	Lacosamide	33.33
44	Lansoprazole	33.33
45	Ledipasvir Premix	16.67
46	Letrozole Intermediate	33.33
47	Levo Milnacipran	16.67
48	Levofloxacin	25
49	Lisinopril Dihydrate	20
50	Lopinavir	66.67
51	Loratadine	6.67
52	Maraviroc	16.67
53	Methyl Cobalamin	16.67
54	Mifepristone	3.33
55	Miglitol	1.67
56	Milnacipran	16.67
57	Milnacipran HCl	1.67
58	Montelukast sodium	25
59	Moxifloxacin	26.67
60	Moxonidine	16.67
61	Nadifloxacin	0.67
62	Nelfinavir	3.33
63	Olanzapine	33.33
64	Oseltamivir phosphate	25
65	Ozagrel HCl	3.33
66	Pantoprazole Sodium	25
67	Perindopril	16.67
68	Phthalazinone	33.33
69	Posaconazole	33.33
70	Rabeprazole Sodium	25
71	Raltegravir	50
72	Ramipril	33.33
73	Ranolazine di HCl	16.67
74	Rasagiline Mesylate	3.33
75	Residronate Sodium	3.33
76	Rifaximin	33.33
77	Roflumilast	3.33
78	Rufinamide	20

79	Rupatadine fumarate	3.33
80	Sequinavir Mesylate	26.67
81	Sertaconazole	16.67
82	Sertraline HCl	25
83	Simvastatin	66.67
84	Sofosbuvir	50
85	Stavudine	16.67
86	Sumatriptan Succinate	3.33
87	Tazarotene	1.67
88	Tegaserod Maleate	1.67
89	Temozolomide	2.67
90	Tiagabine	23.33
91	Tioconazole	26.67
92	Topiramate	16.67
93	Torsemide	2.67
94	Valacyclovir	50
95	Velpatasvir	16.67
96	Venlafaxine	16.67
97	Voriconazole	27.33
98	Zonisamide	33.33
99	Voglibose	1.66
Total Production capacity worst case scenario		1183.33 Kg/day

The total Production Capacity Per Month is 390T

Table 1.3: Hetero Labs Limited (UNIT – IX) – Regular Products

S.No	Name of the Product	Quantity (Kg/Day)
1	Abacavir Sulphate	333.34
2	Atorvastatin Calcium	333.33
3	Darunavir	333.33
4	Dextromethorphan	333.33
5	Diltiazem	150
6	Dolutegravir Sodium	666.67
7	Efavirenz	666.67
8	Emtricitabine	333.33
9	Irbesartan	100
10	Lamivudine	3333.34
11	Levetiracetam	1333.34
12	Lopinavir	166.7
13	Losartan potassium	666.7
14	Naproxen	100
15	Nevirapine	500
16	Olmesartan	333.34
17	Quetiapine Hemifumerate	333.34

18	Stavudine	1000
19	Telmisartan	666.67
20	Tenofovir disoproxil fumerate	666.67
21	Trazodone	333.34
22	Valsartan	666.67
23	Zidovudine	666.67
Total Production capacity worst case scenario		7666.69Kg/Day

Table 1.4: Hetero Labs Limited (UNIT – IX) – Campaign Products

S.No	Name of the Product	Quantity Kg/Day
1	Aripiprazole	16.67
2	Atazanavir Sulphate	33.34
3	Atomoxetine HCL	33.34
4	Butenafine HCL	16.66
5	Candesartan CilexetilL	33.34
6	Cilazapril Monohydrate	16.67
7	Desloratadine	16.67
8	Didanosine	8.33
9	Entacapone	33.34
10	Escitalopram Oxalate	33.34
11	Etoricoxib	100
12	Etravirin	8.33
13	Ezitamibe	33.34
14	Finasteride	20
15	Fosampiravir	10
16	Hydralazine HCL	20
17	Levodopa	100
18	Loratadine	33.34
19	Merviroc	33.34
20	Milanacipron	8.33
21	Moxanidine	0.033
22	Nelfinavir Mesylate	8.3
23	Osaltavir Phosphate	100
24	Pioglitazone HCL	66.67
25	Ramipril	33.34
26	Rilpivirine	8.33
27	Ritonavir	66.67
28	Saquinavir Mesylate	8.33
29	Simvastatin	33.34
30	Spironolactone	33.34
31	Terbinafine	200
32	Toresemide	33.34
33	Verapamil	66.67

34	Voricanazole	16.66
35	Zonisamide	66.67
Total Production capacity worst case scenario		866.7Kg/Day

Table 1.5: Hetero Drugs Limited (UNIT – IX) – Regular Products

S.No	Name of the Product	Qty per Day in Kgs
1	Acyclovir	333.33
2	Bupropion	500
3	Celecoxib	333.33
4	Citaloparm hydro bromide	133.33
5	Diclofenac Diethyl amine	333.33
6	Diclofenac Potassium	333.33
7	Diclofenac Sodium	800
8	Diolat-12	150
9	Divalproex sodium	333.33
10	Esomeprazole Magnesium Di Hydrate	133.33
11	EsomeprazoleMagnesium Tri Hydrate	233.33
12	Fenofibrate	333.33
13	Fexofenadine	300
14	Gabapentine	400
15	Metaxalone	166.67
16	Nabimitone	100
17	Pregabalin	200
18	RitanovirPremix Amorphous &Form)	666.67
19	Sevelamer Carbonate	100
20	Sertraline HCl Form-I & II	600
21	Topiramate	200
Total Production capacity worst case scenario		3166.66Kg/day

Table 1.6: Hetero Drugs Limited (UNIT – IX) – Campaign Products

S.No	Name of the Product	Quantity per day (in Kgs)
1	Carbidopa	20
2	Cinacalcet	16.66
3	Dabigatran Etexilate Mesylate	33.33
4	Eletripan Hydrobromide	16.67
5	Febuxostat	33.33
6	Fesoterodine	6.67
7	Ivacaftror(Premix)	10
8	Lacosamide	50
9	Levodopa	33.33
10	Lopinavir	66.67
11	Lurasidone	40
12	Mamantine HCL	33.33

13	Mexiletine Hydrochloride	80
14	Mirabegron Alpha	20
15	Mirabegron Beta	33.33
16	Pitavastatin	16.67
17	Prasugrel Hydrochloride	17
18	Relaxifene Hydro chloride	33.33
19	Risidronate Sodium	16.67
20	Rilpivirine Hydrochloride	16.67
21	Rivastigmine Base	50
22	Rizatriptan	16.67
23	Rosuvastin	50
24	Rufinamide Premix	30
25	Rufinamide	33.33
26	Silodosin	6.67
27	Sodium Zirconium Cyclosilicate	50
28	Valgaciclovir	33.33
29	Zafirlukast (Amorphous)	10
30	Zolmitriptan	10
31	2-Acetoxy ethyl acetoxymethylethe	2000
32	Validation batches for Samples	100
Total Production capacity worst case scenario		366.66Kg/day

Table 1.7: Effluent generation per day

S. No.	Unit	HTDS & HCOD (KLD)	LTDS & LCOD (KLD)	RO Rejects (KLD)	Domestic (KLD)	Total Effluent Generation (KLD)
1	HDL - IX	62.16	2.5		25	89.66
2	HLL - IX	101.1	4		25	130.1
3	HLL - III	261	32		60	353
4	Honour	30.87	5.35		10	46.22
5	Hetero Infra	--	35.504	30	8	73.504
Total		455.7	79.354	30	128	692.484

Table 1.8: Water Consumption as per Consents

S. No.	Unit	PURPOSE (KLPD)				Total Water Consumption (KLPD)
		Process & washings	Cooling	Domestic	Additional Water to RO	
1	HDL - IX	62.79	50	25	0	137.79
2	HLL - IX	101.13	70	25	0	246.13

3	HLL-III	261	161	70	0	492
4	Honour	32.23	80	10	0	122.23
5	Hetero Infra	--	--	10	107	447

Table 1.9: Details of boilers

S. No.	Capacity
1	20 TPH
2	1x 45 TPH
3	1 x 20 TPH
4	1x 12 TPH

1.5 Green Belt Development

Green belt is recommended as one of the major components of the Environmental Management Plan. The existing industry has green belt and the management emphasizes the development of further greening of the site to enhance environmental quality through mitigation of fugitive emissions, attenuation of noise levels, balancing eco-environment, consumption of treated effluent, prevention of soil erosion, and creation of the aesthetic environment. The greenbelt is in an area of 124.5 acres. The enhancement of the green belt involved the plantation of small species. Proper attention and management are being taken up by the firm to maintain the survival rate of the planted species. For plantation of the small plants digging pits are very important for preparing the soil environment near the roots of the plants. The size of the pit will be optimum enough to supply required nutrients to the roots of the plant. The usual method is to dig a pit of required size three to four months before planting of the species, which is generally done at the break of the monsoon. The pits of 45 cm x 45 cm x 45 cm size in the case of hardier species like Eucalyptus, Shisham, Acacia etc., but larger pit size is preferred for fruit yielding trees like mango, Jamun etc. 1m x 1m x 1m pits may be used for plantation of other trees. The

soils of the plant side will be mixed with 1/3 farmyard manure before refilling about a week prior to planting.

M/s. Hetero Labs Ltd. units are having good environment management plan and made this as part of their corporate policies. The firm has considered Safety, Health and Environmental protection as an integral part of their business. As a part of the environmental management plan the firm established and developed a green belt in and around each block of the plant (Figs. 1.13 to 1.18).



Fig. 1.12: Green Belt inside the factory

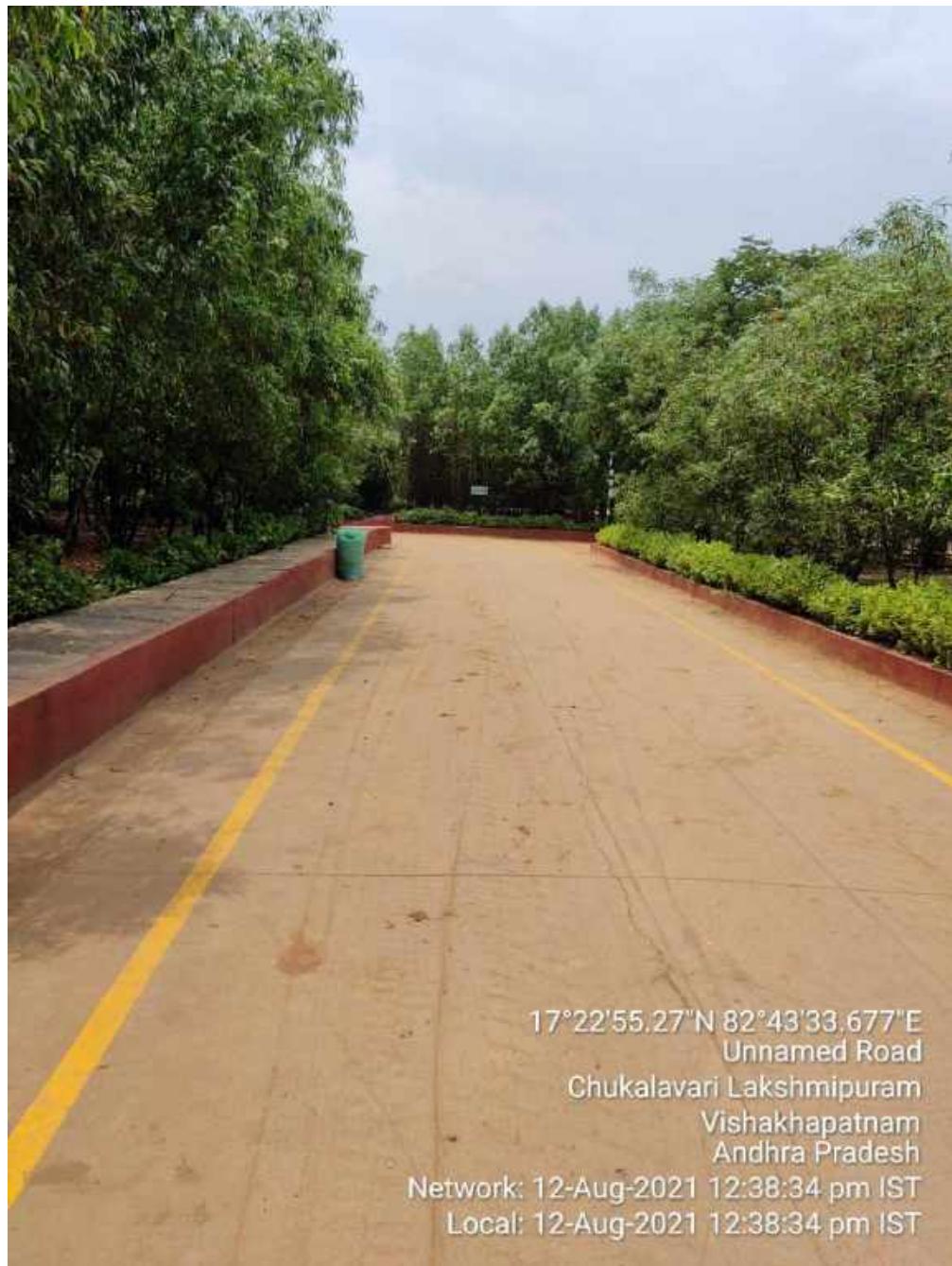


Fig. 1.13: Green Belt within the factory



Fig. 1.14: Green Belt in ETP area



Fig. 1.15: RCC Road connected to Boilers with Green Belt

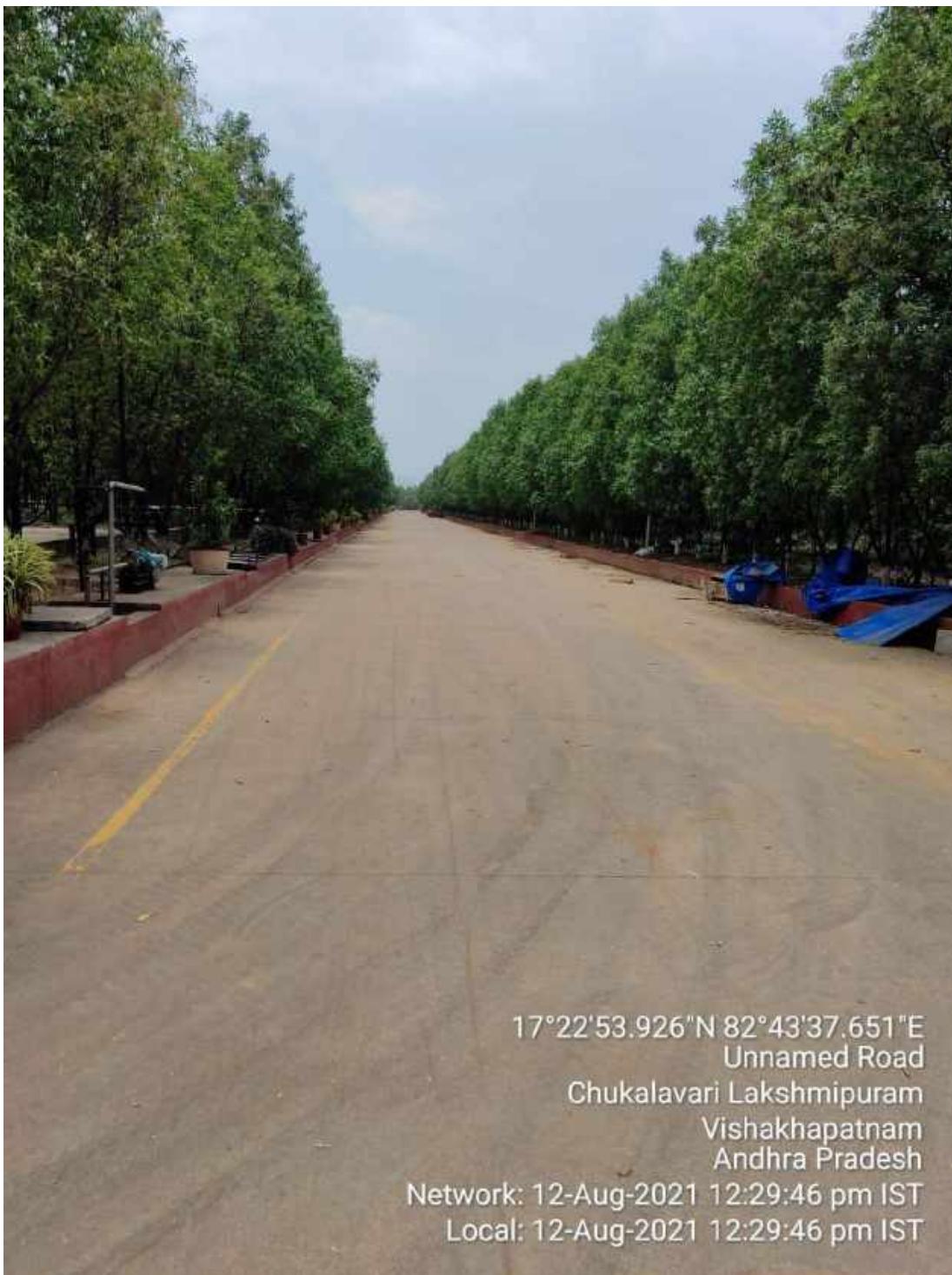


Fig. 1.16: Green Belt in the Hetero premises



Fig. 1.17: Green Belt inside the company

Chapter 2
SAMPLING AND METHODS

1.1. Sample collection

A field campaign for in-situ observations and sample collection in the coastal waters of Nallamattipalem was conducted on 7th May 2022 on a mechanized fishing boat. Samples for physico-chemical, biological, microbiological and sedimentological parameters were collected at selected 12 stations following Paris Commission Guidelines. Stations were fixed in all four directions with a distance of 0.5 km, 1.0 km and 2.0 km from the marine outfall point (MOP) (Fig. 2.1; Table 2.1). Details of the station locations such as latitude, longitude and water column depth were provided in Table 2.1. Treated effluent was collected directly from the guard pond of M/s Hetero Chemical Complex to conduct bio-assay (eco-toxicity) tests and to examine the concentration levels of heavy metals in the treated effluent

A Niskin water sampler (10L, plate. 2.1) was used to collect water samples from surface and near bottom in coastal waters off Nallamattipalem at all stations shown in Figure 2.1. Water samples were collected in pre-cleaned glass/plastic bottles as soon as the water sampler was brought onto the deck (Plates 2.2 and 2.3). The samples in duplicate were fixed immediately for dissolved oxygen (DO) after collection on deck. Samples for phytoplankton were collected in narrow mouth self-sealed 1 litre PVC bottles and added Lugols Iodine (10%) solution as a preservative. Phytoplankton samples were collected in both surface and bottom waters at each station. Meso zooplankton from the surface waters was collected by towing the bongo net fixed with a flow meter. Zooplankton samples collected in the bucket that was fixed at the end of the bongo net were removed and transferred the sampled into a PVC jar as depicted in plates 2.4 and 2.5. The volume of

water filtered through the bongo net was calculated from the flow meter reading. Formalin was added as a preservative to the zooplankton sample and brought to the shore laboratory for further analysis. Surface sediment collected using Van Veen grab sampler (Plate 2.6) and sieved for benthic organisms through the benthic sieve (Plate 2.7). Benthic organisms (both macro and meio-fauna) were separated from surface sediment by washing the sediment sample on the benthic sieve with a gentle flow of water to remove clay and silt particles. Benthic organisms retained on the sieve were transferred to a PVC jar and added Rose Bengal as a preservative. Collection and laboratory analysis of phytoplankton, zooplankton and benthic fauna were given in the methodology section (Section 2.2.2).

For Biochemical Oxygen Demand (BOD) samples were collected in air-tight glass bottles and kept in the BOD incubator for five days. After five days, samples were fixed with Winklers A and B reagents for the determination of DO in the sample. Samples for dissolved inorganic nutrients were collected in plastic bottles and kept frozen until the samples reached the shore laboratory. Samples were preserved in a -20°C deep freezer at the shore laboratory until the analysis is performed. Standard methods have been employed to analyse chemical constituents in seawater samples collected for this study. The collection of water samples from Niskin sampler was shown in plates 2.2 and 2.3, and towing of zooplankton (bongo) net and collection of zooplankton sample from net-bucket were shown in plates 2.4 and 2.5. Surface sediments were collected using Van Veen grab sampler (Plate 2.6) and benthic organisms from surface sediment were separated using benthic sieve (Plate 2.7).



Fig. 2.1: A map showing station locations in the study area, i.e. coastal waters off Nallamattipalem. Red circles show the MOPs of M/s Hetero Chemical Complex. Yellow pins show the stations fixed in all four directions of the MOP with distances of 0.5 km, 1.0 km and 2.0 km from MOP.



Plate. 2.1: Niskin sampler (10L) used for collection of water samples



Plate 2.2: Collection of samples onboard fishing trawler



Plate 2.3: Collection of waters samples from Niskin sampler



Plate: 2.4: Towing of bongo net in surface waters for zooplankton and removal of bucket from bongo net to collect zooplankton sample



Plate: 2.5: Collection of zooplankton sample



Plate 2.6: Van Veen grab sampler



Plate 2.7: Benthic sieve

Table 2.1: Sampling locations in coastal waters off Rajayyapeta

Station Name	Latitude (''N)	Longitude (''E)
HET 1	17°21'13.56"N	82°44'45.84"E
HET 2	17°21'20.16"N	82°45'1.44"E
HET 3	17°21'35.94"N	82°45'30.66"E
HET 4	17°20'52.56"N	82°44'39.18"E
HET 5	17°20'38.22"N	82°44'47.58"E
HET 6	17°20'9.72"N	82°45'3.48"E
HET 7	17°20'58.62"N	82°44'16.02"E
HET 8	17°20'50.34"N	82°44'1.26"E
HET 9	17°20'34.86"N	82°43'31.44"E
HET 10	17°21'20.28"N	82°44'21.00"E
Hetero- MOP1	17°21'7.00"N	82°44'31.00"E
Hetero- MOP2	17°21'04.0"N	82°44'36.0"E

Table 2.2: Names of scientific and technical personnel participated in the field campaign

S. No.	Name of Personnel	Designation
1	Dr. TNR Srinivas	Senior Scientist
2	Mr. I Dhanunjaya Rao	Project Associate
3	Mr. Shrish Vashishth	Project Associate
4	Mr. Joseph Ignitius	Project Associate

2.2. Methodology

2.2.1. Physico-chemical characteristics

The Physico-chemical parameters were analysed through the standard procedures following Carrit and Carpenter (1966), Grashoff (1974), Suzuki and Ishimaru (1990) and

Grassoff et al. (1992). The detailed methodology of each parameter is given below, and the instruments used in this study were given in Table 2.3. Temperature and salinity were obtained from CTD (SBE-19plus; Sea-Bird Electronics, USA) profiler.

a) pH

pH of the seawater sample collected in air-tight glass bottle (60ml) was measured using a Metrohm pH analyzer (Titrando 865). Standard buffer solutions (Merck, Germany) were used for calibration of the instrument. Based on the repeated analysis of aliquots of standards and samples, the precision of the analysis for pH is 0.002 units.

b) Dissolved Oxygen (DO)

Winkler's method was adopted for the determination of DO concentrations. A measured volume of water sample was fixed immediately after collection with the reagents Winkler's A (manganese chloride) and Winkler's B (alkaline potassium iodide). Standard titration with sodium thiosulphate (standardized with potassium Iodate, KIO_3) was adopted for the analysis purpose. Concentration of DO was expressed in mg/l. The precision of analysis, expressed as standard deviation with this method was $\pm 0.07\%$.

c) Biochemical Oxygen Demand (BOD)

Samples for the determination of biochemical oxygen demand were collected in triplicate. The dissolved oxygen concentration was determined using one of the triplicate samples according to Winkler's method, as detailed above. The remaining bottles were kept in the BOD incubator for three days at 20°C. Dissolved oxygen in these samples was determined after fixing the samples on completion of three days of incubation. BOD_3 was computed from the initial DO concentrations and expressed in mg/l.

d) Ammonium - Nitrogen ($\text{NH}_4^+ - \text{N}$)

Ammonical - Nitrogen in seawater samples was determined with the indophenol blue method using trione. Care was taken for the analysis of ammonium and ammonia free distilled water was used for analysis to avoid any contamination as ammonia is highly soluble in water. The absorbance of the coloured complex was measured at 630 nm in Spectrophotometer against a standard. $\text{NH}_4^+ - \text{N}$ is expressed in $\mu\text{mol/l}$ and the precision of analysis, in terms of standard deviation, is $\pm 0.02 \mu\text{M}$

e) Nitrite - Nitrogen ($\text{NO}_2^- - \text{N}$)

Nitrite was determined by the method of Bend Schneider and Robinson whereby the nitrite in the water sample was diazotised with sulphanilamide and coupling with N-1-Naphthyl ethylene diamine dihydrochloride. The absorbance of the resultant azo-dye was measured at 543 nm against a standard solution. Concentrations of $\text{NO}_2^- - \text{N}$ in seawater is expressed in $\mu\text{mol/l}$.

f) Nitrate - Nitrogen ($\text{NO}_3^- - \text{N}$)

Nitrate in the seawater sample was first reduced to nitrite using heterogeneous reduction by passing the buffered seawater samples through an amalgamated cadmium column and the resultant nitrite was determined as above. The measured absorbance was due to initial nitrite present in the sample and nitrite obtained by reduction of nitrate in the sample. Necessary correction was therefore applied for any nitrite initially present in the sample. Concentrations of $\text{NO}_3^- - \text{N}$ in seawater were expressed in $\mu\text{mol/l}$. The precision of analysis for both nitrite and nitrate, in terms of standard deviation, is $\pm 0.02 \mu\text{mol/l}$

g) Phosphate - Phosphorus (PO_4^{3-} -P)

Inorganic phosphate was measured by the method of Murphy and Riley in which the samples were made to react with acidified molybdate reagent and then reduced using ascorbic acid. The absorbance of the resultant phosphorous molybdenum blue complex was measured at 880 nm against a standard. Concentrations of PO_4^{3-} - P in seawater were expressed in $\mu\text{mol/l}$. The precision of analysis, in terms of standard deviation, is $\pm 0.01 \mu\text{mol/l}$

h) Silicate - Silicon (SiO_4^{2-} - Si)

Silicate - silicon was also estimated by reaction with acid - molybdate and ascorbic acid in the presence of oxalic acid. The interference of phosphate is prevented by addition of oxalic acid. The absorbance of the resultant silico - molybdenum blue complex was measured at 810 nm in Spectrophotometer against a standard. Concentration of SiO_4^{2-} - Si in seawater was expressed in $\mu\text{mol/l}$. The precision of analysis, expressed as standard deviation, is $\pm 0.02 \mu\text{mol/l}$

i) Total Phosphorus (TP)

The seawater sample was autoclaved with alkaline potassium persulphate in a closed bottle. The solution was neutralized and then estimated for phosphate as described above for phosphate – phosphorous. The total phosphorus is expressed in $\mu\text{mol/l}$. $\mu\text{mol/l}$. The precision of analysis, expressed as standard deviation, is $\pm 0.02 \mu\text{mol/l}$

j) Total nitrogen (TN)

Aliquot of the seawater samples were analyzed for total nitrogen (TN) on TOC and TN analyzer (Elementar).

k) Total suspended matter (TSM)

One litre of seawater sample was filtered through a pre-weighed Polycarbonate filter (0.22 µm; Millipore) and after filtration the filter was dried for about 2 days at 60°C. The dried filter was weighed and noted down the reading. The filter was dried again and took the weight measurement. This procedure was continued until the weight loss of the filter due to drying is zero. The weight of the material retained on the filter was considered as TSM concentration and was expressed as mg/L.

l) Petroleum Hydrocarbons (PHC)

Total petroleum hydrocarbons (TPHC) concentrations in seawater samples were determined by a standard liquid-liquid extraction method (LLE, EPA method 3510) (Morries, 2013; Ahmed et al., 2015) using Ultra Violet Spectrofluorometric (UVF) detection technique (Greason, 2009) which is more efficient and reliable for TPHC determination in water samples (Adeniji et al., 2017). Seawater sample (500ml) was extracted with HPLC grade n-hexane (20ml) three times and the combined extract was dried over anhydrous sodium sulphate to remove moisture content. Fluorescence of the extract was measured at an emission wave length of 360 nm (excitation wave length 310 nm) using spectrofluorometer (Cary Eclipse, Varian). Blanks prepared by following the same procedure which was employed for sample collection were used to correct the fluorescence of the samples. PHC concentrations in seawater were calculated from the multi-point calibration established by chrysene as a standard. Results of TPHC concentrations in seawater samples are expressed as chrysene equivalents. Repeated analysis of aliquots of samples and standards yielded ±4% of the precision for the TPHC measurements.

2.2.2. Biological Characteristics

All analyses were conducted as per the NIO methodology manual for biological parameters, an in-house compilation based on internationally used published methods

a) Phytoplankton

1-2 litre of the water samples were collected with the help of a Niskin sampler from the surface and bottom. The collected samples were preserved with lugols iodine (10%) and few drops of 2.5 % buffered formalin. In the laboratory, phytoplankton samples were allowed to settle for 24-48 hrs. in one litre measuring jars. After the gravity settlement, the samples were concentrated into 10ml from which 1ml samples were taken and phytoplankton cells were enumerated using a Sedgwick Rafter counting chamber following a standard protocol (UNESCO, 1978). Phytoplankton cells were identified into the genus/species levels using the Olympus inverted microscope (model: IX 71) with the aid of standard taxonomic literatures of Diatoms, Dinoflagellates and Blue-green algae (Subrahmanyam, 1946).

b) Zooplankton

Zooplankton samples were collected through horizontal hauls of HT net (49.5 cm diameter and 200 μm mesh) attached with the calibrated digital flow meter to measure the amount of water filtered through the net. At each station, the net was operated for 5 minutes as shown in Plate 2.4 and the sample remained in the bucket (Plate 2.5) after filtering the seawater through the 200 μm mesh was collected in a pre-cleaned PVC bottle. The excess waters were removed using bolting paper. Zooplankton biomass was measured through the displacement method (Postel et al., 2000). After the biomass measurements, zooplankton samples were preserved in 4-5% buffered formaldehyde for further analysis. In the laboratory, 25-50% of subsamples were taken using Folsom's

plankton splitter the subsamples were analyzed in detail for quantitative analysis. Zooplankton samples were sorted into group levels using the standard literatures of the Conway et al., 2000 and their abundances were represented in m³.

c) Benthos

Samples for benthos i.e., bottom living organisms, were collected using a Van Veen grab (Plate 2.6), covering an area of 0.04m² and a penetration depth of 10 cm. Biota (organisms) contained in the sediment were separated by wet sieving (Plate 2.7).

(i) Meio-fauna

Sub-samples for meiofauna were collected from the Van Veen grab using a hand core (3 cm diameter) and preserved in formalin-Rose Bengal solution. Samples were passed through a set of two sieves; 0.5 mm and 0.045 mm mesh sieve. The material retained on the finer mesh was used for the analysis of meiofauna. All organisms were sorted and counted under binocular stereoscope microscope in the laboratory. An average of three replicates was taken for the population count and expressed as number per 10 cm².

(ii) Macro fauna

The sediment samples for macro fauna was washed through a 0.5 mm mesh size sieve and the retained samples were preserved in 10% seawater formalin containing Rose-Bengal stain. In the laboratory, the macro faunal samples were again washed through 0.5 mm mesh sieve in running water to clear adhering sediments. All stained animals were picked and preserved in 5% formaldehyde. Later organisms were sorted and counted group wise under a stereoscope zoom binocular microscope. Wet weight of major macro faunal taxa was recorded on a single pan balance. Fauna was identified as far as possible.

2.2.3. Microbiological parameters

About 100 ml of the sample was sub-sampled into a pre-sterilized bottle for bacterial analysis. All samples were collected with precautions required for microbiological analysis.

Sample serially diluted to 3 times of 10^{-1} to 10^{-3} with sterile salt water. Heterotrophic bacterial counts were determined using R2A agar. Around 100 μl of each serially diluted water samples is plated on R2A agar plates and spread with sterile glass rod and incubated at 37 °C for 48-72 hours. The colonies formed on the plates are counted using the colony counter and represented as a number of colony forming units (CFU) per ml of water sample after considering dilution factor. Total coliform counts were obtained by plating water samples on MacConkey agar. The colonies formed on the plates are counted using the colony counter and represented as number of colony forming units per ml of water sample after considering the dilution factor. The colonies of pink-red colour and with bile precipitate are counted as ECLO on MacConkey agar plates. The colonies of colourless to pale pink are counted as EFLO on MacConkey agar plates. PALO counts were obtained by plating water samples on Cetrimide agar. The colonies exhibiting fluorescence at 250nm and a blue green pigmentation are considered PALO. VLO counts were obtained by plating water samples on TCBS agar. The colonies formed on the TCBS agar plates are counted as VLO. The colonies of yellow colour are counted as VCLO on TCBS agar plates. The colonies of bluish-green colour are counted as VPLO on TCBS agar plates.

Table 2.3: List of instruments used for this study

S. No.	Name of the instrument	Make & Model	Parameter
1.	CTD Profiler	Sea-Bird Electronics, USA, SBE-19 plus	Temperature and salinity
2.	pH meter	Metrohm, Switzerland Titrando 830	pH
3.	DO titrator	Titrando 835; Metrohm, Switzerland	DO and BOD
4.	Spectrophotometer	Shimadzu, UV-1800	Ammonium
5.	Spectrofluorometer	Turner Designs	Chlorophyll-a.
7.	BOD incubator	Tempo Instrument Pvt. Ltd.; TI 500	BOD (incubation)
8.	Auto Analyzer	Skalar, The Netherlands	Nitrite, nitrate, phosphate, silicate
9.	Diaphragm pumps	KNF and Merk Millipore	Separation of particulate matter
10.	Flow Cam	Fluid Imaging Technologies, VSIV	Phytoplankton and Zooplankton
11.	Fluorescence microscope	Olympus (BX51), Nikon (Eclipse80i)	Phytoplankton and Bacteria
12.	Inverted microscope	Olympus, IX 71	Zooplankton
13.	Stereo zoom microscope	Nikon (SMZ 25)	Benthic organisms
14	Precision balance	Sartorius, Cubis	Total suspended matter

2.2.4. Bio-assay (toxicity) test

Discharges into the aquatic environment of contaminated wastewater from various industries represent a major source of aquatic pollution. Aquatic organisms are exposed to a number of pollutants emanating from various types of industries. Concern for the impact of chemical pollution on the quality of aquatic ecosystems has stimulated over 30 years of research on the biological effects of pollutants. Quantifying the ecotoxicological effects of pollutants is critical to the protection of aquatic ecosystems. Determination of water quality criteria for aquatic life is similar to the solving of most biological problems in which experimental data are obtained under controlled laboratory conditions in order to predict effects that might occur under natural conditions.

Physico-chemical parameters are generally used for the evaluation of effluent quality. However, monitoring of these parameters alone cannot provide a measurable quantity in the toxicity assessment. Furthermore, in some cases, the quality of waste water in terms of physico-chemical parameters may conform to the permissible limits, and the wastewater may be toxic to the aquatic flora and fauna. Therefore, toxicity evaluation through bioassays forms an important and cost-effective tool in wastewater quality monitoring programmes.

Acute toxicity tests (bioassays) are generally performed to evaluate the toxicant and other materials used in the coastal environment to determine the relative sensitivity of different living organisms and permissible effluent discharge dose. It is a procedure in which the responses of aquatic organisms are used to detect or measure the presence or effect of one or more substances, in a particular ecosystem. Median lethal concentration (LC_{50}) of a toxicant is the concentration that results in the mortality of a specified portion of the population within a definite period of time. Median lethal concentration (LC_{50}) of a toxicant in an environmental medium which results in 50% mortality of test organisms within a definite period of exposure periods (such as 24 hrs, 48 hrs, 72 hrs and 96 hrs) is called LC_{50} . The LC_{50} values in turn represent the median lethal concentration or median tolerance limit.

In this study, Acute toxicity tests conducted on treated effluents were carried out using Whole Effluent Toxicity (WET) methods of USEPA to assess the potential toxicity of effluents using the zebrafish specimens of 30-35mm in length as test species, as suggested by central pollution control board (CPCB). The results of these tests can be used for a variety of functions including resource consent monitoring and compliance, toxicity identification evaluations and evaluation of effluent treatment processes. WET tests were

performed to determine the actual impacts of effluents on organisms residing in receiving waters where the effluents were discharged.

2.2.4.1 Whole Effluent Toxicity (WET) Testing

The establishment of toxicity-based limits relies on the use of standardized laboratory toxicity tests that can assess the potential effect of effluents on aquatic life in the receiving system. Since effluents often contain complex mixtures of chemicals that are poorly characterized, a suite of acute and chronic toxicity tests (termed whole effluent toxicity, or WET, testing) is used to measure the aggregate toxicity of chemicals in an effluent (US-EPA, 1991). Whole Effluent Toxicity (WET) testing is a term used to describe the adverse effects or toxicity to a population of aquatic organisms caused by exposure to an effluent. This toxicity can be experimentally determined in the laboratory by exposing sensitive organisms to effluents using WET tests. Responses assessed usually include survival, growth, and/or reproduction. This type of test can be used to evaluate the toxicity of effluents, storm-water, or ambient surface waters. WET testing is used to assess and regulate the combined effects of all constituents of a complex effluent rather than the conventional methods of controlling the toxicity of single chemicals or constituents.

WET testing exposes laboratory populations of aquatic organisms such as fish, invertebrates, and algae to diluted and undiluted effluent samples under controlled conditions in order to estimate the environmental toxicity of that sample. The information is used to prevent the discharge of toxic amounts of pollutants to surface waters. The standardized procedures of WET tests allow one to determine the actual environmental exposure of aquatic life to effluent or ambient water without knowledge of the chemical, physical, and biological characteristics of that discharge or ambient water. Whole Effluent Toxicity (WET) testing is an important component of the US Environmental Protection

Agency's (USEPA's) integrated approach for detecting and addressing toxicity in surface waters.

Aquatic test organisms are placed in test containers that usually contain a series of concentrations of a sample. Tests usually include 100% sample and sample mixed with various amounts of dilution water (control water containing no sample) to form a series of sample dilutions. Observations of the organism's response, such as mortality, are made at specific time intervals. The duration of the test ranges from periods as short as 40 minutes up to 7 days depending on the organisms used and whether acute or chronic effects are of interest. At the end of the test, the results are used to estimate the toxicity of the sample. Control survival must be 90% or greater for an acceptable test. The test "passes" if survival in the control and effluent concentration equals or exceeds 90%. The test "fails" if survival in the effluent is less than 90%, and is significantly different from control survival (which must be 90% or greater), as determined by hypothesis testing.

2.2.4.2 Test Species

Acute toxicity test (bioassays) of treated effluent was carried out using the locally available zebrafish specimens of 30-35mm in length as test organisms, as suggested by CPCB (method IS:6582-1971).

Zebrafish (*Danio Rerio*, F. Hamilton, 1822)

The fish species selected for bioassay experiments were zebra fish, *disambiguation* (*Danio rerio*). The taxonomic position of the test species is given below:

Phylum: Chordata

Class: Actinopterygii

Order: Cypriniformes

Family: Cyprinidae

Subfamily: Danioninae

Genus: *Danio*

Species: *D. rerio*

The test organism selected for toxicity tests was freshwater fish belonging to the minnow family, Cyprinidae, often called as tropical fish. It is a vertebrate model organism that is widely used in scientific research. This fish is also largely available in private ponds in different varieties. Zebra fish of pink variant was used in this study for bio-assay test on treated effluent.



Plate 2.8: Zebrafish (*Danio rerio*)

A large number (~6000) of healthy zebra fish of pink variety were procured from local commercial sources (Visakhapatnam) and transported to the Laboratory of CSIR-National Institute of Oceanography (CSIR-NIO), Regional Centre, Visakhapatnam in oxygenated polythene bags. After the arrival to the Laboratory, zebrafish were acclimatized by keeping them in large tanks with continuous aeration for a minimum period of two weeks before being subjected to bioassay experiments.

During the acclimatization period, zebra fish were fed with artificial pellet feed twice a day. Before the start of bioassay experiments, the length of the test animals was observed and found to be having a length in the range of 30-35 mm. Physico-chemical parameters of seawater in the acclimation tanks fell within the recommended optimum

levels for the rearing of zebrafish: water temperature, (30.3 ± 0.5 °C), dissolved oxygen (6.8 ± 0.2 mg/l), pH (7.6 ± 0.2) and NH_3/NH_4 (<0.5 mg/l).

2.2.4.3 Experimental Set-up

Ground water was used throughout the experiment for the acclimatization of fish, control tank and as diluent. All the experiments were conducted at room temperature of 28 °C, with a maximum day and night variation of 2 °C. No Feed was given to test animals 48 hrs prior to the experiments or during the experiments. Different concentrations of test solutions of effluent were chosen for the following sets of experiments, under slow continuous aeration. Dissolved oxygen in the experimental and control tanks was always maintained at >5 mg/l throughout the exposure study using artificial aeration. Each set of experiment was accompanied by a Control with three replicates. Appropriate volumes of effluent concentration prepared as above were added to containers tanks containing zebrafish (*Danio rerio*) of the pink variety.

The test containers were inspected at regular intervals for recording mortality at different exposure periods of 1 hr, 6 hrs, 12 hrs and 24 hrs during the first day of the experiment followed by every 12 hrs till completion of the experiment (i.e., 96 hrs) for calculating the LC₅₀ values. The dead organisms were removed immediately from tanks in order to avoid any type of bacterial contamination. Records were also maintained for any abnormal behaviour of the test animals. At the end of each test, the organisms were transferred to a clean tank for observing their recovery. The average percent mortality recorded at different test solutions in triplicate test containers during the four exposure periods was determined. The median lethal concentration (LC₅₀) values in the percentage of toxicant for zebra fish exposed to different concentrations of effluent were calculated based on the mortality rates.

2.2.4.4. Data analysis

Mortality of test organisms for different effluent samples over different exposure periods are presented in the Results Section. The mortality values of different effluent water samples for different exposure periods (24 hrs, 48 hrs, 72 hrs and 96 hrs) were calculated following the method of log-probit transformation for time and dose-mortality curves suggested by Finney's method (1971) using LDP line software (<http://embakr.tripod.com/lpline>).

Table 2.4: Summary of conditions and acceptability criteria for WET acute Toxicity Test with zebra fish as test species

Type	Comment
Test condition	Static non-renewal
Test duration	96 hrs
Temperature	>28 °C
Photoperiod	12 hrs light: 12 hrs dark
Test chamber size	25 Litres
Age of test organisms	30 Day Post Larvae
No. organisms per test chamber	30 animals
No. replicate chambers per concentration	Three
Feeding	None
Test solution aeration	Yes, >5 mg l ⁻¹
Dilution water	Groundwater
Test concentrations	07 effluent concentrations and a control
Dilution series	Effluents: ±0.5 dilution series
Endpoint	Effluents: Mortality
Sample volume	Nil
Test acceptability criterion	90% survival in 100% effluent after 96 hrs

2.2.4.5 Acute Toxicity of treated effluents with a WET test

Acute toxicity of treated effluents with whole effluent toxicity test expressed in terms of median lethal concentrations (LC_{50}) was evaluated by subjecting the acclimatized zebra fish of pink variety exposed to four exposure periods (24 hrs; 48 hrs; 72 hrs and 96 hrs) with seven different concentrations (% v/v) of effluent test solutions. Experiments were conducted under static conditions and all experimental tanks had a triplicate and each experimental set included a Control (0%). The average percent mortality recorded at different test solutions in triplicate test containers during the four exposure periods was determined.

Data on average mortality of test animals (in percentage) in different test concentrations of treated effluent collected from M/s Hetero Infrastructure SEZ Limited over four exposure periods is presented in Table 3.23. The median lethal concentration (LC_{50}) of treated effluent to test species at different exposure periods is shown in Table 3.24. No mortality was observed in control treatment during the exposure period of 96 hrs.

Chapter 3
RESULTS AND DISCUSSION

3.1. Physico-chemical characteristics

Physical parameters such as salinity and temperature in the surface and bottom waters of the station locations were provided in Table 3.1. The results of biogeochemical parameters such as pH and Chlorophyll-*a* were provided in Table 3.2, while the concentrations of dissolved inorganic nutrients were given in Table 3.4.

Temperature ranged from 29.14 to 29.98 °C in the surface and from 28.96 to 29.66°C in the bottom waters of the study region (Table 3.1), with mean values of 29.59 ± 0.23 °C and 29.25 ± 0.18 °C, respectively, during the sampling period.

Table 3.1: Temperature (°C) and salinity in the surface (SUR) and bottom (BOT) waters at the sampling stations in the study region

Station Name	Depth (m)	Temperature		Salinity	
		SUR	BOT	SUR	BOT
H1	13.7	29.98	29.20	33.43	33.38
H2	14	29.81	29.24	33.40	33.42
H3	14.1	29.75	29.29	33.40	33.38
MOP1	13.2	29.73	29.27	33.43	33.40
MOP2	14	29.63	29.38	33.45	33.37
H4	14.6	29.62	29.22	33.03	33.40
H5	17.1	29.70	28.99	33.43	33.47
H6	18.8	29.54	28.96	33.69	33.43
H7	13.1	29.14	29.36	33.69	33.40
H8	13.4	29.36	29.31	33.50	33.40
H9	13.5	29.39	29.15	33.56	33.43
H10	8.5	29.46	29.66	33.18	33.41

Sea surface salinity in the study region varied from 33.03 to 33.69 PSU (Table 3.1), with a mean salinity of 33.43 ± 0.18 PSU. In the bottom waters, salinity ranged between 33.37 and 33.47 PSU (Table 3.1), with a mean salinity of 33.41 ± 0.034 PSU during the study period. The range of salinity values observed in this study are close to those reported previously from this region during April-May.

pH of the study region ranged from 8.18 to 8.28 in the surface and from 7.77 to 8.28 in the bottom (Table 3.2; Fig. 3.1), with mean values of 8.24 ± 0.03 and 8.21 ± 0.14 , respectively. These values are concurrent with the range of pH values observed in the coastal waters off Visakhapatnam and Kakinada in the western coastal Bay of Bengal. However, the pH values found in this study are higher when compared to the pH values reported from this region in 2017 (7.4-8.0 and 7.5-8.0 in the surface and bottom waters, respectively). Phytoplankton biomass, expressed in terms of Chlorophyll-*a* (Chl-*a*) concentration, ranged from 0.23 mg/m^3 to 0.42 mg/m^3 in the surface and from 0.31 mg/m^3 to 0.56 mg/m^3 (Table 3.2; Fig. 3.1) in the bottom waters during the study period. Mean Chl-*a* concentrations in the study region are $0.32 \pm 0.1 \text{ mg/m}^3$ in the surface and $0.41 \pm 0.1 \text{ mg/m}^3$ in the bottom waters. The Chl-*a* values found in this study are remarkably lower than those reported in 2018 from this region both in surface (range: $2.43\text{-}7.44 \text{ mg/m}^3$) and in the bottom waters (range: $1.2\text{-}5.86 \text{ mg/m}^3$). The range and mean concentrations of Chl-*a* found in this study are considerably lower than those values observed in the coastal waters off Kakinada and Yanam, and in the nearby coastal location in the western coastal Bay of Bengal. Considerably lower phytoplankton biomass (Chl-*a*) in this study may be due to either lower biological production and/or higher grazing pressure.

Table 3.2: pH and Chlorophyll-a in the surface (SUR) and bottom (BOT) waters at the sampling stations.

Station Name	Depth (m)	pH		Chl-a (mg/m³)	
		SUR	BOT	SUR	BOT
H1	13.7	8.235	8.256	0.24	0.36
H2	14	8.281	8.228	0.28	0.56
H3	14.1	8.271	8.234	0.36	0.45
MOP1	13.2	8.247	7.769	0.25	0.31
MOP2	14	8.24	8.286	0.23	0.32
H4	14.6	8.27	8.244	0.33	0.32
H5	17.1	---	8.242	0.34	0.42
H6	18.8	8.23	8.238	0.36	0.43
H7	13.1	8.284	8.23	0.42	0.42
H8	13.4	8.245	8.283	0.31	0.38
H9	13.5	8.186	8.283	0.32	0.47
H10	8.5	8.221	8.257	-	-

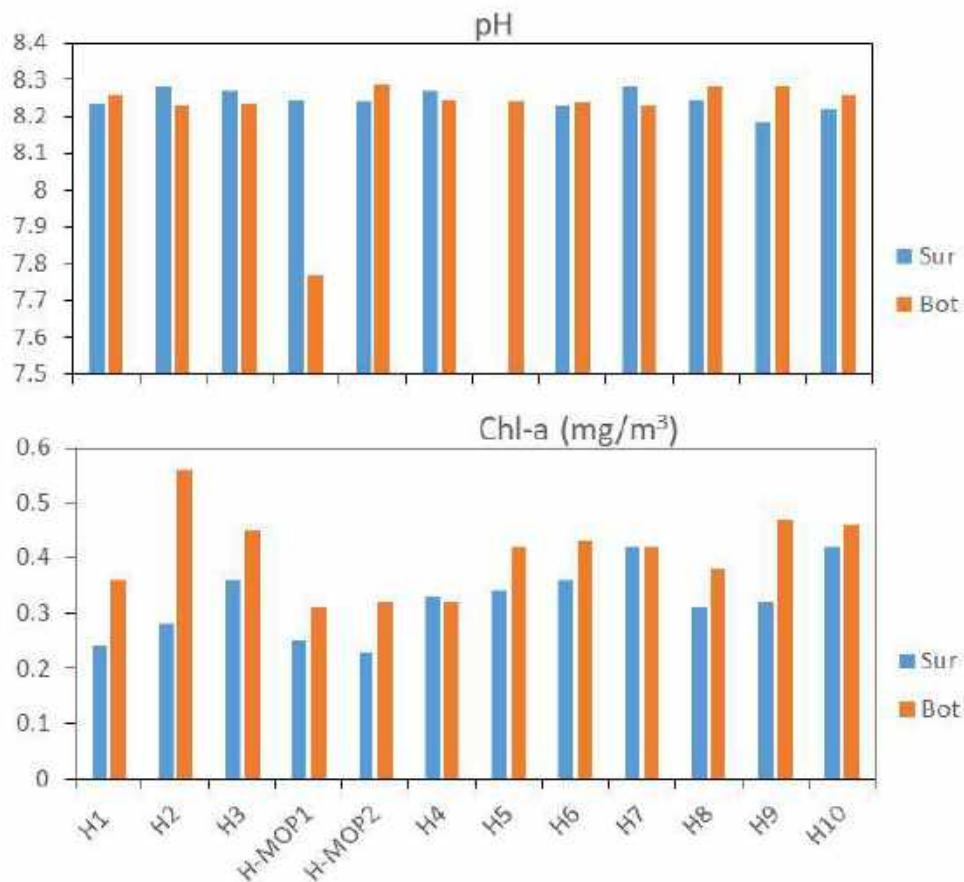


Fig 3.1: Spatial variability of (a) pH and (b) chlorophyll-a (mg/m^3) in the coastal waters off Rajayyapeta during the study period

Dissolved oxygen (DO) concentrations varied from 5.6 to 6.4 mg/L in the surface and from 4.6 to 6.3 mg/L in the bottom waters of the study region (Table 3.3; Fig. 3.2). The mean DO concentrations were 6.1 ± 0.2 mg/L and 5.8 ± 0.5 mg/L in the surface and bottom waters, respectively. DO concentrations found in this study are considerably higher than those found in both surface and bottom waters of this region in 2017 (2.7 – 6.0 mg/L and 3.3-5.9 mg/L, respectively). The DO concentrations found in this study are relatively higher than those found during 2010, 2014 and 2017 monitoring studies conducted in this region and more or less similar to those found during 2007 and 2012 monitoring studies conducted in this region. No significant deviation in DO concentration was found at the

MOP locations compared to the nearby locations around the MOPs in the coastal waters of Rajayyapeta. The mean DO concentrations observed in the surface (6.1 ± 0.2 mg/L) and bottom (5.8 ± 0.5 mg/L) waters of the study region are above the threshold limit of 5.0 mg/L for healthy coastal waters. Nevertheless, the observed DO concentrations in this study are comparable to or slightly higher than those reported in the base line data (EIA report of this project) of this region, indicating that no significant change in the DO concentrations of the marine environment. Biochemical oxygen demand for three days (BOD_3) ranged from 0.6 to 3.2 mg/L in the surface and from 0.8 to 4.1 mg/L in the bottom waters during the study period (Table 3.3; Fig. 3.2). The range of BOD_3 values found in this study is relatively higher than the range of values reported from this region in 2017 (0.4-2.75 mg/L and 0.3-2.10 mg/L in the surface and bottom waters, respectively), indicating that increased input of biodegradable organic matter from local sources to this coastal region in recent years. However, mean BOD_3 values in the surface and bottom waters of this study (1.9 ± 0.7 mg/L and 2.1 ± 1.0 mg/L, respectively) indicates no significant pollution of organic matter in this region during the study period.

Concentrations of dissolved inorganic nutrients such as phosphate, silicate, nitrite, and nitrate in the surface and bottom waters of the study region were given in Table 3.4 and Fig. 3.3. Phosphate concentrations ranged from 0.2 to 0.9 μM in the surface and from 0.2 to 1.1 μM in the bottom waters (Table 3.4), with mean phosphate concentrations of 0.5 ± 0.2 μM and 0.5 ± 0.3 μM , respectively. Phosphate concentrations found in this study are slightly lower than those reported in 2017 from this region in both surface (range: 0.45 to 1.39 μM) and bottom (range: 0.85 to 1.47 μM) waters. Dissolved inorganic silicate concentrations during the study period ranged from 6.7 to 28.0 μM and from 4.6 to 25.9 μM in the surface and bottom waters (Table 3.4), with mean silicate concentrations of 13.4 ± 5.8 μM and 13.5 ± 5.9 μM , respectively. In contrast to that of phosphate, silicate

concentrations are relatively higher than those observed from this region in 2017 both in the surface (range: 4.9-8.9 μM) and bottom (range: 7.4 – 15.5 μM) waters.

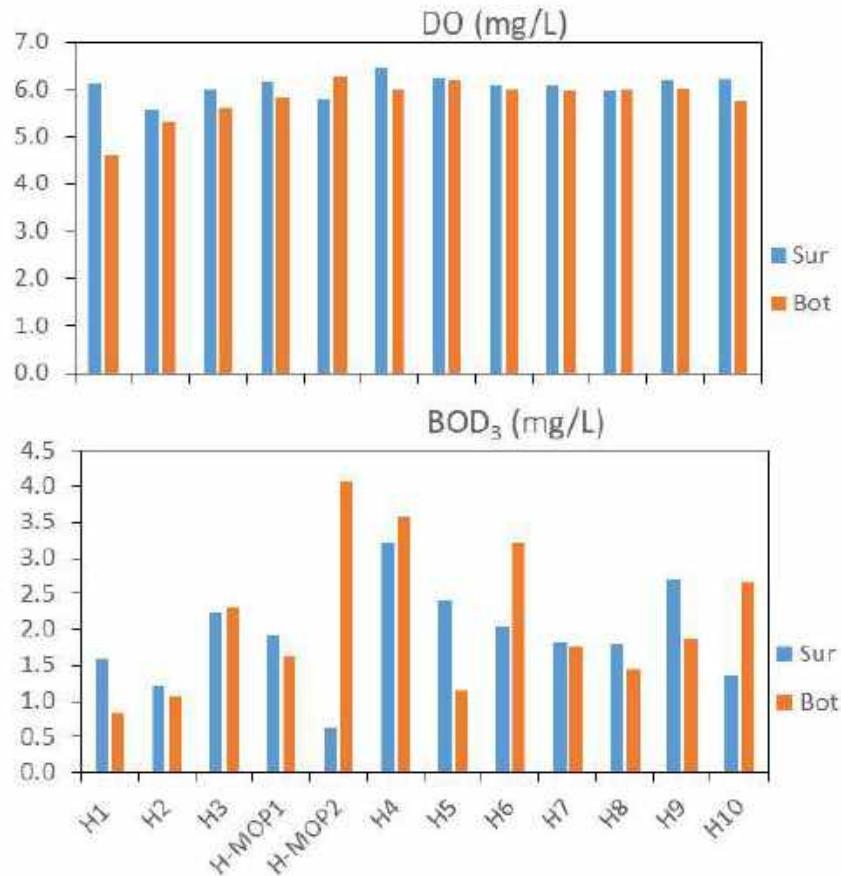


Fig. 3.2: Spatial variability of DO and BOD at various stations in the surface and bottom waters of the study region

Nitrite concentrations varied between 0.02 and 0.52 μM in the surface (mean: $0.13 \pm 0.1 \mu\text{M}$) waters and between ND and 0.78 μM (mean: $0.23 \pm 0.2 \mu\text{M}$) in the bottom waters. The range of nitrite concentrations observed in this study in the surface (0.02-0.52 μM) and bottom (ND-0.78 μM) waters are close to the range of values observed in 2017 from this region (0.1-0.6 μM and 0.1-0.5 μM in the surface and bottom waters, respectively). Nitrate concentrations ranged from 8.1 to 23.4 μM in the surface, with a mean nitrate concentration of $15.6 \pm 5.1 \mu\text{M}$. These concentrations are remarkably higher than those observed in surface waters of this region in 2017 (range: 1.5 – 4.5 μM),

whereas, in the bottom waters nitrate concentrations ranged from 5.7 to 19.9 μM , with a mean concentration of $13.0 \pm 4.4 \mu\text{M}$. Similar to that of the surface waters, bottom waters of this study also recorded significantly higher nitrate concentration compared to those observed in the bottom waters of this region in 2017 (range: 1.5 – 3.8 μM) Both silicate and nitrate concentrations in this study are higher than those reported in 2017 from this region, whereas phosphate concentrations in this study are slightly lower than those reported in 2017 from this region. Nevertheless, nitrate concentrations in this study are relatively higher than those found in this region in 2017 and in coastal waters of the western coastal Bay of Bengal, indicating increased input of nitrate from local sources to this coastal region in recent years.

Table 3.3: Dissolved oxygen (DO; mg/L) and biochemical oxygen demand for three days (BOD₃; mg/L) in the surface (SUR) and bottom (BOT) waters at the sampling stations.

Station Name	DO (mg/L)		BOD ₃ (mg/L)	
	SUR	BOT	SUR	BOT
H1	6.1	4.6	1.6	0.8
H2	5.6	5.3	1.2	1.1
H3	6.0	5.6	2.2	2.3
MOP1	6.2	5.8	1.9	1.6
MOP2	5.8	6.3	0.6	4.1
H4	6.4	6.0	3.2	3.6
H5	6.3	6.2	2.4	1.1
H6	6.1	6.0	2.0	3.2
H7	6.1	5.9	1.8	1.8
H8	5.9	6.0	1.8	1.5
H9	6.2	6.0	2.7	1.9
H10	6.2	5.7	1.3	2.7

Table 3.4: Dissolved inorganic phosphate (μM), silicate (μM), nitrite (μM) and nitrate (μM) concentrations in the surface (SUR) and bottom (BOT) waters at the sampling stations.

Station	Phosphate		Silicate		Nitrite		Nitrate	
	SUR	BOT	SUR	BOT	SUR	BOT	SUR	BOT
H1	0.5	0.3	8.3	11.5	0.06	0.08	11.9	9.1
H2	0.7	0.3	14.8	14.3	0.04	0.06	11.6	19.4
H3	0.3	0.4	28.0	13.2	0.52	0.56	12.7	17.2
MOP1	0.8	1.1	6.7	25.9	0.20	0.78	8.1	5.7
MOP2	0.2	0.3	14.3	15.5	0.26	0.20	22.2	8.8
H4	0.3	0.2	12.6	9.5	0.06	0.26	23.4	9.7
H5	0.5	0.7	11.5	17.8	0.06	0.14	17.9	19.9
H6	0.9	0.5	10.5	9.5	0.20	0.14	14.6	14.0
H7	0.3	0.2	16.8	0.6	0.12	0.12	10.3	14.3
H8	0.4	0.5	18.1	8.0	0.04	0.02	21.4	10.8
H9	0.4	0.6	7.9	18.8	0.02	0.18	19.6	12.5
H10	0.7	0.8	11.2	4.6	0.02	ND	13.9	14.5

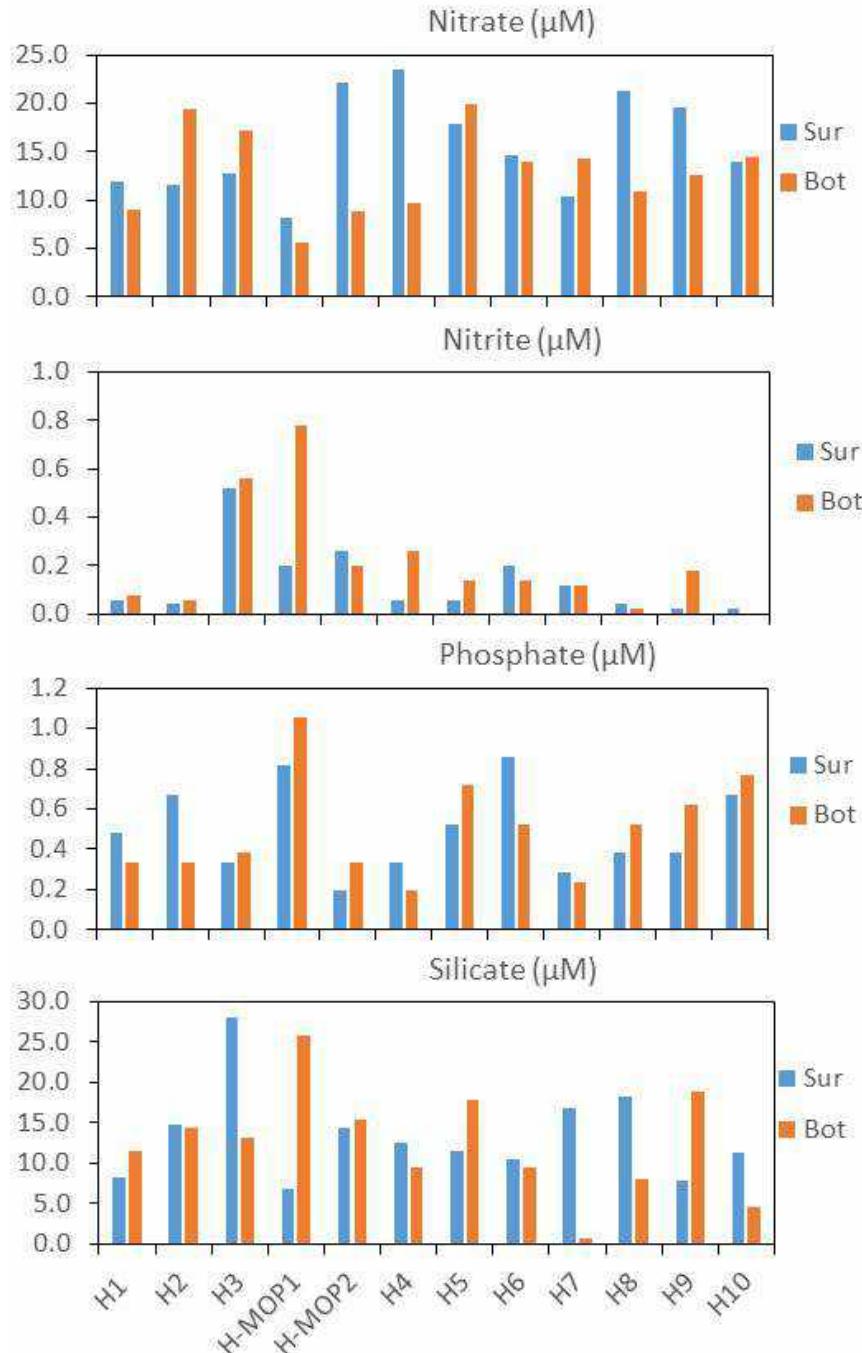


Fig 3.3: Spatial variability of dissolved inorganic nutrients (a) nitrate (μM), (b) nitrite (μM), (c) phosphate (μM) and (d) silicate (μM) in the coastal waters off Rajayyapeta during the study period

Total suspended matter (TSM) concentrations ranged from 20 to 52.3 mg/L (Table 3.5), with a mean value of 33.1 ± 11.5 mg/L in the surface waters of the study region. Bottom

waters recorded TSM concentrations between 24 and 51.8 mg/L (mean: 35.4 ± 8.6 mg/L) during the study period. Both surface and bottom waters recorded similar mean TSM concentrations. TSM concentrations found in this study (range: 20–52.3 mg/L; mean: 34.2 mg/L) are consistent with the range of values reported in the previous monitoring studies conducted in this region during 2010, 2014 and 2017, whereas, relatively higher when compared to the values reported during 2007 and 2012 monitoring studies conducted in this region. Total petroleum hydrocarbon (TPHC) concentrations varied from 10.0 to 22.1 µg/L in the surface waters (Table 3.5), with a mean concentration in the study region of 14.9 ± 4.0 µg/L. In the bottom waters, TPHC concentrations varied broadly from as low as 2.1 µg/L to as high as 37.4 µg/L (Table 3.5), with a mean concentration of 16.0 ± 10.2 µg/L. Compared to the TPHC concentrations reported in the previous monitoring study conducted in this region in 2017 (1.3-10.5 µg/L and 1.7-4.7 µg/L in the surface and bottom waters, respectively), TPHC concentrations found in this study (10.0-22.1 µg/L and 2.1-37.4 µg/L, respectively) are relatively higher, indicating a slight increase in the TPHC input from local sources into the coastal waters of Rajayyapeta in recent years. Overall, the concentrations of physico-chemical parameters found in this study are within the range of values reported from the coastal Bay of Bengal.

Table 3.5: Total suspended matter (mg/L) and total petroleum hydrocarbon (TPHC) concentrations in the surface (SUR) and bottom (BOT) waters at the sampling stations.

Station	TSM (mg/L)		TPHC (µg/L)	
	SUR	BOT	SUR	BOT
H1	21.3	37.7	22.1	15.0
H2	20.0	24.0	10.9	---

H3	27.2	29.6	13.7	16.1
MOP1	34.0	30.8	10.0	31.1
MOP2	31.2	35.0	14.2	14.0
H4	21.8	33.0	14.8	17.4
H5	25.8	25.2	18.0	2.1
H6	26.3	32.3	13.7	6.6
H7	52.3	51.8	21.4	12.8
H8	50.5	49.5	12.1	9.5
H9	44.5	41.0	16.7	37.4
H10	42.3	34.3	11.1	14.0

Table 3.6: Comparison of chemical constituents in the coastal waters off Rajayyapeta during different monitoring studies

Parameter	2007	2010	2012	2014	2017	2022
DO (mg/L)	5.1-6.7	3.2-5.6	5.6-7.6	2.3-5.2	2.7-6.0	4.6-6.4
BOD ₅ (mg/L)	0.29-1.16	0.13-1.5	0.3-4.3	0.4-2.75	0.3-2.1	0.6-4.1
pH	7.9-8.1	8.0-8.1	8.1-8.2	7.4-8.0	7.4-8.0	7.77-8.29
TSM (mg/L)	10.6-35.2	34.2-69.6	19.0-32.8	16.4-48.8	16.8-45.6	20.0-52.3
NO ₂ ⁻ N (μ M)	0.04-0.31	0.1-0.74	0.04-0.49	0.58-1.27	0.11-0.61	ND – 0.78
NO ₃ ⁻ N (μ M)					1.5-4.5	5.7-23.4
PO ₄ ³⁻ P (μ M)	0.3-1.4	0.1-1.1	0.9-2.5	1.4-4.4	0.5-1.6	0.2-1.1
SiO ₄ ²⁻ -Si (μ M)	0.8-5.6	0.7-7.2	3.6-13.6	10.3-14.5	5.0-15.6	4.6-28.0

3.2 Biological Characteristics

4.2.1 Chlorophyll-a:

Chlorophyll *a* pigment in surface water ranged between 0.2 mg/m³ and 0.4 mg/m³ in the surface and between 0.3 mg/m³ and 0.6 mg/m³ in the bottom waters, with mean concentrations of 0.32±0.1 mg/m³ and 0.41±0.1 mg/m³, respectively (Table 3.2). The range of Chl-*a* concentrations found in this study is similar when compared to the Chl-*a* concentrations observed in the coastal waters off Kakinada and Yanam, east coast of India.

4.2.2. Phytoplankton

The detailed results of phytoplankton cell count in surface waters of the study region at all stations are given in (Table 3.9). Phytoplankton abundance in surface waters varied from as low as 3200 Nos./L to as high as 6200 Nos./L, with a mean abundance of 4646 Nos./L. The range of phytoplankton abundance found in this study is considerably lower than the range of phytoplankton abundance reported from this region in the year 2017 (range: 5430 – 15390 Nos./L; mean: 10860 Nos./L; Table 3.7). A total of 29 phytoplankton genera were recorded (Table 3.9) in this study. The number of genera recorded at various stations ranged from 15-27 which is relatively higher than the range of genera reported (12-19) in the previous monitoring study conducted in this region in 2017. Predominant species groups and their contribution to the total phytoplankton abundance were shown in Fig. 3.4. Diatoms are the most predominant in the total phytoplankton abundance at all stations (Fig. 3.5). Diatom contribution to the total phytoplankton varied from 53.3% to 76.7% (Table 3.10), with a mean contribution of 61.7% to the total phytoplankton abundance. The contribution of diatoms to the total phytoplankton in this study is relatively lower when compared to those reported in 2017 from this region. Contribution from dinoflagellates to the total phytoplankton abundance ranged from 16.3% to 27.9 %, with an average contribution of 20.8% which is significantly higher than

those reported in 2017 from this region (3.8%). Cynobacteria appeared in all stations, except at MOP1 station, and its contribution to the total phytoplankton abundance varied from 1.5% to 8.5% only (mean: 4.2%). Average contribution of different phytoplankton groups to the total phytoplankton abundance was shown in Fig. 3.5. Dominant and consistently occurring species were *Chaetoceros* sp., *Skeletonema* sp., *Rhizosolenia* sp., *Cyclotella* sp., *Nitschia* sp., *Navicula* sp., *Ceratium* sp., *Gymnodinium* sp., *Trichodesmium* sp., Cyanobacteria, *Thalassiothrix* sp., etc. The species present in samples but in low abundances were *Coscinodiscus* sp., *Pinnularia* sp., *Cochlodinium* sp., *Chroococcus* sp. etc.

Phytoplankton abundance in bottom waters varied from as low as 4100 Nos./L to as high as 7200 Nos./L, with a mean abundance of 5675 No./L (Table 3.11) and it is exceptionally lower than those reported in 2017 monitoring study conducted in this region (5820-18480 Nos./L; mean: 10698 Nos./L). Phytoplankton abundance in the bottom waters (mean: 5675 Nos./L) is more or less similar compared to that of the surface waters (4646 Nos./L) of the study region. In this study, a total of 29 phytoplankton genera were recorded in the bottom waters (Table 3.11) with a range of 14-24, and it is comparable with the range of genera reported in the previous monitoring study conducted in this region in 2017 (15-22). Predominant species groups and their contribution to the total phytoplankton abundance was shown in Fig. 3.6. Diatoms are the most dominant taxa followed by dinoflagellates at all stations (Table 3.12). Diatoms contribution to total phytoplankton abundance ranged from 32.4% to 70.8%, with a mean contribution of 56.8% (Table 3.12; Fig. 3.7) and it is considerably lower than those found in 2018 in this region (mean: 89.1%).

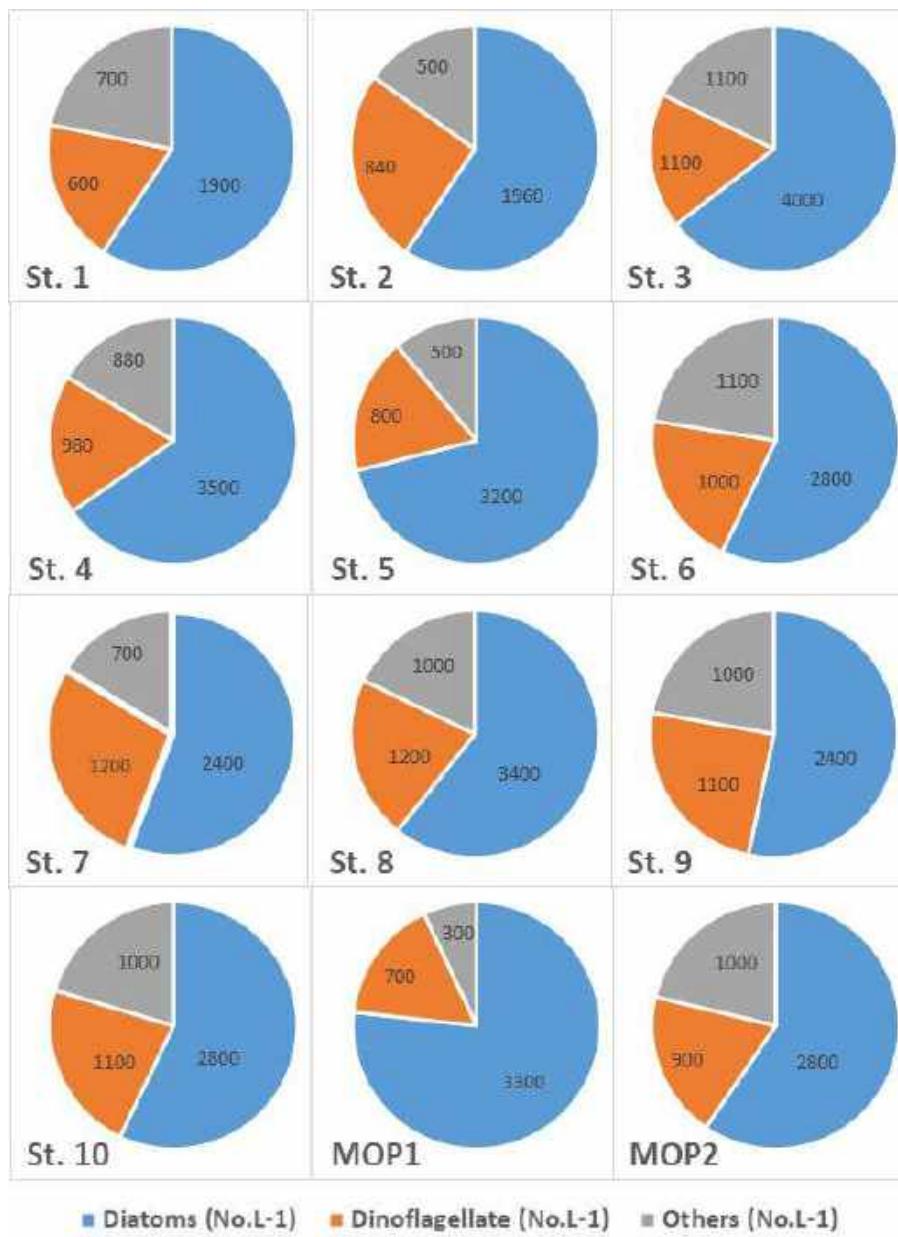


Fig. 3.4: Abundance (No/L) of diatoms and dinoflagellates in the total phytoplankton in the surface waters of the study region

Dinoflagellate's contribution to total phytoplankton abundance varied from as low as 16.7% to 39.7%, with a mean contribution of 25.0% and it is considerably higher than those reported in 2018 (range: 1.5%-5.8%, mean: 4.0%). Cynobacteria contribution to the total phytoplankton is minor as was observed in the surface waters. Compared to surface

waters, dinoflagellate's contribution to the total phytoplankton abundance was slightly higher in the bottom waters. Predominant species present in bottom waters are *Skeletonema* sp., *Rhizosolenia* sp., *Nitschia* sp., *Chaetoceros* sp., *Cyclotella* sp., *Thalassiosira* sp., *Cymbella* sp., *Peridinium* sp., *Gymnodinium* sp., *Cochlodinium* sp. The average contribution of diatoms and dinoflagellates to the total phytoplankton in the bottom waters was shown in Fig. 3.7

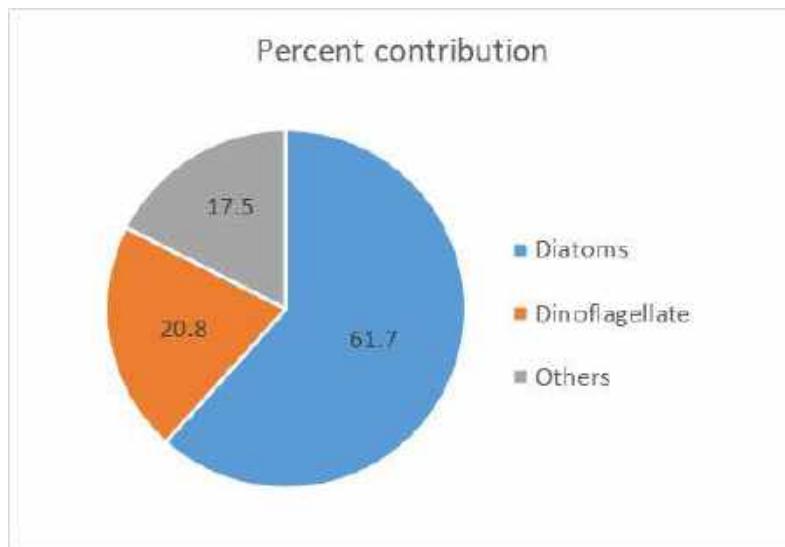


Fig. 3.5: Percent contribution of diatoms and dinoflagellates to the total phytoplankton abundance in the surface waters of the study region

Table 3.7: Comparison of the range of No. of phytoplankton genera and phytoplankton abundance (No./L) during different monitoring studies

Year	No. of Genera (range)		Cell counts (Nos./L)	
	Surface	Bottom	Surface	Bottom
2012	11-17	7-14	200-4800	100-2900
2014	6-20	7-13	2400-16600	3600-18000
2017	12-19	15-22	5430-15390	5820-18330
2022	15-27	14-24	3200-6200	4100-7200

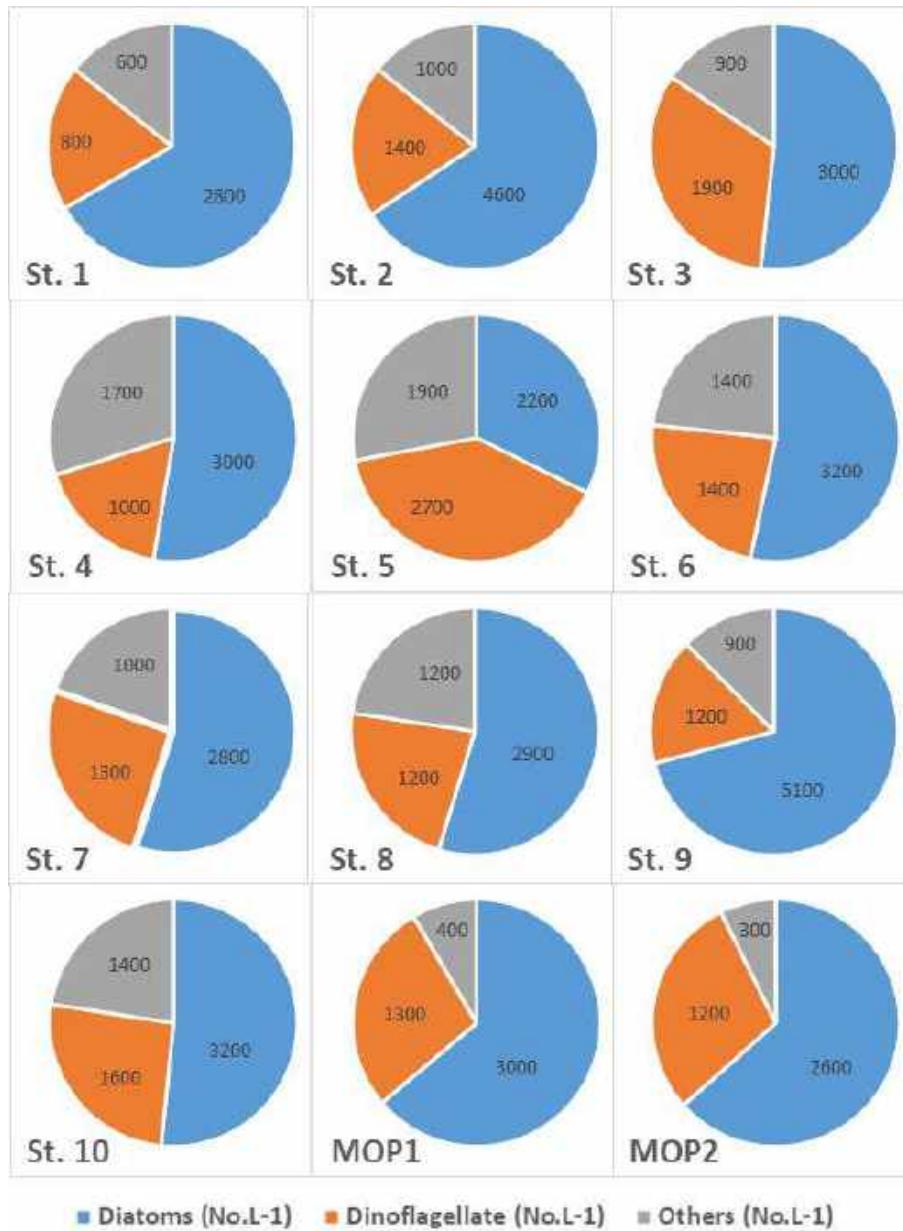


Fig. 3.6: Abundance (No/L) of diatoms and dinoflagellates in the total phytoplankton in the bottom waters of the study region

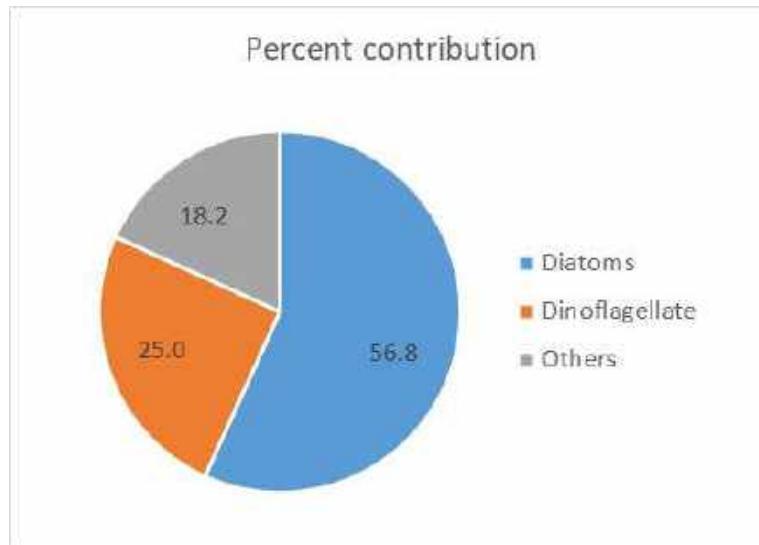


Fig. 3.7: Percent contribution of diatoms and dinoflagellates to the total phytoplankton abundance in the bottom waters of the study region

4.2.3. Zooplankton

The secondary production is the standing stock of zooplankton which feeds on phytoplankton. The seasonal average of zooplankton biomass for the Bay of Bengal (BoB) is 0.43 ml/m^3 in pre-monsoon, 0.24 ml/m^3 in monsoon and 0.99 ml/m^3 in post-monsoon season (Desai & Bhargava, 1998). According to Goswami (1999), the standing stock biomass (ml/m^3) of zooplankton in the Bay of Bengal shows wide variation in space and time in the shelf as well as in the oceanic ecosystems.

Meso-zooplankton abundance in the present study ranged from 208 to 552 No./m^3 with a mean abundance of 395 No./m^3 (Table 3.13; Fig. 3.8). The zooplankton abundance found in this study is considerably lower than the abundance of zooplankton reported in 2017 from this region (range: 500 to 3239 No./m^3 ; mean: 1776 No./m^3). Also, the range and mean values of zooplankton abundance found in this study are significantly lower than those reported in the coastal waters off Kakinada. However, zooplankton abundance found

in this study is considerably higher than those reported in the previous monitoring studies conducted in this region during 2012 (57 No./m³) and 2014 (98 No./m³). These results indicate that zooplankton productivity has decreased in the present study region during recent years. Altogether 17 faunal groups were found in the study region. Copepods are predominant in the total zooplankton abundance (Table 3.14; Fig. 3.9) with a mean contribution of 89.2% (range: 79.5%–94.3%) (Table 3.14). Chaetognatha is the second dominant group that contributes 0.7% to 9.4% to the total zooplankton abundance, with a mean contribution of 3.4% (Table 3.14). Decapod larvae are the third dominant groups in the total zooplankton abundance, with a mean contribution of 1.8% (range: 0.4% to 4.9%) (Table 3.14). The zooplankton groups that contribute >1% to the total zooplankton abundance are Appendicularians (mean: 1.6%). The lowest abundant groups that contribute <1% to the total zooplankton abundance are Bivalve larvae (mean: 0.8%), Cladocerans (mean: 0.6%) and Thaliacea (0.4%).

Table 3.8: Comparison of the range and mean of zooplankton abundance (No./m³) during different monitoring studies.

Year	Zooplankton abundance (No./m ³)	
	range	mean
2012	24-132	57
2014	34-169	98
2017	500-3239	1776
2022	208-552	395

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Table 3.9: Phytoplankton abundance (No./L) at the sampling stations in the surface waters of the study region

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	MOP1	MOP2
Diatoms												
<i>Chaetoceros</i> sp.,	200	200	200	100	0	100	0	100	300	100	100	100
<i>Skeletonema</i> sp.,	200	100	2000	600	400	200	100	100	200	200	800	900
<i>Rhizosolenia</i> sp.,	400	200	0	200	200	400	400	200	300	100	500	300
<i>Coscinodiscus</i> sp.,	0	0	0	100	0	100	0	0	100	200	300	0
<i>Cyclotella</i> sp.,	200	160	200	400	600	200	400	300	0	0	400	200
<i>Thalassiosira</i> sp.,	100	100	0	200	200	100	200	200	400	100	100	200
<i>Hemidiscus</i> sp.,	0	0	0	100	100	200	400	400	200	400	0	200
<i>Leptocylindrus</i> sp.,	0	0	100	100	0	0	0	100	0	100	0	0
<i>Pleurosigma</i> sp.,	100	100	100	100	200	100	200	200	0	0	0	0
<i>Pinnularia</i> sp.,	0	100	0	0	0	0	0	100	0	100	0	0
<i>Striatella</i> sp.,	0	100	200	100	0	0	0	100	0	200	0	100
<i>Nitschia</i> sp.,	200	200	200	200	600	400	300	400	400	600	600	300
<i>Synedra</i> sp.,	100	100	0	100	200	200	0	100	0	100	0	0
<i>Cymbella</i> sp.,	0	100	0	300	200	200	100	200	300	100	100	200
<i>Navicula</i> sp.,	200	200	200	400	200	100	200	400	0	100	300	0
<i>Thalassiothrix</i> sp.,	100	200	800	400	200	100	0	100	0	0	100	100
<i>Amphiprora</i> sp.,	100	100	0	100	100	400	100	400	200	400	0	200
Dinoflagellate												
<i>Prorocentrum</i> sp.,	0	200	200	100	100	100	0	100	200	100	100	200
<i>Ceratium</i> sp.,	300	100	300	200	300	200	100	200	300	200	300	100
<i>Peridinium</i> sp.,	0	0	200	100	100	100	400	400	0	100	0	0
<i>Gymnodinium</i> sp.,	300	100	100	200	200	200	400	100	300	200	0	400
<i>Noctiluca</i> sp.,	0	40	0	100	0	0	0	0	0	100	0	0
<i>Protoperidinium</i> sp.,	0	100	100	80	100	200	200	100	0	100	0	100
<i>Dinophysis</i> sp.,	0	100	100	100	0	100	0	0	0	100	0	0

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<i>Cochlodinium</i> sp.,	0	0	0	40	0	0	100	200	300	0	300	100
<i>Podolampas</i> sp.,	0	200	100	60	0	100	0	100	0	200	0	0
Cyanobacteria	100	100	100	80	100	200	100	400	200	400	0	400
Chroococcus	0	0	0	0	0	0	0	0	0	200	0	0
<i>Trichodesmium</i> sp.,	600	400	1000	800	400	900	600	600	800	600	100	600
Total Abundance (No.L-1)	3200	3300	6200	5360	4500	4900	4300	5600	4500	4900	4300	4700

Table 3.10: Percent contribution of diatoms and dinoflagellates to the total phytoplankton abundance at the sampling stations in surface waters of the study region

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	MOP1	MOP2
Diatoms	59.4	59.4	64.5	65.3	71.1	57.1	55.8	60.7	53.3	57.1	76.7	59.6
Dinoflagellate	18.8	25.5	17.7	18.3	17.8	20.4	27.9	21.4	24.4	22.4	16.3	19.1
Others	21.9	15.2	17.7	16.4	11.1	22.4	16.3	17.9	22.2	20.4	7.0	21.3

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Table 3.11: Phytoplankton abundance (No./L) at the sampling stations in the bottom waters of the study region

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	MOP1	MOP2
Diatoms												
<i>Chaetoceros</i> sp.,	200	100	200	100	100	200	100	200	100	200	200	200
<i>Skeletonema</i> sp.,	600	1600	600	400	100	400	100	300	1600	400	400	600
<i>Rhizosolenia</i> sp.,	400	400	0	200	200	200	400	200	200	600	200	0
<i>Coscinodiscus</i> sp.,	0	200	200	100	200	200	200	400	300	100	0	0
<i>Cyclotella</i> sp.,	200	300	300	400	400	400	600	100	400	400	400	200
<i>Thalassiosira</i> sp.,	200	100	100	0	600	200	100	200	400	0	300	0
<i>Hemidiscus</i> sp.,	0	0	200	200	0	0	0	0	0	0	0	200
<i>Leptocylindrus</i> sp.,	0	200	100	100	0	100	200	0	600	200	400	200
<i>Pleurosigma</i> sp.,	100	200	200	100	200	400	0	100	400	0	0	0
<i>Pinnularia</i> sp.,	0	0	0		0	0	200	100	0	100	200	0
<i>Striatella</i> sp.,	0	100	200	0	0	0	0		0	200	0	200
<i>Nitschia</i> sp.,	600	200	200	600	200	600	200	400	400	200	400	800
<i>Synedra</i> sp.,	0	0	0	100	0	200	200	200	200	100	0	0
<i>Cymbella</i> sp.,	200	0	0	0	0	100	0	100	0	0	200	100
<i>Navicula</i> sp.,	200	200	200	400	200	100	0	200	200	400	0	0
<i>Thalassiothrix</i> sp.,	0	800	400	100	0	0	400	300	100	200	200	100
<i>Amphiprora</i> sp.,	100	200	100	200	0	100	100	100	200	100	100	0
Dinoflagellate												
<i>Prorocentrum</i> sp.,	0	200	100	100	100	200	0	200	0	600	200	200
<i>Ceratium</i> sp.,	0	300	400	100	600	400	200	400	600	400	200	200
<i>Peridinium</i> sp.,	200	200	200	200	800	100	0	100	0	0	0	0
<i>Gymnodinium</i> sp.,	200	200	1000	200	600	200	800	200	600	200	200	400
<i>Noctiluca</i> sp.,	0	0	0	0	100	100	0	0	0	100	0	200
<i>Protoperidinium</i> sp.,	0	0	200	100	200	100	200	200	0	100	200	0
<i>Dinophysis</i> sp.,	0	100	0	0	0	100	0	100	0	100	300	100
<i>Cochlodinium</i> sp.,	400	200	0	200	200	200	0	0	0	0	0	0

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<i>Podolampas</i> sp.,	0	200	0	100	100	0	100	0	0	100	200	100
Cyanobacteria	0	0	100	100	100	200	400	200	200	400	100	100
Chroococcus	0	0	0	0	0	0	0	100	100	200	100	0
<i>Trichodesmium</i> sp.,	600	1000	800	1600	1800	1200	600	900	600	800	200	200
Total Abundance (No.L-1)	4200	7000	5800	5700	6800	6000	5100	5300	7200	6200	4700	4100

Table 3.12: Percent contribution of diatoms and dinoflagellates to the total phytoplankton abundance at the sampling stations in bottom waters of the study region

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	MOP1	MOP2
Diatoms	66.7	65.7	51.7	52.6	32.4	53.3	54.9	54.7	70.8	51.6	63.8	63.4
Dinoflagellate	19.0	20.0	32.8	17.5	39.7	23.3	25.5	22.6	16.7	25.8	27.7	29.3
Others	14.3	14.3	15.5	29.8	27.9	23.3	19.6	22.6	12.5	22.6	8.5	7.3

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Table 3.13: Total zooplankton abundance (No./m³) at the sampling stations in the surface waters of the study region

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	MOP 1	MOP 2
Hydromedusae	0.7	0.1	0	0.2	0.3	0.1	0	1.1	1.7	1.8	0.2	0.4
Siphonophore	0.2	0.7	0.5	0.1	0.4	0.4	0.4	2.1	0	1.6	0.4	1.2
Ctenophora	0.3	0.7	0.1	1.7	0.4	0.4	0.8	1.7	1.3	1.6	0.4	0.6
Chaetognatha	7.5	20.4	18.3	12.9	9.1	6.6	9.16	2.5	35.41	8.3	28.7	4.2
Copepods	326	404	388	359	322	390	442	333	493	374	258	165
Cladocerans	4.2	6.12	0.8	1.6	1.4	0.4	0.8	0.7	0.1	0.4	3.2	4.1
Ostracods	0.2	0.3	0.7	0.1	0.4	0.6	0.9	0.6	0.2	0.3	0.1	0.8
Lucifers	1.3	8.6	1.3	1.7	1.3	2	3.4	1.9	1.6	1.6	3.2	1.4
Thaliacea	1.1	0.7	0.9	0.8	0.8	0.7	0.7	0.4	0.6	0.6	3.12	5.1
Appendicularians	11.2	2.1	1.9	16.6	7.5	2	12.5	4.6	4.3	9.1	0.6	4.1
Polychaete larvae	0.8	0	0.4	0	0.8	0.4	0	0	0	0	0	3.2
Decapod larvae	6.2	8.1	6.4	7.1	9.3	6.4	8.7	5.8	2	1.7	4.1	10.1
Bivalve larvae	5.8	0	4.2	0	6.4	1.2	0	8.5	0.8	0.8	2.3	3.1
Gastropod larvae	0.4	0	0	0.9	0	0	3.1	0	4.3	0	0	4.1
Fish Eggs	0.2	0.3	0.4	0.4	1.1	1.6	1.6	2.5	6.6	1.1	0.1	0.1
Fish larvae	0	1.3	0	0.6	0.8	0.7	0.1	0.3	0	0.4	0.1	0.2
Total (No./m³)	366	454	423	404	362	414	484	366	552	403	304	208

Table 3.14: Percent contribution of various groups to the total zooplankton abundance at different sampling stations in the surface waters of the study region

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	MOP 1	MOP 2
copepods	89	89	92	89	89	94	91	91	89	93	85	80
appendicularians	3.1	0.5	0.4	4.1	2.1	0.5	2.6	1.3	0.8	2.3	0.2	2.0
Decapod larvae	1.7	1.8	1.5	1.8	2.6	1.5	1.8	1.6	0.4	0.4	1.3	4.9
Bivalve larvae	1.6	0.0	1.0	0.0	1.8	0.3	0.0	2.3	0.1	0.2	0.8	1.5
Chaetognatha	2.0	4.5	4.3	3.2	2.5	1.6	1.9	0.7	6.4	2.1	9.4	2.0
Cladocerans	1.1	1.3	0.2	0.4	0.4	0.1	0.2	0.2	0.0	0.1	1.1	2.0
Thaliacea	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	1.0	2.5
Appendicularians	3.1	0.5	0.4	4.1	2.1	0.5	2.6	1.3	0.8	2.3	0.2	2.0

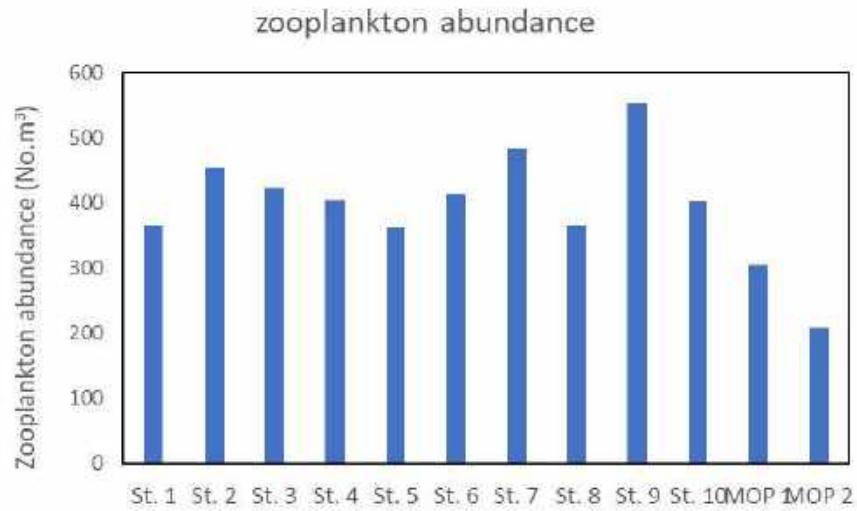


Fig. 3.8: Abundance (No/m³) of zooplankton in surface waters of the study region

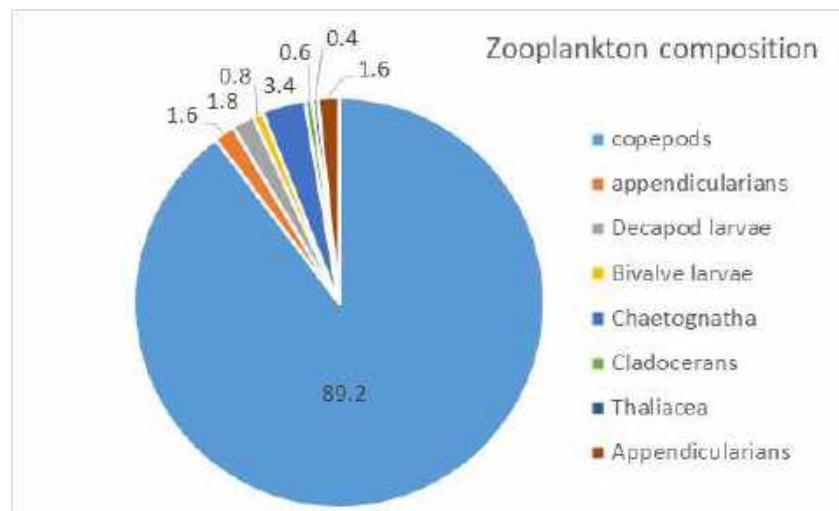


Fig. 3.9: Percent contribution of various groups to the total zooplankton abundance at different stations in the study region

3.2.3. Benthos

Benthos, the seafloor biota, contributes substantially to the secondary production of potential and sustainability of demersal or near bottom living fishable resources. The distribution of biomass production of benthos in the seas surrounding India is reported by

Parulekar et al (1982). A number of comparative studies on benthos of various ecosystems of the seas around India are available and a resume of published results on the standing crop and production of benthos from Bay of Bengal are given in Table 3.15.

Table 3.15: Reported standing crop and production of benthos in the Bay of Bengal

	REGION	BAY OF BENGAL
Biomass (g/m ²)	Shelf	<0.1-98.8 (4.9)
	Slope	0.1-60.2 (4.6)
	Deep	0.1-5.2. (2.3)
Productivity (gC/m ² /y)	Shelf	0.6-3.1 (1.2)
	Slope	0.1-2.4 (0.8)
	Deep	0.4-1.0 (0.8)

4.2.4.1. Macro and meiofauna:

Benthic macro fauna is basically comprised of sedentary and sessile organisms, dominated by polychaete worms and Arthropods. The macro faunal density of the study area ranged from 1950 to 3500 No./m² (Table 3.16; Fig. 3.10). The macrofaunal density range found in this study is slightly lower than those reported in a previous monitoring study conducted in this region in 2017 (900-4650 No./m²), but higher than those reported in 2012 (400-2575 No./m²) and comparable with those reported in 2014 (125-3325 No./m²) from this region (Table 3.16). A total of 27 fauna were found in this study (Table 3.17). Contribution from various groups to the macrofaunal density ranged from 1.6% to 48.2% (Table 3.18). The fauna was dominated by families of polychaeta and their contribution was in the range of 16.1% - 48.2%, with a mean contribution of 30.6% to that of the total abundance (Figs. 3.11 and 3.12). Foraminifera is the second largest group that was contributed to total density of macrofauna and its contribution ranged from 17.9% to

37.7%, with a mean contribution of 24.1% (Fig. 3.12). Mollusca is the third largest group in the total macrofauna and it contributes 22.6% (range: 8.9% to 37.3%) to the total density of the macrofauna in the study region (Fig. 3.12).

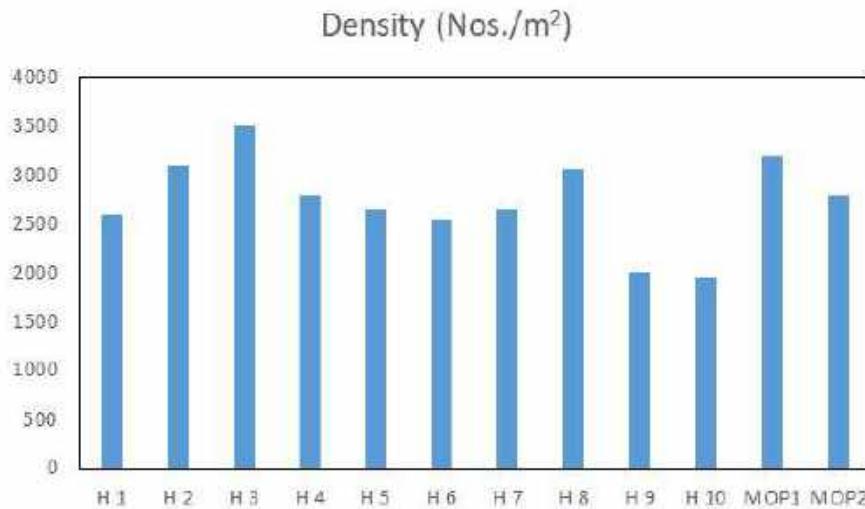


Fig. 3.10: Density of macrofauna in the surface sediments at different stations in the study region

The macro faunal density of the study area found in various previous monitoring studies was given in Table 3.16 and compared with the macro faunal density found in this study.

Table 3.16: Comparison of macrofaunal density in the study region during monitoring studies conducted in different years

Year of monitoring	Macrofaunal density (No./m ²)
2012	400 - 2575
2014	125 - 3325
2017	900 - 4650
2022 (This study)	1950 - 3500

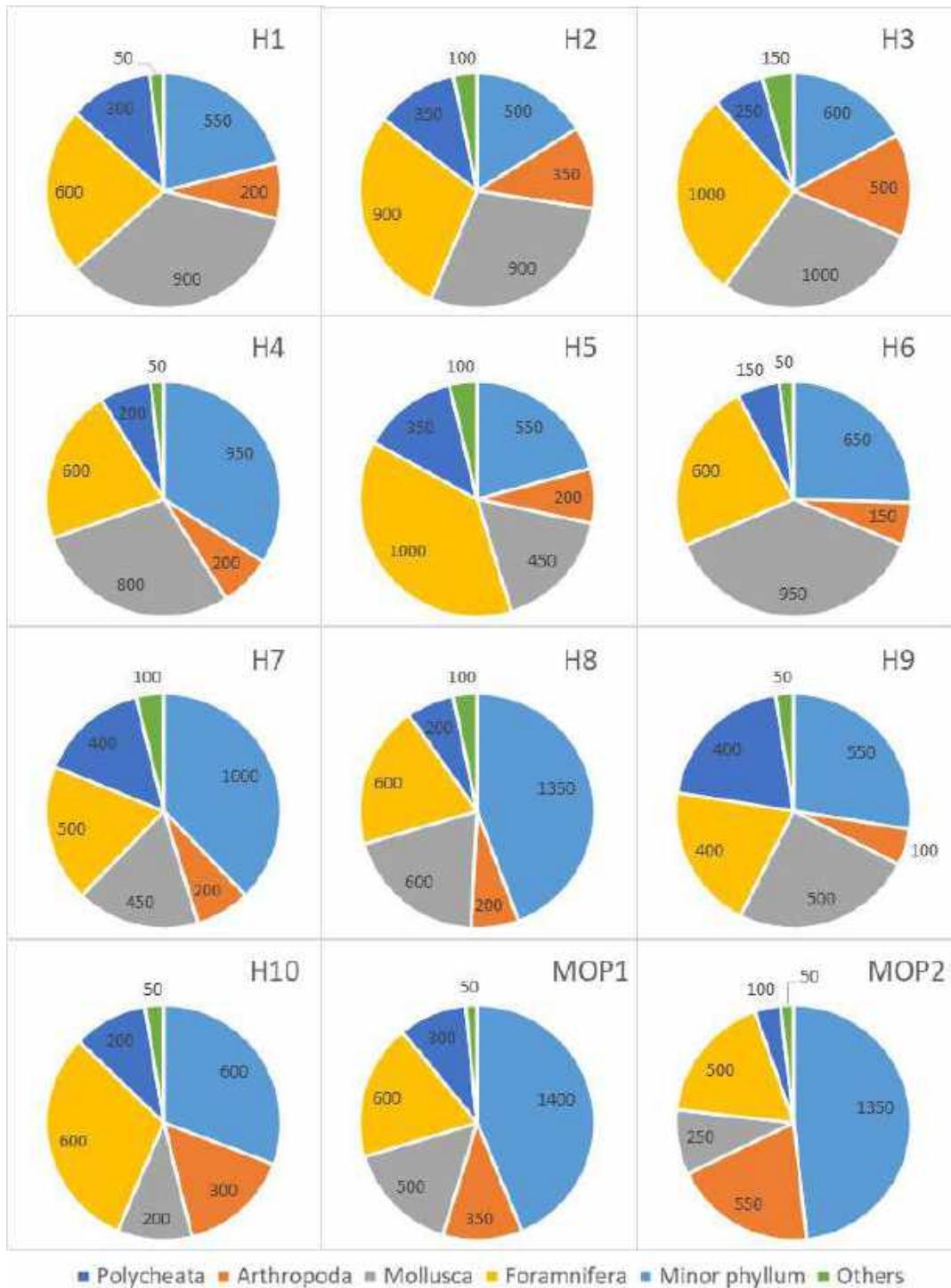


Fig. 3.11: Abundance of various groups (No./m²) contributed to the total macrofaunal density in the surface sediments at different stations in the study region

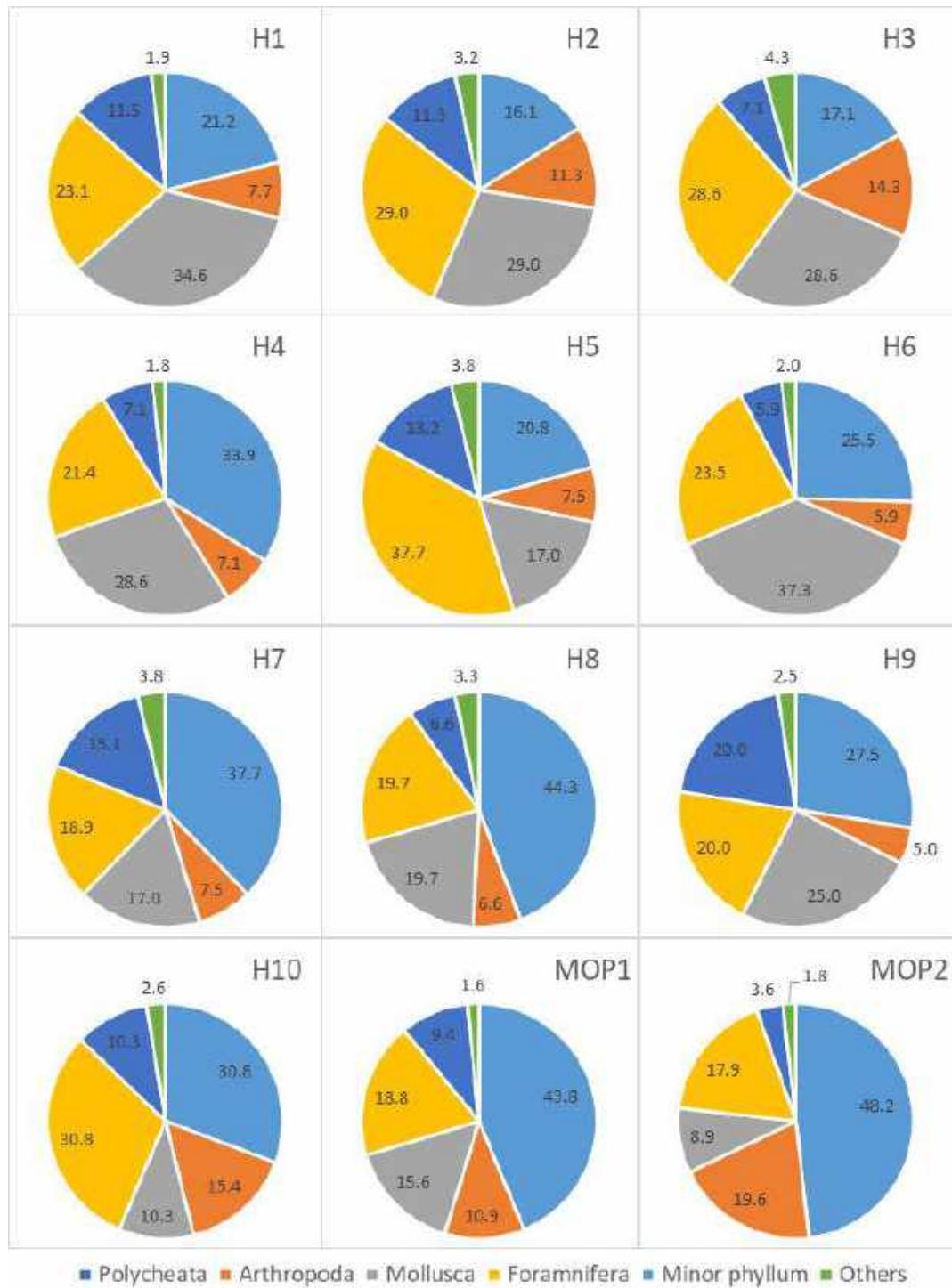


Fig. 3.12: Percent contribution of polychaeta, arthropoda, Mollusca, foraminifera, minor phylum and others to the total macrofaunal density in the surface sediments at different stations in the study region

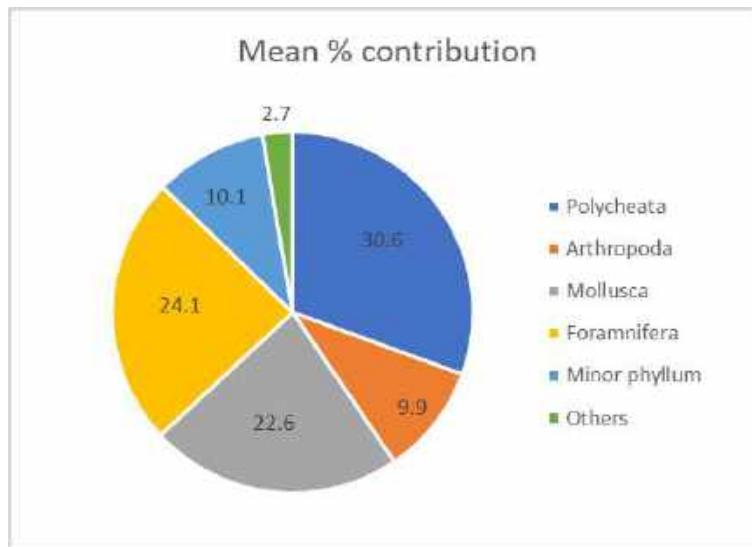


Fig. 3.13: Mean percent contribution of polychaeta, arthropoda, Mollusca, foraminifera, minor phylum and others to the total macrofaunal density in the surface sediments of the study region

The abundance of meio fauna varied from 346 No./10cm² to 870 No./10cm², with an average abundance of 539 No./10cm². Mean abundance of various meio faunal groups is shown in Fig. 3.14 and their percent contributions are shown in Fig. 3.15. The range of values of meio faunal density found in this study is slightly lower than those observed in a previous monitoring study conducted in this region in 2017 (416-1006 No./10cm²) Abundance of Nematoda in this study varied from 100 to 291 No./10cm² (mean: 186.6 No./10cm²) and this range is also comparatively lower than those reported in the 2017 monitoring study (311-710 No./10cm²). Although, Nematoda are the major contributors to the total meio fauna abundance their contribution is lower in this study (34.6%) compared to the previous monitoring study (>80%), indicating increased biodiversity. Foraminifera is the second largest contributors with an average contribution of 16.6 % to the total meio faunal density. Turbellaria is the third largest contributor with a mean contribution of 8.1%. A total of 11 meio faunal groups were found in this study.

Fig. 3.14: Mean abundance of various groups of meio-fauna in the surface sediments of the study region

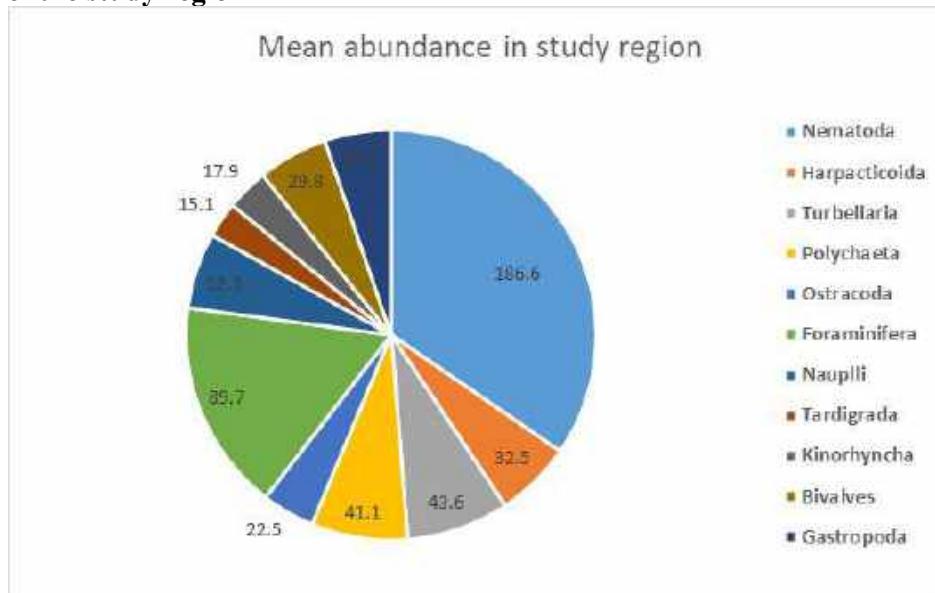
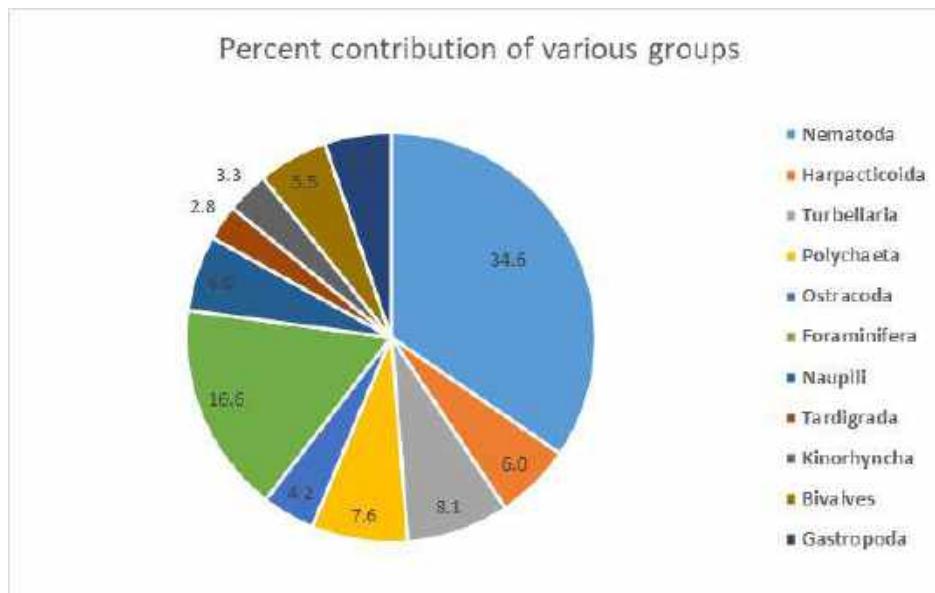


Fig. 3.15: Mean percent contribution of various groups to the total meio-faunal density in the surface sediments of the study region



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Table 3.17: Macrobenthos abundances (No/m²) in surface sediments of the study region

SI.N	Taxa	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H-MOP	H13
O		Polychaeta											
1	Nephtyidae sp.	50	50	0	100	50	50	200	100	0	200	200	200
2	Orbinidae sp.	0	0	0	50	0	0	0	50	0	0	0	0
3	Spionidae sp.	50	50	50	100	0	50	100	100	50	100	0	100
4	Opheliidae sp.	0	50	0	100	0	0	100	100	100	0	0	0
5	Glyceridae sp.	50	0	100	0	100	50	50	50	50	50	400	400
6	Nereidae sp.	50	50	0	100	0	0	0	0	0	0	0	0
7	Pilardigae sp.	0	50	0	50	50	0	50	100	50	0	0	200
8	Aphroditidae sp.	100	0	0	0	0	100	0	200	0	0	0	0
9	Cossuridae sp.	0	0	0	0	0	100	100	0	50	50	100	0
10	Cirratulidae sp.	50	0	100	100	0	0	100	200	100	0	0	200
11	Terebellidae sp.	0	0	50	0	0	0	0	0	0	0	200	0
12	Syllidae sp.	50	50	0	50	100	0	100	50	50	0	0	0
13	Maldanidae sp.	0	0	0	0	0	50	50	0	50	50	0	0
14	Capitellidae sp.	0	0	50	0	0	50	0	0	0	0	200	100

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15	Pisionidae sp.	50	50	0	200	200	50	0	100	0	0	0	0
16	Eunicidae sp.	50	50	50	0	0	0	0	0	100	0	0	50
17	Sabellidae sp.	0	0	0	0	0	50	50	200	50	0	200	0
18	Unidentified	50	100	200	100	50	100	100	100	0	50	100	100
Arthropoda													
19	Amphipoda sp.	50	150	300	100	100	100	100	50	50	150	50	300
20	Tanaidacea	100	200	100	50	50	50	100	150	50	100	300	200
21	Isopoda sp.	50	0	50	0	50	0	0	0	0	50	0	50
22	Cumacean sp.	0	0	50	50	0	0	0	0	0	0	0	0
Mollusca													
23	Gastropoda	500	400	600	200	250	450	250	200	200	100	300	100
24	Bivalvia	400	500	400	600	200	500	200	400	300	100	200	150
25	Foramnifera	600	900	1000	600	1000	600	500	600	400	600	600	500
Minor phylum													
25	Sipunculus	100	50	150	100	50	50	100	0	100	100	0	0
26	Nematoda	200	300	100	100	300	100	300	200	300	100	300	100
27	others	50	100	150	50	100	50	100	100	50	50	50	50
Density	no/m²	2600	3100	3500	2800	2650	2550	2650	3050	2000	1950	3200	2800

Table 3.18: Percent contribution of various groups to the total macrobenthos abundances (No/m²) in surface sediments of the study region.

SI.NO	Taxa	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	HMOP	H13	Mean
1	Nephtyidae sp.	21.2	16.1	17.1	33.9	20.8	25.5	37.7	44.3	27.5	30.8	43.8	48.2	30.6
2	Orbinidae sp.	7.7	11.3	14.3	7.1	7.5	5.9	7.5	6.6	5.0	15.4	10.9	19.6	9.9
3	Spionidae sp.	34.6	29.0	28.6	28.6	17.0	37.3	17.0	19.7	25.0	10.3	15.6	8.9	22.6
4	Opheliidae sp.	23.1	29.0	28.6	21.4	37.7	23.5	18.9	19.7	20.0	30.8	18.8	17.9	24.1
5	Glyceridae sp.	11.5	11.3	7.1	7.1	13.2	5.9	15.1	6.6	20.0	10.3	9.4	3.6	10.1
6	Nereidae sp.	1.9	3.2	4.3	1.8	3.8	2.0	3.8	3.3	2.5	2.6	1.6	1.8	2.7

3.3 Microbiological parameters

Certain aquatic microbes serve as excellent indicators of pollution. Microbes, in particular, bacteria react quickly to changes in environmental conditions. An assessment of the microbial activity is possible by the determination of the microbial biomass (total viable count). Therefore, the total viable counts imply an indirect measure of *in situ* activity in contrast to several specific indicator microbes, and this has been used as one of the principal criteria of pollution in natural water. Besides the pollution indicator bacteria such as total coliforms (TC), *Escherichia coli* like organisms (ECLO) and *Enterococcus faecalis* like organisms (EFLO) occurring in the coastal waters have also been included. These indicator bacteria will presumably show that sewage discharge with human faecal matter is present, which also indicates the possible presence of pathogenic bacteria in the water samples. Apart from that some pathogenic bacteria such as *Vibro cholerae* like organisms (VLO) and *Vibro parahaemolyticus* like organisms (VPLO) abundance was also studied. Water samples from the surface and bottom were collected at each station with the help of a Niskin sampler. All the samples were stored in ice immediately after collection and transferred to the laboratory for the enumeration of different groups of bacteria. Standard microbiological methods were followed for dilution, spread plating and incubation.

Seawater samples collected from the study area were analyzed for the following microbiological parameters:

1. Total viable count (TVC) – R2A Agar seawater medium,
2. Total Coliform (TC) – Mac Conkey's Agar,
3. *Escherichia coli* like organisms (ECLO) – Hichrome Universal Agar,
4. *Enterococcus faecalis* like organisms (EFLO) – Hichrome Universal Agar,
5. *Vibro* like organisms (VLO) – TCBS Agar,

6. *Vibrio cholerae* like organisms (VCLO) – TCBS Agar,
7. *Vibrio parahaemolyticus* like organisms (VPLO) – TCBS Agar,

The counts of different groups of bacteria recorded in the water column are presented in Table 3.19. The values of TVC in the surface water were in the range of 2.9 to 24.6×10^3 CFU/ml. The values for the bottom water were 0.9 to 34.8×10^3 CFU/ml. These counts are comparable with those reported in the previous monitoring study conducted in this region in 2017 ($5.6-13.6 \times 10^3$ CFU/ml and $3.2-33.0 \times 10^3$ CFU/ml in surface and bottom waters, respectively). The total Coliform count was 1.4 to 8.4×10^3 CFU/ml in surface water and 0.01 to 10.0×10^3 CFU/ml in bottom water. The coliform count found in this study are considerably higher than those reported in the previous monitoring study conducted in this region in 2017 ($0.3-0.8 \times 10^3$ CFU/ml and $0.2-1.2 \times 10^3$ CFU/ml in the surface and bottom waters, respectively). Similarly, the *Escherichia coli* like organism (ECLO) counts were NG to 3.2×10^3 CFU/ml in surface water and NG to 3.1×10^3 CFU/ml in bottom water. The range of ECLO found in this study is comparable with those found in the previous monitoring study conducted in this region in 2017 ($1.5-3.7 \times 10^3$ CFU/ml and $0.7-7.4 \times 10^3$ CFU/ml in the surface and bottom waters, respectively). The *Enterococcus faecalis* like organism counts were NG to 22.9×10^3 CFU/ml in surface water and NG to 1.6×10^3 CFU/ml in bottom water. The *Vibrio* like organism (VLO) counts were NG to 3.0×10^1 CFU/ml in surface water and NG to 1.0×10^1 CFU/ml in bottom water. Similarly, the *Vibrio cholerae* like organism (VCLO) counts were NG to 3.0×10^1 CFU/ml in surface water and NG to 1.0×10^1 CFU/ml in bottom water. There is no growth of *Vibrio parahaemolyticus* like organism (VPLO) in both surface and bottom waters.

Wide variation in TVC is observed spatially both in surface and bottom waters. ECLO and EFLO counts were observed in most of the stations and were high in the few

samples but a large variation was observed, which showed the influence of anthropogenic activities such as domestic and industrial discharge, recreational activities, open defecation in coastal (beach) regions (in villages), fisherman activities etc. The counts were higher than the reported from the coastal waters and as per standards of coastal recreational waters. VLO and VCLO counts were observed only in two stations out of the 12 stations sampled in the coastal waters off Rajayyapeta.

Table 3.19: Abundance (CFU/ml) of various bacterial populations in the water column of the study region

Station	Depth	TVC (x10 ³)	TC (x10 ³)	ECLO (x10 ³)	EFLO (x10 ³)	VLO (x10 ¹)	VCLO (x10 ¹)	VPLO (x10 ³)
HET1	SUR	8.8 ³	4.0	0.7	1.2	3.0	3.0	NG
	BOT	21.6	9.0	2.4	NG	NG	NG	NG
HET 2	SUR	15.2	5.6	1.6	0.2	NG	NG	NG
	BOT	5.6	6.2	NG	1.1	NG	NG	NG
HET 3	SUR	8.3	8.0	2.9	0.1	NG	NG	NG
	BOT	3.4	9.5	3.1	0.1	NG	NG	NG
HET 4	SUR	3.4	2.0	0.1	0.2	NG	NG	NG
	BOT	34.8	10.0	NG	0.2	NG	NG	NG
HET 5	SUR	11.8	7.2	NG	22.9	NG	NG	NG
	BOT	20.4	1.5	NG	0.1	NG	NG	NG
HET 6	SUR	12.2	6.0	1.5	0.5	NG	NG	NG
	BOT	18.0	9.0	NG	1.6	NG	NG	NG
HET7	SUR	15.6	7.5	1.9	0.3	NG	NG	NG
	BOT	3.1	0.4	NG	NG	1.0	1.0	NG
HET 8	SUR	4.8	5.7	1.8	NG	NG	NG	NG
	BOT	8.8	3.0	NG	0.1	NG	NG	NG
HET 9	SUR	2.9	8.4	3.2	8.4	NG	NG	NG
	BOT	0.9	1.7	0.4	NG	NG	NG	NG
HET 10	SUR	11.4	1.4	0.4	NG	NG	NG	NG
	BOT	5.1	1.1	0.1	0.1	NG	NG	NG
MOP1	SUR	18.6	6.9	1.2	0.6	NG	NG	NG
	BOT	3.1	0.01	NG	NG	NG	NG	NG
MOP2	SUR	24.6	3.0	0.8	0.1	NG	NG	NG
	BOT	4.0	1.5	0.3	0.1	NG	NG	NG

TVC	Total Viable Count
TC	Total Coliform Count
ECLO	<i>Escherichia coli</i> like organism Count
EFLO	<i>Enterococcus faecalis</i> like organism Count
VLO	<i>Vibrio</i> like organism Count
VCLO	<i>Vibrio cholerae</i> like organism Count
VPLO	<i>Vibrio parahaemolyticus</i> like organism Count
NG	No Growth

3.4.1 Eco-toxicity of treated effluent

The toxicity of the effluents can be evaluated by employing several tests. Bioassay is one of the important tests among them and it is used to test the sensitivity of the organisms on exposure to a toxicant. Bioassay is defined as the test in which a living tissue, organism or group of organisms are used as a reagent for the determination of the potency of any physiologically active substance of unknown activity. In this experiment, a test species either a larva or adult is exposed to different concentrations of toxicant in a given time in order to know the nature and degree of response. During acute toxicity experiments, the tolerance response of the organism is evaluated by exposing it to the specified toxicant for a short period of time. In general, the level of tolerance of any organism to the toxicant is observed for a period of 96 hrs. in acute toxicity experiments. Static bioassay is widely used as a short-term response experiment for acute toxicity experiments and this is one of the best methods to provide the results very fast and accurately. In this experiment, the response of a toxicant to the organism is measured in terms of mortality or lethality.

The physico chemical characteristics of the treated effluent collected from M/s Hetero Infrastructure SEZ Limited are given in Table 3.20. Test conditions and test acceptable criteria for whole effluent toxicity of treated effluent with pink zebra fish are presented in Table 3.21. Acute toxicity of treated effluent collected from the guard pond of M/s Hetero Infrastructure SEZ Limited with whole effluent toxicity test expressed in terms of median lethal concentrations (LC_{50}) was evaluated by subjecting the acclimatized pink zebrafish (*D. rerio*) exposed to different exposure periods (24 hrs; 48 hrs; 72 hrs. and 96 hrs.) with eight different concentrations (%), v/v of treated effluent test solutions.

Table 3.20: Physico-chemical characteristics of the treated effluent and dilution water used for preparing test solutions

Parameter	Treated effluent	Dilution water
pH	7.4±0.1	7.06±0.4
Salinity (ppt)	0.8±0.2	0.6±0.1
Nitrite-Nitrogen (mg/L)		<0.03
Ammonium (mg/L)	32.1±0.7	<0.01
Nitrate-nitrogen (mg/L)	2.7±0.4	2.5±0.4
DO (mg/L)	6.48±0.2	7.01±0.1
BOD ₅ (mg/L)	1.23 mg/L	0.2±0.1
TSM (mg/L)	20.7±1.2	1.5±0.1

Table 3.21: Summary of conditions and acceptance criteria for WET acute Toxicity Test with pink zebra fish as test species

Type	Comment
Test condition	Static non-renewal
Test duration	96 hrs.
Temperature	>28 °C
Photoperiod	12 hrs. light: 12 hrs. dark
Test chamber size	12 Litres
Length of test organisms	30±5 mm
No. fishes per test chamber	20 fishes
No. replicate chambers per Conc.	Three
Feeding	None
Test solution aeration	Yes, >6 mg l ⁻¹
Dilution water	0 ± 1 ‰ salinity
Test concentrations	effluent conc. and a control
Dilution series	10%, 20%, 30%, 50%, 60%, 90% and 100% treated effluent
Endpoint	Mortality of fishes
Test acceptability criterion	90% survival in 100% effluent after 96 hours

Experiments were conducted under static conditions and all experimental tanks had a triplicate and each experimental set included a Control (0%). The test containers were inspected at regular intervals for recording mortality at different exposure periods of 12 hrs, 24 hrs, 36 hrs, 48 hrs, 60 hrs, 72 hrs and 96 hrs for calculating the LC₅₀ values. The dead organisms were removed immediately from tanks in order to avoid any type of bacterial contamination. At the end of each test, the organisms were transferred to a clean tank for observing their recovery. The average percent mortality recorded at different test solutions in triplicate test containers during the four exposure periods was determined. The median lethal concentration (LC₅₀) values in the percentage of toxicant for zebra fish exposed to different concentrations of effluent were calculated based on the mortality rates. The average percent mortality recorded at different test solutions in triplicate test containers during the four exposure periods was determined.

The mortality of test organisms (pink zebra fishes) for effluent samples over different exposure periods are presented in Table 3.22. The mortality values of effluent water samples for different exposure periods (24 hrs, 48 hrs, 72 hrs and 96 hrs) were calculated following the method of log-probit transformation for time and dose-mortality curves suggested by Finney's method (1971) using LDP line software (<http://embakr.tripod.com/ldpline>).

Data on the average mortality of test animals (in %) recorded in different test concentrations of treated effluent from Hetero Infrastructure SEZ Limited over four exposure periods is presented in Table 3.23. The median lethal concentrations (LC₅₀) of treated effluent from Hetero Infrastructure SEZ Limited at different exposure periods are shown in Table 3.24.

Table 3.22: The survival rate of zebra fish exposed to different concentrations of treated effluent to different exposure periods

Exposure Time	Control 0%	Effluent Concentration						
		10%	20%	30%	50%	60%	90%	100%
1 hr.	100	100	100	100	100	100	100	100
6 hrs.	100	100	100	100	100	100	100	100
12 hrs.	100	100	100	100	100	100	100	95
24 hrs.	100	100	100	100	100	100	95	95
36 hrs.	100	100	100	100	100	100	95	95
48 hrs.	100	100	100	100	100	100	95	90
60 hrs.	100	100	100	100	100	95	95	90
72 hrs.	100	100	100	100	100	95	95	85
84 hrs.	100	100	100	100	95	95	90	75
96 hrs.	100	100	100	100	95	95	90	75

Table 3.23: Cumulative mortality of test (pink zebra) fish at different exposure periods in the 96-hour long experiment with treated effluent

Effluent conc. (% v/v)	Cumulative Mortality (%) of zebra fish during exposure periods			
	24 hrs	48 hrs	72 hrs	96 hrs
0%	0	0	0	0
10%	0	0	0	0
20%	0	0	0	0
30%	0	0	0	0
50%	0	0	0	5
60%	0	0	5	5
90%	5	5	5	10
100%	5	10	15	25

Table 3.24: Median Lethal concentrations (LC₅₀) of treated effluent from Hetero Infrastructure SEZ limited at different exposure periods

Exposure period (hrs.)	Median Lethal concentration (LC ₅₀), %
24	-
48	-
72	326.7
96	187.6

Experimental setup used for 96 hrs. LC₅₀ of Hetero Infrastructure Limited effluent with pink zebra fish was shown Fig. 3.16. Dose-Mortality curves generated from the LDP Line software for median Lethal Concentrations (LC₅₀) during different exposure periods were shown in Fig. 3.17

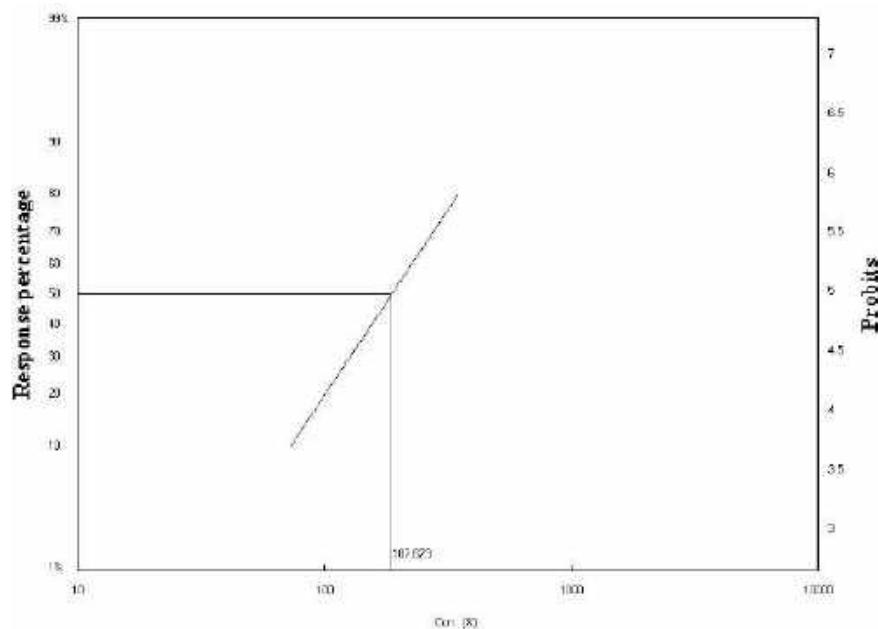
During the 96 hrs. exposure period, no mortality was observed in control treatment. No mortality was found during the test time (96 hrs.) in the effluent concentrations of 10%, 20% and 30%. Effluent of 50% concentrations recorded 5% mortality during the last 24 hours. Whereas, 60% effluent recorded 5% mortality during the last 48 hours. The 90% effluent recorded 10% mortality while the 100% effluent recorded 25% mortality during the test time of 96 hours. These results indicate that the treated effluent collected from the guard pond of M/s Hetero Infrastructure SEZ Limited does not fulfill the test acceptability criterion. The results of this 4-day long bio-assay experiment revealed that the treated effluent of M/s Hetero Infrastructure SEZ Limited did not fulfil the CPCB norms for the bio-assay test, i.e. 90% of survival of zebra fish in 100% of treated effluent during the test time of 96 hours.

Fig. 3.16: Experimental set up for the bio-assay test



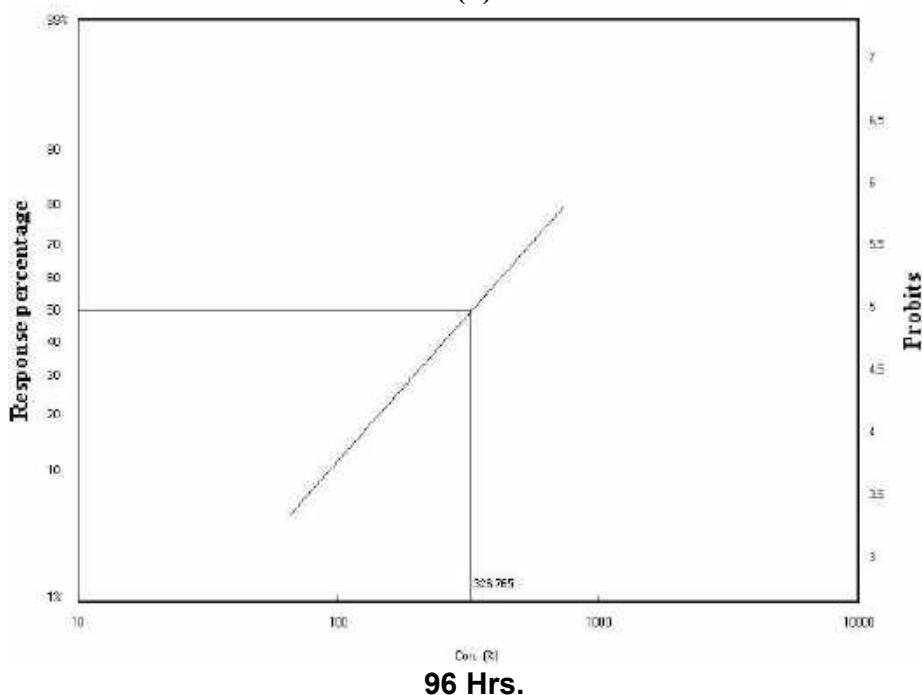
Fig. 3.17: Dose-Mortality curves generated from LDP Line software for median lethal concentration (LC_{50}) of zebra fish to the treated effluent during the exposure periods of (a) 72 hrs. and (b) 96 hrs.

(a)



72 Hrs.

(b)



Furthermore, an assessment of acute eco-toxicity of the treated effluent collected from M/s Hetero Infrastructure SEZ Limited was made in terms of Acute Toxicity Units (TUa). Recently, various industrial effluents that require discharge permits are assessed through the 'TUa' ($TUa = 100/LC_{50} \text{ %v/v}$). It is a specified criterion used for discharge monitoring permits routinely used by the US-EPA. For each test performed the toxicity unit was calculated as 100% (full-strength effluent expressed as percentage) divided by the LC_{50} values. Acute toxicity units (TUa) obtained for treated effluents from M/s Hetero Infrastructure SEZ Limited is 0.56 (range: 0.35 to 0.71) for zebra fish.

The following criteria (Table 3.25) used by Pool et al (2009) were used to assess the level of eco-toxicity of treated effluents for zebra fish.

Table 3.25: Acute Toxicity Grading of treated effluents based on Toxicity Units (TUa)

Toxicity Unit (TUa)	Category
< 1.0	Limited/or not acutely toxic
1 - 2	Negligibly acute toxic
2- 10	Mildly acute toxic
10 – 100	Acutely toxic
>100	Highly acutely toxic

Based on the above criterion, the treated effluent from M/s Hetero Infrastructure SEZ Limited is graded as **Limited Toxic**.

3.4.2. Trace metals in the treated effluent

Trace element concentrations in the treated effluent were determined by the ICP-MS analysis. Concentrations of all the elements measured in the treated effluent fulfil the norms of the Central Pollution Control Board (CPCB) (Table 3.26) set for treated effluent for sea discharge.

Table 3.26: Trace metal concentrations in the treated effluent collected from the guard pond

Element	Concentration ($\mu\text{g/L}$)	Standard Limit Max. ($\mu\text{g/L}$)
Al	162.8	-
V	8.6	200
Cr	13.9	2000
Mn	160.2	2000
Fe	274.3	3000
Co	3.5	-
Ni	11.5	2000
Cu	87.5	3000
Zn	494.7	5000
As	1.4	200
Se	9.7	50
Cd	2.7	50
Pb	29.5	100

Chapter 4
SUMMARY AND CONCLUSION

1. The quality of waters around the marine outfall point during the observational period is similar to that of a typical coastal environment. The results of the present study are comparable to those obtained in earlier monitoring studies conducted in 2012 and 2014 in the same region. Relatively high nutrients and less dissolved oxygen in the bottom waters than that of the surface are due to the consumption of nutrients by phytoplankton in the surface and the release of nutrients and consumption of oxygen during the heterotrophic decomposition of organic matter in the bottom waters.
2. The concentration ranges of all chemical constituents in the vicinity of marine outfall are well within the ambient levels of a healthy coastal environment and would not pose a threat to marine biota.
3. The normal range of microbial flora such as total viable bacterial counts (TVC), total coliform and *E. coli* like organisms (ECLO) in the surface waters ($5.6 - 13.6 \times 10^3$, $0.3 - 0.8 \times 10^3$ and $1.5 - 3.7 \times 10^3$ CFU/ mL respectively) and bottom waters ($3.2 - 33.0 \times 10^3$, $0.2 - 1.2 \times 10^3$ and $0.7 - 7.4 \times 10^3$ CFU/ mL respectively) suggest that the marine environment in the vicinity of the outfall location is healthy and no significant microbial contamination is evident in the region.
4. A total number of phytoplankton genera recorded in the surface water varied from 12-19 in the surface and 15-22 in the bottom waters. The majority of the phytoplankton taxa are diatoms. The important genera of phytoplankton in the region are *Cheatocerus*, *Nitzschia* sp., *Pseudo-nitzschia*, *Rhizosolenia* sp., *Skeletonema*, *Navicula*, *Thalassionema*, *Thalassiosira*, *Thalassiothrix*, *Coscinodisus* and *Guinarida*.

5. A total of 15 different taxa including larvae were recorded for zooplankton. The numerical counts of different taxa recorded in the study area varied between 500 and 3239 Nos/m³ while the biomass was in the range of 0.03 - 0.41 mL /m³. The most dominant taxa recorded was the copepod, with a contribution of 75.8 to 94.3% to the total abundance. The overall picture of the zooplankton in the study area suggests that the composition and biomass were moderately high and attributed to inter annual variations.
6. The population density of macrofauna ranged from 900 to 4650 Nos/m². The total wet weight of biomass was in the range of 1.22–8.99 g/m². Polychaetes are the major contributor to the wet weight of biomass.
7. The total count of meiofauna was in the range of 416-1006 No/10cm² with a mean value of $661 \pm 186/10\text{cm}^2$. Nematodes were the most dominant group with numerical density of 311-710/10cm² and percent composition of >80% at all stations
8. A comparison of biological data of the present study with the results of previous monitoring studies conducted in 2012, 2014 and 2017 revealed that the abundance of both phytoplankton and zooplankton were relatively low in this study compared to those found in 2017 but comparable with those found in 2012 and 2014. Therefore, relatively low abundance of phyto- and zooplankton may be due to inter annual variability associated with inter annual variability in physical and biogeochemical processes
9. Bioassay tests conducted on treated effluent collected from the guard of M/s Hetero Infrastructure SEZ Limited using zebrafish revealed that the treated effluent did not fulfill the CPCB norms for bioassay test of treated effluent for sea discharge,,i.e., 90% survival in 100% effluent during the test time of 96 hours. Only 75% survival of zebra fish was found in the 100% effluent after 96 hours, suggesting that it is required to

improve the quality of effluent before releasing it into the sea. Extensive algal growth in the guard ponds, due to the availability of nutrients such as nitrate, phosphate and silicate, may be suppressed in eco-friendly manner.

**Chapter 5
RECOMMENDATIONS**

Based on in-situ observations and results on laboratory analysis of samples collected during the field work the following recommendation are given to improve the quality of treated effluent and to maintain the health of the ecosystem in the coastal waters of Nallamattipalem.

1. Due to the decrease in the abundance of phytoplankton and zooplankton in this study compared to the previous study conducted in 2017, it is recommended to monitor the marine environment continuously for the next three years during the pre-SW monsoon season of each year.
2. Sludge should be removed from the guard ponds on regular time intervals, at least quarterly time scales
3. Extensive algal growth found in the guard ponds caused by the availability of plenty of nutrients such as nitrate, phosphate and silicate, should be suppressed. Algal growth suppression should be achieved in eco-friendly manner, such as continuous mixing of effluent in the guard pond using air blowers.

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HETERO INFRASTRUCTURE SEZ LTD

ANNEXURE-B

Display Boards along Marine Disposal pipeline at the crossing of Creek and Road





**Andhra Pradesh Coastal Zone Management Authority (APCZMA),
Andhra Pradesh
Ministry of Environment Forests & Climate Change Government of
India**
Paryavaran Bhavan, APIIC Colony Road, Gurunanak Colony,
Autonagar, Vijayawada-520007



Letter No. 382/CRZ/IND/2022-

Dated: 09.10.2023

To
The Secretary,
Ministry of Environment and Forests and Climate Change,
Indira Paryavaran Bhavan,
Jorbagh Road,
New Delhi - 110 003.

Sir,

Sub: APCZMA - CRZ - M/s. Hetero Infrastructure SEZ Ltd. at N. Narasapuram (V), Ch. Lakshmipuram (V), Rajaihpeta (V), PedaTeernala (V), of Nakkapalli (M), Visakhapatnam District, Andhra Pradesh - Proposal for regularization of existing desalination plant in CRZ area - CRZ Clearance under the provisions of the CRZ Notification, 2011 - Recommendations of APCZMA - Communicated - Reg.

Ref: 1) Proposal received from M/s. Hetero Infrastructure SEZ Ltd, Visakhapatnam on 02.08.2022, 08.11.2022 & 09.12.2022.
 2) APCZMA meeting held on 13.10.2022 at Vijayawada.
 3) O.A. No. 23 of 2022 (SZ), the Hon'ble NGT, Chennai
 4) T.O. letter dated: 09.11.2022.
 5) Information received on 08.11.2022 & 09.12.2022.
 6) APCZMA meeting held on 08.02.2023 at Vijayawada.
 7) T.O. letter dated: 23.02.2023 addressed to the committee members and applicant for constitution of the Technical Committee.
 8) Appeal No. 04 of 2023 (SZ) in OA No. 23 of 2022 the Hon'ble NGT, Chennai.
 9) A mail was addressed to the Technical Committee on 09.03.2023 for inspection on 14.03.2023 & 15.03.2023.
 10) T.O. letter dated: 24.04.2023 addressed to the project proponent and to the EE, RO: Visakhapatnam.
 11) The applicant furnished information on 04.05.2023.
 12) The Committee submitted report on 26.05.2023.
 13) APCZMA meeting held on 17.08.2023 at Vijayawada.
 14) APCZMA Letter dated: 20.09.2023.
 15) EFS&T Dept., letter dated 29.09.2023.

1) M/s. Hetero Infrastructure SEZ Ltd., at N. Narasapuram (V), Ch. Lakshmipuram (V), Rajaihpeta (V), PedaTeernala (V), of Nakkapalli (M), Visakhapatnam District, Andhra Pradesh and submitted the proposal for regularization of existing

desalination plant in CRZ area. The applicant sought clearance under the provisions of CRZ Notification 2011.

- 2) Earlier, the project proposal was placed in the 52nd and 55th APCZMA meetings held on 13.10.2022 and 08.02.2023 at Vijayawada. A Technical Committee was constituted vide letter dt: 28.02.2023 to examine the following:
 - The report of Joint Committee constituted by the Hon'ble NGT regarding OA No. 23 of 2022;
 - The certified compliance report & other documents submitted by the project proponent and the consultant
 - Visit the area to assess the environmental damages caused by the construction of Desalination in CRZ area and shall give specific recommendation in respect of activities corresponding to the environmental or ecological damage assessed, to be taken up by the project proponent under Compensatory Conservation Plan (CCP) and Community Resource Augmentation Plan (CRAP), as per the MoEF&CC OM dated 19.02.2021 and OM F.No.19-125/2019-IA.III, dated: 05.03.2020.
- 3) The Committee inspected on 14.03.2023 and examined the issues and submitted a report on 26.05.2023.
- 4) The project proponent along with their consultant M/s. Indomer Coastal Hydraulics Pvt. Ltd., Chennai attended the meeting and explained about the proposal as follows:
 - a) The proponent is ready to pay the compensation of Rs. 9.7 Crore proposed by the Committee constituted by the APCZMA.
 - b) The Hon'ble NGT in OA. No. 23 of 2022 had constituted a Joint committee and one of the committee recommendations is as follows:
"M/s. Hetero Infrastructure SEZ Ltd., shall obtain approval from MoEF&CC for operation of desalination unit in CRZ area and also shall obtain necessary amendments for operation of the desalination plant in CFO of APPCB." The Committee report has already been submitted to the Hon'ble NGT. There are no further orders from the Hon'ble NGT.
 - c) Appeal No. 04 of 2023 has also been filed in Hon'ble NGT against the industry. However, there are no orders of the Hon'ble NGT.
 - d) The request for regularization of the desalination plant may be considered subject to the further orders of the Hon'ble NGT in OA No 23 of 2022 and Appeal No 04 of 2023.

5) The Authority noted the following observations:

- a) The existing desalination plant is located in CRZ III (NDZ) area as per CRZ Notification, 2011. The approval taken earlier was for desalination plant in non-CRZ area; however, the desalination plant has been put up in CRZ III (NDZ) area. Hence, the proposal for regularization.
- b) As per Para 8 (III) (A) (iii) (h) of CRZ Notification, 2011 - "Foreshore facilities for desalination plant and associated facilities" is a permissible activity in CRZ III (NDZ) area.
- c) As per Para 5.3 (i) of CRZ Notification, 2019, "Desalination plants and associated facilities" is a permissible activity in CRZ III (NDZ) area as it is a permissible in CRZ IB area (5.1.2 (xviii))." However, CRZ Notification, 2019 is still to come in force in the State of AP.
- d) There are sand dunes at a distance of 2.8 Km northeast of the desalination plant as per the EIA Report.
- e) In OA No 23 of 2022, the Hon'ble NGT formed a committee. The committee has submitted its report to the Hon'ble NGT (*ANNEXURE-A*). In the committee report, there are observations of the committee, violations of CRZ, EC and CFO conditions. The Committee has also submitted its final recommendations along with the Environmental Compensation. The case is still pending in the Hon'ble NGT and there are no further orders.
- f) Further, Appeal No. 04 of 2023 has been filed in the Hon'ble NGT after issue of CRZ orders by MoEF&CC vide dated 11th January, 2023. The case is pending in the Hon'ble NGT and no further interim / final orders have been issued by the Hon'ble NGT.
- g) The proposal for linking of the desalination plant reject pipeline with the effluent marine discharge pipeline is absolutely against the marine discharge SOP of APPCB as no pipeline can be added after the guard ponds. Hence, the proposal for linking of the desalination plant reject pipeline cannot be considered.
- h) The committee constituted by the APCZMA in the 55th APCZMA meeting has submitted a detailed report dt. 26.05.2023 (*ANNEXURE-B*), wherein the committee has recommended the regularization of desalination plant in NDZ area as the desalination plant does not create any major impact on the environment. However, the implementation of the Environmental Compensation will ensure prompt action and meet the goals of Sustainable development and socio economic progress of the region. The committee has made many observations and other recommendations in its report.
- i) It was also presented that the condition of the desalination plant reject pipeline into the sea is not in good condition. The desalination plant needs to have independent intake pipeline and reject pipeline without any mixing with the effluent marine discharge pipeline. Hence, it is essential that the separate intake and reject pipeline of the desalination plant are duly verified for fitness and rectified if not in a fit condition.

- j) There are number of other conditions recommended in the committee reports at ANNEXURE-A & ANNEXURE-B which need to be complied.
- k) The Authority noted that the Para No 4 of the OM F.No. IA3-12/1/2022-IA.III, dated 26.04.2022 issued by the MoEF&CC, GoI, New Delhi reads as follows:

"In case, the CZMA desires to consider an activity which is not explicitly mentioned in the notification or not permissible, such recommendations shall be forwarded with detailed justification to the Ministry for consideration."

- 6) Taking note of the above, after detailed discussions, the Authority decided to recommend the proposal of M/s. Hetero Infrastructure SEZ Ltd., at N. Narasapuram (V), Ch. Lakshmipuram (V), Rajaihpeta (V), PedaTeernala (V), of Nakkapalli (M), Visakhapatnam District, Andhra Pradesh to MoEF&CC, GoI, New Delhi to consider the proposal for regularization of existing desalination plant, duly taking into account the pending court cases and the above observations of the authority, with the following specific and general conditions, subject to orders in the Court cases:

PART - A: Specific Conditions:

- (i) *Compliance of all the conditions recommended by the committee constituted by the Hon'ble NGT, including the following, subject to the orders of the Hon'ble NGT:*
 - a) *M/s. Hetero Infrastructure SEZ Ltd., shall obtain approval from MoEF&CC for operation of desalination unit in CRZ area and also shall obtain necessary amendments for operation of the desalination plant in CFO of APPCB.*
 - b) *M/s. Hetero Infrastructure SEZ Ltd., & M/s. Hetero Labs Ltd, N-Narasapur Village, Nakkapalli Mandal, Visakhapatnam District shall pay the Environmental compensation of Rs.6,94,95,000/- for the failure to comply with the conditions of Environmental Clearance issued by MoEF&CC and Consent issued by APPCB and same shall be paid to APPCB.*
 - c) *M/s. Hetero Infrastructure SEZ Ltd., & M/s. Hetero Labs Ltd shall comply with the conditions issued by the MoEF&CC & APPCB.*
 - d) *The industry shall explore the possibility of recycling of treated wastewater and reducing the withdrawal of the sea water.*
 - e) *The industry shall make efforts to recycle and reuse the treated effluents so as to reduce the intake water quantity from the Sea.*
 - f) *The industry shall conduct long term Environmental Impact Assessment study to ascertain the impact of pollution on water, air, soil and agricultural crops within 5 Km radius of the industry through any reputed Institutes viz., NEERI, IIT, EPTRI.*
 - g) *The industry shall conduct impact assessment study on human health due to pollution of M/s. Hetero Infrastructure SEZ Ltd., & M/s. Hetero Labs Ltd if*

any through ICMR institute/any reputed Government institutions in 5 KMs radius in view of the apprehensions of the villagers on Health impacts due to operation of the industries.

- h) The industry shall carry out an assessment study of the marine environment around the marine outfall point (MOP) of M/s. Hetero Infrastructure SEZ Ltd., including desalination rejects discharge point through NIO.

i) The industry close the excess raw water discharge pipeline (as observed in the report by the committee).

(ii) Compliance of all the conditions recommended by the committee constituted by the APCZMA, including the following:

 - The industry close down the existing excess seawater discharge pipeline.
 - The industry shall allocate the budget of Rs. 9.7 Crores (Compensatory Conservation Plan (CCP) - Rs.6.8 Crores & Community Resources Augmentation Plan (CRAP) - Rs.3.0 Crores) for implementing the activities under CCP & CRAP.
 - The industry increase the budget depending on the requirement under Compensatory Conservation Plan (CCP) and Community Resource Augmentation Plan(CRAP), as per the MoEF&CC OM dated 19.02.2021 and OM F.No.19-125/2019-IA.III, dated: 05.03.2020.

(iii) The proposal for linking of the desalination plant reject pipeline with the effluent marine discharge pipeline is absolutely against the marine discharge SOP of APPCB as no pipeline can be added after the guard ponds. Hence, the proposal for linking of the desalination plant reject pipeline cannot be considered. The desalination plant shall have its own separate intake and reject pipelines.

(iv) The separate intake and reject pipeline of the desalination plant shall be duly verified for fitness and rectified immediately.

(v) The proposed constructions shall conform to the norms prescribed in CRZ Notification issued by the Ministry of Environment and Forests, Government of India S. O. No.19(E), dated 06-01-2011 and shall not affect the coastal ecology of the area.

(vi) No activity on ground shall be undertaken without obtaining Environmental Clearance from the Ministry of Environment and Forests, Government of India as per S. O. No.19(E), dated 06-01-2011.

(vii) During accidental breakage of pipeline, the necessary mitigation measures like immediately attending the repair of pipeline has to be taken up. Necessary spares of pipeline segments with bends/tees and divers with experience in salvation operation irrespective of sea condition have to be kept ready always within the industrial unit.

(viii) A Continuous monitoring system should be put in place by the applicant to find

out the impact on marine life/flora/fauna, due to discharge.

- (ix) *The applicant shall ensure that Continuous monitoring of all likely affected parameters including air/ water quality/ reject water discharges are monitored and monthly report is to be submitted to the APPCB.*
- (x) *Priority to be given to the maintenance of storm water drains from the surrounding area to prevent possible flooding of the surrounding areas.*
- (xi) *No solid waste shall be disposed in the Coastal Regulation Zone area. The solid waste shall be properly collected, segregated and disposed as per the provision of Solid Waste (Management and Handling) Rules, 2000 and amendment thereof.*
- (xii) *The proponent shall implement all the mitigation measures as mentioned in the Marine EIA report.*
- (xiii) *Once in a year around the discharge point, the biological fauna especially benthic organism status shall be studied and for that effect a report should be submitted to APCZMA.*

PART B: General Conditions:

- (i) *A copy of the clearance letter shall also be displayed on the website of the AP Pollution Control Board. The Clearance letter shall also be displayed at the AP Pollution Control Board Regional Office, District Industries Centre and District Collector Office/ Mandal Revenue Office for 30 days.*
- (ii) *The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to the Andhra Pradesh Coastal Zone Management Authority (APCZMA) and AP Pollution Control Board Regional Office.*
- (iii) *Concealing factual data by the project proponent, any officer on behalf of the project proponent and consultants hired by the project proponent or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.*
- (iv) *Consent for Establishment (CFE) and Consent for Operation (CFO), as may be applicable, shall be obtained from State Pollution Control Board under the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974.*

All waste (liquid and solid) arising from the proposed development shall be disposed of as per the norms prescribed by State Pollution Control Board. There shall not be any disposal of untreated effluent into the sea/coastal water bodies.

- (v) *Full co-operation shall be extended to the officials from the APCZMA, APPCB and Regional Office of MoEF&CC, during monitoring of implementation of environmental safeguards stipulated. It shall be ensured that documents/data sought pertinent is made available to the monitoring team. A complete set of all the*

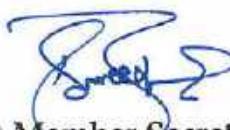
documents submitted to APCZMA shall be forwarded to the AP Pollution Control Board Regional Office.

- (vi) *In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by the APCZMA.*
- (vii) *The APCZMA reserves the right to add additional safeguard measures subsequently, if found necessary, and to take action including revoking of the CRZ clearance under the provisions of the Environmental (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.*
- (viii) *All other statutory clearances shall be obtained, as applicable by project proponents from the respective competent authorities.*
- (ix) *The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded CRZ Clearance and copies of clearance letters are available with the AP Pollution Control Board and may also be seen on the website of APCZMA. The advertisement should be made within Seven days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the AP Pollution Control Board Regional Office.*
- (x) *This Clearance is subject to any order passed by any Hon'ble Courts, as may be applicable to this project.*
- (xi) *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.*
- (xii) *The proponent shall upload the status of compliance of the stipulated conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the AP Pollution Control Board Regional Office and the APPCB, Head Office.*
- (xiii) *The Project Proponent shall ensure that there is no destruction of mangroves, if any, during the construction as well as the operation phase of the project.*
- (xiv) *There shall be no dressing or alteration of the sand dunes and natural features, including landscape changes for beautification, recreation and other such purpose.*
- (xv) *No permanent labour camp, machinery and material storage shall be allowed in CRZ area.*
- (xvi) *There shall be no ground water drawl within CRZ without prior approval of the State Ground Water Authority.*
- (xvii) *Disposal of muck during construction phase should not create any adverse effect on the neighboring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the*

approval of competent authority.

- 7) The MoEF&CC, GoI, New Delhi vide dt: 26.04.2022 issued Office Memorandum for the procedure for Clearance of Permissible Activities as per the CRZ Notification, 2011 and IPZ Notification, 2011 wherein, as per paragraph (5) stated that "*in case the Coastal Zone Management Authorities (CZMA) are not in existence due to delay in their reconstitution or any other reasons, then it shall be responsibility of the Dept. of Environment in the State Government or Union territory Administration, for providing comments and recommendation to the proposals in terms of the provisions of the said notification, to the concerned authority, as the case may be*".
- 8) The EFS&T Dept., Govt. of A. P., vide letter dated 29.09.2023, authorized the Member Secretary, APPCB to communicate the recommendations to the MoEF&CC, as per the approved minutes of the meeting held on 17.08.2023, as per the norms.
- 9) In view of the above, Recommendations of APCZMA on the proposal of M/s. Hetero Infrastructure SEZ Ltd., at N. Narasapuram (V), Ch. Lakshmipuram (V), Rajaihpeta (V), PedaTeernala (V), of Nakkapalli (M), Visakhapatnam District, Andhra Pradesh are communicated to MoEF&CC, GoI, New Delhi to consider the proposal for regularization of existing desalination plant, duly taking into account the pending court cases and the above observations of the authority, with the following specific and general conditions, subject to orders in the Court cases

Yours faithfully,



(2) Member Secretary
APPCB & APCZMA
[Handwritten signature]

Encl:

1. CRZ Form I;
2. EIA Report;
3. CRZ Report;
4. Copy of the Minutes of the APCZMA Meeting.

Copy to Sri. S. Kullayi Reddy, Associate Vice- President - EHS, M/s. Hetero Infrastructure SEZ Ltd., N. Narasapuram (V), Ch. Lakshmipuram (V), Rajaihpeta (V), Peda Teernala (V), Nakkapalli (M), Visakhapatnam District for information.



SV ENVIRO LABS & CONSULTANTS

(ENVIRONMENTAL ENGINEERS & CONSULTANTS IN POLLUTION CONTROL)

Corporate Office & Laboratory : Enviro House, B-1, Block-B, IDA, Autonagar, Visakhapatnam-530012.
Hyderabad: Flat No. 302, H.No. 7-1-396/B/12, Sai Ram Residency, Balkampet Road, S.R.Nagar, Hyderabad-500038.
 ☎ +91-9440338628, +91-7207664444 📩 senviro_labs@yahoo.co.in, info@senvirolabs.com 🌐 www.senvirolabs.com
 Recognized by Govt. of India-MoEF & CC, New Delhi, Accredited by : NABL & NABET



Ref: SVELC/HIL/23-11/01

Date: 20-11-2023

NAME AND ADDRESS : M/s. HETERO LABS LIMITED (UNIT-III),
 NALLAMATIPALEM (V),
 NAKKAPALLI (M),
 VISAKHAPATNAM (Dist).

SAMPLE PARTICULARS : SOIL

SOURCE OF COLLECTION :

- 1. HETERO LABS -III UNIT
- 2. HETERO LABS-IX
- 3. HETERO DRUGS UNIT-IX

DATE OF COLLECTION : 11-11-2023

DATE OF RECEIPT : 11-11-2023

TEST REPORT

S.NO	PARAMETER	UNIT	1	2	3
1.	pH	-	7.68	7.36	7.95
2.	Conductivity	ms/cm	0.461	0.428	0.416
3.	Moisture	%	5.24	6.31	5.18
4.	Bulk density	g/cc	1.83	1.96	1.72
5.	Porosity	%	62	54	48
6.	Organic Matter	%	0.78	0.65	1.13
7.	Nitrogen as N	mg/100gm	0.39	0.41	0.47
8.	Phosphorus as P	mg/100gm	6.4	5.6	6.1
9.	Potassium as K	mg/100gm	3.1	4.0	3.7

CHECKED BY



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Hyderabad: Flat No. 302, H.No. 7-1-396/B/12, Sai Raim Residency, Balkampet Road, S.R.Nagar, Hyderabad-500038.
+91-9440338628, +91-7207684444 svenviro_labs@yahoo.co.in, info@svenvirolabs.com www.svenvirolabs.com
Recognized by Govt. of India-MoEF & CC, New Delhi, Accredited by : NABL & NABET



Ref: SVELC/HISL/23-11/02

Date: 20-11-2023

NAME AND ADDRESS : M/s. HETERO LABS LIMITED (UNIT-III),
NALLAMATIPALEM (V),
NAKKAPALLI (M),
VISAKHAPATNAM (Dist).

SAMPLE PARTICULARS : WATER

SOURCE OF COLLECTION : 1. BOREWELL – 1 (Near ETP)
2. BOREWELL – 2 (Near Honour Labs)
3. BOREWELL – 3 (Near Labour Shed)
4. BOREWELL – 4 (Near HLL-3)

DATE OF COLLECTION : 11-11-2023

TEST REPORT

S.No	Parameter	Unit	Results			
			1	2	3	4
1.	pH	-	7.60	7.43	7.80	8.12
2.	Total Dissolved Solids	mg/l	7421	30142	13024	13492
3.	Total Alkalinity as CaCO ₃	mg/l	481	367	438	540
4.	Total Hardness as CaCO ₃	mg/l	922	8856	1862	1698
5.	Calcium as Ca	mg/l	48.2	573	136	184
6.	Magnesium as Mg	mg/l	195	1804	307	301
7.	Chlorides as Cl ⁻	mg/l	3204	13826	5197	5583
8.	Copper as Cu	mg/l	<0.01	<0.01	<0.01	<0.01
9.	Manganese as Mn	mg/l	0.25	3.1	0.55	0.05
10.	Zinc as Zn	mg/l	0.40	0.48	0.17	0.29
11.	Aluminum as Al	mg/l	0.12	0.53	0.04	0.16
12.	Boron as B	mg/l	1.96	0.74	1.42	1.15
13.	Barium as Ba	mg/l	0.18	0.07	0.05	0.09
14.	Selenium as Se	mg/l	0.01	0.06	0.04	0.03
15.	Silver as Ag	mg/l	<0.01	<0.01	<0.01	<0.01
16.	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01	<0.01
17.	Cyanide as CN	mg/l	<0.01	<0.01	<0.01	<0.01
18.	Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01
19.	Mercury as Hg	mg/l	<0.01	<0.01	<0.01	<0.01
20.	Nickel as Ni	mg/l	0.07	<0.01	<0.01	<0.01
21.	Total Arsenic as As	mg/l	0.02	0.10	0.03	0.02
22.	Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	<0.01
23.	Iron as Fe	mg/l	0.21	0.13	0.10	0.07

Note: All the above parameters are tested as per APHA methods, 24th Edition, 2023

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SV ENVIRO LABS & CONSULTANTS



भारत सरकार

Government of India

यांगिन्य और उपीय बोर्ड

Ministry of Commerce & Industry

पेट्रोलियम तथा विस्फोटक उत्तरांश बोर्ड (पैसो)

Petroleum & Explosives Safety Organisation (PESO)

बोर्ड ताल, ए-ब्लॉक, रोड़ ३०, अंगनवाड़ी, निमती हिन्दु

नागपूर - 440006

5th Floor, A-Block, CGO Complex, Seminary Hills,

Nagpur - 440006



E-mail : explosives@explosives.gov.in

Phone/Fax No.: 0712-2510248, Fax-2510577

संख्या /No. P/HQ/6PH5/3852 (P250196)

दिनांक /Dated : 23/12/2014

सेवा में /In

M/s. Hetero Drugs Limited (Unit IX),
Hetero Corporate, 7-2-A2,
Indl. Estate, Sanath Nagar,
Hyderabad,
District: HYDERABAD,
State: TELANGANA
PIN: 500015

विषय /Sub : Plot No, Sy. No. 119/1A to 119/1F, 119/2A to 119/2F, 119/3 & 120/1, 120/2A to 120/2L, NA, N. Narasapuram (v), Nakkapally (m), District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 999999 ने
रिप्पत पेट्रोलियम वर्ग A,B अधिकार्यालय - पेट्रोलियम विभाग 2002 के अन्तर्गत प्रधान XV में जारी अनुमति से P/HQ/AP/15/3852 (P250196) - संशोधन के सहित में।

Existing Petroleum Class A,B Installation at Plot No, Sy. No. 119/1A to 119/1F, 119/2A to 119/2F, 119/3 & 120/1, 120/2A to 120/2L, NA, N. Narasapuram (v), Nakkapally (m), District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 999999- Licence No. P/HQ/AP/15/3852 (P250196) - granted in form XV under Petroleum Rules 2002 - Amendment regarding

महोदय /Sir

(S).

कृपया आपके उपर्युक्त विषय में नवीनीकृत पर जनक्षय expol/petro/unit/02/2014-15 दिनांक 29/10/2014 का संदर्भ बहुत करें।

Reference to your letter No. expol/petro/unit/02/2014-15 dated 29/10/2014 on the above subject.

दिनांक 31/12/2024 तक वैध अनुमति जारी की जाएगी P/HQ/AP/15/3852 (P250196) दिनांक 23/12/2014 मिम्नलिखित यांत्र एवं मात्राओं में पेट्रोलियम अंदाजण के लिए वथा संशोधित कर इस पर के साथ संतुष्ट जा रही है।

Licence No. P/HQ/AP/15/3852 (P250196) dated 23/12/2014 valid upto 31/12/2024 is returned herewith duly amended with respect to Capacity Amendment,

पेट्रोलियम वर्ग विवरण /Description of Petroleum

मिलोर्डीटर्स में अनुमति कामता /Quantity licenced in KL

वर्ग A के प्रथम पेट्रोलियम /Petroleum Class A, in bulk	620.00 KL
वर्ग A के प्रथम पेट्रोलियम से अन्य /Petroleum Class A, otherwise than in bulk	NIL
वर्ग B के प्रथम पेट्रोलियम /Petroleum Class B, in bulk	124.00 KL
वर्ग B के प्रथम पेट्रोलियम से अन्य /Petroleum Class B, otherwise than in bulk	NIL
वर्ग C के प्रथम पेट्रोलियम /Petroleum Class C, in bulk	NIL
वर्ग C के प्रथम पेट्रोलियम से अन्य /Petroleum Class C, otherwise than in bulk	NIL

कुल कामता /Total

744.00 KL

कृपया जारी हो।

Please acknowledge the receipt.

Note : Your Balance Amount with the Organisation is Rs 2000/- which will be used for processing of the same Licence in future.

महोदय /Yours faithfully,

(अर.पी.सिंह)
(R.P.Singh)
उप मुख्य विस्फोटक विभाग
Dy. Chief Controller of Explosives
उप मुख्य विस्फोटक विभाग
For Chief Controller of Explosives
नागपूर
Nagpur

Copy forwarded to :-

1. The The District Revenue Officer & Additional District Magistrate, Visakhapatnam, VISAKHAPATNAM(Andhra Pradesh) with reference to his NOC No 2897/2010/C6, Dated 20/05/2011.
2. Jt. Chief Controller of Explosives, South Circle Office, CHENNAI. A Copy of the licence along with approved plan is enclosed.
3. Dy. Chief Controller of Explosives, Visakhapatnam, VISAKHAPATNAM. A Copy of the licence along with approved plan is enclosed.

For Chief Controller of Explosives
Nagpur

FORM XV
(see Article 6 of the First Schedule)

1823

LICENCE TO IMPORT AND STORE PETROLEUM IN AN INSTALLATION

Licence No.: P/HQ/AP/15/3852(P250196)

Fee Rs. 11660/- per year

Licence is hereby granted to **M/s. Hetero Drugs Limited (Unit IX), Hetero Corporate, 7-2-A2, Indl. Estate, Sanath Nagar, Hyderabad, District: HYDERABAD, State: TELANGANA, PIN: 500018** valid only for the importation and storage of **744.00 KL** Petroleum of the class(es) and in quantities as herein specified and storage thereof in the place described below and shown on the approved plan No **P/HQ/AP/15/3852(P250196)** dated **20/07/2011** attached hereto subject to the provisions of the Petroleum Act, 1934 and the rule made thereunder and to the further conditions of this Licence.

The Licence shall remain in force till the 31st day of December 2024

Description of Petroleum	Quantity licenced in KL
Petroleum Class A, in bulk	620.00 KL
Petroleum Class A, otherwise than in bulk	NIL
Petroleum Class B, in bulk	124.00 KL
Petroleum Class B, otherwise than in bulk	NIL
Petroleum Class C, in bulk	NIL
Petroleum Class C, otherwise than in bulk	NIL
Total	744.00 KL

July 20, 2011


Chief Controller of Explosives

- 1). Amendment dated - 16/02/2012
- 2). Amendment dated - 23/12/2014

DESCRIPTION AND LOCATION OF THE LICENSED PREMISES

The licensed premises, the layout , boundaries and other particulars of which are shown in the attached approved plan are situated at Plot No: Sy. No. 119/1A to 119/1F, 119/2A to 119/2F, 119/3 & 120/1, 120/2A to 120/2L, NA, N. Narasapuram (v), Nakkapally (m), District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 999999 and consists of Twenty aboveground Petroleum Class A & Four aboveground Petroleum Class B storage tanks together with connected facilities, together with connected facilities.

Licence No. P/HQ/AP/15/3852 (P250196)

SPACE FOR ENDORSEMENT OF RENEWALS

This licence shall be renewable without any concession in fee for ten years in the absence of contravention of any provisions of the Petroleum Act, 1934 or of the rules framed thereunder or of any of the conditions of this licence.

Date of Renewal Date of Expiry of license Signature and office stamp of the licencing authority.

1). 16/02/2012 31/12/2015 Sd/-
T R Thomas

2). 23/12/2014 31/12/2024 Sd/-
R.P.Singh
Dy. Chief Controller of Explosives
For Chief Controller of Explosives
Nagpur

This licence is liable to be cancelled if the licensed premises are not found conforming to the description given on the approved plan attached hereto and contravention of any of the rules and conditions under which this licence is granted and the holder of this licence is also punishable for the first offence with simple imprisonment which may be extend to one month, or with fine which may extend to one thousand rupees, or with both and for every subsequent offence with simple imprisonment which may extend to three months, or with fine which may extend to five thousand rupees or with both.



भारत सरकार

Government of India

मार्गीन और उपाय मंत्रालय

मेट्रोलियम तथा विस्फोटक सुरक्षा संगठन (पैसो)
Petroleum & Explosives Safety Organisation (PESO)
पौधा तल, प-व्हाल, लैप्टो बोर्डर्स कॉम्प्लेक्स, सेमिनरी हिंज
नगपूर - 440006
5th Floor, A-Block, CGO Complex, Seminary Hills,
Nagpur - 440006

SPEED POST

Ministry of Commerce & Industry

मेट्रोलियम तथा विस्फोटक सुरक्षा संगठन (पैसो)

Petroleum & Explosives Safety Organisation (PESO)

पौधा तल, प-व्हाल, लैप्टो बोर्डर्स कॉम्प्लेक्स, सेमिनरी हिंज

नगपूर - 440006

5th Floor, A-Block, CGO Complex, Seminary Hills,

Nagpur - 440006

E-mail : explosives@explosives.gov.in

Phone/Fax No : 0712-2510248, Fax-2510577

संख्या /No. : P/HQ/AP/15/3863 (P260194)

दिनांक /Dated : 02/02/2015

54 FEB 2015

संगठन में /To,

M/s. M/s. Hetero Labs Ltd., (Unit IX),
Hetero Corporate, 7-2-A2,,
Indi Estate, Saneth Nagar,
Hyderabad,
District: HYDERABAD,
State: TELANGANA
PIN: 500018

विषय /Subject: Plot No. Sy. No. 119/1A to 119/1F, 119/2A to 119/2F, 119/3 & 120/1, 120/2A to 120/2L, NA, N.Narasapuram (v), Nakkapalle, Taluka: Nakkapalle, District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 599999 में स्थित पेट्रोलियम कारो A,B अपाराधिक - पेट्रोलियम नियम 2002 के अनुरूप एवं XV में जारी अनुशासि से P/HQ/AP/15/3863 (P260194) - तरीके से रद्द करने में।

Existing Petroleum Class A,B Installation at Plot No. Sy. No. 119/1A to 119/1F, 119/2A to 119/2F, 119/3 & 120/1, 120/2A to 120/2L, NA, N.Narasapuram (v), Nakkapalle (m), Nakkapalle, Taluka: Nakkapalle, District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 599999. Licence No. P/HQ/AP/15/3863 (P260194) - granted in form XV under Petroleum Rules 2002 - Amendment regarding

मर्दोदय /Sir

(s).

कृपया आपके अनुरूप विषय से संबंधित पर तब्दीय Explo/Petro/Unit-IX/03/2014-15 दिनांक 26/12/2014 का रद्द करना चाहे।
Reference to your letter No. Explo/Petro/Unit-IX/03/2014-15 dated 26/12/2014 on the above subject.

दिनांक 31/12/2024 तक वैध अनुशासि संख्या P/HQ/AP/15/3863 (P260194) दिनांक 02/02/2015 दिनांकित कारो एवं आवासी में पेट्रोलियम बंडरपा के लिए यथा संशोधित कर इस पर के साथ लाठार्ड जा रही है।
Licence No. P/HQ/AP/15/3863 (P260194) dated 02/02/2016 valid upto 31/12/2024 is returned herewith duly amended with respect to Lay out Amendment.

पेट्रोलियम का विवरण /Description of Petroleum

विलोक्तीतरी में अनुशासि कारणा /Quantity licenced in KL

कारो का प्रमुख पेट्रोलियम /Petroleum Class A, in bulk	328.00 KL
कारो का प्रमुख पेट्रोलियम से अन्य /Petroleum Class A, otherwise than in bulk	NIL
कारो वा प्रमुख पेट्रोलियम /Petroleum Class B, in bulk	112.00 KL
कारो वा प्रमुख पेट्रोलियम से अन्य /Petroleum Class B, otherwise than in bulk	NIL
कारो वा प्रमुख पेट्रोलियम /Petroleum Class C, in bulk	NIL
कारो वा प्रमुख पेट्रोलियम से अन्य /Petroleum Class C, otherwise than in bulk	NIL

कुल कारणा /Total 840.00 KL

कृपया याची है।

Please acknowledge the receipt.

Note : Your Balance Amount with the Organisation is Rs 1000/- which will be used for processing of the same Licence in future.

अपर्याप्त /Yours faithfully,

(श.र.पी.सिंह)
(R.P.Singh)
उप मुख्य विस्फोटक नियंत्रक
Dy. Chief Controller of Explosives
उप मुख्य विस्फोटक नियंत्रक
For Chief Controller of Explosives
नगपूर
Nagpur

For Chief Controller of Explosives
Nagpur

Copy forwarded to :-

1. The District Revenue Officer & Additional District Magistrate, Visakhapatnam, VISAHKAPATNAM (Andhra Pradesh) with reference to his NOC No 2898/2010/C6 Dated 20/05/2011
2. Dy. Chief Controller of Explosives, South Circle Office, CHENNAI. A Copy of the licence along with approved plan is enclosed.
3. Dy. Chief Controller of Explosives, Visakhapatnam, VISAHKAPATNAM. A Copy of the licence along with approved plan is enclosed.

FORM XV
(see Article 6 of the First Schedule)

69

LICENCE TO IMPORT AND STORE PETROLEUM IN AN INSTALLATION

Licence No. : P/HQ/AP/15/3853(P250194)

Fee Rs. 7100/- per year

Licence is hereby granted to M/s. M/s. Hetero Labs Ltd., (Unit IX), Hetero Corporate, 7-2-A2,, Indl. Estate, Sanath Nagar, Hyderabad, District: HYDERABAD, State: TELANGANA, PIN: 500018 valid only for the importation and storage of 440.00 KL Petroleum of the class(es) and in quantities as herein specified and storage thereof in the place described below and shown on the approved plan No P/HQ/AP/15/3853(P250194) dated 20/07/2011 attached hereto subject to the provisions of the Petroleum Act, 1934 and the rule made thereunder and to the further conditions of this Licence.

The Licence shall remain in force till the 31st day of December 2024

Description of Petroleum	Quantity licenced in KL
Petroleum Class A, in bulk	328.00 KL
Petroleum Class A, otherwise than in bulk	NIL
Petroleum Class B, in bulk	112.00 KL
Petroleum Class B, otherwise than in bulk	NIL
Petroleum Class C, in bulk	NIL
Petroleum Class C, otherwise than in bulk	NIL
Total	440.00 KL

July 20, 2011

Chief Controller of Explosives

- 1) Amendment dated - 16/02/2012
- 2) Amendment dated - 02/02/2015

DESCRIPTION AND LOCATION OF THE LICENSED PREMISES

The licensed premises, the layout , boundaries and other particulars of which are shown in the attached approved plan are situated at Plot No: Sy. No. 119/1A to 119/1F, 119/2A to 119/2F, 119/3 & 120/1, 120/2A to 120/2L, NA, N.Narasapuram (v), Nakkapally (m), Nakkapalle, Taluka: Nakkapalle, District: VISHAKHAPATNAM, State: Andhra Pradesh, PIN: 999999 and consists of Twenty Four aboveground Petroleum Class A & Two aboveground Petroleum Class B storage tanks together with connected facilities. together with connected facilities.

Licence No. P/HQ/AP/15/3853 (P250194)

SPACE FOR ENDORSEMENT OF RENEWALS

This licence shall be renewable without any concession in fee for ten years in the absence of contravention of any provisions of the Petroleum Act, 1934 or of the rules framed thereunder or of any of the conditions of this licence.

Date of
RenewalDate of
Expiry of licenseSignature and office stamp of the
licensing authority.

- 1). 16/02/2012 31/12/2017 Sd/-
T R Thomas
- .2). 23/12/2014 31/12/2024 Sd/-
R.P.Singh
Dy. Chief Controller of
Explosives
For Chief Controller of
Explosives
Nagpur

This licence is liable to be cancelled if the licensed premises are not found conforming to the description given on the approved plan attached hereto and contravention of any of the rules and conditions under which this licence is granted and the holder of this licence is also punishable for the first offence with simple imprisonment which may be extend to one month, or with fine which may extend to one thousand rupees, or with both and for every subsequent offence with simple imprisonment which may extend to three months, or with fine which may extend to five thousand rupees or with both.



Government of India
मानव और संग्रहीत
Ministry of Commerce & Industry
पेट्रोलियम और अन्य विद्युतीय संसाधनों का विभाग
Petroleum & Explosives Safety Organisation (PESO)
विश्वासी, उत्तम, विश्वासी, विश्वासी
ठाणे-440066
5th Floor, A-Block, CGO Complex, Sanitary Hills,
Nagpur - 440005



E-mail: explosives@explosives.gov.in
Phone/Fax No : 0712 - 2818245, Fax-2810577

Date/Dated : 26/10/2016

स्पीड पोस्ट SPEED POST

Ref. No. : PIHQAPM154097 (P321361)

To/To,

Mrs. Honour Lab Chelladi - Unit - III,
K. No. 8-3-160/7M, Helene House, Erragadda,
Hyderabad,
District: HYDERABAD,
State: TELANGANA.
PIN: 500002

26 OCT 2016

Re/Re:

Bureau No. 128 & 138, Hetero Infrastructure SEZ Limited, N. Narasapuram, Taluk: Nekkappally, District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 531001 Grant of A,B or otherwise approved under Class A,B installation of Survey No. 128 & 138, Hetero Infrastructure SEZ Limited, N. Narasapuram, Taluk: Nekkappally, District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 531001 Grant of Licence regarding.

Re/Re/Br/Br/

प्रधानमंत्री वर्षाकालीन HONOUR-HIMSEOPETRO/2016-17 दोष 01/10/2016 का सम्बोधन है।
Please refer to your letter No. HONOUR-HIMSEOPETRO/2016-17 dated 01/10/2016

प्रधानमंत्री वर्षाकालीन HIMSEOPETRO/2016-17 दोष 01/10/2016 का सम्बोधन No. PIHQAPM154097 (P321361) का दोष 24/10/2016 का रिकॉर्ड
Licence No. PIHQAPM154097 (P321361) dated 24/10/2016 granted in Part XV under the Petroleum Rules, 2002 and valid till 31/12/2025 for the storage of the following kinds and quantities of Petroleum at the subject installation is forwarded herewith.

पेट्रोलियम की प्रकार/Description of Petroleum	रजिस्ट्रेशन की मात्रा/Quantity licenced in KL
पेट्रोलियम की प्रकार/Petroleum Class A in bulk	185.00 KL
पेट्रोलियम की प्रकार/Petroleum Class A, otherwise than in bulk	NIL
पेट्रोलियम की प्रकार/Petroleum Class B in bulk	22.00 KL
पेट्रोलियम की प्रकार/Petroleum Class B, otherwise than in bulk	NIL
पेट्रोलियम की प्रकार/Petroleum Class C in bulk	NIL
पेट्रोलियम की प्रकार/Petroleum Class C, otherwise than in bulk	NIL
कुल क्षमता/Total Capacity	
220.00 KL	

प्रधानमंत्री की 2002 के विधि में अन्तिम तिथि 148 से बाहर रहने के बाद जल्दी से जल्दी इसका रद्द करना चाहिए तो रद्द करने की आवश्यकता आवाहन की गई है। By. Chief Controller of Explosives, Visakhapatnam द्वारा की गई है।
Please follow the procedure strictly as laid down in rule 148 of the Petroleum Rules, 2002 and submit complete documents for the Rendition of the Licence to Dy. Chief Controller of Explosives, Visakhapatnam, so as to reach His office on or before the date on which Licence expires.

एस.पी.ओ. का नियम अनुसार इसका रद्द करना अनिवार्य है ताकि इसका उपयोग नहीं किया जा सके।

This approval/permission, however, does not absolve from obtaining necessary permission/clearance from other authorities or under other statutes as applicable.
Note : Your Balance Amount with the Organisation is Rs.30000, which will be used for processing of the same licence in future.

मेरा/Your faithfully,

(Name)
J. Sankar
Controller of Explosives
पेट्रोलियम का विभाग
For Chief Controller of Explosives
Nagpur

For Chief Controller of Explosives
Nagpur

ग्रन्थ XV
(प्रथम अधिकार का अनुच्छेद ६ से लिया)

FORM XV
(see Article 6 of the First Schedule)

अधिकारीद्वारा देशोंस्थित के आवास और स्टोरेज के लिए अनुमति
LICENCE TO IMPORT AND STORE PETROLEUM IN AN INSTALLATION



संख्या सं. (Licence No.): P/HQ/AP/15/4097(P321361)

M/s. Honour Lab Limited - Unit - III, H. No. 8-3-166/7/1, Hetero House, Erragadda, Hyderabad, District: HYDERABAD, State: TELANGANA, PIN: 500018 के निम्नलिखित कार्यालयों में ऐडोलियम के आवास और स्टोरेज के लिए अनुमति

Licence is hereby granted to M/s. Honour Lab Limited - Unit - III, H. No. 8-3-166/7/1, Hetero House, Erragadda, Hyderabad, District: HYDERABAD, State: TELANGANA, PIN: 500018 valid only for the importation and storage of 220.00 KL Petroleum of the class and quantities as herein specified and storage thereof in the place described below and shown on the approved plan No P/HQ/AP/15/4097(P321361) dated 24/10/2016 attached hereto subject to the provisions of the Petroleum Act, 1934 and the rule made thereunder and to the further conditions of this Licence.

एवं अनुमति 31st day of December 2025 तक प्रभुत्वरता है।

The Licence shall remain in force till the 31st day of December 2025

ऐडोलियम का विवर /Description of Petroleum	अनुमति का मात्रा (लिंगोलर्ड ३) /Quantity licenced in KL
वर्षा अनुबंध ऐडोलियम /Petroleum Class A, in bulk	188.00 KL
वर्षा अनुबंध ऐडोलियम से अन्य /Petroleum Class A, otherwise than in bulk	NIL
वर्षा अनुबंध ऐडोलियम /Petroleum Class B, in bulk	22.00 KL
वर्षा अनुबंध ऐडोलियम से अन्य /Petroleum Class B, otherwise than in bulk	NIL
वर्षा अनुबंध ऐडोलियम /Petroleum Class C, in bulk	NIL
वर्षा अनुबंध ऐडोलियम से अन्य /Petroleum Class C, otherwise than in bulk	NIL
	220.00 KL

October 24, 2016

[Signature]
For Chief Controller of Explosives
HQ, Nagpur

DESCRIPTION AND LOCATION OF THE LICENSED PREMISES

अनुमति दीवार का विवरण अवधि अनुमति नं. १२५ & १३८, Hetero Infrastructure SEZ Limited, N. Narasapuram, Taluka: Nakkapally, District: VISAKHAPATNAM, राज्य: Andhra Pradesh, PIN: 531081 अवधि अनुमति १८ अवधि अनुमति १८ Above Ground tank(s) for CLASS A, 2 Above Ground tank(s) for CLASS B, संस्थानित है।

The licensed premises, the layout, boundaries and other particulars of which are shown in the attached approved plan are situated at Survey No: 125 & 138, Hetero Infrastructure SEZ Limited, N. Narasapuram, Taluka: Nakkapally, District: VISAKHAPATNAM, State: Andhra Pradesh, PIN: 531081 and consists of 18 Above Ground tank(s) for CLASS A, 2 Above Ground tank(s) for CLASS B, together with connected facilities.

**HETERO INFRASTRUCTURE SEZ LIMITED****NOISE LEVEL MONITORING****LOCATION: ETP****DATE: 13.10.2023****FREQUENCY: MONTHLY**

S. No.	Location	TLV dBA	Day time reading		Night time reading		Remarks
			Ground floor	First floor	Ground floor	First floor	
1	Cooling tower	85 dBA	78	--	74	--	
2	ATFD	85 dBA	79	75	75	75	
3	Vacuum Pump	85 dBA	78	--	77	--	
4	Air Blower (Aerator)	85 dBA	86	--	81	--	Use ear plug
5	Air Blower (Guard Pond)	85 dBA	85	--	82	--	Use ear plug
6	RO Plant	85 dBA	76	--	75	--	
7	STP	85 dBA	64	--	60	--	
8	Scrap Yard	85 dBA	64	--	52	--	
9	De-toxification yard	85 dBA	65	--	51	--	
10	East Compound wall	85 dBA	50	--	48	--	
11	North Compound wall	85 dBA	69	--	67	--	
12	West Compound wall	85 dBA	68	--	63	--	

Done By: C. JayDate : 13/10/23Checked By: S. SreejithDate : 13/10/23



HETERO INFRASTRUCTURE SEZ LIMITED

NOISE LEVEL MONITORING

LOCATION: ETP

DATE: 16.11.2023

FREQUENCY: MONTHLY

S. No.	Location	TLV dBA	Day time reading		Night time reading		Remarks
			Ground floor	First floor	Ground floor	First floor	
1	Cooling tower	85 dBA	77	--	74	--	
2	ATFD	85 dBA	78	73	74	73	
3	Vacuum Pump	85 dBA	76	--	77	--	
4	Air Blower (Aerator)	85 dBA	85	--	82	--	Use ear plug
5	Air Blower (Guard Pond)	85 dBA	85	--	81	--	Use ear plug
6	RO Plant	85 dBA	74	--	73	--	
7	STP	85 dBA	65	--	61	--	
8	Scrap Yard	85 dBA	64	--	45	--	
9	De-toxification yard	85 dBA	64	--	45	--	
10	East Compound wall	85 dBA	52	--	48	--	
11	North Compound wall	85 dBA	67	--	65	--	
12	West Compound wall	85 dBA	66	--	63	--	

Done By: C. T. S.

Date : 16/11/23

Checked By: C. A. S.

Date : 16/11/23

**GOVERNMENT OF ANDHRA PRADESH
WATER RESOURCES DEPARTMENT**

ANNEXURE-XIV

From,
Sri B.Sreenivasa Rao, B.E
Executive Engineer, W.R Dept
Visakhapatnam Division,
Visakhapatnam

To,
M/s Hetero Infrastructure SEZ Ltd.,
M. Narasapuram (V)
Nakkapalli (M)
Anakapalli District

Letter No. 622AM **EE/ID/VSP DB/ATO /File No.** 10 -07-2023.

Gentlemen,

Sub:- W.R Dept - Nakkapalli(M)– Ch.Lakshmiapuram(V) Representation received from M/s Hetero Infrastructure SEZ Ltd., Technical Suggestions for strengthening and permission for Drawl of water from the Natural canal–Submission of detailed Report with recommendations for according permission-Regarding

**Ref:- 1)Hetero Infrastructure SEZ Ltd., Lr No HIS/EHS/Irrigation /2022-23/02
 2)Dy EE YLM Sub – Division YLM Lr No 134E Dated 05-07-2023**

X-X-X-

In the reference to the 1st cited, the M/s Hetero Infrastructure SEZ Ltd., of N. Narasapuram (V) of Nakkapalli (M) of Anakapalli District has put in a represented for drawl of wats from the Naturall canal.

In the reference 2nd cited, the Dy Executive Engineer, Yellamanchilli Sub – Division Yellamanchilli has reported that the site was inspected along with filed staff. During the inspection it is observed that the natural canal is following adjust to the company connecting to the upputeru tank which is finally joint in Bay of Bengal through dondawaka jetty/ gedda at Dondawaka (V) in Nakkapalli Mandal Anakapalli District duly following consitions as noted below.

- 1) Strengthening the existing canal should be done by the company as it is oriented by the company in and around the company, it should not be occupied by the company or its bunds used for the sole benefit of the company, if any construction are already made on the canal, it should not cause any obstruction to the free flow of water under any circumstances.
- 2) The rerouted canal formed should confirm our irrigation source continuity as feeder to upputeru cheruvu from upper reach water sources.
- 3) Necessary protection arrangements like canal lining are to be provided to the canal to with stand against the scouring action.
- 4) The suggestions does not confer any right to use the land other than which the suggestion is sought and should not encroach the channel in any way in what so ever manner or does not confirm any unauthorized occupation of Government land.
- 5) The canal maintenance such as jungle clearance and silt removal to be attended periodically with the presence of section officer of this department.

P.T.O

It is advised for drawal / collecting of water from the natural canal may not be permitted and it is advised to utilize surface water available in your boundary premises, without disturbing the existing canal.

- 7) If any legal complications or objections arise from public in future, the applicant has to bear the soul responsibility as per final verdicts of the court.
- 8) This permission may be cancelled automatically when the above conditions are violated.
- 9) The Water resources department has got full rights to cancel the permission in full or some part of the permission without assigning any reasons or issue of any prior notice.

Yours Sincerely


Executive Engineer, W.R.Dept
Visakhapatnam Division, Visakhapatnam


10/7/23

**FEASIBILITY REPORT
ON
NEW EFFLUENT TREATMENT PLANT
(1.2 MLD CAPACITY)**

AT



M/S HETERO INFRASTRUCTURE SEZ LTD

N.Narasapuram Village, Nakkapalli Mandal
Visakhapatnam Dist -531081
Andhra Pradesh

PREPARED BY



Flat No. 4K, B-Block, Jain Srikanth Auroville,
Near 'N' Convention, Madhapur
Hyderabad – 500 081
Website: www.greentekindia.in, email: info@greentekindia.in

PREAMBLE

The Management of HETERO INFRASTRUCTURE SEZ Limited has assigned M/s Greentek Environmental Private Limited, Hyderabad to prepare Feasibility Report of the proposed 1.2 MLD new Effluent Treatment Plant.

The team of M/s Greentek Environmental Private Limited visited the site of M/s HETERO Infrastructure SEZ Limited and interacted with Mr. S. Kullayi Reddy, Associate Vice President-EHS and his team to collect the data related to proposed Effluent Treatment Plant like Characteristics of Effluents (both inlet & outlet), technical details of Stripper/MEE/ATFD, Site Conditions etc.

This feasibility report consists of the operations of the various units of ETP, details of the mechanical equipments, Layout of the proposed ETP and the process flow diagram and has been prepared to meet the statutory requirements of M/s Hetero Infrastructure SEZ Ltd.

This Report is duly acknowledged by the AVP-EHS of M/s Hetero Infrastructure SEZ Ltd on 10th September 2022.

For Greentek Environmental Pvt. Ltd



G. Balarama Krishna
Director

Received
10/09/2022

HETERO INFRASTRUCTURE
SEZ
M/s. N. Narla Apurva & Sons

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Chapter -1

INTRODUCTION

Hetero is a globally renowned vertically integrated pharmaceutical company engaged in research and development, manufacturing and marketing of high-quality chemical and biologic medicines across diverse therapeutic areas. Backed by 27+ years of expertise in the pharmaceutical industry, Hetero's strategic business areas spread across APIs, Global Generics, Biosimilars and Custom Pharmaceutical Services. The company is among the largest producers of Active Pharmaceutical Ingredients (APIs) in the world.

M/s Hetero, Hyderabad is operating the Industrial Estate (Both SEZ and Non-SEZ) exclusively for its own group of companies for manufacturing of Bulk Drugs (Active Pharmaceutical Ingredients) and its intermediates at Sy. No: 215,286/1, 286/2, 283/1 of Ch.Lakshmipuram village, 312/1 to 312/5, 312/10 to 312/12, 313/1 to 313/7 of Rajayyapeta village, 19(P) & 20 of Peda teenerla village, 117/1 to 117/3,119/1, 119/2, 120/1,120/2, 126, 129/1 to 129/9, 142, 150, 151 of N.Narasapuram Village of Nakkapalli Mandal Visakhapatnam District spread in an area of about 500 Acres. This facility is designed to meet the best global standards for an API facility and to meet the growing demands of Bulk Drugs worldwide.

The SEZ is surrounded by open lands in the south direction, open land in the east and north direction, and road connecting Upamaka with Rajayyapeta in the west direction. The NH5 is in the north direction at distance of 4 km. The nearest railway station is at Narsipatnam at a distance of 9 km in the north direction. The airport is located at a distance of 70 km in the northeast direction at Visakhapatnam. The Bay of Bengal is on the south-eastern side at 1.2 km. The area is drained by Varaha River at north in 13 km and by Tandava River at southwest in 14 km. At present the following units are in operation at the facility:

- M/s Hetero Labs Ltd., Unit-III (Non SEZ)
- M/s Hetero Labs Ltd., Unit-IX (SEZ)
- M/s Hetero Drugs Ltd., Unit-IX (SEZ)
- M/s Honour Lab Ltd., Unit-III (SEZ)
- M/s Hetero Infrastructure SEZ Ltd. (SEZ & Developer)

M/s Hetero has invested about Rs. 1500 Crores for setting up of industries and developed common infrastructure facilities like Water Treatment plants, Boilers, Effluent Treatment Plants, Sewage Treatment Plant, Hazardous waste storage area, Scrap yard, parking facilities, Roads & drains etc for meeting the requirement of the above-mentioned units in the premises of M/s Hetero Infrastructure SEZ Ltd.

At present, the Industry is having 550 KLD Effluent Treatment plant consisting of Pre-treatment, Strippers, Multiple Effect Evaporators, Dual stage Biological Treatment based on Activated Sludge process and Guard Ponds with Marine Disposal facility.

The Industry is going for Expansion of its unit M/s Hetero Labs Ltd, Unit-III due to market trends and hence proposed to install 1.2 MLD Effluent Treatment Plant for the treatment of effluents generated from the unit.

Chapter-2

DESIGN DETAILS OF THE EFFLUENT TREATMENT PLANT

Design Basis: The plant is designed based on the following characteristics of Effluent

Table-1
Characteristics of Raw Effluent (Inlet of Equalization Tanks)

S.No	Parameter	Unit	HTDS	LTDS
1	pH	--	4 - 6	7.0
2	Biochemical Oxygen Demand (BOD)	ppm	14000	2000
3	Chemical Oxygen Demand (COD)	ppm	25000	4000
4	Total Suspended Solids (TSS)	ppm	2500	< 1500
5	Total Dissolved Solids (TDS)	ppm	25000	< 6000
6	Oil & Grease	ppm	30	NIL
7	Ammonical Nitrogen	ppm	2000	<100
8	Flow	KLD	950	250

Note: Total effluent is proposed to treat in Stripper, MEE, ATFD followed by Biological Treatment & Disposal to Sea through Guard Ponds.

Table-2
Characteristics of MEE Condensate

S.No	Parameter	Unit	MEE Condensate
1	pH	--	7 – 7.5
2	Biochemical Oxygen Demand (BOD)	ppm	5000
3	Chemical Oxygen Demand (COD)	ppm	10000
4	Total Suspended Solids (TSS)	ppm	< 200
5	Total Dissolved Solids (TDS)	ppm	< 1000
6	Oil & Grease	ppm	<5
7	Ammonical Nitrogen	ppm	<500
8	Flow	KLD	950

Note: The Condensate of MEE, ATFD and LTDS effluent after pre-treatment is proposed to be mixed in the Intermediate Tank before subjected to Biological Treatment.

The Characteristics of effluents after mixing Condensate of MEE/ATFD and LTDS effluent after primary treatment which are considered for the design of the Biological Treatment are shown below:

Table-3
Characteristics of Inlet of Biological Treatment (MEE Condensate + LTDS)

S.No	Parameter	Unit	MEE Condensate + LTDS
1	pH	--	7 – 7.5
2	Biochemical Oxygen Demand (BOD)	ppm	4375
3	Chemical Oxygen Demand (COD)	ppm	8750
4	Total Suspended Solids (TSS)	ppm	< 275
5	Total Dissolved Solids (TDS)	ppm	< 2400
6	Oil & Grease	ppm	--
7	Ammonical Nitrogen	ppm	<850
8	Flow	KLD	1200

Table-4
Expected Treated Effluent Quality (After Biological Treatment)

S. No	Parameters	Unit	Values
1	pH	--	7 – 7.5
2	Biochemical Oxygen Demand (BOD)	ppm	<100
3	Chemical Oxygen Demand (COD)	ppm	<250
4	Total Suspended Solids (TSS)	ppm	< 300
5	Total Dissolved Solids (TDS)	ppm	< 2400
6	Ammonical Nitrogen	ppm	<20
7	Flow	KLD	1200

Note: The above quality of outlet of ETP is achieved subject to the following:

- Plant is strictly operated as per Operation Manual and Instructions
- The output quality is guaranteed subject to the influent quality being within + or – 5 %, of the values given.
- Close Monitoring of parameters of Effluents at different stages is required for getting desired results.

Chapter-3

Effluent Treatment Scheme

The proposed treatment scheme will have the following units:

1. Primary Treatment of Effluent:

- Grit Chamber
- Oil & Grease Removal
- Equalization Tank (04 nos each of one day storage capacity)
- Flash Mixer
- Flocculator
- Clarifier/Tube Settler
- Clarified effluent Tank

2. Thermal Treatment

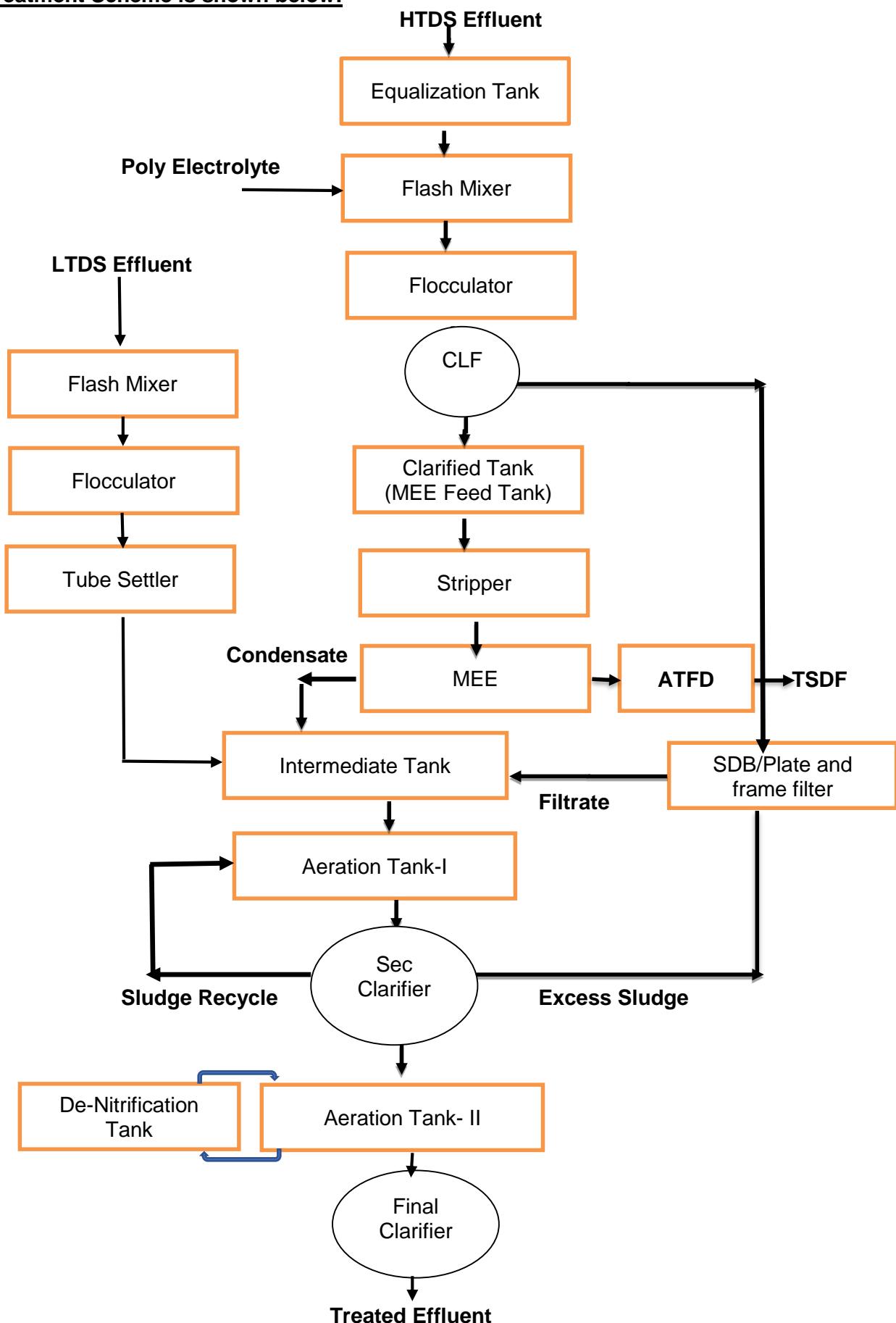
- Stripper (Steam operated)
- Multiple Effect Evaporator (05 Effect)
- Agitated Thin Film Drier

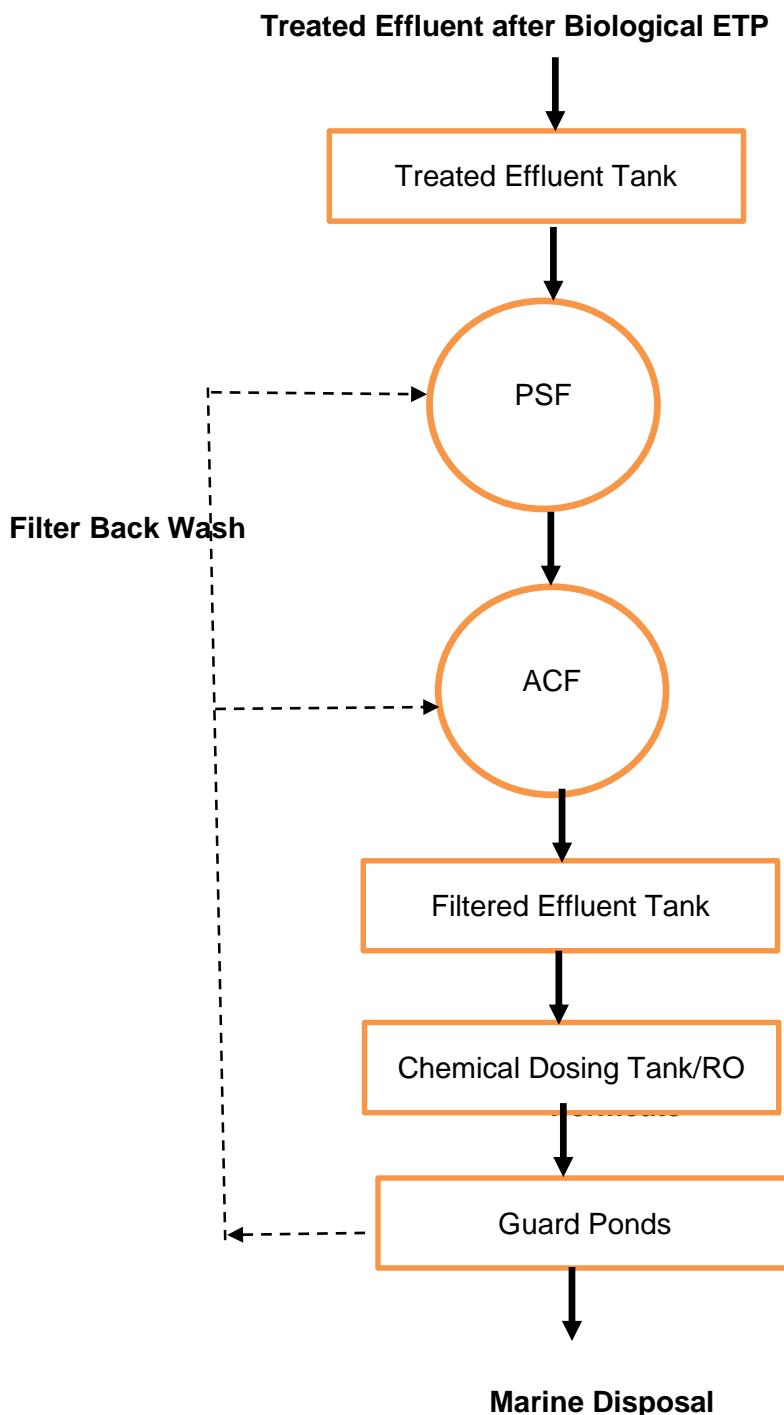
3. Secondary Treatment (Biological Treatment)

- Intermediate Storage Tank
- Aeration Tank -I
- Secondary Clarifier
- Aeration Tank -II
- Final Clarifier
- Sludge Handling Unit (SDB/Filter Press/Belt Press)
- Treated effluent tank

4. Final Treatment

- Pressure Sand Filter
- Activated Carbon Filter
- Filtered treated Effluent Tank
- RO Plant (Optional and can be decided at later stage)
- Guard Ponds
- Marine Disposal System

Treatment Scheme is shown below:




Note: For reducing Phosphate's concentration in the treated effluent, the following treatment system is recommended:

- Lime treatment followed by neutralization or
- RO Plant

Chapter-4

Unit Operations

4.1 Screen Chamber:

Screening devise is used to remove the Coarse solids from the effluent. Coarse solids consist of rags, boards, and other large objects. The primary purpose of the screen is to protect the pumps and other mechanical equipments and to prevent the valves and other appurtenances in the onwards treatment units of effluent treatment plant.

4.2 Grit Chamber:

The effluent of the pharmaceutical industry contains some inorganic solids such as sand, pebbles, chemical sludges and metal fragments. The purpose of grit chamber is to remove these heavier objects from the effluent before entering the effluent into Fat trap. Most of the substances in the grit are abrasive in nature and will cause accelerated wear on pumps and sludge handling equipment with which it comes in contact in the onward treatment units. These solids deposit in the areas of low hydraulic shear in pipes, sumps and clarifiers may absorb grease and solidify. Additionally, these materials are not biodegradable and occupy valuable space in sludge digesters. It is therefore always desirable to separate them from the organic suspended solids.

4.3 Fat Trap/ Scum Removal:

The pharmaceutical/Bulk drug industry effluent contains lot of water immiscible solvents, oils and greases. Some of the chemicals in the wastewater mixes with these solvents and form scum (Floating layer) in the collection tanks of the effluent. The primary function of this chamber is to remove these solvents and oils from the effluent before entering into the Equalization tanks. These substances will cause hinderances in the onward treatment systems by way of improper coagulation & settling in the primary treatment and also causes smell nuisance in the equalization tanks. Also it will obstruct the oxygen transfer into the effluent in the biological treatment of effluent. Hence it is always essential to remove these floating solvents, oils and greases from the effluent for proper treatment in the onward units of ETP.

4.4 Equalization Tanks:

The primary purpose of the equalization tanks is to collect and hold the effluent after Screen, Grit and fat removal for specific time. The effluent of Bulk Drug/pharmaceutical industry is very typical in nature and one cannot assume effluent with uniform characteristics. Hence the effluents of different characteristics will be collected in the tank to equalize the properties of the effluent before sending for onward treatment. Also the effluent will be neutralized in these tanks by addition of either alkali or base depending on the characteristics of the effluent and proper mixing. By way of equalization and neutralization, one can ensure the effective coagulation and sedimentation in the primary treatment and to protect the equipment like stripper, MEE and ATFD.

4.5 Flash Mixer:

A flash mixer is a chamber that contains mechanical stirrer which is designed to ensure fast, thorough mixing of polyelectrolyte and other chemicals/ coagulants with the effluent for the purpose of creating floc. After Screen, Grit and fat removal and equalization & neutralization the effluent treatment really begins at the flash mixer chamber. Here the chemicals/polyelectrolytes are added to the effluent, primarily to aid in coagulation and flocculation. In the flash mixer, the wastewater is agitated violently for a short period of time before being released into the flocculation tank.

4.6 Flocculator:

Flocculator is the chamber where in the fine suspended solids in the effluent form flocs and will be removed from the effluent. The effluent after flash mixer enters the flocculation tank where the floc formation happens spontaneously in the presence of chemicals and gentle agitation. The primary purpose of the flocculator in the effluent treatment plant is to optimize particles coagulation and flocculation prior to settling in the primary clarifier.

The primary function of the flash mixer and flocculator is to remove suspended solids from the effluent to avoid frequent chocking of the equipments Stripper, MEE & ATFD and also to ensure the effective biological treatment.

4.7 Primary Clarifier:

Primary clarifier is the most important unit in the primary treatment of wastewater as the design of primary treatment of effluent is inadequate without primary clarifier. Primary clarifier is a unit operation primarily designed to concentrate and remove suspended solids from the effluent and clear supernatant flows into the MEE Feed tank. This will ensure the effective treatment in Stripper, Multiple effect evaporators and also to avoid frequent chocking of the thermal systems of effluent treatment plant.

4.8 Strippers

Steam stripping is used to remove various organic contaminants from plant wastewater to meet guidelines set by pollution controlling agency. The organics and steam from the top of the column are then condensed and separated using structural packing in the column. The condensed steam/solvent is refluxed to the top of the column. The system is used for treating the high TDS and high COD stream and the effluent is fed to the solvent stripper to minimizing low boiling solvents from the feed of the evaporator by maintaining temperature 90 ± 5 degrees. The low boiling solvent vapor condensed by passing through condensers. Mixed solvent is collected separately in solvent collection vessel.

4.9 Multiple Effect Evaporator (MEE):

Multiple Effect Evaporators are used for the removal of total solids from the effluent to reduce toxicity & COD/BOD levels in the effluent. In MEE the effluent is concentrated from 2-4% solids to 35-40% solids and then the concentrate will be fed to ATFD for removal of solids from the effluent. The condensate of MEE can easily be treated in the Biological Treatment system to meet the required standards prescribed the Pollution Control Board.

A multiple-effect evaporator is an equipment for efficiently using heat from steam to evaporate water. In a multiple-effect evaporator, wastewater is boiled in a sequence of vessels, each held at a lower pressure than the last. Because the boiling temperature of water decreases as pressure decreases, the vapor boiled off in one vessel can be used to heat the next, and only the first vessel (at the highest pressure) requires an external source of heat and thus saves energy and overall operational cost.

4.10 Agitated Thin Film Drier (ATFD):

Agitated Thin Film Dryer is used to dry and collect baggable solids from high TDS effluent that comes out of Multi Effect Evaporator after evaporating the effluent from 2-4% solids to 35-40% solids. The condensate of ATFD will be subjected to Biological Treatment along with MEE Condensate to meet the standards prescribed by SPCB. A typical Agitated Thin Film Drier (ATFD) consists of a tubular heat transfer area with an external heating jacket and a fast-revolving, inner rotor with flexible or rigid wiper elements. The feed product is evenly distributed by the rotor and its wipers over the heating surface, forming a thin liquid film of uniform thickness. This assures excellent heat transfer combined with constant renewal of the product film and provides an even heating and short residence time of the product.

4.11 Intermediate Tank:

The main purpose of the intermediate tank to make the feed to Biological Treatment with uniform characteristics and flow to get optimum results from the Biological Treatment. In this tank the LTDS effluent after primary treatment, MEE Condensate and ATFD condensate are mixed and then fed to biological treatment system. Also the effluent will be cooled by providing air grid in the tank to meet the requirements of biological Treatment as the condensate of MEE&ATFD will be on higher side.

4.12 Aeration Tank-I:

Aeration Tank-I is the first step of a Conventional Activated Sludge (CAS) system and is used to remove BOD from the Effluent. The effluent from intermediate tank will be pumped to the aeration tank-I and in the aeration tank, the wastewater is mixed with air to activate micro-organisms. While digesting the wastewater, the organisms collide with each other, forming larger particles called flocs, which have a larger capacity to degrade the biological components of the wastewater.

The rate at which oxygen is consumed by the microorganisms in the biological reactor is called the oxygen utilization rate. For the activated sludge process, the oxygen utilization rate will always exceed the rate of natural replenishment, thus some artificial means of adding oxygen must be used. Oxygen is supplied by aerating the mixed liquor in the aeration tank. Aeration techniques will be used to inject compressed air into the aeration tank using mechanical mixers to stir the contents violently enough to entrain and distribute air through the liquid.

4.13 Secondary Clarifier:

The aeration basin is followed by a secondary clarifier or settling tank. During this step, the mixed liquor from the aeration tank -I flows into the clarifier and micro-organisms with their adsorbed organic material settle at the bottom of clarifier and the clear supernatant liquid flows into the onward treatment units for further purification.

The surplus micro-organisms can easily be channeled to any of sludge treatment solutions and another part of the micro-organisms is fed back into the aeration tank to keep the load of micro-organisms at a sufficient level for the biological degrading processes to continue.

4.14 Aeration Tank -II (Extended Aeration Tank):

This unit works on the same principle of Aeration tank-I and this tank is mainly used to reduce left over BOD from the effluent after conventional aeration & secondary clarification system. This system helps in meeting the discharge standards of effluent prescribed by the State Pollution Control Board/MoEF&CC/CPCB.

Normally effluent after secondary clarifier with low BOD is fed to Aeration tank- II and this system works under endogenic respiration principle. Higher MLSS concentration will be maintained in the aeration tank as compared to the Aeration tank-I. Oxygen is supplied by aerating the mixed liquor in the aeration tank. Aeration techniques will be used to inject compressed air into the aeration tank using mechanical mixers to stir the contents violently enough to entrain and distribute air through the liquid.

4.15 Final Clarifier:

The aeration tank-II is followed by a final clarifier or settling tank. During this step, the mixed liquor from the aeration tank -II flows into the clarifier and micro-organisms with their adsorbed organic material settle at the bottom of clarifier and the clear supernatant liquid flows into the onward treatment units for further purification.

The surplus micro-organisms can easily be channeled to any of sludge treatment solutions and another part of the micro-organisms is fed back into the aeration tank-II to keep the load of micro-organisms at a sufficient level for the biological degrading processes to continue.

4.16 De-Nitrification Tank:

Excessive usage of nitrogen compounds in various industries, e.g., agricultural, pharmaceutical, dairy or food, contribute to nitrogen pollution. A common method of treating N-pollution is nitrification, followed by denitrification. Biological denitrification enables transformation of oxidized nitrogen compounds by a wide spectrum of heterotrophic bacteria into harmless nitrogen gas with accompanying carbon removal. The liquid from the aeration tank-II is fed to De-nitrification tank where anoxic conditions will be created to convert the ammonical nitrogen into Nitrates & Nitrites to Nitrogen gas. During this process, the bacteria derive their oxygen from the oxygen contained in the nitrate. The nitrogen gas produced is in the form of nitric oxide (NO), nitrous oxide (N_2O) or nitrogen gas (N_2). The net removal of nitrogen is accomplished by stripping the nitrogen gas formed during denitrification out of the wastewater in a subsequent aeration process. The optimum pH range for de-nitrification is 7-8.5 and the DO level to be maintained in the Denitrification process is 0.3 mg/l (Anoxic Conditions).

The process of De-nitrification would enable the industry to meet the standards prescribed by the Board and also to avoid oxygen depletion in the receiving body, reducing the toxicity levels in the treated effluent, eutrophication and methemoglobinemia in the receiving body.

4.17 Treated effluent Tank:

The clear supernatant from the final clarifier flows into the treated effluent tank. The main purpose of this tank is to collect and store the treated effluent for further treatment in Tertiary treatment units.

4.18 Pressure Sand Filter:

The treated effluent from the treated effluent tank is pumped to Pressure sand filter to remove turbidity and suspended particles present in the treated effluent with minimum pressure drop. The Pressure Sand Filter consists of a multiple layer of sand with a variety in size and specific gravity.

In a Pressure Sand Filter, treated effluent is passed through multi layers of filter media consisting graded sand, pebbles and gravels layers. The contaminants in the effluent are captured in the media bed and filtered water passes into the discharge manifold

at the bottom of the tanks. The next and last step is backwashing, a process of effectively removal of captured contaminants from the media bed. After backwashing the filter is rinsed with raw water and after the required quality of water is achieved the filter is put back into service.

4.19 Activated Carbon Filter:

The effluent from the pressure sand filter outlet is then passed through the activated Carbon filter. Activated Carbon Filter is used to adsorb chlorine, organics, tri-halo methane (THM), taste, odour, and colour from treated effluent. Activated carbon is a charcoal that has been treated with oxygen to open up millions of tiny pores between the carbon atoms. Activated carbon filtration is an adsorptive process in which the contaminant is attracted to and adsorbed onto the surface of the carbon particles. The efficiency of the adsorption process is influenced by carbon characteristics (particle and pore size, surface area, density and hardness) and the contaminant characteristics.

4.20 Guard Ponds:

The treated effluent after Activated Carbon filter/RO plant will be pumped to the Guard ponds. The main purpose of these tanks is to collect and store the treated effluent before discharging into the Sea. Marine disposal pumping station is connected to the Guard ponds for pumping the treated effluent into the Sea.

4.21 Sludge Blender and Sludge Thickener:

Sludge Blending and thickening is the primary step in sludge treatment. It allows the solids and excess water to separate properly from the sludge. The main purpose of this stage is to reduce the moisture content in the sludge. The sludge contains a high amount of moisture content; therefore it becomes really necessary to reduce the amount of water content in sludge and thicken and condense it.

Sludge thickening is done by gravity in the thickener. Rotating scraper mechanism is provided to separate the settled sludge and liquid. The settled sludge is then pumped to either Filter Press or Belt press for further dewatering of sludge and drying.

Chapter -5
SIZES AND SPECIFICATIONS OF UNITS

UNIT	SCREEN CHAMBER
Duty	To remove larger particles which are in suspension (if any) from the effluent
Number of Units	02 (01 working and 01 standby)
Size of the unit	2.15m x 1m x 2.4m
MOC	Reinforced Cement Concrete (RCC) with acid proof lining
Provision	Screens with removable arrangement for cleaning purpose.

UNIT	GRIT CHAMBER
Duty	To remove heavy suspended particles from the effluent
Number of Units	02 (01 working and 01 standby)
Size of the unit	2.15m x 5.3m x 2.4m
MOC	Reinforced Cement Concrete (RCC) with acid proof lining
Provision	Drain valve and inlet valve arrangement for cleaning and controlling the flow respectively

UNIT	FAT TRAP
Duty	To remove oil & grease from the effluent. This would also help in removing water immiscible solvents from the effluent
Number of Units	01
Size of each tank	2.15m x 4m x 2.4m
MOC	Reinforced Cement Concrete (RCC) with Acid proof lining
Provision	Fine bubble diffuser for carrying oil & grease to the top of tank and scraper arrangement for removal of accumulated fat on the top of liquid surface

UNIT	EQUALISATION TANK
Duty	<ul style="list-style-type: none"> ➤ For equalizing the effluents of different characteristics and for neutralization. ➤ To avoid shock loading in the subsequent units i.e Pre-treatment & Secondary treatment
Number of Units	04 (02 working and 02 for collection of effluents)
Size of each tank	21.6 m x 15m x 3.5 m SWD + 0.5m FB (1050 KL x 4 Nos)
MOC	Reinforced Cement Concrete (RCC) with Acid proof lining
Provision	<ul style="list-style-type: none"> ➤ Air Grid with blower for Equalizing the Effluents ➤ Hoods and scrubbers for controlling the smell in and around ETP ➤ Flow control arrangement

UNIT	FLASH MIXER (HTDS)
Duty	To mix the effluent & catalyst (Polyelectrolyte) thoroughly for floc formation
Number of Units	02
Size of each tank	1.12m X 1.12m X 2.6m
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Agitator with gear box for thorough mixing ➤ Chemical Dosing system (tanks & dosing pumps) for addition of polyelectrolyte

UNIT	FLOCCULATOR (HTDS)
Duty	To mix effluent to form flocs for separation of suspended matter from the effluent in the subsequent clarification unit
Number of Units	02
Size of each tank	2.3m x 2.3m x 2.4m SWD + 0.9FB
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Agitator with gear box for gentle mixing ➤ Removal of floating matter

UNIT	PRIMARY CLARIFIER
Duty	For separation of suspended matter from the effluent to have clear liquid for subsequent units
Number of Units	02
Size of each tank	8 m dia x 3.5m SWD
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Scraper Mechanism for collection of settled suspended solids to the centre of clarifier. ➤ Sludge pumps for removal of settled sludge from the clarifier. ➤ Feed well and outer well for avoiding foam entry into launder

UNIT	FLASH MIXER (LTDS)
Duty	To mix the effluent & catalyst (Polyelectrolyte) thoroughly for floc formation
Number of Units	02
Size of each tank	1.35m x 1.1m x 2.0m SWD + 0.6FB
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Agitator with gear box for thorough mixing ➤ Chemical Dosing system (tanks & dosing pumps) for addition of polyelectrolyte

UNIT	FLOCCULATOR (LTDS)
Duty	To mix effluent to form flocs for separation of suspended matter from the effluent in the subsequent clarification unit
Number of Units	02
Size of each tank	2.9m x 2.6m x 2.5m SWD + 0.9FB
MOC	Reinforced Cement Concrete (RCC)
Provision	Agitator with gear box for gentle mixing

UNIT	TUBE SETTLER
Duty	For separation of suspended matter from the effluent to have clear liquid for subsequent units
Number of Units	01
Size of each tank	2.85m x 2.4m x 4m
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ UV Stabilized PVC media for settling of solids. ➤ Sludge pumps for removal of settled sludge from the clarifier. ➤ Overflow launder for collection of supernatant Liquid

UNIT	MEE Feed Tank
Duty	For collection and storage of clear effluent from the primary clarifier and to have uniform feed to stripper and MEE.
Number of Units	01
Size of each tank	13.5m x 8m x 3 m SWD + 0.5m FB
MOC	Reinforced Cement Concrete (RCC)
Provision	MEE Feed pumps with necessary flow control arrangement

UNIT	STRIPPER
Duty	For removal of low boiling organics/Solvents from the effluent to reduce COD.
Number of Units	02
Size & Capacity of stripper	1.5m dia X 14 meter Column height Total Height of Stripper -24 m 600 KLD or 30 KL/hour feed each
MOC	Duplex steel or SS-316L
Provision	<ul style="list-style-type: none"> ➤ Reboiler with thermosiphon system with steam line ➤ Structural packing inside the column and ➤ condensate collection and pumping arrangement.

UNIT	MULTIPLE EFFECT EVAPORATOR (MEE)
Duty	For concentration of effluent to the required level in multistage effect evaporator (5 effect or 6 effect)
Number of Units	02
Capacity of MEE	600 KLD or 30 KL/hour feed each
MOC	<ul style="list-style-type: none"> ➤ All contact parts are of SS Ti grade ➤ Shell is of either Duplex steel or SS-316L ➤ Piping in SS-316 L
Provision	<ul style="list-style-type: none"> ➤ Steam and cooling water ➤ Condensate collection and pumping arrangement

UNIT	AGITATED THIN FILM DRIER (ATFD)
Duty	For separation of salts from the concentrated effluent by drying and to make the salts suitable for disposal.
Number of Units	06
Size of unit	30 m ² area each Feed Rate : 2000 – 2500 Litres/hour
MOC	Either Duplex steel or SS-316L
Provision	<ul style="list-style-type: none"> ➤ Steam and cooling water ➤ Condensate collection and pumping arrangement and ➤ Salt collection

UNIT	INTERMEDIATE TANK
Duty	For collection, mixing of MEE Condensate & LTDS effluent and cooling of the effluent to make it suitable for treatment in biological system.
Number of Units	01
Size of each tank	13.5m x 8m x 3.5m Volume: 380 KL
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Air Grid or Coarse Bubble diffusers with air blower for thorough mixing and cooling of effluent ➤ Pumping arrangement of effluent

UNIT	AERATION TANK – I
Duty	To enable degradation of organic matter through biochemical oxidation of the wastewater in presence of atmospheric air.
Number of Units	02
Size	55m x 40m x 6.0 m SWD+ 0.5m FB Volume:13000 KL
MOC	RCC Tank with baffle wall in the tank
Provision	Provision shall be made for installation of triton aerators & working platforms.

UNIT	SECONDARY CLARIFIER
Duty	To enable solid liquid separation
No. of units	02
Size	8 m dia x 3.5 m SWD
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Hopper bottom shall be provided for collecting sludge ➤ Provision shall be made for fixing of Scraper mechanism and overflow launder and ➤ Sludge recirculation pumps

UNIT	DENITRIFICATION TANK
Duty	For removal of Nitrates by way of oxidization of N-compounds
No. of units	01
Size	11.4 m x 11.4m x 5.0 m SWD + 0.5 FB
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Agitators/mixers for mixing of effluents ➤ Provision shall be made for dosing of chemicals for increasing pH. ➤ Pumps for transferring effluent from De-nitrification tank to Aeration Tank-2

UNIT	AERATION TANK – II
Duty	To enable degradation of left over organic matter through biochemical oxidation of the wastewater in presence of atmospheric air after conventional treatment in Aeration Tank-I and secondary Clarifier.
Number of Units	01
Size	63m x 15m x 4.5mSWD + 0.5m FB Volume : 4250 KL
MOC	RCC Tank with baffle wall in the tank
Provision	Provision shall be made for installation of triton aerators & working platforms.

UNIT	FINAL CLARIFIER
Duty	To enable solid liquid separation
No. of units	01
Size	10m x 3m SWD
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Hopper bottom shall be provided for collecting sludge ➤ Provision shall be made for fixing of Scraper mechanism and overflow launder and ➤ Sludge recirculation pumps

UNIT	TREATED EFFLUENT TANK
Duty	To Collect and temporarily store the treated effluent before pumping to filtration
No. of units	01
Size	10m x 15m x 4m SWD+0.5 m FB Volume: 400 KL
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Air grid to keep the treated effluent in aerobic condition. ➤ Pumping arrangement for pumping treated effluent to Filters.

UNIT	SLUDGE BLENDER
Duty	To blend the excess sludge from Primary and secondary clarifiers for dewatering purpose.
No. of units	01
Size	5.5 m x 6 m x 4m SWD + 0.5FB
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Agitator with gear box for gentle mixing ➤ Provision for chemical/polyelectrolyte dosing ➤ Drain provision. ➤ Hydraulic lifting arrangement for Scraper

UNIT	SLUDGE THICKENER
Duty	For separation of Solid and Liquid for thickening of sludge and to remove moisture from the sludge.
No. of units	01
Size	10m dia x 4m SWD
MOC	Reinforced Cement Concrete (RCC)
Provision	<ul style="list-style-type: none"> ➤ Scraper arrangement for separation of solids with hydraulic lifting arrangement ➤ Screw pumps for pumping the settled sludge to filter press or Belt press ➤ Drain provision with pumping arrangement

UNIT	FILTER PRESS or BELT PRESS
Duty	For dewatering and drying of sludge.
Number of Units	04 nos filter press or 02 Nos of Belt Press
Size	Filter press with 32 Plates or Belt press unit
MOC	PP plates with filter cloth for filter press or SS with belt for belt press.
Provision	<ul style="list-style-type: none"> ➤ Provision shall be made for leachate collection and its recycling back to Equalization Tank. ➤ Sludge drying platform for further removal of moisture from the sludge.

UNIT	PRESSURE SAND FILTER
Duty	To remove turbidity and suspended particles present in the treated effluent with minimum pressure drop
Number of Units	02 Nos
Size	03 m Dia and 4-meter height
MOC	MSRL or Stainless Steel.
Provision	<ul style="list-style-type: none"> ➤ Provision shall be made for backwash of the filter ➤ Air provision for backwash

UNIT	ACTIVATED CARBON FILTER
Duty	To adsorb chlorine, organics, tri-halo methane (THM), taste, odour, and colour from treated effluent
Number of Units	02 Nos
Size	2.6 m Dia and 4-meter height
MOC	MSRL or Stainless Steel.
Provision	<ul style="list-style-type: none"> ➤ Provision shall be made for backwash of the filter ➤ Air provision for backwash

UNIT	FILTERED EFFLUENT TANK
Duty	To collect and store treated filtered effluent for further treatment (if required)
Number of Units	01 Nos
Size	8m x 12m
MOC	Reinforced Cement Concrete
Provision	<ul style="list-style-type: none"> ➤ Provision shall be made for air grid or agitator ➤ Pumping arrangement for pumping the effluent to onward treatment units or Guard Ponds

UNIT	GUARD PONDS
Duty	To collect and store treated filtered effluent before discharging into the Sea
Number of Units	04 Nos
Size	Guard Pond-1 : 1920 KL (Existing Pond) Guard Pond-2 : 2400 KL (Existing Pond) Guard Pond-3 : 3000 KL (25m x 30m x 4 m SWD) Guard Pond-4 : 3000 KL (25m x 36m x 4 m SWD)
MOC	Reinforced Cement Concrete
Provision	<ul style="list-style-type: none"> ➤ Provision shall be made for air grid or agitator. ➤ Pumping arrangement for pumping the effluent to Sea. ➤ Provision for connecting the effluent line to online effluent monitoring system. ➤ Locking arrangement for Effluent pipes.

UNIT	RO PLANT or CHEMICAL TREATMENT
Duty	To remove phosphates from the treated effluent
Number of Units	01 Nos
Size	As per the requirement
RO plant (optional)	50 m ³ /hour feed rate
Accessories	All required equipments for the operation of the RO plant

UNIT	INTERCONNECTING PATHWAYS, FOUNDATIONS AND MISC. WORKS
Duty and specifications	<p>To connect the various units of Effluent Treatment Plant, foundations for equipment and other miscellaneous works as required for proper and safe operation of the ETP shall be provided.</p> <p>All walkways and foundations shall be made of RCC. The minimum width of walkway shall be 1.0 m to 1.2 m and railing shall be provided to all the walkways for safety of operating personnel.</p>

UNIT	CONTROL PANELS
Duty and specifications	<p>PCC panel shall be provided for main supply for the plant and 03 Nos of MCC panels shall be provided for safe and easy operation and for the isolation of power during any breakdowns without interrupting other operations.</p> <p>One panel will be provided for primary treatment, one will be for Stripper/MEE/ATFD and one will be provided for Biological Treatment. Isolated MCC panels will also reduce the cost of cables & cable trays.</p>

Chapter-6

STRIPPER/MEE/ATFD

Capacity of Unit : 600 KLD
Operating Hours : 20 hours
No. of Systems : 02 Nos

Detail of the system are as below:

Equipment	Technical Details	Remarks
STRIPPER -01 No		
Stripper		
Dia of Stripper Column	1500 mm	Effluent feed rate: 31200 KL/hour
Height of stripper Column	18 meter	Solvent Recovery rate : 1610 Lt/hour MOC:
No. of Packed beds	04	Shell : SA 240 GR 316
Packing height/ section	02 meter	Packings : SA 240 GR 316
Packing details	SS 316L pal rings and structural packing	Internals : SA 240 GR 316
Reboiler Effective heat transfer area	90 m ²	MOC: Tubes :SA 213 TP 316Ti Tube sheet :SA 240 GR 316 Main shell :SA 240 GR 304 Top & Bottom Dish : SA 240 GR 316
Surface Condenser Effective heat transfer area	80 m ²	MOC: Tubes : SA 213 TP 316 Tube sheet : SA 240 TP 316 Shell : SA 240 TP 304 Side Dish : SA 240 TP 304
Tanks & Vessels Stripper Feed Tank Stripper Bottom Vessel Reflux Drum(Solvent Holding)	01 No 01 No 01 No	MOC SA 240 GR 316
Ancillary Units	<ul style="list-style-type: none"> • Stripper feed pumps • Circulation pumps • Piping & pipe fittings 	Pumps of suitable make & capacity and piping connections as required.

MULTIPLE EFFECT EVAPORATOR – 01 No

(5 effect or 6 effect)

Total Heat transfer area of Calendria (Approx)	2500 m ² (Approx)	MOC Tubes : Ti Gr2 Tubesheet :SA240GR 316+Ti Bonding Main Shell : SA 240 GR 316 Top & Bottom Covers : SS 316 L
Preheaters – 04 or 05 Nos		
Vapour Separators	As required	MOC : SS316 L
Vapour Ducts	As required	MOC :
Process pipes & fittings	As required	Main Duct : SA 312 TP 316
Condensate & non-condensate piping	As required	Fittings : SA 403 GR 316 Flanges : SA 182 F 316
Surface Condensers	01 Nos (250 M ²)	MOC Tubes : SA 213 GR 316 Tube Sheet : SA 240 GR 316

		Main shell, TOP & Bottom Cover: SS304
Ancillary Units	Recirculation pumps	As per the requirement for plant operation
	Vacuum pumps	
	Concentrate Pumps	
	Condensate pumps	
	Temperature Gauges	
	Vacuum Gauges	
	Pressure Gauges	

AGITATED THIN FILM DRIER (ATFD)- 03 NO

Capacity of each ATFD	30 m ²	MOC: Inner Vessel : SA 240 GR 316 Shell : SA 240 GR 316
Surface Condensers	03 Nos	As per the requirement MOC: Tubes : SA 213 TP 316 Tube sheet : SA 240 TP 316 Shell : SA 240 TP 304 Side Dish : SA 240 TP 304
Balance Tanks	As per the requirement	MOC : SS 316
Ancillary Units	Pumps with Motors <ul style="list-style-type: none"> • Feed Pumps • Condensate Pumps • Gear Box with Motor 	As per the requirement
	Cyclone Separator	Duplex Steel
	Vapour Ducts <ul style="list-style-type: none"> • Pipes • Fittings • Flanges 	SA 312 TP 316 SA 403 GR 316 SA 182 F 316
	Blower with Motor	
	Vacuum Gauge	
	Temperature Gauge	

ADDITIONAL REQUIREMENTS

Electrical Panels (As per the requirement)
Automation & instrumentation for operation of the plant with all accessories.
PLC with SCADA arrangement
Electrical Cables (preferably Copper Cables)
Cable Trays (GRP Cable Trays)
Gratings (GRP Gratings)
Structural Steel (Hetero will make foundations upto first floor)

Technical Proposal with complete details of equipments Submitted by M/s Chemin Enviro Systems and Certified by Technical Consultant Mr. Narasimham is enclosed

Chapter – 7

Details of Mechanical Equipments

Details : 1 MLD New Effluent Treatment Plant

S.NO	Name of the Unit	Equipment	Quantity	Technical Details
1	Flash Mixer (Size of tank: 1.2X1.2X2m)	Mixer mechanism with Agitator, Gear Box, Motor and Structural supports	03 Nos	Gear Box: Make : Elecon Gear Ratio : 10:1 Motor: Make : ABB/CG
		Dosing Tanks	06 Nos	MOC : PP/FRP Capacity : 1000 Litres
		Dosing Pump	06 Nos	Make : Sandur Flow : 50 l/hr Pr : 3.5 Bar Motor: Make : ABB/CG
		Agitator with necessary gear box & Motor for dosing tank	06 Nos	Gear Box: Make : Elecon Gear Ratio : 10:1 Motor: Make : ABB/CG
2	Flocculator (Size of tank: 2.5X2.5X2.5m)	Mixer mechanism with Agitator, Gear Box, Motor and Structural supports	03 Nos	Gear Box: Make : Elecon Gear Ratio : 20:1 Motor: Make : ABB/CG
3	Clarifiers (8.0m dia x 3.5m SWD)	Clarifier Mechanism	02 Nos	Gear Box: Make : Elecon Gear Ratio : 128:1 Motor: Make : ABB/CG
		Sludge pumps	04 Nos	Flow : 20 m ³ /hr Head : 30 mtr MOC : SS316 Make : NAGA, KSB, Wilo, Jhonson Motor: Make : ABB/CG
		Valves, Piping & Pipe fittings	Lot	PIPE HDPE 16KG/CM2 2" (63MM): 700mtrs 3" (90MM): 60mtrs 6" (160MM): 36mtrs 8" (200MM): 300mtrs 10" (250MM): 100mtrs BALL VALVE PP 3PC F/E 2": 58 No 3": 15 No 6": 10 No 8": 2 No KNIFE EDGED GATE VALVE SS316 W/F 8"-10 No

				<p>BALL VALVE MOC SS316 3PC F/E 1": 68 No 2": 54 No 3": 18 No PIPE SS316 SMLS A 312 SCH40 1": 60 m 2": 250 m 3": 50 m 4": 60 m 6": 12 m</p> <p>And other related Fittings as per pumps Suction & Delivery Sizes</p>
4	Tube Deck (Size of tank: 3mX3mX3.2m)	Tube Deck Media	15 m ³	<p>PVC UV Stabilized tube deck Specification: Media FS 41.50, Colour: Black, Vertical Height: 1200mm, Angle:60 Deg, Thickness: 1mm MOC: HDPE Make: MM Aqua</p>
		Sludge Pumps	02 Nos	<p>Flow : 20 m³/Hr Head : 30 Mtrs MOC : SS 316 Make : NAGA, KSB, Wilo, Jhonson Motor: Make : ABB/CG</p>
5	Sludge Handling	Filter Press/Belt Press	02 Nos	---
6	Electrical Works	MCC Panel	1 No	To Be Designed with circuit breakers, Feeders, Energy meters, MCB, MCCB and protection devices, etc.
		Cables	Lot	XLPE Armor FRLS Copper 4 Core Cables: 2.5 sqmm: 5000 m 1.5 sqmm: 5500 m 6 sqmm : 1000 m 300sqmm: 700 m
		Cable Trays	Lot	GRP Cable Trays 600mm : 500 m 450mm : 200 m 300mm : 200 m 200mm : 200 m 100mm : 600 m and Required fittings as per the requirement
7	Fat Trap	Scraper for fat removal	02 Nos	Gear Box: Make : Elecon Gear Ratio : 30:1

				With Mechanism Motor: Make : ABB/CG
8	Oil and Grease transfer pumps with motors	8 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 20 m ³ /hr Head: 30 m MOC: SS Motor: Make : ABB/CG
9	Lye transfer pump with motors	2 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 20 m ³ /hr Head: 30 m MOC: SS Motor: Make : ABB/CG
10	Sulphuric Acid transfer pumps with motors	2 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 20 m ³ /Hr Head: 20 Mtrs MOC: MS Motor: Make : ABB/CG
11	Effluent transfer pumps with motors	8 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 50 m ³ /Hr Head: 30 m MOC: CI with PP lining Motor: Make : ABB/CG
12	Equalization tank mix up blower with motors	3 Nos		Make: Everest Flow: 900 m ³ /Hr MOC: CI Motor: Make : ABB/CG
13	LTDS TANK Transfer Pumps with Motor	2 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 20 m ³ /hr Head: 30 Mtrs MOC: SS Motor: Make : ABB/CG
14	Intermediate Tank Transfer Pumps with Motor	2 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 50 m ³ /hr Head: 30 m MOC: SS Motor: Make : ABB/CG
15	MEE Feed Pumps with Motor	4 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 30 m ³ /hr Head: 30 m MOC: SS

				Motor: Make : ABB/CG
16	Intermediate tank mix up blower with motors	3 Nos		Make: Everest Flow: 450 m ³ /Hr MOC: CI Motor: Make : ABB/CG
17	Stripper Condensate transfer pumps with motors	2 Nos		Make : NAGA, KSB, Wilo, Jhonson Flow: 10 m ³ /hr Head: 20 Mtrs MOC: SS Motor: Make : ABB/CG
18	Effluent transfer pumps from Intermediate tank to Aeration Tank-1	2 Nos		Make : KSB, Wilo, Jhonson MOC : SS304 Flow: 50 m ³ /hr Head: 30 m Motor: Make : ABB/CG
19	Aeration Tank-1	Aerators	12 Nos	Make : Triton (Eurotek) HP : 60 HP Motor: Make : ABB/CG
20	Secondary Clarifiers (8m dia)	Clarifier Mechanism	02 Nos	Gear Box: Make : Elecon Gear Ratio : 128:1 Motor: Make : ABB/CG
		Sludge pumps	04 Nos	Flow : 20m ³ /hr Head : 30 mtr MOC : SS316 Make : NAGA, KSB, Wilo, Jhonson Motor: Make : ABB/CG
		Valves, Piping & Pipe fittings	Lot	PIPE HDPE 16KG/CM2 3" (90MM): 100mtrs Piping for Pump Headers BALL VALVE PP 3PC F/E 3": 15 No 6": 6 No PIPE SS316 SMLS A 312 SCH40 8": 60 mtrs And other Fittings as per pumps Suction & Delivery Sizes
21	Denitrification Tank	Agitators/Mixers	02 Nos	Make : Triton (Eurotek) HP : 20 HP Motor: Make : ABB/CG
22	Aeration Tank -2	Aerators	06 Nos	Make : Triton (Eurotek) HP : 60 HP

				Motor: Make : ABB/CG
23	Final Clarifier (10m dia)	Clarifier Mechanism	01 Nos	Gear Box: Make : Elecon Gear Ratio : 128:1 Motor: Make : ABB/CG
		Sludge pumps	02 Nos	Flow : 20m ³ /hr Head : 30 mtr MOC : SS316 Make : NAGA, KSB, Wilo, Jhonson Motor: Make : ABB/CG
		Valves, Piping & Pipe fittings	Lot	PIPE HDPE 16KG/CM2 3" (90MM): 100mtrs Piping for Pump Headers BALL VALVE PP 3PC F/E 3": 15 No 6": 6 No PIPE SS316 SMLS A 312 SCH40 8": 60 mtrs Other Fittings as per pumps Suction & Delivery Sizes
24	Treated Effluent Tank	Pumps	02 Nos	Flow : 50 m ³ /hr Head : 50 mtr MOC : SS304 Make : KSB, Wilo, Jhonson Motor: Make : ABB/CG
		Air Grid	Lot	HDPE pipes, Supports and Valves & fittings as required
25	Sludge Blender	Mixer mechanism with Agitator, Gear Box, Motor and Structural supports	01 Nos	Gear Box: Make : Elecon Gear Ratio : 20:1 Motor: Make : ABB/CG
26	Sludge Thickener	Scraper Mechanism with Hydraulic lifting provision	01 Nos	Gear Box: Make : Elecon Gear Ratio : 128:1 Motor: Make : ABB/CG
		Sludge pumps	02 Nos	Flow : 10m ³ /hr Head : 30 mtr MOC : SS316 Make : Screw pumps Motor: Make : ABB/CG
		Valves, Piping & Pipe fittings	Lot	Pipes, Valves & fittings as per the requirement
27	Guard Ponds	Pumps	02 Nos	Flow : 650 m ³ /hr Head : 50 mtr

				MOC : SS304 Make : KSB, Wilo, Jhonson Motor: Make : ABB/CG
		Piping	Lot	SS 2": 100 m SS 6": 200 m Valves & Fittings: As per Requirement
28	Miscellaneous items		All bought out items as per the requirement during execution of the project.	

N. Narasimham

M.Tech

Consultant

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Bagh Amberpet, Hyderabad-500013

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25th September 2022

S. Kullayi Reddy
Associate Vice President -EHS
Hetero Infrastructure SEZ Ltd
Nakkapalli
Anakapalli Dist

Dear Sir,

Sub : Technical Evaluation of Proposed Stripper, MEE and ATFD – Regarding

Ref : Purchase Order No: 4900212839 dated 30/07/2022

This is to inform you that, I have technically verified all the specifications of Stripper, Multiple Effect Evaporator and ATFD in the final proposal submitted by M/s Chemin Enviro Systems Pvt Ltd dated 20/09/2022 for your upcoming Effluent Treatment Plant.

This is to certify that, M/s Chemin Enviro Systems Pvt Ltd have incorporated all the changes which I have suggested in the initial proposal for the better performance of the system in the final proposal and now the design parameters are as per the requirement.

You can go ahead with the system for your proposed new Effluent Treatment Plant.

Thanking you,

Yours faithfully,



M.Narasimham

Technical Consultant



CHEMIN ENVIRO SYSTEMS PVT. LTD.

Ref : CES/HD/922(F)/2022

Date : 20.09.2022

To

Mr.S.Kullayi Reddy,

Sr.General Manager –EHS,

Hetero Drugs

Dear Sir,

Subject: 600 KLD- Zero Liquid Discharge Systems.

As per the discussions had with you, we have mentioned below technical & commercial details of above mentioned ZLD system based on the revised URS Sheet dated on 05.09.2022.

Reject Concentration & ZLDS

Design Considerations

TDS for our Design	:	25000-40000mg/l
Total Suspended Solid	:	500-1000mg/l
Salt Present	:	Mixed Salt
Total Hardness	:	3000-6000mg/l
COD	:	40000-80000mg/l
BOD	:	20000-50000mg/l
pH	:	7-8

System Offered – Reject Concentration:

- ✓ **Stripper Column and its accessories**
- ✓ **Six Stage Evaporator, to raise concentration from 4.22% to 35%.**
- ✓ **Three Sets of Agitated Thin Film Dryer System, to recover the mixed salt.**

Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC



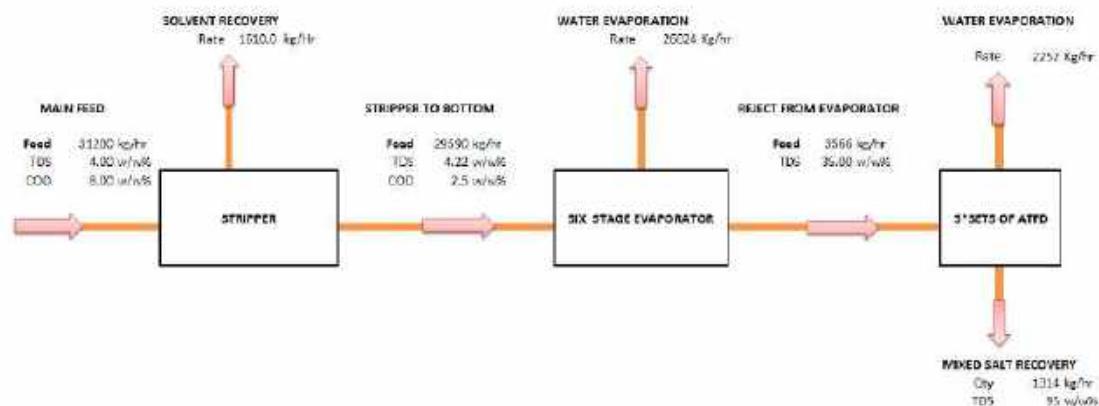
Please find enclosed here with following data

- Basis of Design
- Equipment details which includes Technical Specifications, Material of Construction & Scope of supply
- Battery limits and exclusion
- Terms & Conditions

We wish that our proposal is lined up with your requisite. We now would like to invite your good office to visit our work place and looking forward for encouraging consideration from your side. For further information or clarification, please do not hesitate to contact us.

I. Basis of Design

Mass balance chart for 600KLD ZLDS @ 40000 PPM



Recovered Water Quality:

Parameters	MEE Condensate Quality	ATFD Condensate Quality
TDS	<500 PPM	<1000 PPM
pH	7.5 to 8.5	7.5 to 8.5
COD	Based on Volatile COD Present in the Feed	

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PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





II.Equipment Details

1. Stripper Column

[a].Operating Parameters:

Sl. No.	Particulars	Unit	Technical Details
1.	Solvent Recovery Rate	Kg/hr	1610
2.	Product Feed Rate	Kg/hr	31200
3.	Outlet Rate	Kg/hr	29590
4.	Total Solids in Product Feed	Weight %	4%
5.	Total Solids in Outlet	Weight %	4.22%
6.	Initial COD	Weight %	8%
7.	Cooling Water Inlet Temp.	°C	32
8.	Cooling Water Outlet Temp.	°C	38
9.	Cooling Water Recirculation Rate	m ³ / hr	118
10.	Motive Steam Pressure	Kgf / cm ² (g)	3-4
11.	Motive Steam Consumption	Kg/hr	3936
12.	Plant Power Requirement	Kwh	11.25
13.	Vacuum Pump Power	Kwh	3.75
14.	Cooling Tower Pump Power with Fan	Kwh	18.75
15.	Total Power Installed	Kwh	33.75
16.	Electricity Supply Required	415V, 3Ph, 50Hz, AC	
17.	Operating hours	Hrs / Day	20

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[b]. Material of Construction with Qty

Scope of Supply – Stripper & its accessories		
Stripper Column		
Qty	:	1 No
Flow,m3/hr	:	30
Dia/Column, mm	:	1500
Height of the Stripper Column, mtrs	:	18
Packing Details	:	Packing Bed - 2" SS316L Pall rings & structure packings
MOC of the Shell (Column)	:	SA 240 GR 316L(6mm Thick)
MOC of Internals	:	SA 240 GR 316L
MOC of Packings	:	SA 240 GR 316L
Reboiler		
Qty	:	1 No
Effective heat Transfer Area , Sq.M.	:	90
MOC of the Tubes	:	SA 213 TP 316Ti(Seamless)(1.2mm Thick)
MOC of Tube Sheet	:	SA 240 GR 316L (20mm Thick)
MOC of Main Shell	:	SA 240 GR 304 (5mm Thick)
MOC of Top & Bottom Cover	:	SA 240 GR 316L (5mm Thick)
Tube Details	:	OD-31.75, Height-2mtrs, Total no.of Tubes -450 Nos
Surface Condenser		
Qty	:	1No
Effective heat Transfer Area , Sq.M.	:	80
MOC of the Tubes	:	SA 213 TP 316L(ERW) (1.2mm Thick)

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ASME
PRESSURE VESSEL





CHEMIN ENVIRO SYSTEMS PVT. LTD.

MOC of Tube Sheet	:	SA 240 GR 316L (20mm Thick)
MOC of Main Shell	:	SA 240 GR 304 (5mm Thick)
MOC of Top & Bottom Cover	:	SA 240 GR 304 (6mm Thick)
Tube Details	:	OD-19.05, Height-3mtrs, Total no.of Tubes -446 Nos
Stripper Bottom Vessel		
Qty	:	01 No
MOC of the Shell	:	SA 240 GR 316L
Thickness of the Shell	:	5mm Thick
Volume, KL	:	6.25
Reflux Drum (Solvent Holding)		
Qty	:	01 No
MOC of the Shell	:	SA 240 GR 316L
Thickness of the Shell	:	5mm Thick
Volume, KL	:	0.5
Pumps With Motors		
Feed Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	30
Head,mtrs	:	15
Power in HP/Kwh	:	5/3.75
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole

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PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





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Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Reflux Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	6.5
Head,mtrs	:	20
Power in HP/Kwh	:	5/3.75
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Circulation/Outlet Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	30

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PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





CHEMIN ENVIRO SYSTEMS PVT. LTD.

Head,mtrs	:	20
Power in HP/Kwh	:	5/3.75
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Cooling Tower Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	118
Head,mtrs	:	25
Power in HP/Kwh	:	15/11.25
Motor RPM	:	1450
Motor Efficiency	:	IE3
No.of Poles	:	4 Pole
Seal Type	:	Single Mechanical Seal
Seal Mechanism	:	Silicon Carbide (SiC)
Pump Make	:	Johnson
Motor Make	:	BB/CG
Vacuum Pump		
Qty	:	1 W+1FSB

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





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Pump Type	:	Water Ring Liquid
MOC	:	Cl+CF8
Flow,m3/hr	:	81
Power in HP/Kwh	:	5/3.75
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Pump Make	:	PPI
Motor Make	:	BB(CG)
Pipelines & Fittings		
Process Pipelines		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Schedule of Pipe	:	Sch 10
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Vapour Duct		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Thickness of Pipe	:	5 mm Thick
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L(Chemin Std)
Solvent Outlet Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Schedule of Pipe	:	Sch 10

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ASME
BPE





MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
PHE for Stripper		
Qty	:	1 No
Make	:	Alfalaval/Sondex/Trantor

2. Six Stage Evaporator

[a].Operating Parameters:

Sl. No.	Particulars	Unit	Technical Details
1.	Water Evaporation Capacity	Kg/hr	26024
2.	Product Feed Rate	Kg/hr	29590
3.	Concentrate Outlet Rate	Kg/hr	3566
4.	Total Solids in Product Feed	Weight %	4.22%
5.	Total Solids in Concentrate Outlet	Weight %	35%
6.	Concentrate Outlet Temp.	Around °C	48
7.	Cooling Water Inlet Temp.	°C	32
8.	Cooling Water Outlet Temp.	°C	38
9.	Cooling Water Recirculation Rate	m ³ / hr	380
10.	Motive Steam Pressure	Kgf / cm ²	3-4
11.	Motive Steam Consumption	Kg/hr	5200
12.	Plant Power Requirement	Kwh	309.375
13.	Vacuum Pump Power	Kwh	45
14.	Cooling Tower Pump Power with Fan	Kwh	60
15.	Total Power Installed	Kwh	414.375

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

16.	Electricity Supply Required	415V, 3Ph, 50Hz, AC	
17.	Operating Hours	hrs / day	20

[b]. Material of Construction with Qty

Scope of Supply – Six Stage Evaporators		
Calandria		
Qty	:	6 Nos
Type	:	Forced Circulation
Tube MOC	:	TiGrII Seamless (1 – 1.2mm Thick)
Tube Dia, mm	:	38.1
Tube Height, mtrs	:	9
MOC of the Tube Sheet	:	SA 240 GR 316 with Ti Bonding (25mm Thick)
MOC of Shell	:	SA 240 GR 316L (6mm Thick)
MOC of Top & Bottom Cover	:	SA 240 GR 316L (8mm Thick)
No.of Tubes		Cal-I : 554Nos Cal-II : 536Nos Cal-III : 464Nos Cal-IV : 332Nos Cal-V : 217Nos Cal-VI : 217Nos
Effective Heat Transfer Area,Sq.m		
Calandria-I	:	597Sq.m
Calandria-II	:	577Sq.m

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Calandria-III	:	500Sq.m
Calandria-IV	:	358Sq.m
Calandria-V	:	234Sq.m
Calandria-VI	:	234Sq.m
Total Heat Transfer Area	:	2500Sq.m
Preheater	:	
Qty	:	6 Nos
Type	:	Straight Tube type
Tube MOC	:	TiGrII Seamless (1 – 1.2mm Thick)
Tube Dia, mm	:	31.75
Tube Height, mtrs	:	8.85
MOC of the Tube Sheet	:	SA 240 GR 316 with Ti Bonding (16mm Thick)
MOC of Shell	:	SA 240 GR 316L (Sch 10 Pipe)
MOC of Top & Bottom Cover	:	SA 240 GR 316L (Sch 10 Pipe)
No.of Tubes	:	PHE-I : 12Nos PHE-II : 12Nos PHE-III : 12Nos PHE-IV : 12Nos PHE-V : 12Nos PHE-VI : 12Nos
Effective Heat Transfer Area,Sq.m	:	
Preheater-I	:	10.5Sq.m
Preheater-II	:	10.5Sq.m

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Preheater-III	:	10.5Sq.m
Preheater-IV	:	10.5Sq.m
Preheater-V	:	10.5Sq.m
Preheater-VI	:	10.5Sq.m
Total Heat Transfer Area	:	63Sq.m
Vapour Separator	:	
Qty	:	6 Nos
Type	:	Cylindrical Vertical arrangement
MOC of the Shell	:	SA 240 GR 316L
Thickness of the Shell	:	6mm Thick
Capacity for each Vapour separator , CuM except the duct	:	
Vapour Separator-I	:	14m ³
Vapour Separator-II	:	14m ³
Vapour Separator-III	:	14m ³
Vapour Separator-IV	:	14m ³
Vapour Separator-V	:	14m ³
Vapour Separator-VI	:	14m ³
Surface Condenser	:	
Qty	:	1 No
Type	:	Surface Type (Shell &Tube)
Tube MOC	:	SA 213 TP 316L (1.2mm Thick)
Tube Dia, mm	:	19.05
Tube Height, mtrs	:	9
MOC of the Tube Sheet	:	SA 240 GR 316L(20mm Thick)
MOC of Shell	:	SA 240 GR 316L (5mm Thick)

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MOC of Top & Bottom Cover	:	SA 240 GR 316L (8mm Thick)
Heat Transfer Area,Sq.m	:	250
No.of Tubes	:	464Nos
Balance Tank		
Qty	:	1 No
MOC	:	SA 240 GR 316L
Thickness of Shell,mm	:	5
Volume,KL	:	1.5
Pumps With Motors		
Feed Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	40
Head,mtrs	:	30
Power in HP/Kwh	:	15/11.25
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Condensate Pump		
Qty	:	1 W+1FSB

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	40
Head,mtrs	:	20
Power in HP/Kwh	:	10/7.5
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Recirculation Pump- I		
Qty	:	1 No
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	1000
Head,mtrs	:	9-10
No.Of passes	:	5
Power in HP/Kwh	:	60/45
Motor RPM	:	960
Motor Efficiency	:	IE3
No.of Poles	:	6 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC)

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

		Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Recirculation Pump- II		
Qty	:	1 No
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	1000
Head,mtrs	:	9-10
No.Of passes	:	5
Power in HP/Kwh	:	60/45
Motor RPM	:	960
Motor Efficiency	:	IE3
No.of Poles	:	6 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Recirculation Pump- III		
Qty	:	1 No
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	1000
Head,mtrs	:	9-10
No.Of passes	:	5

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Power in HP/Kwh	:	60/45
Motor RPM	:	960
Motor Efficiency	:	IE3
No.of Poles	:	6 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB(CG)
Recirculation Pump- IV		
Qty	:	1 No
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	1000
Head,mtrs	:	9-10
No.Of passes	:	3
Power in HP/Kwh	:	60/45
Motor RPM	:	960
Motor Efficiency	:	IE3
No.of Poles	:	6 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB(CG)
Common Store Standby Pump only for Recirculation	:	1 No

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

I to IV		
Recirculation Pump- V		
Qty	:	1 No
Pump Type	:	Axial
MOC	:	CF8M (SS316)
Flow,m3/hr	:	1500-1600
Head,mtrs	:	5
No.Of passes	:	1
Power in HP/Kwh	:	60/45
Motor RPM	:	900
Motor Efficiency	:	IE3
No.of Poles	:	6 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Propeller/JEC
Motor Make	:	BB(CG
Recirculation Pump- VI		
Qty	:	1 No
Pump Type	:	Axial
MOC	:	CF8M (SS316)
Flow,m3/hr	:	1500-1600
Head,mtrs	:	5
No.Of passes	:	1
Power in HP/Kwh	:	60/45
Motor RPM	:	900

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Motor Efficiency	:	IE3
No.of Poles	:	6 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Propeller/JEC
Motor Make	:	BB/CG
Common Store Standby Pump only for Recirculation V& VI	:	1 No
Concentrate Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	40
Head,mtrs	:	20
Power in HP/Kwh	:	10/7.5
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
ML Pump		

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	30
Head,mtrs	:	25
Power in HP/Kwh	:	7.5/5.625
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB(CG)
Seal Water Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	30
Head,mtrs	:	30
Power in HP/Kwh	:	10/7.5
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC)

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ASME
BPE





CHEMIN ENVIRO SYSTEMS PVT. LTD.

		Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB/CG
Cooling Tower Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	348
Head,mtrs	:	25
Power in HP/Kwh	:	50/37.5
Motor RPM	:	1450
Motor Efficiency	:	IE3
No.of Poles	:	4 Pole
Seal Type	:	Single Mechanical Seal
Seal Mechanism	:	Silicon Carbide (SiC)
Pump Make	:	Johnson
Motor Make	:	BB/CG
Vacuum Pump		
Qty	:	1 W+1FSB
Pump Type	:	Water Ring Liquid
MOC	:	CI+CF8
Flow,m3/hr	:	1700
Power in HP/Kwh	:	60/45
Motor RPM	:	725
Motor Efficiency	:	IE3
No.of Poles	:	6 Pole

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Pump Make	:	PPI
Motor Make	:	BB/CG
Pipelines & Fittings		
Process Pipelines		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Schedule of Pipe	:	Sch 10
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Vapour Duct		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Thickness of Pipe	:	5mm Thick
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Condensate Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Schedule of Pipe	:	Sch 10
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Non Condensate Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Schedule of Pipe	:	Sch 10
MOC of Fittings	:	SA 403 GR 316L

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Cooling Tower Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	IS2062
Schedule of Pipe	:	C Class
MOC of Fittings	:	IS2062
MOC of Flanges	:	IS2062 (Chemin Std)
Vacuum Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	IS2062
Schedule of Pipe	:	C Class
MOC of Fittings	:	IS2062
MOC of Flanges	:	IS2062 (Chemin Std)
PHE for Vacuum		
Qty	:	1 No
Make	:	Alfalaval/Sondex/Trantor
Seal Water Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes & Fittings	:	UPVC
Schedule of Pipe	:	Sch 40
PHE for Seal Water		
Qty	:	1 No
Make	:	Alfalaval/Sondex/Trantor

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3. Agitated Thin Film Dryer (ATFD)

[a]. Operating Parameters:

Sl. No.	Particulars	Unit	Tech. details
1.	Water Evaporation Capacity	Kg/hr	2252
2.	Product Feed Rate	Kg/hr	3566
3.	Mixed Salt Recovery Rate	Kg/hr	1314 max
4.	Weight percentage of Product Feed	Wt %	35%
5.	Weight Percentage of Concentrate Outlet	Wt %	95%
6.	Salt Outlet Temp.	Around oC	55
7.	Cooling Water Inlet Temp.	oC	32
8.	Cooling Water Outlet Temp.	oC	38
9.	Cooling Water Recirculation Rate	m ³ / hr	223
10.	Motive Steam Consumption	Kg/ hr	3031
11.	Motive Steam Pressure	Kgf / cm ²	3-4
12.	Process Power Required	Kwh	72.75
13.	Cooling Tower Pump Power	Kwh	30
14.	Blower Power	Kwh	16.875
15.	Total Power Installed	Kwh	119.625
16.	Operating Hours	hrs / day	20
17.	Duty	-	Continuous

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[b]. Material of Construction with Qty

Scope of Supply – Agitated Thin Film Dryer		
ATFD		
Qty	:	3 Nos
Type	:	Scrapper Mechanism
Contact Parts MOC	:	Inner Drum: SA 240 GR 316L (6mm Thick) Main Shell : SA 240 GR 316L (8mm Thick)
Jacket MOC	:	SA 240 GR 304 (8mm Thick)
Heat Transfer Area,Sq.m	:	30Sq.m*3 Nos
Cyclone Separator		
Qty	:	3 Nos
Type	:	Conical
MOC of the Shell	:	SA 240 GR 316L
Thickness of the Shell	:	5 mm Thick
Surface Condenser		
Qty	:	3 Nos
Type	:	Surface Type (Shell &Tube)
Tube MOC	:	SA 213 TP 316L (1.2mm Thick)
Tube Dia, mm	:	19.05
Tube Height, mtrs	:	6
MOC of the Tube Sheet	:	SA 240 GR 316L (20mm Thick)
MOC of Shell	:	SA 240 GR 304 (5mm Thick)
MOC of Top & Bottom Cover	:	SA 240 GR 304 (8mm Thick)

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Heat Transfer Area, Sq.m	:	51.6 /each
No.of Tubes	:	96Nos/Each
Balance Tank		
Qty	:	1 No
MOC	:	SA 240 GR 316L
Thickness of Shell, mm	:	5
Volume, KL	:	1.5
Pumps With Motors		
Feed Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	8
Head,mtrs	:	15
Power in HP/Kwh	:	3/2.25
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB(CG)
Condensate Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

MOC	:	CF8M (SS316)
Flow,m3/hr	:	8
Head,mtrs	:	15
Power in HP/Kwh	:	2/1.5
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Seal Type	:	Double Mechanical Seal
Seal Mechanism	:	Inboard –Silicon Carbide (SiC) Outboard –Carbon Silicon Carbide
Pump Make	:	Johnson
Motor Make	:	BB(CG)
Cooling Tower Pump		
Qty	:	1 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8M (SS316)
Flow,m3/hr	:	223
Head,mtrs	:	25
Power in HP/Kwh	:	20/15
Motor RPM	:	1450
Motor Efficiency	:	IE3
No.of Poles	:	4 Pole
Seal Type	:	Single Mechanical Seal
Seal Mechanism	:	Silicon Carbide (SiC)
Pump Make	:	Johnson
Motor Make	:	BB(CG)

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Blower		
Qty	:	3 W+1FSB
Pump Type	:	Centrifugal
MOC	:	CF8
Power in HP/Kwh	:	7.5/5.625 (Each)
Motor RPM	:	2900
Motor Efficiency	:	IE3
No.of Poles	:	2 Pole
Pump Make	:	Nadi
Motor Make	:	BB/CG
Gear Box -ATFD		
Qty	:	3 Nos
MOC	:	Std
Power in HP/Kwh	:	30/22.5 (Each)
Motor RPM	:	1450
Gear Box Make	:	Bonfiglioli
Motor Make	:	BB/CG
Gear Box -BT		
Qty	:	1 No
MOC	:	Std
Power in HP/Kwh	:	2/1.5
Motor RPM	:	1450
Gear Box Make	:	Bonfiglioli
Motor Make	:	BB/CG
Pipelines & Fittings		
Process Pipelines		

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CHEMIN ENVIRO SYSTEMS PVT. LTD.

Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Schedule of Pipes	:	Sch 10
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Vapour Duct		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Thickness of Pipe	:	5 mm Thick
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Condensate Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	SA 312 TP 316L
Schedule of Pipes	:	Sch 10
MOC of Fittings	:	SA 403 GR 316L
MOC of Flanges	:	SA 182 F 316L (Chemin Std)
Cooling Tower Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	IS2062
Schedule of Pipes	:	C Class
MOC of Fittings	:	IS2062
MOC of Flanges	:	IS2062 (Chemin Std)
Blower Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes	:	IS2062

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Schedule of Pipes	:	C Class
MOC of Fittings	:	IS2062
MOC of Flanges	:	IS2062 (Chemin Std)
Seal Water Pipes & Fittings		
Qty	:	1 Lot
MOC of Pipes & Fittings	:	UPVC
Schedule of Pipes	:	Sch 40

Note: All gear box assembly and its construction in IS 2062, Big flanges bottom and top support are in IS 2062.

III. List of our Standard Make:

Sl. No	Description	Make
1.	Electrical Accessories	Siemens
2.	Process Pump	Johnson
3.	Vacuum Pump	PPI
4.	Motors	BB/CG
5.	Steel (SS)	Jindal
6.	MS Structure (Main Column-H Section)	Vizag/Sail
7.	Instruments	E&H/ Forbes/Krohne Marshall
a.	Vacuum transmitter	E&H/ Forbes/Krohne Marshall
b.	Temperature transmitter	E&H/ Forbes/Krohne Marshall
c.	Pressure transmitter	E&H/ Forbes/Krohne Marshall
d.	Feed flow meter	E&H/ Forbes/Krohne Marshall
e.	Condensate flow meter	E&H/ Forbes/Krohne Marshall
f.	Pneumatic valve	Aira/Uflow
g.	TDS transmitter	E&H/ Forbes/Krohne Marshall

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





CHEMIN ENVIRO SYSTEMS PVT. LTD.

h.	Rotameter	Forbes/Krohne Marshall
i.	Level transmitter	E&H/ Forbes/Krohne Marshall
j.	Steam Control Valve	Technik/ Forbes Marshall
k.	Steam Flow meter	E&H/Forbes Marshall
7.	Blower	Nadi
8.	Gear Box	Bonfiglioli
9.	VFD	Yaskawa/Siemens

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





IV. Scope of Supply - Electrical & Instrument Parts:

Sl.No.	Specification	Quantity
1.	<p>Control Panel with</p> <ul style="list-style-type: none">a. Power & Motor Control Systemb. PLC Control Systemc. Energy meter	1 Unit
2.	<p>Field Instruments</p> <ul style="list-style-type: none">a. Vacuum transmitter-6 Nosb. Temperature transmitter-6 Nosc. Pressure transmitter-3 Nosd. Feed flow meter-1 Noe. Condensate flow meter-1 Nof. Mass Flow Meter-1 Nog. Pneumatic valve-4 Nosh. TDS transmitter-1 Noi. Rotameter-2 Nosj. Level transmitter-6 Nosk. Steam Control Valve-2 Nosl. Steam Flow meter-2 Nos	1 Lot
3.	<p>Software</p> <ul style="list-style-type: none">a. PLC With SCADA Programming	1 Lot

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





CHEMIN ENVIRO SYSTEMS PVT. LTD.

V. Scope of Supply –Other accessories:

A) Cooling Tower-TR		:	1500
Qty		:	1 Lot
Water Flow Rate,CMH/Cell		:	286.67/Cell*3 Nos
Total Flow Rate,CMH		:	860.01
Total Fan Motor HP,Kw		:	60/45
Fan Motor RPM		:	477
B) MS Structural for Equipments		:	
Material Qty,Tons		:	150
Gratings Qty,Nos		:	85
GRP Coating area,Sq.mtr		:	3000 (GRP Coatings for all columns and Tie beams)
C) Electricals		:	
Type		:	Non Compartment
Fixing Type		:	Non-Draw Out Type
		:	Floor Mounted
MOC		:	MS with Powder Coated
Protection		:	IP-30
Cable Entry		:	Bottom Cable Entry, Single Front
Paint Shade		:	RAL7035 (Siemens Grey)
Base Frame		:	75 x 38 mm ISMC
Input Supply		:	415 ± 10 VAC, 3 Phase, 50 Hz, 4 Wire

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





CHEMIN ENVIRO SYSTEMS PVT. LTD.

Switchgears & Accessories Make	:	Siemens
Electrical Cable Make	:	Polycab/Hawells
Cable MOC	:	Copper Armoured
Cable Tray MOC	:	GRP
D) Insulation		
75mm Rockwool with 26SWG Aluminium Cladding for all units where live steam is applied (Stripper,Calandira-I & ATFD) and 50mm Thick & 26SWG aluminium Cladding for remaining units.		

VI. Utility Details:

1. Steam Consumption:

For Stripper	-3936Kg/hr @ 3-4Kgf / cm ²
For Evaporator	-5200Kg/hr @ 3-4Kgf / cm ²
For ATFD	-3031Kg/hr @ 3-4Kgf / cm ²
Total Steam	- 12167Kg/hr

2. Power Consumption:

For Stripper	-33.75Kwh
For Evaporator	-414.375Kwh
For ATFD	-119.625Kwh
Total Installed Power	-567.75Kwh

3. Cooling Tower Circulation Rate:

For Stripper	-118m ³ /hr @ 1-2 Kgf / cm ²
--------------	--

Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





CHEMIN ENVIRO SYSTEMS PVT. LTD.

For Evaporator	-380m ³ /hr @1-2 Kgf / cm ²
For ATFD	-223m ³ /hr @1-2 Kgf / cm ²

4. Fresh Water Required for Makeup:

For Cooling Tower & Seal Water	-7500Ltr/hr (Continuous)
Fresh Water Quality	- RO Permeate or Equivalent Quality

VII. Battery Limits and Exclusions

Battery Limits:

Feed	:	At the inlet of the Stripper, Evaporator / ATFD Balance Tank
Steam	:	At that inlet of the Stripper, ATFD/Evaporator Equipment inlet nozzle
Product outlet	:	At that outlet of the ATFD
Solvent outlet	:	At that outlet of the Solvent Collections
Process condensate	:	At the outlet of the Condensate Pump of Evaporator/ATFD
Sealing water	:	At the inlet of the Seal water Tank
Raw water	:	At the inlet of the both Balance Tank, Cooling Tower & Seal water Tank
Drain	:	At individual Equipment & Piping
Power/Earthing	:	At the panel (MCC) incoming at individual motors

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





Scope of Supply Details:

SI. No	DESCRIPTION	Scope Details
1.	All Equipment Supply as Per above Scope of Supply.	Chemin
2.	All civil works related with System, such as foundation of column, equipment and pumps, Necessary storage tank, if other civil works not mentioned and related to the system.	Client
3.	All statutory, legal and government formalities and permission for the erection and operation of the plant (Electrical/PCB activities).	Client
4.	Unloading, storing of the equipment and safety at site.	Client
5.	Steam boiler, Pipeline and Valves upto the system.	Client
6.	All Input and output Pipelines.	Client
7.	Cooling Tower, Pump & its Pipelines.	Chemin
8.	Foundation Bolt, Nut and its accessories	Client
9.	Supply of Electrical Cables, Tray and its accessories	Chemin
10.	MS Structure and its accessories.	Optional
11.	Motor Cover and its Painting work	Chemin
12.	Lubrications of the Rotating Equipments.	Client
13.	Painting Work at site	Client
14.	Roof shed & its accessories.	Client
15.	Insulation of the Equipments and pipelines	Chemin
16.	Instrument and its Automation Work.	Chemin

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC





CHEMIN ENVIRO SYSTEMS PVT. LTD.

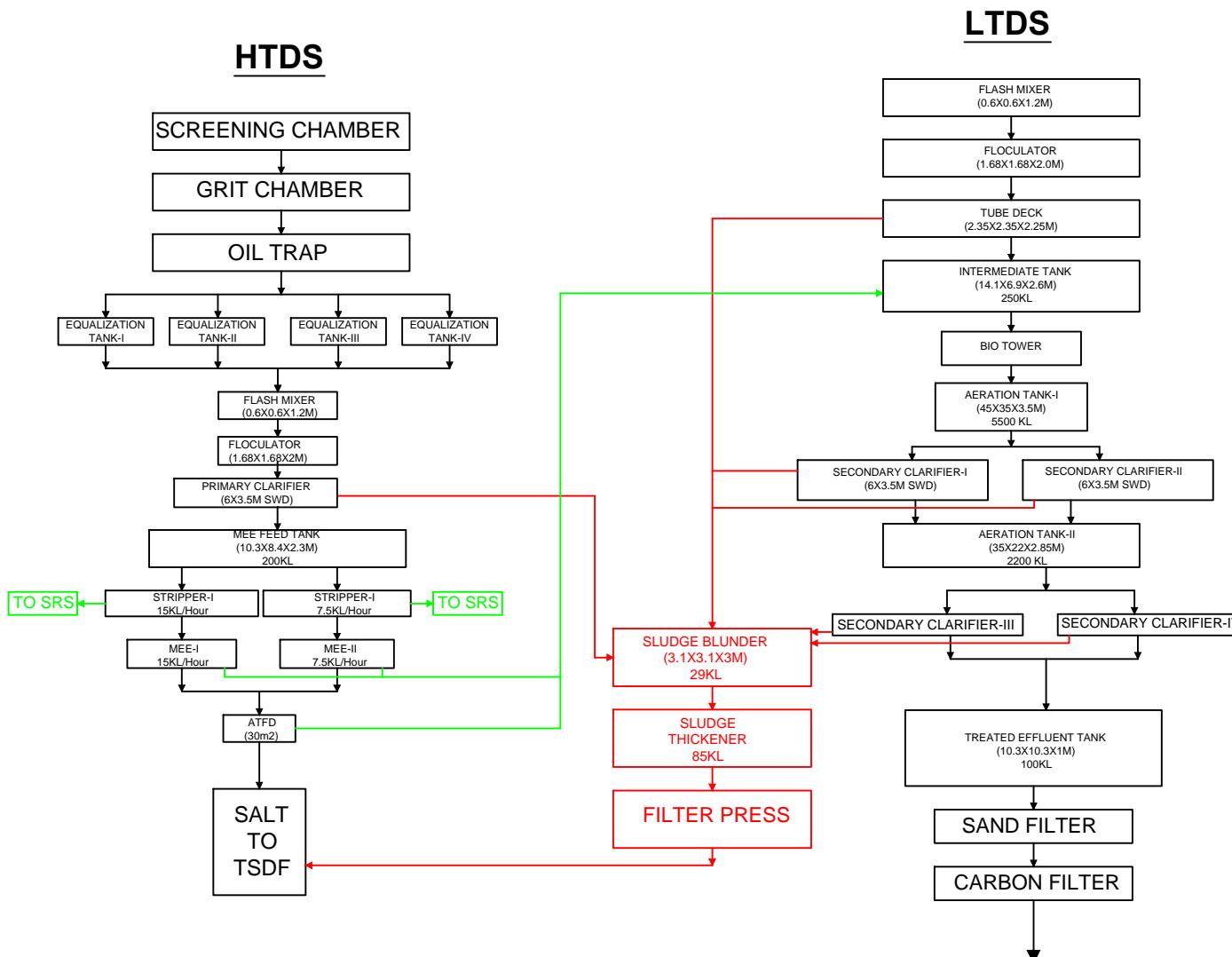
17.	Food, Travelling & Accommodation of Our Engineers and Labours at the time of Erection Supervision.	Chemin
18.	Crane Charges for Erection at Site.	Client
19.	Erection & Fabrication at site	Chemin
20.	Supervision of Commissioning at site.	Chemin
21.	Necessary Electrical power supply and water supply for the equipment erection and fabrication at site.	Client
22.	Necessary chemical and tools for trail run and commissioning of the system.	Client
23.	If any other thing not mentioned other than the offer.	Client

📍 Plot No. D-12, SIPCOT Industrial Growth Centre, Perundurai, Tamil Nadu, India. Pin code - 638052.

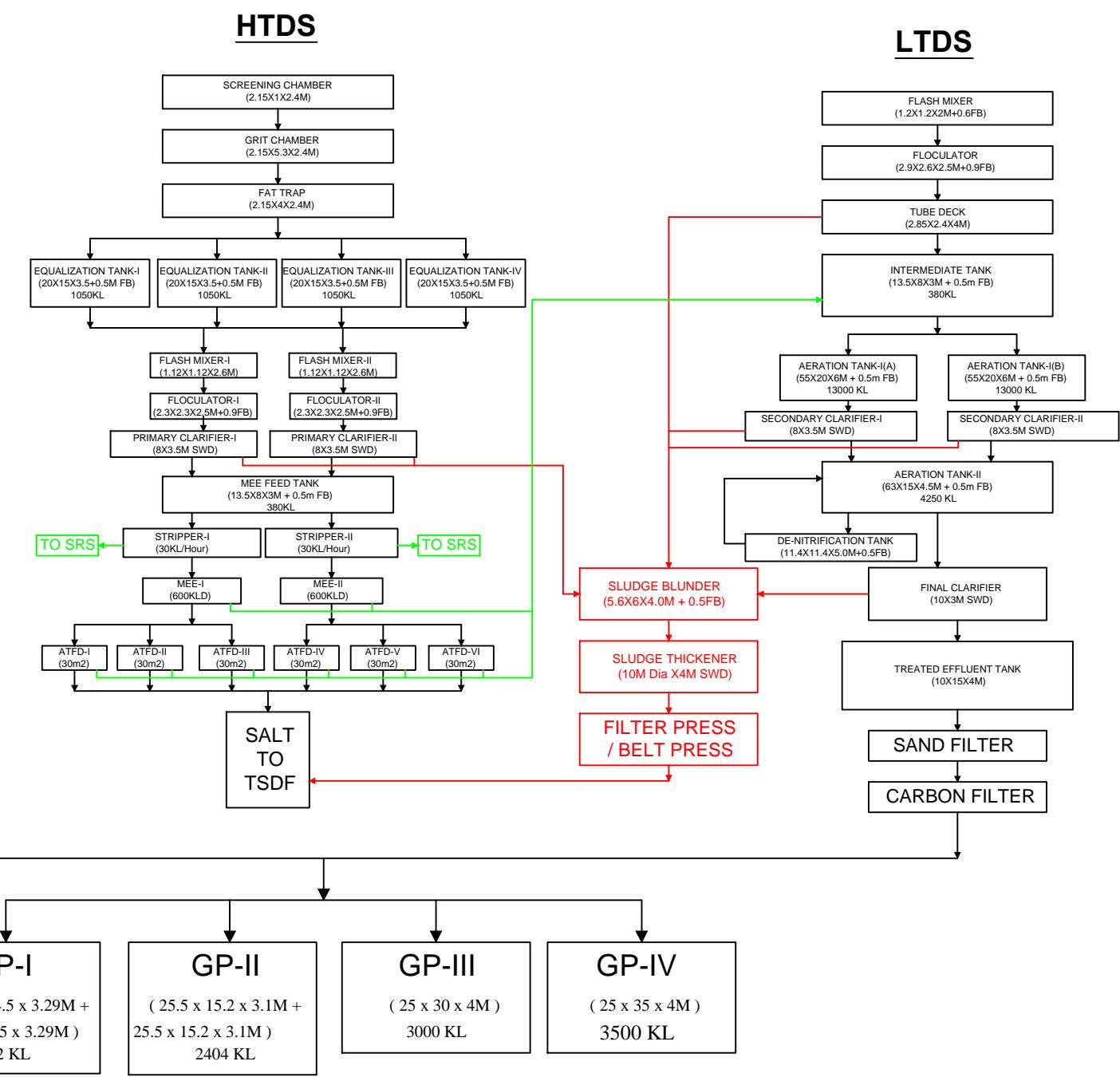
PAN No: AAFCC2731C | GST No.: 33AAFCC2731C1ZC



OLD ETP

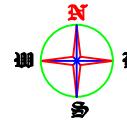
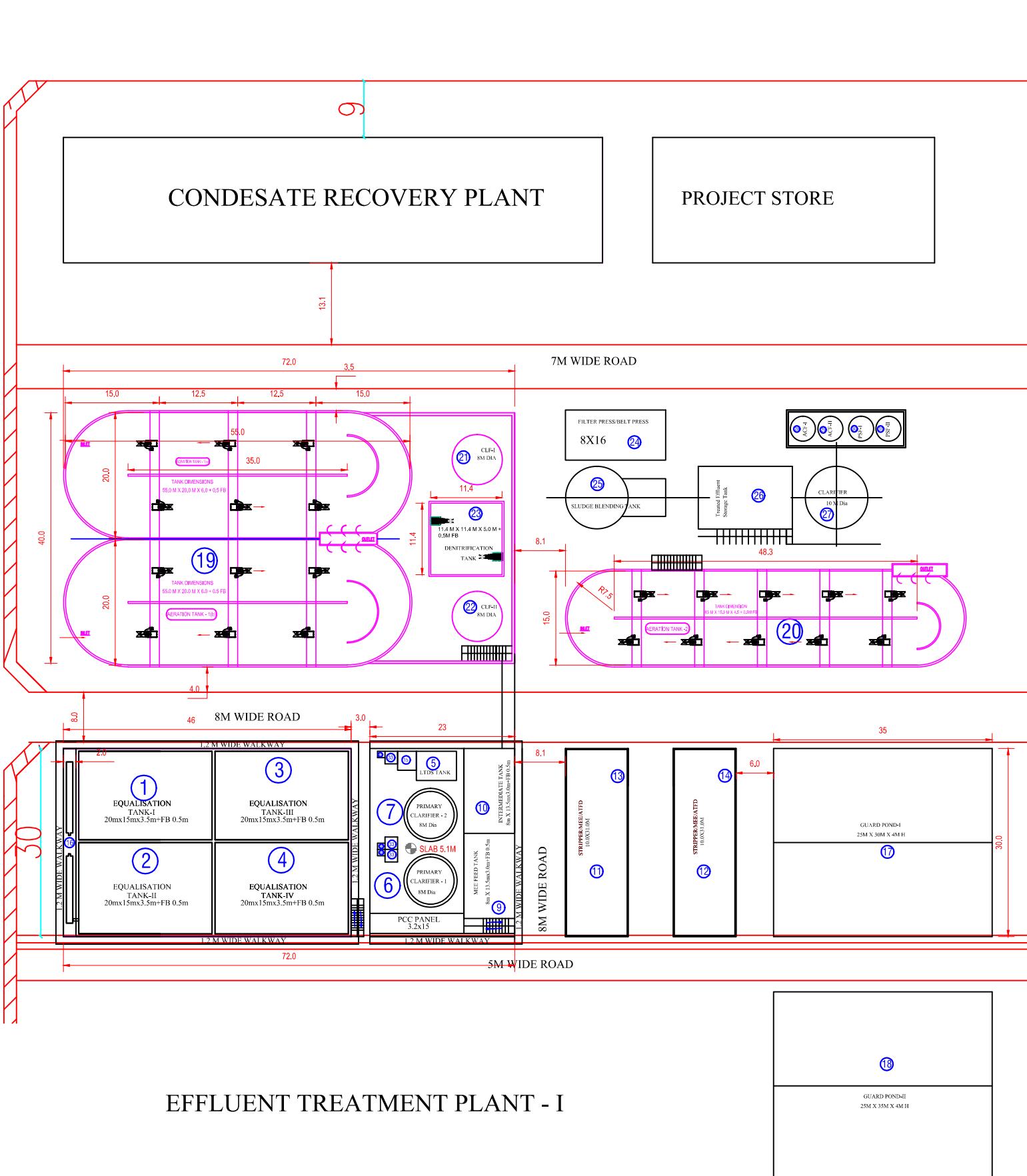


1 MLD NEW ETP



1 MLD EFFLUENT TREATMENT PLANT SITE LAYOUT

HETERO LAB LIMITED, UNIT - IX



COMPONENTS OF ETP:

- 1. EQUALISATION TANK - I : 1 NO - 20mx15mx3.5m+FB 0.5m
- 2. EQUALISATION TANK - II : 1 NO - 20mx15mx3.5m+FB 0.5m
- 3. EQUALISATION TANK - III : 1 NO - 20mx15mx3.5m+FB 0.5m
- 4. EQUALISATION TANK - IV : 1 NO - 20mx15mx3.5m+FB 0.5m
- 5. LTDS TANK : 1 NO - 4.5mx4.2mx3.5m+FB 0.5m
- 6. PRIMARY CLARIFIER-1 : 1 NO - Dia8mx3.5mSWD
- 7. PRIMARY CLARIFIER-2 : 1 NO - Dia8mx3.5mSWD
- 8. MCC ROOM : 1 NO - 8m X 23mX4.5m+FB 0.5m
- 9. MEE FEED TANK : 1 NO - 8m X 13.5mx3.0m+FB 0.5m
- 10. INTERMEDIATE TANK : 1 NO - 8m X 13.5mx3.0m+FB 0.5m
- 11. STRIPPER/MEE/ATFD-1 : 1 NO - 10.0mX31.0m
- 12. STRIPPER/MEE/ATFD-2 : 1 NO - 10.0mX31.0m
- 13. COOLING TOWER-1 : 1 NO - 10m X 6m x3m+FB 0.5m
- 14. COOLING TOWER-2 : 1 NO - 10m X 6m x3m+FB 0.5m
- 15. TUBE SETTLER : 1 NO - 2.85m X 2.4m X 4m
- 16. GRIT CHAMBER : 25M X 30M X 4M H
- 17. GUARD POND-I : 25M X 35M X 4M H
- 18. GUARD POND-II : 55.0 M X 20.0 M X 6.0 + 0.5 FB
- 19. AERATION TANK-I : 63mX15mX4.5m+FB 0.5m
- 20. AERATION TANK-II : 1 NO - 8M DIAx3.5mSWD
- 21. CLARIFIER - 1 : 1 NO - 8M DIAx3.5mSWD
- 22. CLARIFIER - 2 : 1 NO - 11.4M X 11.4M X 5.0M + 0.5M FB
- 23. DE-NITRIFICATION TANK : 1 NO - 8m X 16m
- 24. FILTER PRESS/BELT PRESS : 1 NO - 10m X 15m X 4m
- 25. SLUDGE BLENDING TANK : 1 NO - 10M DIAx3.0mSWD
- 26. Treated Effluent STORAGE TANK : 1 NO - DIA 2.8m
- 27. CLARIFIER : 1 NO - DIA 2.8m
- 28. ACTIVATED CARBON FILTER-1 : 1 NO - DIA 2.1m
- 29. ACTIVATED CARBON FILTER-2 : 1 NO - DIA 2.1m
- 30. PRESSURE SAND FILTER -1 : 3 NO - 1.2m X 1.2m X 2m + 0.6FB
- 31. PRESSURE SAND FILTER -2 : 3 NO - 2.9m X 2.6m X 2.5m + 0.9FB
- 32. FLASH MIXER : 3 NO - 2.9m X 2.6m X 2.5m + 0.9FB
- 33. FLOCUULATOR : 3 NO - 2.9m X 2.6m X 2.5m + 0.9FB

ALL DIMENSIONS ARE IN METERS

HETERO INFRASTRUCTURE SEZ LIMITED
N.NARSAPURAM, NAKKAPALLI MANDAL
VISAKHAPATNAM – 531081

TITLE

1 MLD ETP LAYOUT

DRAWN	NAME	DATE	SIGNATURE	SCALE: 1:1000	SHEET-1/1	REV-0
CHECKED	SK REDDY	20.02.21		Drg no:-		
APPROVED	SK REDDY	20.02.21		HLL-III/ETP/01-2021		

VERMI COMPOST PLANT



Design Parameters:

Plant is designed to treat 100 Kgs of wet Garbage Per Day

HAZARDOUS WASTE AND MODE OF DISPOSAL

Hazardous wastes are being disposed as per the conditions stipulated by APPCB in the CTO.

Minimum stocks are being maintained in the Hazardous waste storage yard.

Hazardous waste and mode of disposal specified by the APPCB in CTO is mentioned below:

S.No	Details of waste	Mode of Disposal
1	Process Solid waste	To TSDF, Parawada, Anakapalli Dist. For secured Land filling
2	MEE/ Forced Evaporation Salt	
3	Incineration Ash	
4	ETP Sludge	
5	Solvent Residue/Organic Residue	Shall be incinerated to sent to Cement industries for Co-incineration/Coprocessing/ Pre-processing units
6	Spent Carbon	
7	Damage or Rejected APIs/products	
8	Damaged or Expired Raw materials	
9	Used PPEs	Shall be incinerated in in-house incinerator or sent to Cement industries for incineration
10	Used Oils	To Re-processing units authorized by APPCB
11	Used Batteries	Shall be sent to suppliers on buy back basis
12	e-Waste/ electrical waste	Sent to Authorized Recyclers approved by APPCB/CPCB.
13	Empty Drums/ Containers/ Liners contaminated with Hazardous chemicals/waste	To outside agencies after complete detoxification.
14	Empty barrels / containers / liners contaminated with hazardous chemicals / wastes	
15	LDPE Paper	To authorized Recyclers/ outside agencies
16	Coal Ash from Boilers	To Brick manufacturing units
17	Spent Solvents	Shall be recycled within the units of Hetero Infrastructure SEZ Ltd or sold to outside agencies
18	Recovered Solvents	



HETERO INFRASTRUCTURE SEZ LIMITED

NOISE LEVEL MONITORING

LOCATION: ETP

DATE: 13.10.2023

FREQUENCY: MONTHLY

S. No.	Location	TLV dBA	Day time reading		Night time reading		Remarks
			Ground floor	First floor	Ground floor	First floor	
1	Cooling tower	85 dBA	78	--	74	--	
2	ATFD	85 dBA	79	75	75	75	
3	Vacuum Pump	85 dBA	78	--	77	--	
4	Air Blower (Aerator)	85 dBA	86	--	81	--	Use ear plug
5	Air Blower (Guard Pond)	85 dBA	85	--	82	--	Use ear plug
6	RO Plant	85 dBA	76	--	75	--	
7	STP	85 dBA	64	--	60	--	
8	Scrap Yard	85 dBA	64	--	52	--	
9	De-toxification yard	85 dBA	65	--	51	--	
10	East Compound wall	85 dBA	50	--	48	--	
11	North Compound wall	85 dBA	69	--	67	--	
12	West Compound wall	85 dBA	68	--	63	--	

Done By: C. JayDate : 13/10/23Checked By: S. SreejithDate : 13/10/23



HETERO INFRASTRUCTURE SEZ LIMITED

NOISE LEVEL MONITORING

LOCATION: ETP

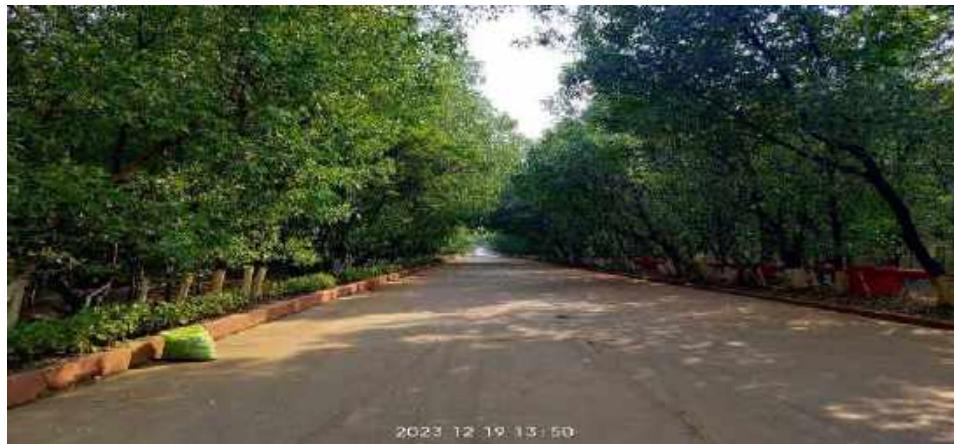
DATE: 16.11.2023

FREQUENCY: MONTHLY

S. No.	Location	TLV dBA	Day time reading		Night time reading		Remarks
			Ground floor	First floor	Ground floor	First floor	
1	Cooling tower	85 dBA	77	--	74	--	
2	ATFD	85 dBA	78	73	74	73	
3	Vacuum Pump	85 dBA	76	--	77	--	
4	Air Blower (Aerator)	85 dBA	85	--	82	--	Use ear plug
5	Air Blower (Guard Pond)	85 dBA	85	--	81	--	Use ear plug
6	RO Plant	85 dBA	74	--	73	--	
7	STP	85 dBA	65	--	61	--	
8	Scrap Yard	85 dBA	64	--	45	--	
9	De-toxification yard	85 dBA	64	--	45	--	
10	East Compound wall	85 dBA	52	--	48	--	
11	North Compound wall	85 dBA	67	--	65	--	
12	West Compound wall	85 dBA	66	--	63	--	

Done By: C. T. S.Date : 16/11/23Checked By: C. A. S.Date : 16/11/23

HETERO INFRASTRUCTUE SEZ LTD
Green Belt Photos



HETERO INFRASTRUCTUE SEZ LTD
Green Belt Photos



HETERO INFRASTRUCTUE SEZ LTD
Green Belt Photos





SV ENVIRO LABS & CONSULTANTS

(ENVIRONMENTAL ENGINEERS & CONSULTANTS IN POLLUTION CONTROL)

Corporate Office & Laboratory : Enviro House, B-1, Block-B, IDA, Autonagar, Visakhapatnam-530012.
Hyderabad: Flat No. 302, H.No. 7-1-396/B/12, Sai Raim Residency, Balkampet Road, S.R.Nagar, Hyderabad-500038.
 ☎ +91-9440338628, +91-7207684444 📩 senviro_labs@yahoo.co.in, info@senvirolabs.com 🌐 www.senvirolabs.com
 Recognized by Govt. of India-MoEF & CC, New Delhi, Accredited by : NABL & NABET



Ref: SVELC/HISL/23-11/02

Date: 20-11-2023

NAME AND ADDRESS : M/s. HETERO LABS LIMITED (UNIT-III),
 NALLAMATIPALEM (V),
 NAKKAPALLI (M),
 VISAKHAPATNAM (Dist).

SAMPLE PARTICULARS : WATER

SOURCE OF COLLECTION : 1. BOREWELL – 1 (Near ETP)
 2. BOREWELL – 2 (Near Honour Labs)
 3. BOREWELL – 3 (Near Labour Shed)
 4. BOREWELL – 4 (Near HLL-3)

DATE OF COLLECTION : 11-11-2023

TEST REPORT

S.No	Parameter	Unit	Results			
			1	2	3	4
1.	pH	-	7.60	7.43	7.80	8.12
2.	Total Dissolved Solids	mg/l	7421	30142	13024	13492
3.	Total Alkalinity as CaCO ₃	mg/l	481	367	438	540
4.	Total Hardness as CaCO ₃	mg/l	922	8856	1862	1698
5.	Calcium as Ca	mg/l	48.2	573	136	184
6.	Magnesium as Mg	mg/l	195	1804	307	301
7.	Chlorides as Cl ⁻	mg/l	3204	13826	5197	5583
8.	Copper as Cu	mg/l	<0.01	<0.01	<0.01	<0.01
9.	Manganese as Mn	mg/l	0.25	3.1	0.55	0.05
10.	Zinc as Zn	mg/l	0.40	0.48	0.17	0.29
11.	Aluminum as Al	mg/l	0.12	0.53	0.04	0.16
12.	Boron as B	mg/l	1.96	0.74	1.42	1.15
13.	Barium as Ba	mg/l	0.18	0.07	0.05	0.09
14.	Selenium as Se	mg/l	0.01	0.06	0.04	0.03
15.	Silver as Ag	mg/l	<0.01	<0.01	<0.01	<0.01
16.	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01	<0.01
17.	Cyanide as CN	mg/l	<0.01	<0.01	<0.01	<0.01
18.	Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01
19.	Mercury as Hg	mg/l	<0.01	<0.01	<0.01	<0.01
20.	Nickel as Ni	mg/l	0.07	<0.01	<0.01	<0.01
21.	Total Arsenic as As	mg/l	0.02	0.10	0.03	0.02
22.	Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	<0.01
23.	Iron as Fe	mg/l	0.21	0.13	0.10	0.07

Note: All the above parameters are tested as per APHA methods, 24th Edition, 2023

CHECKED BY



SV ENVIRO LABS & CONSULTANTS

E-WASTE MANIFEST

1.	Sender's name and mailing address (including Phone No.):	Helego Labs Limited Unit - 9
2.	Sender's authorisation No, If applicable. :	7994 APPCB 20-VSP/CF0/E-WASE/HO/2017
3.	Manifest Document No.:	03 APPCB VSP E-Waste HO 2017
4.	Transporter's name and address (including Phone No.)	Veera Waste Management Systems
5.	Type of vehicle	(Truck or Tanker or Special Vehicle) Mini Van
6.	Transporter/s registration No.	AP31TF4176
7.	Vehicle registration No.	AP31TF4176
8.	Receiver's name & address :	VEERA WASTE MANAGEMENT SYSTEM (VSP)
9.	Receiver's authorisation No, if applicable.	03/APPCCB/VSP/E-WASE/HO/2017-
10.	Description of E-Waste (Item, Weight / Numbers):	Attached as Annexure-1
11.	Name and stamp of sender* (Manufacturer or producer or Bulk Consumer or Collection Centre or Refurbisher or dismantler): Signature : <i>[Signature]</i>	Month Day Year 30-06-2022
12.	Transporter acknowledgment of receipt of E-Wastes Name and stamp: Signature : <i>[Signature]</i>	Month 06 Day 30 Year 2022 30-06-2022
13.	Receiver* (Collection Centre or Refurbisher or Dismantler or Recycler) certification of receipt of E-waster Name and stamp: Signature : <i>[Signature]</i>	Month 06 Day 30 Year 2022 30-06-2022

* As applicable

Note:-

Copy number with color code (1)	Purpose (2)
Copy 1 (Yellow)	To be retained by the sender after taking signature on it from the transporter and other three copies will be carried by transporter.
Copy 2 (Pink)	To be retained by the receiver after signature of the transporter.
Copy 3 (Orange)	To be retained by the transporter after taking signature of the receiver.
Copy 4 (Green)	To be returned by the receiver with his/her signature to the sender

E-WASTE MANIFEST

1.	Sender's name and mailing address (including Phone No.):	Hetero Drugs Limited Unit - 9
2.	Sender's authorisation No, If applicable. :	4994/APPCE/2017/CFO/WGA/2017
3.	Manifest Document No.	03/APPCE/VSP/E-waste/HO/2017-
4.	Transporter's name and address (including Phone No.)	VEERA Waste Management Systems
5.	Type of vehicle	(Truck or Tanker or Special Vehicle) Mini Van
6.	Transporter/s registration No.	AP 31 TF 4176
7.	Vehicle registration No.	AP 31 TF 4176
8.	Receiver's name & address :	VEERA WASTE MANAGEMENT SYSTEM (VSP)
9.	Receiver's authorisation No, if applicable.	03/APPCE/VSP/E-WASE/HO/2017-
10.	Description of E-Waste (Item, Weight / Numbers):	Attached as Annexure - I
11.	Name and stamp of sender* (Manufacturer or producer or Bulk Consumer or Collection Centre or Refurbisher or dismantler): Signature : <i>[Signature]</i>	Month 06 Day 30 Year 2022 30-06-2022
12.	Transporter acknowledgment of receipt of E-Wastes Name and stamp: Signature : <i>[Signature]</i>	Month 06 Day 30 Year 2022 30-06-2022
13.	Receiver* (Collection Centre or Refurbisher or Dismantler or Recycler) certification of receipt of E-waster Name and stamp: Signature : <i>[Signature]</i>	Month 06 Day 30 Year 2022 30-06-2022

* As applicable

 Note:-


Copy number with color code (1)	Purpose (2)
Copy 1 (Yellow)	To be retained by the sender after taking signature on it from the transporter and other three copies will be carried by transporter.
Copy 2 (Pink)	To be retained by the receiver after signature of the transporter.
Copy 3 (Orange)	To be retained by the transporter after taking signature of the receiver.
Copy 4 (Green)	To be returned by the receiver with his/her signature to the sender



POLICY SCHEDULE FOR PUBLIC LIABILITY (Act Only) INSURANCE

UIN NUMBER - IRDAN190P0076100001

Insured's Name	HETERO INFRASTRUCTURE SEZ LIMITED		
Customer ID	PO92918286		
Address	SY NO 125 138 150, N NARASAPURAM, NAKKAPALLY MANDAL, N NARASAPURAM, VISAKHAPATNAM, ANDHRA PRADESH, NAKKAPALLI ,ANDHRA PRADESH, 531081	Office Code	: HYDERABAD LCBO 960000 (960000)
Phone No		Phone No	: 4027810302
E-mail/Fax	krishna.d@heterodrugs.com, /	E-mail/Fax	: nia.960000@newindia.co.in /
PAN No		S.Tax Regn. No	: AACCN4165CST178
GSTIN/UIN	37AABCH6897E3Z6 / NA	GSTIN	: 36AACN4165C3ZQ
		SAC	: 997139 (Other non-life insurance services excl RI)

Policy Details			
Policy Number	96000036233300000024		Business Source Code
Period of Insurance	From: 11/11/2023 12:00:01 AM To: 10/11/2024 11:59:59 PM		Dev.Off. level/Broker/Corp. Agent/Web Aggregator/CPSC User
Date of Proposal	11-Nov-23		Agent/Bancassurance/S pecified Person
Prev. Policy no.	96000036223300000021		Phone No
Client Type	Non-Corporate		E-mail/Fax

Premium(₹)	ERF Premium(₹)	GST(₹)	Total (₹)	Total (₹ in words)	Receipt No. & Date
11132	11132	0	22,264	RUPEES TWENTY-TWO THOUSAND TWO HUNDRED SIXTY-FOUR ONLY	960000812300000518 1 - 17/11/23

Details of risk covered under current year policy:

								Deductible s	
Retroactive Date	Paid Up Capital	No Of Locations Involved	AOA	AOA:AOY	AOY	Annual Turnover - Previous Year	Annual Turnover - Proposed Year	No of workmen	No of Other Employee
11/11/2021	<= 15 Crore	1	50000000	1:3	15000000	10000000 00	11000000 00	90	24

Retroactive Dates

								Deductibl es		
Retroactiv e Date Details	Date	Paid Up Capital	No Of Locations Involved	AOA	AOA:AOY	AOY	Annual Turnover - Previous Year	Annual Turnover - Proposed Year	No of workmen	No of Other Employee
RETROACTIV E DATE 1	11/11/2021	<=15Cro re	1	5000000	1.3	1500000	1000000 000	1100000 000	90	24

RETRO-DATE IS SUBJECT TO LESSER OF LIMITS - NARROWER OF COVER.

Extensions under the Policy

Name of the Extension	Sub Limit of the Extension	Deductibles of the Extension
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Special Conditions	Paid up capital: ₹1cr. Estimated Annual Turnover: ₹110 crs. Condition precedent to liability- Nil claims as on date of inception of policy AS PER PUBLIC LIABILITY ACT POLICY Absolute exclusion for losses directly or indirectly arising out of contributed to by or resulting from Coronavirus (Covid 19 and /or nCov 2019) or any mutations or variations thereof
Special Exclusions	NA
Special Excess/Deductible	0
Retroactive Dates	Date
Retroactive date	11/11/2021

The Policy shall be subject to PUBLIC LIABILITY (Act Only) INSURANCE Policy clauses attached herewith.

Clauses	Description	
Premium and GST Details		
Premium	Rate of Tax	Amount in INR
Premium	₹	22,264
SGST	0	0
CGST	0	0
IGST	0	0

In witness whereof the undersigned being duly authorised by the Insurers and on behalf of the Insurers has (have) hereunder set his (their) hand(s) on this 23rd day of November, 2023.

For and on behalf of
The New India Assurance Company Limited

Date of Issue: 23/11/2023

Duly Constituted Attorney(s)

Stamp Duty under the Policy is ₹1

Mudrank _____ Dt. _____ consolidated Stamp Fees Paid by Pay Order Number _____ vide receipt number _____ dt. _____.

IRDA Registration Number: 190
NIA PAN NUMBER: AAACN4165C



HETERO INFRASTRUCTURE SEZ LTD.
 Ch. Lakshmiapuram (Vill)
 N. Narasapuram (Village), Rajeyyapeta (Vill),
 Nellokpalli (Mandal);
 Anakapalli (Dist) - 531 081, A.P., INDIA.
 Tel : +91 8931 227307, Fax: +91 8931 227200

Letter No:HIS/EHS/APPCB/2023-24/17

30TH September 2023

**The Environmental Engineer
 Regional Office
 Andhra Pradesh Pollution Control Board
 Visakhapatnam**

Dear Sir

Sub : Submission of Environmental Statement in Form-V of M/s Hetero Infrastructure SEZ Ltd, for the Financial Year 2022-2023 – Regarding

Ref : APPCB/VSP/219/CFO/HO/2010 Dated ,15/02/2023

With reference to above, we are here with submitting the environmental statement in Form-V for the financial year 2022-2023 for your information and perusal.

Kindly acknowledge the receipt of the same.

Thanking You Sir,

Yours Faithfully

For Hetero Infrastructure SEZ Ltd.

**S. Kullayi Reddy
 Associate Vice President - EHS**

Enclosures: As above



3.10.23

PROFILE

M/s. HETERO INFRASTRUCTURE SEZ Ltd., obtained EC & consent for establishment for setting up of 17 manufacturing facilities for producing Bulk Drug intermediates & APIs and also got Consent for operation for the same SEZ. Out of 17 permitted units, Hetero constructed following 03 units in Hetero Infrastructure SEZ Ltd,

- Hetero Drugs Ltd, Unit-IX (Plot No:1)
- Hetero Labs Ltd, Unit-IX (Plot No: 2 & 3)
- Honour Lab Ltd, Unit-III (Plot No:4)

All above mentioned units are producing Bulk Drugs & API and all these products are being manufactured on Regular basis. Manufacturing of the products is being undertaken as per the consent conditions.

Hetero Infrastructure is providing services like Water, Steam, Effluent Treatment Plant, Sewage Treatment plant, Vermi Compost plant, Scrap Yard, Hazardous waste management etc to all the above mentioned units.

Apart from above mentioned units, the other unit Hetero Labs Ltd, Unit-III is making use of these facilities of Hetero Infrastructure SEZ Ltd as per the CFE & CFO.

Salient features of M/s. Hetero Infrastructure SEZ Limited

Total Site Area	340 Acres
Built up Area	180 Acres
Area of Green Belt Developed	100 Acres
Area available for Green Belt Development	50 Acres
Year of Establishment	2010
Year of Commissioning	2011
Capital Cost	120 Crores
Type of plant	Facilitator for Bulk Drug Manufacturing units
Water Consumption as on date	242 KLD
Investment on Pollution Control	
• Capital Investment	100 Crore
• Recurring O & M	300 Lakhs/annum
Employment	300

MINISTRY OF ENVIRONMENT AND FORESTS NOTIFICATION
New Delhi, the 22nd April 1993
(PART II, SECTION 3, SUB-SECTION (1))

"FORM - V"
ENVIRONMENTAL STATEMENT FOR
THE FINANCIAL YEAR ENDING THE 31ST MARCH 2023

PART - A

Name and address of the owner/
Occupier of the industry, operation
Or process : Dr. C. Mohan Reddy, Director
7-2-A2, Hetero Corporate,
Industrial Estate
Sanathnagar
Hyderabad -500018

Registered Office Address : M/s. Hetero Infrastructure SEZ Ltd,
7-2-A2, Hetero Corporate
Industrial Estate
Sanathnagar
Hyderabad -500018
Tel: 040- 23704923/24/25

Works address : M/s. Hetero Infrastructure SEZ Ltd,
N.Narsapuram (V),
Nakkapally (Md),
Visakhapatnam Dist - 531081.

Industry Category : Red.

Production Capacity : NA (Only Services)

Month and Year of Establishment : 2010.

Date of Last Environmental Statement
Submitted : September 2022

PART-B
Water and Raw Material Consumption

S.No	Water Consumption	Water Consumption (m ³ /day)	
		Quantity (KL/day) Including power plant	Quantity (KL/day) Including power plant
1.	Process & Washing	-	-
2.	Cooling tower Make up	-	-
3.	Boiler Feed	242	246
4.	Domestic	-	-
5.	Raw water RO make up	-	-
Total		242	246

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

	Quality of Pollutants discharged (mass/day)	Concentrations of Pollutants discharges (Mass/volume)	Percentage of variation from prescribed standards with reasons.
1.Ambient Air Quality	Analysis Report Enclosed		Within the limits
2.Stack Emissions			
3.Noise levels			
4.Effluent			

PART-D
HAZARDOUS WASTES
(As specified under 1[Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008])

Hazardous Wastes	Total Quantity (Kg.)	
	During the previous financial Year (2021-22)	During the current financial Year (2022-23)
Forced Evaporation Salts	1676.84	2358T
ETP Sludge	47.46	54.68T
Incinerator Ash	0	9.92T

PART-E
Solid Wastes

Solid waste	Total Quantity	
	During the previous financial year (2021-22)	During the current financial year (2022-23)
Boiler ash	9418 Tons	9079 Tons

PART-F
Characteristics in terms of Composition and quantum of hazardous as well as solid wastes and the disposal practices adopted by them

- | | |
|---------------------------|--|
| Fly Ash from Boiler | : To Brick Manufacturers |
| Spent Carbon from Process | : To TSDF , Parawada / Cement Industries |
| Forced Evaporation Salts | : To TSDF , Parawada |
| Organic Residue | : To TSDF , Parawada and Cement Industries |

PART-G

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

The industry has adopted following measures for the conservation of natural resources:

- Sea water Desalination Plant for meeting the water requirement of the industry.
- Sewage Treatment Plant for reuse of Domestic wastewater for gardening purposes.
- Usage of vermicomposting for green belt and grounding purpose as a replacement for chemical fertilizers.
- Green belt Development for abatement of pollution

The industry adopted all possible pollution control measures (Common Facility located at M/s Hetero Infrastructure SEZ Ltd) which includes Equipment's for Conservation of energy, Effluent Treatment Plants (Stripper, MEE, ATFD Bio-tower & Dual stage aerobic Treatment plant based on ASP), Sewage Treatment plants, Equipments for controlling fugitive emissions (Scrubbers, Condensers) for the abatement of pollution. To avoid any chances of ground water/ Soil contamination, the industry has constructed all above Ground tanks for ETP, STP etc.

Further the industry has installed 03 nos of Continuous Ambient Air Quality Monitoring (CAAQM) stations for monitoring the quality of the air, Online effluent monitoring system (OEMS) for various parameters to check the quality of treated effluents being disposed into Sea, Portable & online VOC meters for measuring organic vapours concentration in and around factory area.

PART-H

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

The industry has already invested around Rs. 100.00 Crores towards installation of pollution control devices in Hetero Infrastructure SEZ Ltd and developed green belt in and around the factory Premises in an area of more than 40% of the total area of the Industry. Green belt consists of various plants like Ganuga, Neem, Almond, Silver oak, Plintoform, casurina, Eucalyptus and Conacorpus etc.

All installed Pollution control equipments are periodically evaluated and necessary modifications/replacements are being made for improvement in their performances from time to time as and when required irrespective of Budget allocations.

The Industry proposed to invest additional amount of Rs 100 crore towards installation of new 1.2 MLD Effluent Treatment plant and associated facilities.

PART-I

Any other particulars for Improving the quality of the environment

- Increasing the greenbelt area by planting more plants, lawns, bushes etc.
- Industry is maintaining good housekeeping, mitigating fugitive emissions, reducing spills of raw material by taking all possible measures.
- Recovering of solvents from the effluents in stripper thereby reducing the organic vapours entry into the atmosphere and effective biological treatment.
- Rainwater harvesting by collecting complete run off in an open pond for recharging of ground water as well as for reuse.
- Captive power generation of 6.1 MW in connection to the existing 45 TPH Boiler.
-

CONCLUSION

Hetero Infrastructure SEZ limited is taking all possible measures for the abatement of pollution and certain steps are in consideration for workplace improvement and cost reduction. The following are the pollution abatement measures taken by the industry:

Taking all steps required to assure low emission levels, without any prejudice to the quantum of production.

1. Utilization of domestic wastewater discharges for development of greenery after treating in Sewage Treatment Plants.
 2. Giving due importance to the greenery and ultimately taken care in abating the pollution.
 3. Rainwater harvesting by way of collecting rainwater in a pond created by the Industry
 4. Online instruments for monitoring the pollution levels in and around factory premises.
 5. Operating Effluent Treatment Plant (Common) for bringing the pollution levels well within the norms of the Board.
 6. Regular monitoring of air, water, effluent and Ground water by third party once in a month to keep watch on the pollution levels.
- *****