HALDIA PETROCHEMICALS LTD

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CIN:U24100WB2015PLC205383

HPL/IMS/HSEF/R/4.3.2/08/ENV/E-06/MoEF&CC

June 1, 2026

Dr. Shahida Parvin Quazi
Scientist-E
Ministry of Environment, Forest and Climate Change
Regional Office, Bhubaneswar
Sub-Office, Kolkata
IB – 198, Sector-III, Salt Lake City,
Kolkata – 700 106

Sub: Half Yearly Report on the Status of Compliance against Conditions of Environmental Clearance for petrochemical complex at the existing plant facility at Tehsil Sutahata-I, Haldia, Dist. East Medinipur, West Bengal by M/s Haldia Petrochemicals Ltd – Split of Environmental Clearance

Madam,

With reference to the above subject, please find enclosed herewith the following documents for your kind perusal.

A. Compliance Status against conditions stipulated in "Environmental Clearance" for the period of October '25 to March '26

   File No. J-11011/194/2016-IA II (I), EC Identification No EC24A2101WB5101335S dated 25.03.25 and amended EC Identification No EC26A2101WB5962026A dated 02.03.26 for Petrochemical Complex at the existing plant facility.

B. Half Yearly Environmental Data Generation Report (October '25 to March '26).

Trust, the above will meet your requirements. In case you need to have further information pertaining to these reports, please do write to us.

Thanking you,

Yours very truly,

Parminder Singh Sawhney
Chief GM & Head HSEF
Encl. as above

CC: The Regional Directorate
CPCB, Kolkata

CC: The Member Secretary
WBPCB, Kolkata

Subject: Environmental Clearance for petrochemical complex at the existing plant facility at Tehsil Sutahata-I, Haldia, Dist. East Medinipur, West Bengal by M/s Haldia Petrochemicals Ltd – Split of Environmental Clearance reg

Specific EC Conditions for (Petroleum Products and petrochemical based processing such as production of carbon black and electrode grade graphite (processes other than cracking)

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
1.1	The company shall comply with all the environmental protection measures and safeguards proposed in the documents submitted to the Ministry. All the recommendations made in the EIA/EMP in respect of environmental management and risk mitigation measures relating to the project shall be implemented.	Being implemented. All environment protection measures and safeguards as recommended in the EIA/EMP report are incorporated at design and construction stage of the project to ensure compliance.
1.2	Total freshwater requirement shall not exceed 37308.5 KLD which will be met by the Haldia Development Authority. Necessary permission in this regard shall be obtained from the concerned regulatory authority. The freshwater requirement shall be reduced after installation of rainwater harvesting system in the unit/project area.	**Full Compliance** Freshwater is being supplied by HDA which has necessary agreement with HPL for supply of freshwater. 35539.5 KLD freshwater was supplied by HDA during last six months (Oct'25 to Mar'26) Currently, rainwater harvesting is made through (a) Collection of rainwater runoff water in storage ponds and (ii) Direct rainfall harvesting in collection ponds and transfer to water treatment section Total 1210890 KL rainwater (3317.5 KLD or 0.7 MGD) was utilized in FY 2025-26. Further, reputed engineering consultant/ In house engineering team has been engaged to develop scheme to harness additional rainwater within the remaining catchment area of the property, to meet water requirement supplementing the water supply by HDA
1.3	Industry shall comply with undertaking submitted for reusing 10% of treated process effluent by mid-2025; to reuse and recycle 50% treated effluent by December 2026 and to adhere action plan submitted for achieving ZLD by 2030.	Being Implemented The design capacity of the current WWTP in Haldia Petrochemical complex is 4090 KL/Day. For Process effluent treatment from Adplus Chemicals and Polymers Private Limited, Development of design basis, techno-commercial bidding, technical bid evaluation has been completed for reuse and recycling of

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
		50% of treated effluent. The proposed scheme is enclosed as **Annexure I.** EPC Package contract has been awarded to M/s VA TECH WABAG on March 26. A comprehensive study for achieving ZLD for the entire Haldia Petrochemical and Adplus Chemicals has been undertaken through M/s DCPL, Project Management Consultants. A scheme for water management, including ZLD shall be implemented in phases to meet the water requirement of the entire complex as per the commitment made to MoEF&CC.
1.4	PP shall increase CoC to more than seven and switch from water-cooled system in the CPP to aircooled system by 2026.	Being implemented Several measures have been adopted in the plant during turnaround undertaken in Apr-Jun 2025, after which significant improvement has been achieved in CoC. The CoC has gradually improved to more than 7 in recent months through effective chemical treatment and efficient operations. However, during summer months, high salinity in inlet water is a challenge. HPL is evaluating multiple options to improve water quality and is committed to maintain high CoC. Based on the feasibility study report on November 2025 , (conducted by Engineering consultant M/s DCPL), it is recommended “to retain the water-cooled condenser. Rather improving COC and minimizing blowdown will be more prudent alternative”.
1.5	Comprehensive water audit shall be conducted annually and a report submitted to the concerned Regional Office of MoEF&CC. Outcome from the report to be implemented for conservation scheme.	**Being Complied** Comprehensive Water Audit has been conducted by CII and final report was received on October 2025. (Refer **Annexure -II**) Based on the findings of water audit, major focus areas for water conservation have been identified as below: i. Enhancing CoC of Cooling Water System ii. Enhance Rainwater Harvesting & Reuse iii. Reduce Domestic Water Consumption using Water Efficient Faucets and Fixtures Based on the recommendation, scheme is being developed for budgeting and implementation during FY 27- FY 29
1.6	Process effluent/ any wastewater shall not be allowed to mix with	Full Compliance

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
	storm water. Storm water drain shall be passed through the guard pond	Dedicated below ground sewerage channels and above ground pipeline system is constructed for transferring all process effluents to WWTP for treatment, meeting norms for discharge to green belt channel. Further, process area containment dykes are provided for collection of rainwater and transfer to WWTP through below ground Oily Water System for treatment and discharge to Green Belt Channel. In non-process areas, the storm water drains with sluice gates are provided that discharge un-contaminated rainwater to natural drains outside the plant boundary. In case of any contamination of stormwater, the sluice gates are operated to transfer such contaminated storm water to WWTP for appropriate treatment and discharge to Green Belt channel.
1.7	Hazardous chemicals shall be stored in tanks, tank farms, drums, carboys etc. Flame arresters shall be provided on tank farm, and solvent transfer to be done through pumps.	Complied All the hazardous chemicals are stored in properly designed tanks, drums, carboys etc. Flame arrestors are installed at the tank farm. Solvent is transferred through pump only.
1.8	Process organic residue and spent carbon, if any, shall be sent to cement industries. ETP sludge, process inorganic & evaporation salt shall be disposed of to the TSDF. The ash from the boiler shall be sold to brick manufacturers/cement industry.	Complied The ash from the coal fired boilers is used for internal land reclamation, brick manufacturing and Cement manufacturing as per MoEF&CC's Ash Notification dated 31.12.2021 and subsequent Amendments. Dried sludge from ETP is sent for co processing in cement kiln. Process Inorganic waste, mainly catalysts is sent back to authorized recyclers. Molecular sieve and other process inorganic wastes are sent to WBWML, a CHWTSDF facility in Haldia. . Hazardous waste generation and disposal details are submitted to WBPCB through Annual Returns in Form 4
1.9	Regular VOC monitoring shall be done at vulnerable points.	Complied. Online continuous ambient air monitoring stations for Total Hydrocarbon (THC), Methane Hydrocarbon (MHC), and Non Methane Hydrocarbon (NMHC) have been installed at Central Lab Building (Northern Side) and

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
		South Control Room (Southern Side of Complex). Physical monitoring of VOCs is done at 4 Locations along the boundary every month through 3rd party agency recognized by MoEFCC/CPCB. Reports of the Online VOCs monitoring and Manual monitoring is enclosed in the six-monthly environmental data generation report (Refer **Annexure – III, Chapter 5 &6**).
1.10	The oil sludge shall be subjected to melting pit for oil recovery and the residue shall be bioremediated. The sludge shall be stored in HDPE lined pit with proper leachate collection system.	Enhanced compliance achieved The oily sludge is collected in a HDPE lined pit with leachate collection system. The dewatered oil sludge is co-processed in Cement Kiln. As an alternative option, an agreement with West Bengal Waste Management Limited (WBWML) for disposal to CHWTSDF is maintained.
1.11	Oil catchers/oil traps shall be provided at all possible locations in rain/storm water drainage system inside the factory premises	Complied The process area of the plant is designed with kerb walls and 2-valve pit to ensure that no process spill reaches to stormwater channel. In addition to above, sluice gates have been provided at six strategic locations to manage any accidental spills and leaks by diverting any contaminated stormwater to WWTP for treatment and disposal.
1.12	The company shall undertake waste minimization measures as below: a) Metering and control of quantities of active ingredients to minimize waste. b) Reuse of by-products from the process as raw materials or as raw material substitutes in other processes. c) Use of automated filling to minimize spillage. d) Use of Close Feed system into batch reactors. e) Venting equipment through vapor recovery system.	Complied. Some of the key measures implemented are – • Metering system in all major input and output lines to establish proper accounting and ensure waste minimization • Byproducts being utilized as feedstock or for conversion into further value-added production– e.g. C5/C6 generated from Cracker is used for MS production and balance being used as Cracker feedstock. HPL also extracts Cyclopentane and Normal Pentane/Iso Pentane to substitute CFCs. • Automatic filling system in loading gantries and polymer bagging for all processes and products. • Closed Feed System for all reactors • Benzene Recovery Unit for vapor recovery etc. Similar actions would be incorporated in future capacity

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
	Use of high-pressure hoses for equipment cleaning etc. to reduce wastewater generation.	additions.
1.13	The greenbelt of 5-10 m width in total area of 116.0 ha, i.e. 26.7 % of the total plant area shall be developed and maintained within the plant premises. Selection of plant species shall be as per the CPCB guidelines in consultation with the State Forest Department. Saplings 4-6 feet high shall be planted. Selection of plant species shall be as per the CPCB guidelines and in consultation with the State Forest Department and native species shall be only planted. Industry shall comply with the NOC obtained vide Memo No. 2886/Comp./DLLRO/PM/25 dated 08.04.2025 and Memo No 8412/14/IDT/Misc/2025 dated 24.12.2025 for 50 ha CSB plantation in Purba Medinipur district during the period 2024-25 to 2027-28. M/s AdPlus will be responsible for developing approximately 4.9 acres (~1.98 Ha), while M/s HPL will take the responsibility of maintaining the plantation in 118.7 acres (~48 Ha) of the greenbelt area and shall regularly update the maintenance status to the Regional Office, MoEF&CC along with six monthly compliance reports. Annual audit shall be conducted by the industry for updating progress of the greenbelt developed outside the Industry which shall be submitted to Regional Office along with 6 monthly compliance reports. Greenbelt outside the project site shall be maintained for the lifetime of the industry. PP shall submit undertaking for enhancement & densification of the existing Greenbelt with tree density of 2500 trees/Ha. Trees shall be planted in the Green Belt under the campaign	Being Complied. Greenbelt of 103 hectare have been developed within the property boundary surrounding the process plants and along the boundary of the property. Action for densification of existing tree plantation areas to meet 2500 trees / acre is under progress. The work order has been awarded to WBFDCL (Green Project Wing) vide an MoU signed on 26.05.2025. Plantation work for this area is under progress. However, for 50-hectare plantation outside complex, the condition has been amended on 2nd March 2026 vide EC Identification No. EC26A2101WB5962026A as ***"Industry shall comply with the NOC obtained vide Memo No. 2886/Comp./DLLRO/PM/25 dated 08.04.2025 and Memo No 8412/14/IDT/Misc/2025 dated 24.12.2025 for 50 ha CSB plantation in Purba Medinipur district during the period 2024-25 to 2027-28"*** District Administration of Purba Medinipur has allocated a char land. About 2 Hectares has been allocated to AdPlus and 48 Hectares has been allocated for the greenbelt development of HPL. Eco-Restoration for plantation work is under progress. The details of the tree species and number of trees will be uploaded in the MeriLiFE portal annually based on actual progress made.

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
	and uploaded on the MeriLiFE portal (https://merilife.nic.in/).	
1.14	PP proposed to allocate Rs. 3.0 Crore towards Extended EMP	This condition has been amended vide EC dated 02.03.2026. It is now appearing in the EC of AdPlus only.
1.15	A separate Environmental Management Cell (having qualified person with Environmental Science/Environmental Engineering/specialization in the project area) equipped with full-fledged laboratory facilities shall be set up to carry out the Environmental Management and Monitoring functions	Complied. Separate Environmental Management Cell has been functional since inception. Two full-fledged laboratory facilities (Water & Air) have been operational within HPL premises through a 3rd party (Scientific Research Laboratory), duly recognized by WBPCB & CPCB and accredited by NABL.
1.16	Continuous online (24x7) monitoring system for stack emissions shall be installed for measurement of flue gas discharge and the pollutants concentration and the data to be transmitted to the CPCB and SPCB server. PP shall ensure that the concentration of pollutants in the ambient air quality remain within the norms specified in NAAQS 2009. In case any exceedance of air quality parameters is observed, the unit shall take action to curtail its activities immediately, till such time the ambient air quality is restored within the norms and inform the status to RO, MoEF&CC	Partly Complied • A continuous online emission monitoring system for SOx, NOx & PM are installed in CPP and connected to CPCB Server(ODAMS)- ▪ Auxiliary Boiler stacks-2 nos. ▪ HRSG stacks-2 nos. ▪ Common stack for 3 nos. CFBC boilers • Online Flue Gas Analysers in Process Heaters (PGDS & PGHU) have been installed and commissioned as well as connected to CPCB server (ODAMS portal) • With regards to OCEMS in Naphtha Cracker Unit (NCU) Stacks installed in 1998-1999, designed based on then European standards using Sulfur free Residual Fuel Gas (Mixture of Methane and Hydrogen), Feasibility Study by M/s DCPL, project engineering consultant, was conducted for installation of OCEMS. As per the study findings, installation of OCEMS in NCU heater stacks is not technically feasible considering structural integrity related issues. Letter seeking exemptions from installation of OCEMS is submitted to Chief Engineer (O&E) WBPCB and Regional Director CPCB . We continue to monitor gaseous parameters in the stack through 3rd party laboratory (Monitoring data attached as **Annexure III**, Chapter 3). In case of any exceedance of parameters in stack, appropriate action to curtain operation and troubleshooting is done to ensure compliance to emission norms as applicable. Air quality is being monitored as per NAAQ 2009 guidelines through 3rd party MoEFCC /CPCB accredited agencies.
1.17	PP to set up Occupational Health Centre for surveillance of the	Complied

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
	workers health within and outside the plant on a regular basis. The health data shall be used in deploying the duties of the workers. All workers & employees shall be provided with required safety kits/mask for personal protection	A full equipped OHC (Occupational Health Centre) is established in the factory premises for undertaking periodic health check of permanent and contractual employees in compliance to the Factories Act. Every permanent and contract employee undergo mandatory joining premedical health check-up and periodic occupational health check-ups. For the period Oct'25 - March'26, 481 Nos. own employee, 241 Nos. contractual employees have undergone through Periodic Medical examination. All employees are provided with necessary PPEs based on the area of work and occupational hazard. Job rotation is provided to avoid prolonged exposure.
1.18	The National Emission Standards for Petrochemical (Basic & Intermediates) issued by the Ministry vide G.S.R. 820 (E) dated 9th November 2012 as amended from time to time shall be followed.	**Complied.** The Emission standards as per G.S.R. 820 (E) dated 9th November 2012 as applicable are periodically monitored through 3rd party MoEFCC accredited agencies and reported to WBPCB
1.19	Recommendations of mitigation measures for possible accidents shall be implemented based on Risk Assessment studies conducted for worst-case scenarios using the latest techniques	**Complied.** Mitigation measures as recommended by the Risk Assessment Study were incorporated in the plant design to prevent any accidents based on worst case scenario. Further, appropriate training are provided to employees and mock drills are conducted regularly for different emergency scenarios.
1.20	The unit shall make the arrangement for protection of possible fire hazards during the manufacturing process in material handling. The firefighting system shall be as per the norms. PESO certificate shall be obtained. Location of storage tanks of hazardous/flammable/toxic substances shall be placed in such a way that in the event of any fire, accident, explosion or any unforeseen conditions the impact of such an event should not go beyond the boundary of the plant i.e. the risk should be tolerable (acceptable) at the boundary.	Complied The layout of the plant including the location of the storage tanks for hazardous/ flammable/toxic substances are made following the international standards for Petrochemical industry. The fire-fighting system is designed in compliance to the guidelines of OISD-116 and certified by West Bengal Fire Services Act,1950 (Licence No: IND/WB/FSL/20182019/114821).
1.21	Company shall maintain an Emergency Response Decision	**Shall be Complied.**

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
	support system in such a way so that identification of the detector's network for the leak source and the probable leaked quantity in real time, followed by modelling of the dispersion of the plume and consequences as forecast is done in advance and thus, no leak accident may go unattended. Accordingly, a Risk Mitigation plan shall be in place and tested using the 3D CFD modelling	An ONSEMP and OFFSEMP System is in place for managing emergency response.
1.22	Company shall determine the distance of fire hydrant while finalizing its location from storage tanks of flammable substance or any other hazardous storage substance shall be based on dispersion of Thermal Radiation so that during any unforeseen situation fire hydrant is always available to operate manually	**Complied.** Fire hydrants are being put-up as per applicable OISD 116 that takes into consideration the dispersion of thermal radiation due to any fire incident and the fire hydrant is at appropriate distance for manual operation. Further, fire suits are also maintained for ensuring protection and safety from Thermal Radiation exposure of fire fighters.
1.23	The project proponent shall develop R&D facilities to develop their own technologies for propylene and polypropylene processing	**Complied** A state-of-the art Application Research and Development Centre (ARDC) of HPL is functional for developing Polypropylene processing applications.
1.24	PP shall sensitize and create awareness among the people working within the project area as well as its surrounding area on the ban of single Use plastic in order to ensure the compliance of notification published by MOEFCC on 12th August 2021. A report along with photographs on the measures taken shall also be included in the six-monthly compliance report being submitted to concerned authority	**Complied.** Photographs on the measures taken is enclosed as **Annexure – IV**

General EC Conditions for (Petroleum Products and petrochemical based processing such as production of carbon black and electrode grade graphite (processes other than cracking)

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
2.1	No further expansion or modifications in the plant, other than mentioned in the EIA Notification, 2006 and its amendments, shall be carried out without prior approval of the Ministry of Environment, Forest and Climate Change/SEIAA, as applicable. In case of deviations or alterations in the project proposal from those submitted to this Ministry for clearance, a fresh reference shall be made to the Ministry/SEIAA, as applicable, to assess the adequacy of conditions imposed and to add additional environmental protection measures required, if any	Shall be Complied.
2.2	The energy source for lighting purpose shall be preferably LED based, or advanced having preference in energy conservation and environment betterment.	**Being complied** Presently all existing lighting fixtures in the Plant are being replaced with LED fixtures in a phased manner and > 95 % have already been replaced or being replaced. For all new projects and installations, only LED lighting fixtures.
2.3	The overall noise levels in and around the plant area shall be kept well within the standards by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels shall conform to the standards prescribed under the Environment (Protection) Act, 1986 Rules, 1989 viz. 75 dBA (day time) and 70 dBA (night time)	Complied Noise generating equipment are procured with noise reducing/attenuating measures by the OEM preferably below 80dBA or minimum 25 dBA insertion. Further, acoustic hoods, silences and enclosures are provided as applicable for reducing noise pollution. Noise generating equipment are maintained through vibration monitoring, preventive and predictive maintenance. Ambient noise monitoring and work place noise monitoring is measured/monitored periodically during day and night operations during Day and Night time for compliance. The ambient noise monitored through 3rd party CPCB/WBPCB recognised and NABL accredited laboratory at multiple location along the boundary in every quarter and report submitted to MoEF&CC/CPCB/WBPCB along with six-monthly EC compliance report. The monitoring data is summarized in **Annexure III**, Chapter 7
2.4	The company shall undertake all relevant measures for improving the socio-economic conditions of the surrounding area. CER activities	Complied.

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
	shall be undertaken by involving local villages and administration and shall be implemented. The company shall undertake economic developmental measures including community welfare measures in the project area for the overall improvement of the environment	
2.5	The company shall earmark sufficient funds towards capital cost and recurring cost per annum to implement the conditions stipulated by the Ministry of Environment, Forest and Climate Change as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so earmarked for environment management/ pollution control measures shall not be diverted for any other purpose	Complied The budget for capital and recurring cost for implementation of conditions stipulated in EC and CTO are allocated annually and are accounted separately. The expenditure towards Environmental Management during Oct'25-Mar'26 is mentioned as in the **Annexure - V**
2.6	A copy of the clearance letter shall be sent by the project proponent to concerned Panchayet, Zilla Parishad/Municipal Corporation. Urban local Body and local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal	**Complied.** The copy of the Environmental Clearance letter was sent to Haldia Municipality and Haldia Development Authority.
2.7	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated Environmental Clearance conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF&CC, the respective Zonal Office of CPCB and SPCB. A copy of Environmental Clearance and six-monthly compliance status report shall be posted on the website of the company	**Being complied.** The first six monthly compliance report to the EC is submitted in June 2025. As per the circular of the MoEFCC, only soft copy of the EC compliance report is sent to MoEF&CC/CPCB/WBPCB through email and hardcopy submission discontinued. The EC compliance report is also uploaded on the Parivesh Portal. A copy of the Six-monthly EC compliance report is uploaded on the company website. https://www.haldiapetrochemicals.com
2.8	The environmental statement for each financial year ending 31st march in Form-V as is mandated shall be submitted to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective Regional Office of MoEF&CC by e-mail.	**Being Complied.** The Environmental Statement in Form-V was submitted to WBPCB and Integrated Regional Office of MoEFCC on 24.09.2025 through email..
2.9	The project proponent shall inform the public that	**Complied.**

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
	the project has been accorded environmental clearance by the ministry and copies of the clearance letter are available with the SPCB/Committee and may also be seen at Website of the Ministry and at https://parivesh.nic.in/. This shall be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same shall be forwarded to the concerned Regional Office of the Ministry	Advertisements were published in two local newspapers in English (The Telegraph) and in Bengali (Anandabazar Patrika) on 29.03.2025 to inform the public that the project has been accorded environmental clearance.
2.10	The project authorities shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of the project	The financial closure of the project has been achieved.
2.11	This Environmental clearance is granted subject to final outcome of Hon'ble Supreme Court of India, Hon'ble High Court, Hon'ble NGT and any other Court of Law, if any, as may be applicable to this project.	Noted.

Additional EC Conditions

Sl. No.	EC Conditions	Compliance Status as on 31.03.2026
3.1	PP shall split additional greenbelt of total 50 Ha area in forest land proportionally between M/s HPL and M/s AdPlus developed outside the HPL Complex and maintain greenbelt area for lifetime of the project. M/s AdPlus will be responsible for developing approximately 4.9 acres (~1.98 Ha), while M/s HPL will take charge of around 118.7 acres (~48 Ha) of the greenbelt area which shall be maintained for the lifetime of the industries. Annual audit shall be conducted by the industry for updating progress of the greenbelt developed outside the industry which shall be submitted to the Regional Office along with the 6-monthly compliance reports	Being Complied. **Refer Response to Specific Condition No. 1.13**

Treated Effluent Recycle Project

Phase-1 – 50% Recycle

Effluent Recycle Capacity

Phase 1 : 300 m3/hr

Phase 2 : Additional 229 m3/hr

System Description for Phase - 1

Raw effluent from existing common effluent sump beside existing Guard Pond shall be tapped to the proposed Recycle Plant from the common effluent header to outfall upstream of the connection for treated phenolic effluent thus eliminating requirement of new pumps and pump house.

In the Recycle Plant, the effluent shall be subjected first to clarification for removal of suspended solids by coagulation and settling. Suitable chemicals shall be added for aiding coagulation, pH correction and biocide reduction and partial softening. The High Rate Solid Contact Clarifier (HRSCC – 1 No.) shall be of RCC construction. The HRSCC overflow shall be collected in Clarified Water Tank (MS Epoxy / Sheet Molding Compound (SMC) Panel construction). The sludge from the HRSCC shall be collected in a sludge sump and further dewatered to be suitably disposed of by HPL in the form of cake. The recovered water from sludge dewatering shall be fed to the common Waste Water Sump (RCC construction) for collection of waste streams from various plant units**.**

The Effluent piping from the common effluent header, Clarifier, Sludge dewatering facilities and wastewater sump shall be designed to handle total flow of Phase - 1 & 2 i.e. for 529 m3/hr of Recycled effluent and all downstream equipment for 300 m3/hr Recycled effluent.

Clarified water from Clarified Water Tank shall be subjected to further suspended solids removal in Dual media filter (DMF) and Activated Carbon Filter (ACF). Filter feed pumps (2W+1S) shall be provided to pump water from Clarified Water Tank to the Filtration system. The filtered water shall be collected in Filtered Water Tank of MS Epoxy / Sheet Molding Compound (SMC) Panel. The filters will be backwashed periodically with filtrate water. Backwash pumps (1W+1S) shall be provided for filtered water supply during backwash. The backwash water shall be drained to the common Waste Water Sump and recycled back to the existing Guard Pond by Waste Water Recycle Pumps (1W+1S).

Filtered water from Filtered Water Tank shall be pumped to UF system (2W+0S) by UF feed pumps (2W+1S). The system shall also include any pretreatment if necessary, as per EPC/LSTK supplier's design and also necessary facilities for backwash and Chemical Enhanced Backwash (CEB). Filtrate from UF shall be collected in RO Feed Tank (MS Epoxy / Sheet Molding Compound (SMC) Panel Construction). UF backwash waste shall be terminated to the Waste Water sump to be mixed with Filter backwash and pumped to the existing Guard Pond. Minimum expected recovery from UF system is 90%.

RO Feed Tank shall be provided with RO Feed Pumps (2W+1S) to pump water to the RO system. RO shall be designed for 2X50% configuration with no standby. The system shall include upstream Micron Cartridge Filter (MCF), High Pressure Pumps, two stage RO Skid, anti-scalant and SMBS dosing, facilities for cleaning in process (CIP) and permeate pH correction. Permeate and reject from RO shall be collected respectively in RO Permeate Tank and RO Reject sump. RO permeate Tank shall be of MS Epoxy / Sheet Molding Compound (SMC) Panel construction and RO reject sump shall be an underground RCC sump with lining.

For transfer of permeate from RO Permeate Tank to existing Cooling Towers, Permeate Transfer Pumps (1W+1S) shall be installed. For handling RO Reject in Phase –1, Reject Transfer Pumps (1W+1S) shall be installed. HPL intends surface discharge of the reject in Phase – 1. The Phase – 1 reject shall be fed to the existing effluent header to outfall upstream of the online monitoring station.

DWG. NO. 24A17-SKM-DWG-M-0001 REV. 1

REJECT FROM PHASE 1

PHENOLIC EFFLUENT 26 M³/Hr

DISPOSAL TO GREEN BELT CHANNEL

EXISTING PUMP HOUSE
7 NOS PUMP. HEAD = 30M
FLOW = 450 M³/Hr EACH

NEW BFV

NEW NRV

EXISTING ONLINE MONITORING

POLYMER

$Fe\ CL_3$

SODA ASH

LIME

ACID DOSING

COMMON SUMP

EXISTING CTBD 1

EXISTING CTBD 2

EXISTING GUARD POND 2
2 x 4090M³

EXISTING GUARD POND 1

TAPPING FOR PHASE 1 & 2

363.5 M³/Hr

HPL

EPC / LSTK VENDOR

HyPO

CLARIFICATION SYSTEM
NOTE : 1

720 M³/Hr (DES)

CLARIFIED WATER TANK (MS EPOXY / SMC PANEL)
(1200 M³)

FILTER FEED PUMPS
(2W+1S)
245 M³/Hr (DES)

440 M³/Hr (2x50%)
(FOR 22 Hrs.)

FILTRATION UNIT (DMF / MGF + ACF)
NOTE : 2

~9680 M³/Day

FILTER B/W PUMPS
(1W+1S)

FILTERED WATER TANK
(MS EPOXY / SMC PANEL)
(1000 M³)

~9400 M³/Day

DES CAP.430 M³/Hr
(2x50%)
FOR 22 Hrs..

UF SYSTEM
(≥**90% RECOVERY**)
NOTE : 3

UF FEED PUMPS
(2W+1S)
235 M³/Hr

FILTER B/W WASTE
117 M³/Day

SLUDGE
(@2% SOLIDS)

SLUDGE SUMP
(RCC)

DEWATERING POLYMER

SLUDGE DEWATERING

EPC / LSTK VENDOR

HPL

SLUDGE CAKE FOR DISPOSAL

EPC / LSTK VENDOR

HPL

WASTE WATER RECYCLE PUMP

TO GUARD POND

CAP. 75 M³/Hr (DES)

WASTE WATER SUMP
(RCC)
250 M³

UF BACK WASH WASTE

~940 M³/Day

~940 M³/Day

8460 M³/Day

ACID / NaOH

ANTISCALANT

SMBS

RO FEED WATER TANK
(MS EPOXY / SMC PANEL)
(1000 M³)

353 M³/Hr.

RO FEED PUMPS
(2W+1S)
200 M³/Hr

300 M³/Hr 2x50%)
24 Hr.

TWO STAGE RO SYSTEM
(RECOVERY ≥85)
NOTE : 4

300 M³/Hr

RO PERMEATE TANK
(MS EPOXY / SMC PANEL)
(400Cum)

RO PERMEATE PUMPS
(1W+1S)
400 M³/Hr (DES)

HPL

EPC / LSTK VENDOR

RO PERMEATE TO COOLING TOWER
(TDS < 300PPM)

REJECT FROM FUTURE RO

~52 M³/Hr

RO REJECT SUMP
(RCC+TILING)
(400Cum)

HPL

EPC / LSTK VENDOR

REJECT TRANSFER PUMPS
60 M³/HR
(1W+1S)

UF BACK WASH PUMPS
(1W+1S)

NOTE:

1. INCLUDES CLARIFIER FLASH MIXING, CHEMICAL DOSING & SLUDGE REMOVAL.
2. INCLUDES FILTERS WITH FRONTAL PIPING, BLOWERS, ACF (IF REQD.) ETC.
3. INCLUDES UPSTREAM STRAINER, UF SKID, BACKWASH TANKS & PUMPS ETC.
4. INCLUDES MCF, RO HP PUMPS, RO SKID, CIP TANK & PUMPS, DOSING SYSTEM, pH CORRECTION.
5. EQUIPMENT / SYSTEM INDICATED IN – – – – – LINES ARE UNDER FUTURE PH II.
6. ALL EQUIPMENTS / SYSTEM CAPACITIES INDICATED FOR PH I ONLY. FINAL CAPACITIES SHALL BE AS PER DESIGN OF EPC / LSTK SUPPLIER.
7. ALL RECOVERY FIGURES ARE TENTATIVE. EXACT FIGURES SHALL BE AS PER DESIGN OF EPC/LSTK SUPPLIER.

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
	REVIEWED						SB	SN	1	05.11.25

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REVIEWED: ARCHITECTURAL; CIVIL & STRUCTURAL; ELECTRICAL; INSTRUMENTATION; MECHANICAL

SCHEME DRAWING (PHASE- 1)

RECYCLE OF TREATED EFFLUENT

HALDIA PETROCHEMICALS LTD

DEVELOPMENT CONSULTANTS LTD.
CONSULTING ENGINEERS
CALCUTTA·MUMBAI·MADRAS·NEW DELHI

DRAWN : SN	CHECKED : SB	SCALE	NIL
REVIEWED : SB		DATE	11/02/25
APPROVED : DSM		JOB NO.	24A17

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WATER AUDIT REPORT

Haldia Petrochemicals Limited
Haldia, West Bengal

Prepared By

Confederation of Indian Industry
CII – Triveni Water Institute

April 2025

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Abbreviations

ACF	Activated Carbon Filter
AHP	Ash Handling Plant
CHP	Coal Handling Plant
COC	Cycle of Concentration
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CT	Cooling Tower
CW	Circulating Water
ETP	Effluent Treatment Plant
MB	Mixed Bed
MoEFCC	Ministry of Environment Forest & Climate Change
O&G	Oil & Grease
OHT	Overhead Tank
RWH	Rainwater Harvesting
RGSF	Rapid Gravity Sand Filter
RO	Reverse Osmosis
SAC	Strong Acid Cation
SBA	Strong Base Anion
SCADA	Supervisory Control and Data Acquisition
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UF	Ultrafiltration
UFM	Ultrasonic Flow Meter
WBA	Weak Base Anion
WTP	Water Treatment Plant
CST	Condensate Storage Tank
DMF	Dual Media Filter
NCU	Naphtha Cracker Unit
CPP	Captive Power Plant
CTBD	Cooling Tower Blow Down
CPU	Condensate Polishing Unit
MCS	Mist Cooling System
N-Pit	Neutralization Pit

Executive Summary

Haldia Petrochemicals Limited is a 7,00,000 TPA operational state-of-the-art naphtha cracker complex located in Haldia, West Bengal. The major raw material for the plant is Naphtha.

HPL manufactures over 1.7 million tons of products which include polymers, such as Linear Low-Density Polyethylene (LLDPE), High Density Polyethylene (HDPE), Polypropylene (PP) and chemicals such as Benzene, Butadiene, C4 Raffinate, Liquefied Petroleum Gas (LPG), Pyrolysis Gasoline, Motor Spirit and Cyclopentane. The plant is also equipped with a captive power plant, extensive water storage facilities and large hydrocarbon and polymer warehouses. The plant expands over an area of 723 acres.

The source of water to the plant is surface water from Haldi river. This river water is supplied to the plant by the Haldia Development Authority (HDA). The plant has an agreement with HDA for the withdrawal of 43594 KLD of water from Haldi river dated 22.02.2019. The plant utilizes river water for its domestic and industrial operations. The plant also uses borewell water through four borewells inside the premises only when necessary for which the plant has a separate permit from West Bengal Ground Water Resource Authority. The present water consumption of the plant is approximately 41878.6 KLD from HDA based on the data from the period January 2024 to December 2024.

The plant has installed water flowmeter at river intake and several strategic locations to account for the water extraction and consumption at various locations.

The plant has a valid consent to operate issued by West Bengal Pollution Control Board dated 23.07.2024 which is valid upto 31.03.2029.

The plant is equipped with an Effluent Treatment Plant (ETP) having a capacity of 4,090 KLD, which comprises both primary and secondary treatment systems. The process effluent and sanitary wastewater are collectively treated in the ETP. CT blowdown along with DM plant regeneration is routed to the CTBD Reservoir for discharge outside the premises.

The stage of groundwater extraction as reported by CGWB (assessment year: 2024) is 36.37% which puts East Medinipur district of West Bengal in the category of safe zone.

Given the above scenario of prevailing resource challenge, accelerating over time progressive management Haldia Petrochemicals Limited, Haldia, WB is very keen to do water audit of premises. To get benefit of water saving projects, management of HPL awarded the task of water audit of its premises to CII Triveni Water Institute.

The audit is focused on improving water usage efficiency and identifying water conservation opportunities. Accordingly, the field study and data collection for the said water audit was carried out by CII team from 10/02/2025 to 14/02/2025. This report discusses the water balance and various water saving options derived on the basis of observation made, data collected and their analysis.

Summary of Water Audit findings are presented in the following table shown below:

Proposed Schemes		Water Savings (KLD)	Water Savings (Annual)	Cost Savings (Annual)
I	**Total Water Intake (KLD)**	41878.6		
II	**Savings Achievable (KLD)**	8468.5		
III	**Water Saving Potential (%)**	20.2		
Recommended Projects				
1	Reduce domestic water consumption inside the plant by using water efficient faucets and fixtures	559.5	204217.5	47.8
2	Enhance CoC of Cooling Towers	4778.6	1744189	408.5
3	Collect filters backwash and final rinse water at DM & CPU unit into the backwash collection tank	444.3	162169.5	37.98
4	Enhance rainwater harvesting and reuse through Natural Pond	2686.1	980426.5	226.67
Observations				
1	Plant may explore the option of floating solar system to control evaporation losses from reservoirs			
2	Enhance recovery of RO systems			
3	Higher domestic water consumption in winter season			
4	Proper Recording and Maintenance of Flowmeter Logbooks			
5	Reduce water consumption in urinal flush by using urinal screen/mat			

- Water balance across the plant has been successfully achieved. Total consumption: 41878.6 KL/day (average of Jan 2024 – Dec 2024)

- Strategies identified for reduction, reuse and recycle shows that around **20.2 % savings** can be achieved in terms of freshwater.

- In monetary terms ~ **Rs. 720.95 lakhs/annum** cost savings can be achieved.

- **Implementation Plan:**

  - Need to be conduct water conservation awareness program for amongst the staff.
  - Identification of key resource person from concerned departments to lead the water conservation and management activities along with the water management department. (*immediate*)
  - Plan implementation with time and target (management decisions) (strategically to continue)
  - Monitor proposal-by-proposal

- Undertake regular water audit for streamlining the activity and sustaining benefits of the study in long run.

1. Background and Introduction

1.1. Introduction

Water scarcity, a looming threat to global stability, presents a multifaceted risk with cascading consequences. From insufficient access to safe drinking water and sanitation for billions, to the crippling effects of droughts on agricultural production and economic growth, water insecurity poses a significant challenge to human health, food security, and overall well-being.

The World Economic Forum recognizes water security as one of the most critical challenges facing the planet today. They emphasize that despite the abundance of water on Earth, its distribution and management are crucial issues. Climate change, population growth, and unsustainable practices are pushing the global water cycle out of balance, leading to water scarcity, intense droughts, and unpredictable weather patterns. The Forum acknowledges the urgency of addressing this crisis, highlighting the 40% gap projected between global water demand and safe supply by 2030 if current practices continue.

The present study focuses on Haldia Petrochemicals Limited, Haldia, West Bengal for water audit at the plant level that would help in identification of appropriate water management and conservative strategies to minimize the risks to operations. This analysis will provide a comprehensive understanding of the facility's water usage patterns, aiming to identify areas for water conservation and develop effective water management strategies. By minimizing water-related risks to operations, the study seeks to ensure the long-term sustainability and resilience of the plant.

The foundation for effective water management and conservation lies in accurately monitoring and mapping water consumption across different processes. This is achieved through regular water audits, which identify and quantify both water usage and losses within a water system. By pinpointing areas of inefficient consumption and potential leaks, water audits provide crucial insights for implementing targeted conservation strategies and optimizing overall water resource management.

A comprehensive water audit provides a detailed picture of the water distribution system and water usage patterns across various users. This comprehensive understanding empowers more efficient and effective resource management, leading to improved system reliability. By pinpointing specific areas of water usage and potential inefficiencies, the audit facilitates accurate diagnosis of water-related challenges, paving the way for the development of optimal solutions that address them directly.

1.2. Description of Site: Haldia Petrochemicals Limited

Haldia Petrochemicals Limited is a naphtha-based integrated petrochemicals complex situated in Haldia, West Bengal, approximately 125 km from capital city Kolkata.

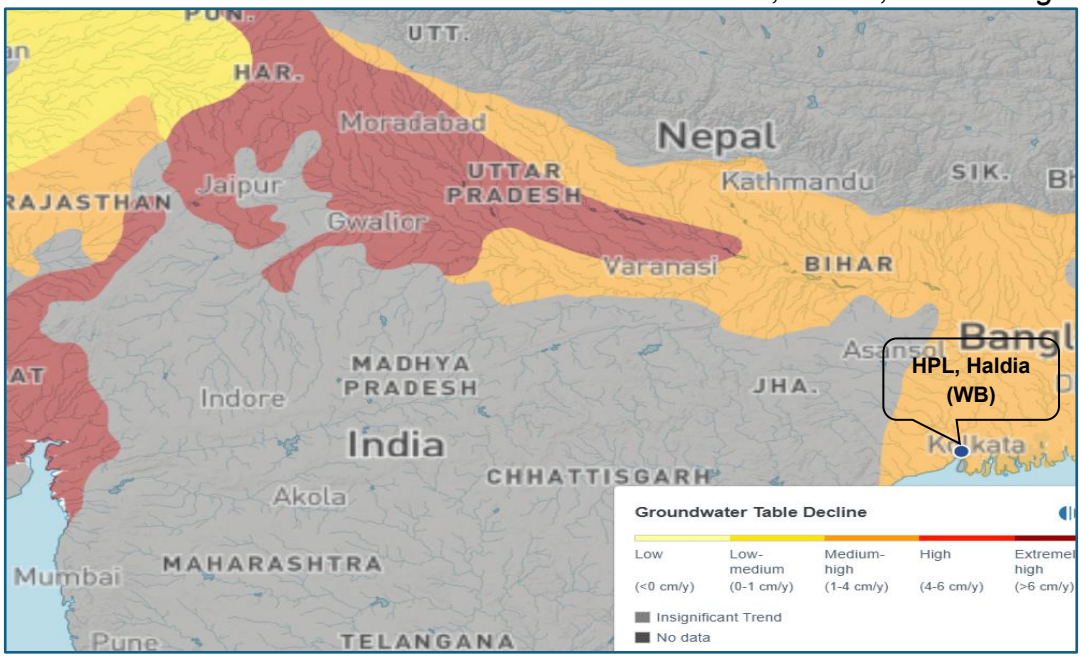
HPL manufactures over 1.7 million tons of products which include polymers, such as Linear Low-Density Polyethylene (LLDPE), High Density Polyethylene (HDPE), Polypropylene (PP) and chemicals such as Benzene, Butadiene, C4 Raffinate, Liquefied Petroleum Gas (LPG), Pyrolysis Gasoline, Motor Spirit and Cyclopentane. The complex is equipped with a captive power plant, extensive water storage handling facilities, and large hydrocarbon and polymer warehouses. The plant expands over an area of 723 acres.

Figure 1.1 Study Location: Haldia Petrochemicals Limited, Haldia, West Bengal

1.3. Groundwater situation at the plant site

The stage of groundwater extraction as reported by CGWB (assessment year: 2024) is 36.37% which puts East Medinipur district of West Bengal in the category of safe zone.

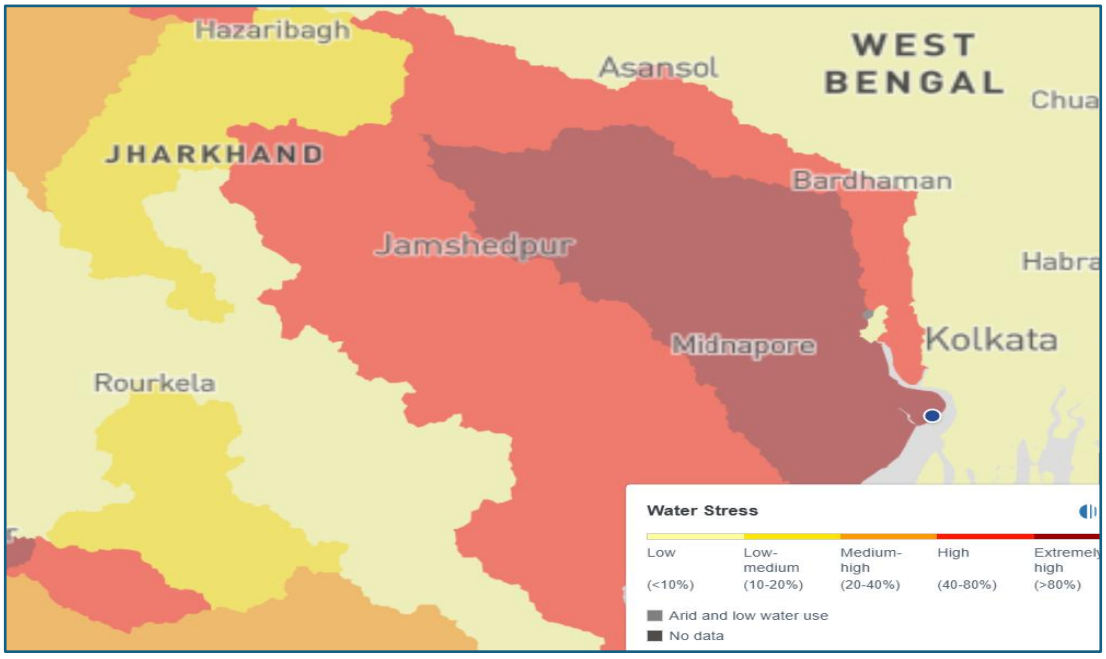
The groundwater table decline measures the average decline of the groundwater table for average change which is expressed in centimetres per year (cm/yr). Higher values indicate higher levels of unsustainable groundwater withdrawals. As per the WRI Aqueduct tool, groundwater table is showing Medium to High (1- 4 cm/y) decline trend.



Source: WRI Aqueduct Water Risk Tool

Figure 1.2 Groundwater Block Categorization of East Medinipur district (WB)

Baseline water stress measures the ratio of total water demand to available renewable surface and groundwater supplies. Water demand includes domestic, industrial, irrigation, and livestock uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability.



Source: WRI Aqueduct Water Risk Tool

Figure 1.3 Baseline Water Stress of East Medinipur district (WB)

As per the WRI Aqueduct tool the block lies in Extremely High (>80%) baseline water stress zone. High value indicates that there is more competition, and low value indicates that less competition among the users related to water for domestic, industrial, agriculture and other purposes.

1.4. Rainfall Pattern in last 5 years

Total rainfall received in Haldia district based on the data shared by the plant team shows that average rainfall is around 2643.9 mm. The rainfall varies between 2028.9 mm to 3712.5 mm in the last 5 years (2020 to 2024)

Table 1.1 Average annual rainfall in last 5 years

Year & month	Rainfall in mm				
	2020	**2021**	**2022**	**2023**	**2024**
Jan	77.00	Nil	15.40	Nil	31.40
Feb	15.80	Nil	48.60	Nil	22.20
Mar	25.60	Nil	22.80	169.70	57.80
April	55.00	16.90	18.40	40.60	Nil
May	333.00	387.00	205.30	81.30	376.20
June	263.80	238.60	220.40	537.30	122.00
July	242.70	548.30	496.40	282.50	343.80
August	1137.60	667.05	516.20	445.70	348.20
September	492.70	1343.45	577.20	546.40	483.30
October	164.20	402.20	234.30	172.70	216.00
November	10.80	Nil	Nil	22.50	2.80
December	Nil	109.00	Nil	6.50	25.20
Total	**2818.2**	**3712.5**	**2355.0**	**2305.2**	**2028.9**

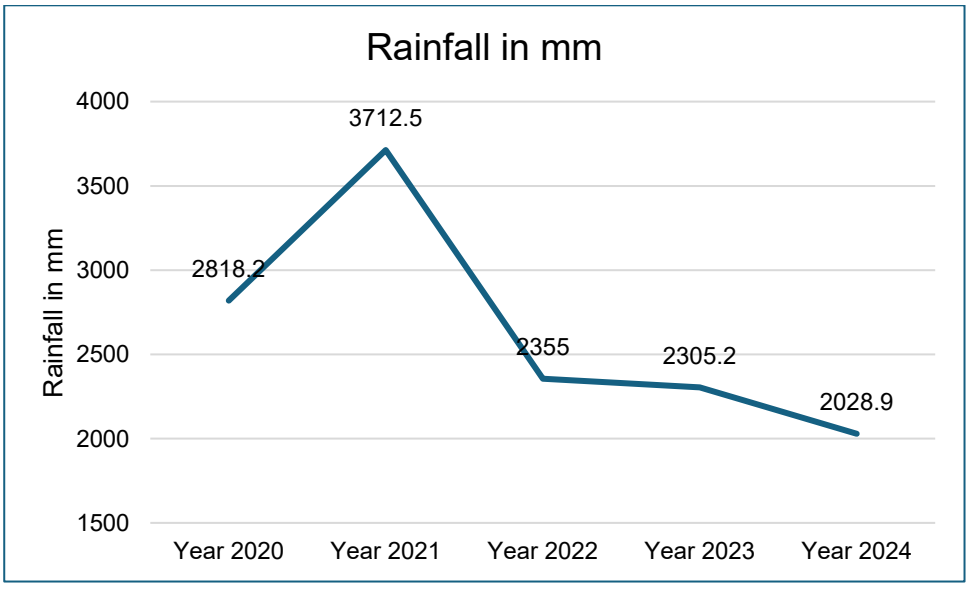


Figure 1.4 Annual Rainfall Trend in mm (Year 2020 to 2024)

2. Scope of Work and Objectives

The objective of the entire study to conduct a thorough water audit of Haldia Petrochemicals Limited, Haldia, West Bengal aimed at accurately quantifying water consumption, monitoring water usage across various activities and processes, identifying and rectifying water leakages or losses, and exploring opportunities to optimize water use through recycling, process improvements, technological advancements, and the adoption of best practices.

This audit will serve as a foundation for developing a comprehensive water conservation plan that promotes sustainable water management within the facility.

The scope of work for the study includes the following:

- Detailed process study including all utilities and water usage with process flow diagram
- Study/examine each utility and its water usage with regard to its performance efficiency.
- Identify water consumption areas based on process study and develop an adequate plan for carrying out field measurements with maximum accuracy and reasonableness.
- Monitor and measure water flow/usage using scientific methods and devices according to the plan.
- Quantify water usage, identify water-intensive activities and processes and mark unaccounted water (if any).
- Assess/examine water quality for usage in different processes, domestic use, green belt, washing, dust suppression etc with an objective to explore potential use of recycled water.
- Prepare water balance diagram including all water input and output points and quantities.
- Discuss findings with the industry management in order to ensure accuracy of data/information and water balance diagram.
- Develop water saving measures for process, each utility, domestic use, green belt, washing, dust suppression etc.
- Carry out economic, technical, and environmental feasibility of each water saving measure.
- Examine wastewater treatment systems and explore possibilities of recycling by utilizing advanced wastewater treatment technologies and tertiary treatment.
- Examine rainwater harvesting facilities and use of harvested water in place of fresh water in the industry.
- Develop a detailed plan with timeline, investment and payback for each water-saving measure, recycling, and maximized use of rainwater harvesting.

3. Methodology of the Study

3.1. Study Approach

The study was made possible with valuable support from Haldia Petrochemicals Limited, Haldia, West Bengal plant team. The study methodology involved the following steps:

1. Preliminary discussions were conducted with plant personnel, accompanied by observations in all areas where water was consumed.
2. A team of auditors conducted an in-depth site visit from **10th to 14th February 2025**. This comprehensive evaluation covered all areas of the plant, allowing the team to analyse existing water management practices and identify potential areas for enhancement.
3. Data collection was carried out through customized area specific questionnaires, discussions, examination of historical records, and scrutiny of specifications to gain a comprehensive understanding of water management practices. The analysis is based on data collected for the period **January 2024 to December 2024**.
4. Water conservation opportunities were identified for short-term, Medium-term and long-term application, emphasizing opportunities to improve water use efficiency.
5. Investment-grade projects within the plant were pinpointed for a detailed analysis, further paving the way for their potential implementation.
6. The primary objective of the study was to enhance water utilization efficiency and uncover avenues for water conservation. Economic feasibility was also evaluated using simple payback calculations, which determined the time required to recover investments made for implementing the recommendations.
7. The audit study used specialized instruments such as the ultrasonic water flow meter and multiparameter quality analyzer to facilitate precise measurements and analyses. Continuous engagement with facility personnel ensured that the proposed suggestions were both realistic and practicable, allowing for seamless concurrent implementation alongside existing operations.

8. A report summarizing the study's findings was prepared, discussed internally, and subsequently shared to the plant's management for their consideration.

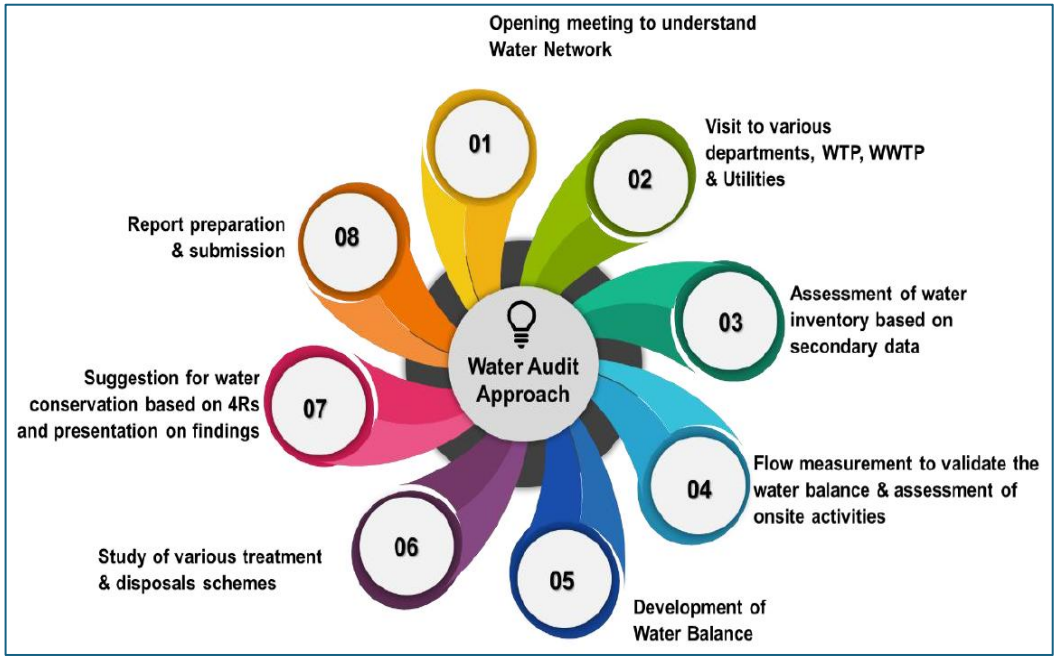


Figure 3.1 Approach and methodology of the study

3.2. Plant Survey

The water audit site visit was conducted from 10th February to 14th February 2025 to understand the sources of water, water treatment system, water distribution networks, points of water consumption and wastewater treatment processes and disposal schemes.

The activities carried out during the visit include:

- On site discussion with different area managers to understand the water distribution network.
- Flow measurement was conducted for validating existing water flowmeters and at various other locations for determination of instantaneous flows.
- Understanding pipe layout networks feeding into different storages, units, and operations.
- Collation and compilation of information for preparing water inventory identifying various water sources (quality & quantity); existing water distribution system, water usage for process, utilities, domestic & other areas and wastewater discharge points.

- Identification of wastewater streams from key areas
- Opportunities for water conservation (projects) were also explored during the site visit.
- The projects were discussed with the plant management for their valuable input and suggestions.

3.3. Tools & Techniques

To establish the water balance, flow measurements were conducted at various locations. The flow can be estimated using ultrasonic flow meters, resorting to a bucket and stopwatch method only when metering with an ultrasonic flow meter was not feasible.

Ultrasonic Clamp-On Water Flowmeters: Principle and Application

Ultrasonic clamp-on flowmeters are innovative devices designed to accurately measure the flow rate of liquids inside pipes without the need for direct contact or intrusion into the piping system. These flowmeters operate on the principle of ultrasonic technology, utilizing sound waves to gauge the velocity of the fluid within the pipe.

The fundamental principle behind ultrasonic flowmeters involves the transmission of ultrasonic signals through the fluid in the pipe. These signals are composed of high-frequency sound waves that travel upstream and downstream within the liquid. When the liquid is flowing, the downstream signal travels slower than the upstream signal, and the device calculates the time difference between them. This time differential, combined with the pipe's internal dimensions, allows the flowmeter to compute the precise flow rate.

Figure 3.2 Photograph: Clamp on Ultrasonic Water Flowmeter

Measurements were conducted using two techniques: single traverse (diagonal) and double traverse (reflex). In the single traverse method, two transducers are positioned on opposite sides of the pipe, allowing the signal to pass through once at a 45° angle. Conversely, in the double traverse method, the signal travels through the fluid twice before reaching the other transducer.

Prior to mounting the transducers, the team ensured that the pipe surfaces were thoroughly cleaned to ensure precise flow measurements. In some areas, the presence of scaling had the potential to interfere with the signal in the double traverse mode. Consequently, for enhanced accuracy, particularly in larger pipe diameters, the single traverse mode was adopted for water flow measurements.

Additionally, an encompassing water distribution plan for the plant was devised, and a comprehensive review of metering and control practices was conducted across various user areas. Notably, it was observed that the plant had initiated efforts to install meters in key consumption zones as part of their commitment to effective water management.

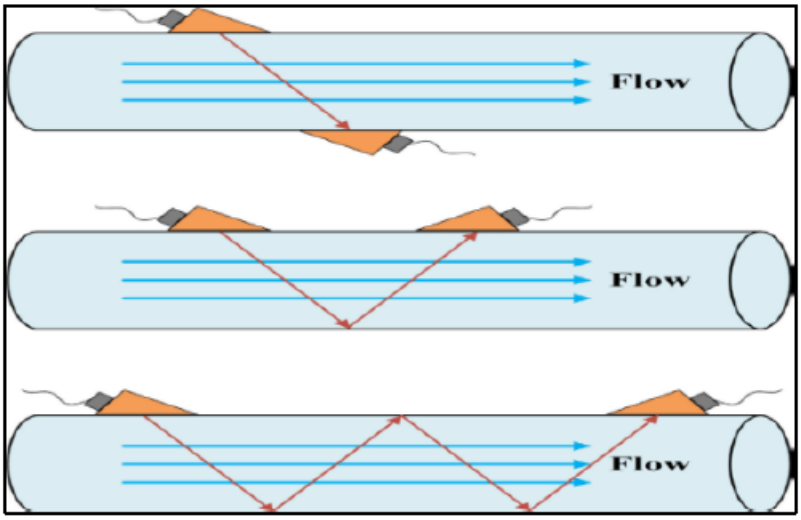


Figure 3.3 Common mounting configurations: Z method & V method

Utilization of the multi-parameter PCSTestr 35 in Water Quality Assessment

During the water audit, the multi-parameter PCSTestr 35, manufactured by Eutech (part of Thermo Fisher Scientific), was used for conducting precise water quality assessments. This portable device aided in measuring multiple essential parameters, including pH, conductivity, salinity, and temperature. It's use helped to gather accurate and comprehensive data on water quality during the assessment process, ensuring a thorough evaluation of the water system.

Figure 3.4 Photograph: Multi-Parameter PCSTestr 35

Table 3.1 Water Audit Instruments with Specifications

S no	Instrument name	Make	Model No.	S/N	Temp Range (Deg C)	Measurement range
1. Ultrasonic Flowmeter Details						
1	Ultrasonic Flow Meter	GE Digital Flow (TM) ISX878	TUF-2000H	81702256H	-30 to 90	DN 25-6000 mm
2	Transducer Small	GE Digital Flow (TM) ISX878	TS-2-HT	TST0006799	-30 to 90	DN 25-100 mm
3	Transducer Medium	GE Digital Flow (TM) ISX878	TM-1-HT	TMT0006201	-30 to 90	DN 50-700 mm
2. Multi-Parameter PCS Testr 35 Make: Eutech						

3.4. Data synthesis and analysis

Following the steps described previously, the secondary data, flow readings as well as the observations were compiled and analyzed. These included the following:

- Analysis of the system of water supply and its distribution
- Analysis of wastewater generated, recycled, and reused.
- Analysis of water quality at the intake, treatment & consumption of various areas.

4. Industry Process Study

4.1. Overview

Haldia Petrochemicals Limited is a 7,00,000 TPA operational state-of-the-art naphtha cracker complex located in Haldia, West Bengal. The major raw material for the plant is Naphtha.

Ethylene and propylene are important building blocks in the petrochemical industry, which are primarily produced through a process called cracking. Cracking refers to the breaking down of larger hydrocarbon molecules into smaller ones, typically involving the conversion of long-chain alkanes (such as those found in crude oil) into shorter-chain alkenes like ethylene and propylene.

HPL manufactures various products which include polymers, such as Linear Low-Density Polyethylene (LLDPE), High Density Polyethylene (HDPE), Polypropylene (PP) and chemicals such as Benzene, Butadiene, C4 Raffinate, Liquefied Petroleum Gas (LPG), Pyrolysis Gasoline, Motor Spirit and Cyclopentane.

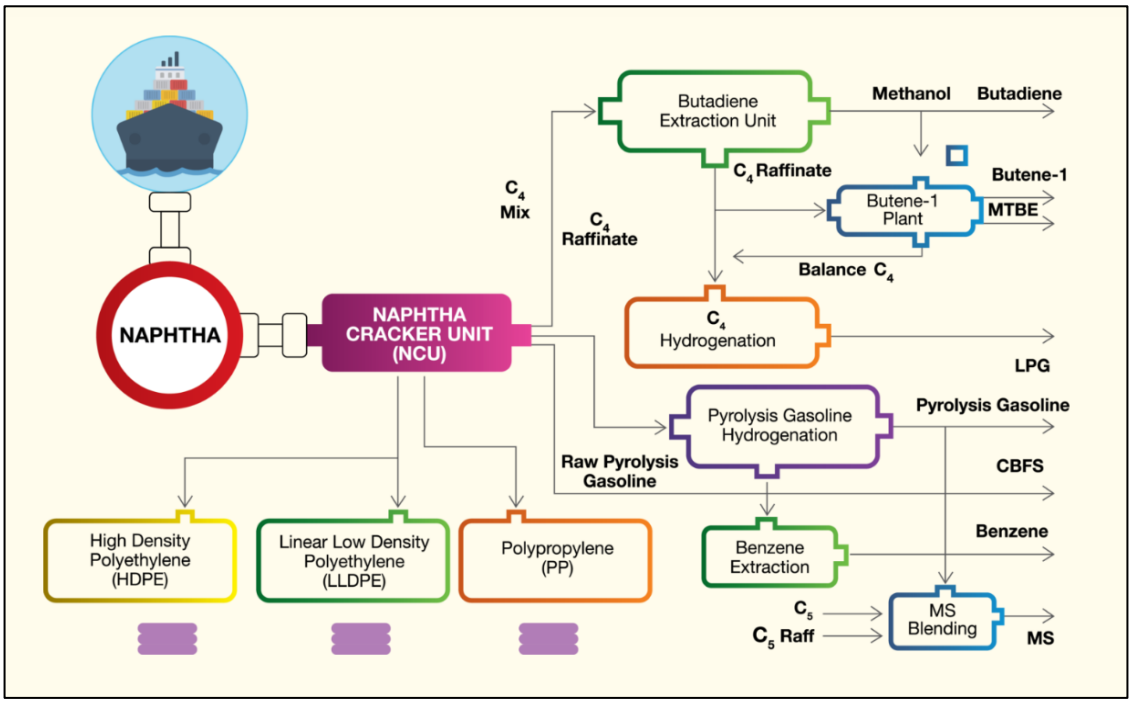


Figure 4.1 Manufacturing Process

5. Assessment of Present Water Usage including Recycling

5.1. Water Sources

The source of water to the plant is surface water from Haldi river. This river water is supplied to the plant by the Haldia Development Authority (HDA). The intake system of Chaitanyapur Pump house (HPL Pumping Station) and Basudevpur Pump house at Gaowkhali are designed to draw water to meet the plant's requirements. The plant also uses borewell water through its four borewells only when necessary. The river water intake, according to flow meter readings shared by the plant, varies from 37756.6 m^3/day to 49563.3 m^3/day for the period January 2024 to December 2024. The present water consumption of the plant is approximately 41878.6 KLD from HDA based on the data from the period January 2024 to December 2024.

5.2. Water Supply & distribution details

The water drawn from the river is initially stored in two separate reservoirs, named as North Pond and West Pond.

From the North Pond, water is pumped to stilling chamber for regulating flow and controlling sedimentation. From stilling chamber, water enters flash mixer through two outflow structures where provision is provided to intake borewell water from four borewells and East Pond water in the flash mixer where chemical dosing is done. Following uniform mixing of chemicals in flash mixer, it enters WTP clarifier where suspended solids are removed through coagulation and flocculation. The clarified water is then directed to a rapid gravity sand filter with design capacity of 520*5 m^3/hr (1 standby) for filtration. After filtration, the filtered water is stored in two WTP Reservoirs having storage capacity of 4000 KL and distributed to the different areas for various applications such as backwashing of filters, feeding the RO Plant, domestic applications, gardening and for the makeup of cooling towers. Other than this, North Pond water is directly used for fire hydrant applications and for various other applications in the plant as service water.

From the West Pond, water is pumped to stilling chamber where provision is also provided for intake of water from North Pond. Water flows through flash mixer where chemical dosing is done. Following uniform mixing of chemicals in flash mixer, it enters PTP clarifier, where suspended solids are removed through coagulation and flocculation. The clarified water is then directed to a rapid gravity sand filter with design capacity of 250*2 m^3/hr for filtration. After filtration, the filtered water is stored in two PTP Reservoirs having storage capacity of 750 KL and distributed to the different areas for various applications such as feeding the RO & DM plant, CPU, domestic and gardening applications. The plant has a provision to use the water for RO feed, domestic applications, gardening applications from both the WTP as well as PTP reservoir.

The RGSF backwash from WTP and PTP plant and DMF backwash from the RO plant are directed to a backwash collection tank with a capacity of 705.6 KL. From there, the supernatant water is collected in a clear water tank with a capacity of 204 KL and then finally transferred to the north pond for reuse.

A detailed diagram of the water supply and distribution network is given in further sections of this report.

5.3. Plant Water Consumption Trends

Monitoring water consumption trends within a plant involves tracking the variations in water usage over monthly and yearly intervals. This process entails collecting data on the amount of water utilized during specific timeframes, allowing for a comprehensive view of how water consumption evolves throughout the year. Monthly water trends highlight short-term fluctuations, while yearly trends provide a broader perspective, aiding in the identification of seasonal patterns and long-term changes in water usage.

The present water consumption of the plant is approximately 41878.6 KLD from HDA based on the data for the period January 2024 to December 2024. The daily freshwater consumption varies from 37756.7 m^3/day to 49563.3 m^3/day.

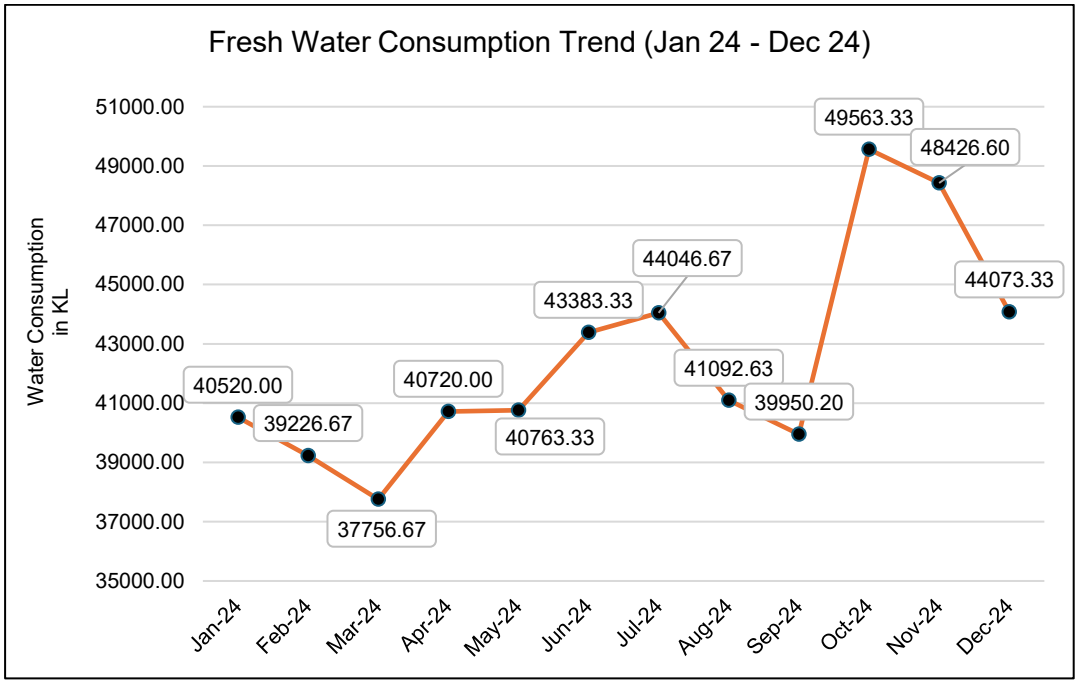


Figure 5.1 Daily Fresh Water consumption trend (Jan 24 to Dec 24)

5.4. Water Balance

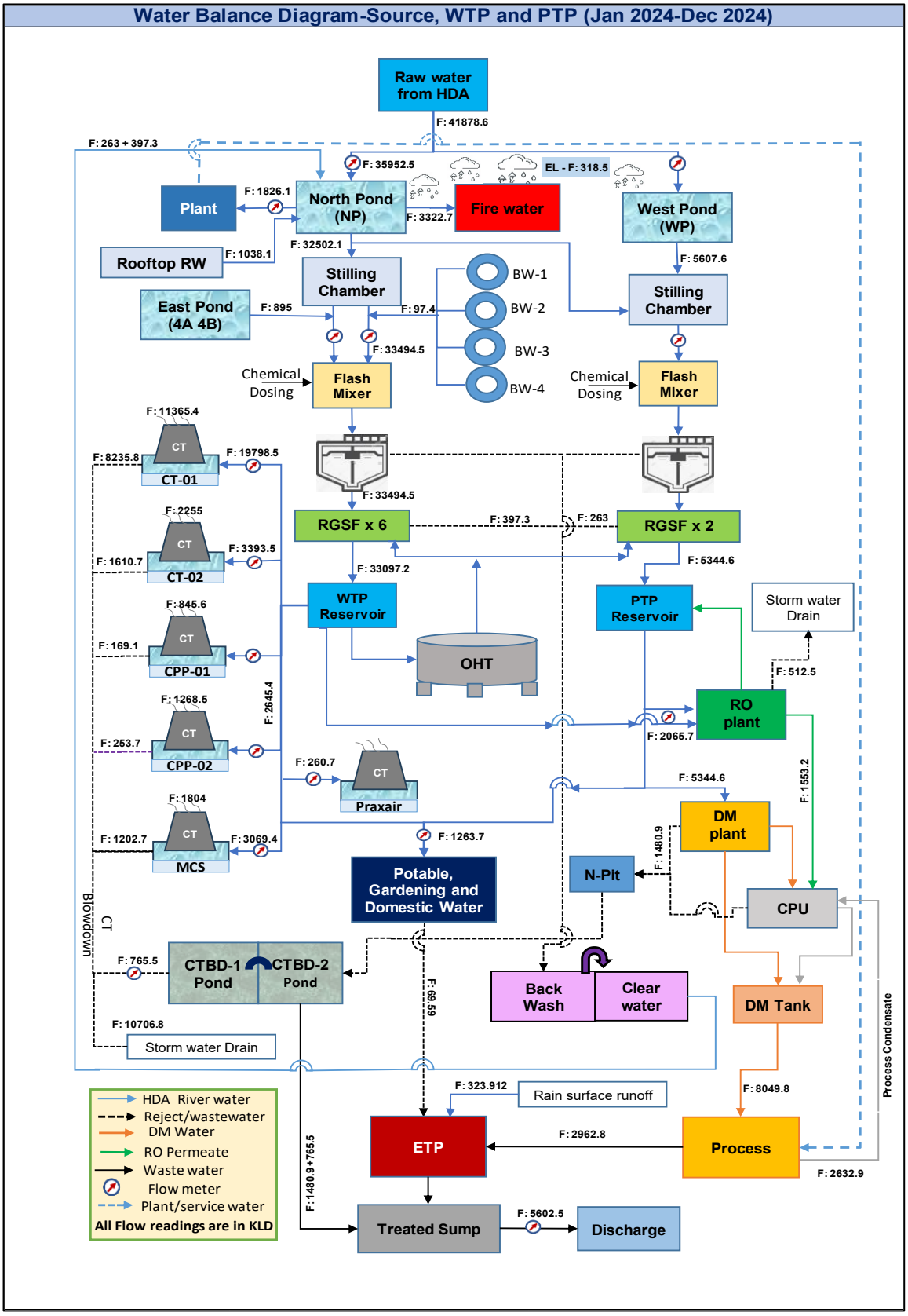


Figure 5.2 Water Distribution network & Balance diagram (WTP & PTP)

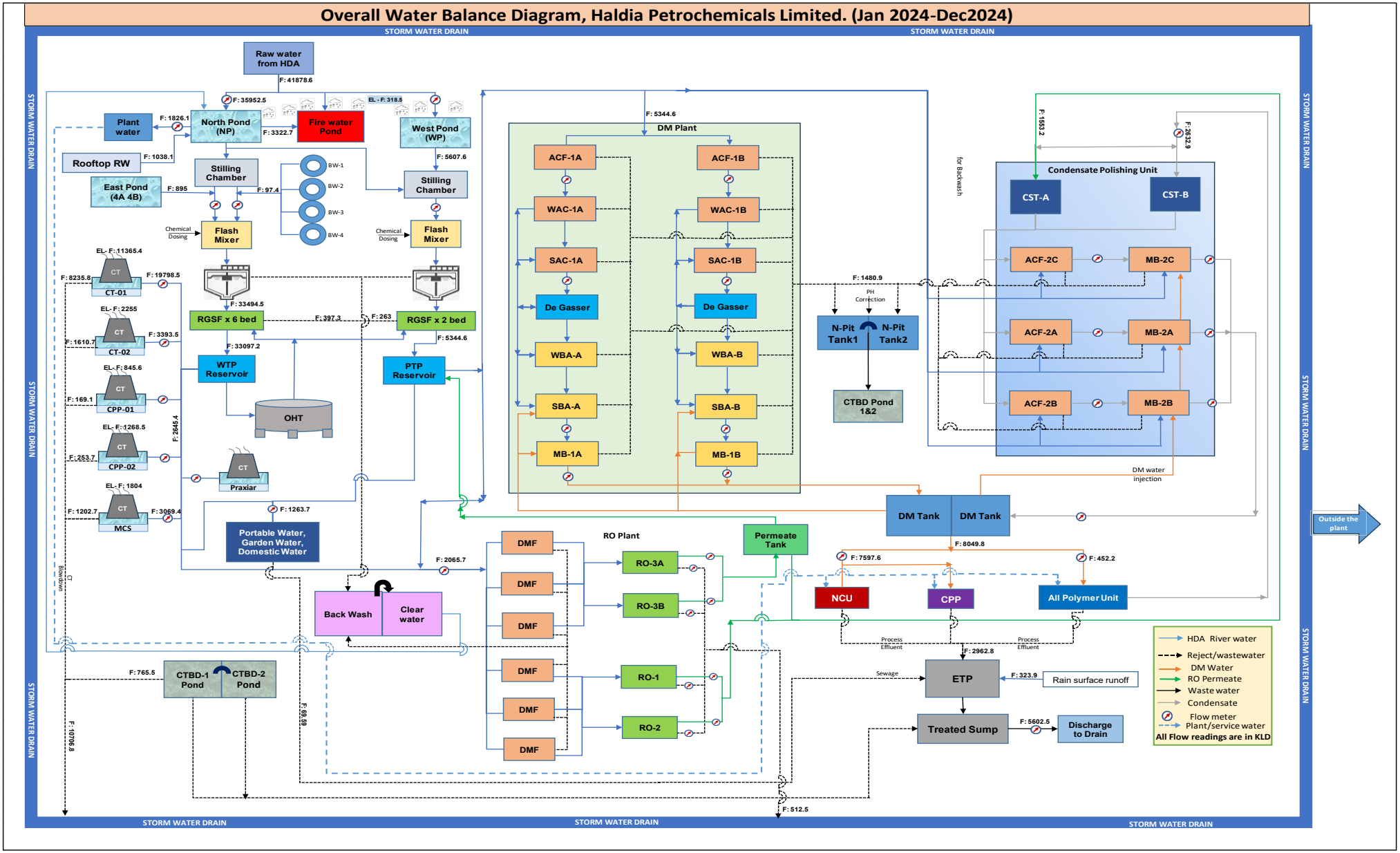


Figure 5.3 Water Distribution network & Balance diagram (Overall distribution)

Overall water balance of the plant is shown in the table below:

Table 5.1 Water Balance

S. No.	Description	Flow (KLD)	Remarks
1	Raw water from HDA	41878.6	Metered
Distribution			
1	North Pond (Including fire water)	35952.5	Data shared by the plant team
2	West Pond	5607.6	Metered
3	Evaporation losses	318.5	Calculated
North Pond Intake			
1	HDA water	35952.5	Calculated
2	WTP backwash	397.3	Data shared by the plant team
3	PTP backwash	263	Data shared by the plant team
4	Rainwater	1038.1	Data shared by the plant team
	Total intake	37650.9	Calculated as sum of above
North pond distribution			
	Total Distribution	**37650.9**	
1	Plant water	1826.1	Metered
2	Fire water tank	3322.7	Data shared by the plant team
3	WTP inlet	32502.1	Data calculated as below
WTP intake			
1	North pond to WTP stilling chamber	32502.1	RGSF inlet - Sum of water (from east pond + Borewell water)
2	East Pond	895	Data shared by the plant team
3	Borewell water	97.4	Metered
4	RGSF inlet	33494.5	Metered
5	Backwash (WTP)	397.3	Data shared by the plant team
6	WTP RGSF outlet to WTP reservoir	33097.2	Calculated as difference
WTP Reservoir distribution			
1	CT makeup	29767.7	Metered
2	Potable and gardening	1263.7	Metered
3	All RO plant feed	2065.7	Metered
	Total	33097.1	Calculated as sum
PTP Plant			
1	PTP inlet (Stilling chamber outlet)	5607.6	Metered
2	RSSF inlet	5607.6	

S. No.	Description	Flow (KLD)	Remarks
3	Backwash (PTP)	263	Data shared by the plant team
4	RGSF outlet to PTP reservoir	5344.6	Metered
PTP reservoir distribution			
1	DM plant	5344.6	Metered
RO plant			
1	Total RO feed from WTP reservoir	2065.7	Metered
2	RO Permeate to CST tank	1553.2	Metered
3	Total RO reject to storm water drain	512.5	Calculated as difference
DM and CPU Plant			
1	Feed from RO plant	1553.2	Metered
2	condensate from NCU & CPP	2632.9	Metered
3	Filtered water from PTP reservoir	5344.6	Metered
4	Total DM+CPU feed	9530.7	Calculated as sum of above
5	Filter Backwash + DM regeneration	1480.9	Calculated as difference
6	DM water produced	8049.8	Metered
DM water Distribution			
1	NCU and CPP	7597.6	Metered
2	Polymer unit	452.2	Metered

5.5. Water Metering & Monitoring System

Monitoring is the most important prerequisite for efficient water management. Thus, in the water supply network, it is necessary to have a robust system of monitoring. The presence and regular monitoring of flow meters ensures that the flows in the plant are well accounted for.

A robust monitoring system, characterized by the consistent presence and diligent maintenance of flow meters, stands as a cornerstone in achieving efficient water management within industrial operations. Consequently, during the comprehensive audit of the water supply network, considerable emphasis was placed on assessing both the functionality and adequacy of the existing flow meters. This critical evaluation process ensures that the flows throughout the plant are meticulously accounted for, underscoring the indispensable role of regular monitoring in maintaining operational integrity and resource efficiency

Table 5.2 Present Metering Status

S. No.	Flow meter Location	CII Ultrasonic FM (m^3/hr)	Plant meter (m^3/hr)	% Variation
1	6 MGD Old	425	400	5.9
2	8 MGD Old	823	837.2	-1.7
3	WTP Reservoir to all CT makeup	1312.0	1070.0	**18.4**
4	Drinking line feed	68.0	68.0	0.0
5	DM plant ACF Outlet	330.0	301.0	8.8
6	DM plant ACF Outlet	16.4	16.0	2.4
7	DM outlet to Polymer plant	16.4	16.0	2.4
8	DM outlet to (CPP+NCU)	272.0	285.0	-4.8
9	CPU ACF 2B Outlet	104.0	109.0	-4.8
10	Pump house to Plant water	74.0	72.0	2.7
11	WTP Stilling	1280.0	1275.0	0.4
12	WTP Stilling			
13	Cooling tower 1 makeup line	645.0	550.0	14.7
14	Cooling tower 2 makeup line	160.0	105.0	**34.4**
15	RO 1 Feed	95.0	95.0	0.0
16	RO 1 Permeate	64.0	65.0	-1.6
17	RO 1 Reject	31.0	30.0	3.2
18	RO 2 Feed	95.0	No Flowmeter	-
19	RO 2 Permeate	54.0	62.0	**-14.8**
20	RO 2 Reject	31.0	32.0	-3.2
21	RO 3A Feed	127.0	No Flowmeter	-
22	RO 3A Permeate	93.0	94.0	-1.1
23	RO 3A Reject	34.0	32.4	4.7
24	HSF 1	225.0	No Flowmeter	-
25	HSF 2	72.0	No Flowmeter	-
26	HSF 3	68.0	No Flowmeter	-
27	HSF 4	96.0	No Flowmeter	-
28	MCS NCU Recirculation line	3811.0	3988.0	- 4.6
29	MCS AU Recirculation line	9107.0	9217.0	-1.2
30	MCS Makeup	221.0	40.0	**81.9**
31	Equalization tank inlet	68.0	63.7	6.3
32	Equalization tank inlet	65.0	62.5	3.8
33	Sanitary Effluent	15.2	14.6	3.9
34	ETP Outlet	208.0	199.9	3.9
35	CPP Makeup	162.0	170.0	- 4.9
36	West pond to ETP treatment plant	250.0	255.0	- 2.0

Note-Flowmeters showing variation greater than 10% needs calibration

5.6. Water Quality Assessment

Monitoring water quality in industrial operations is of paramount importance to ensure product quality, regulatory compliance, and environmental responsibility. Key quality parameters such as Total Dissolved Solids (TDS), conductivity and pH levels play a crucial role in maintaining water purity. Furthermore, monitoring water quality in water and wastewater treatment plants guarantees compliance with discharge regulations and minimizes environmental impact. Proper treatment and monitoring processes enable the safe reuse or discharge of water, reducing the industry's overall water footprint and contributing to sustainable practices. During the water audit, samples from various points were collected and analysed to gain an informed understanding of quality, aiming to enhance operational efficiency and suggest multiple Strategies for reuse, reduction, and recycling.

Table 5.3 Water quality measurement conducted during the site visit

S. No.	Description	pH	Conductivity (Us/cm)	TDS (ppm)	Salinity (ppm)
1	Filtered water	8.8	1155	820	573
2	RO-2 permeate	7.2	90	64	45
3	RO-2 reject	7.8	3461	2457	1713
4	CT-1 Sump	8.8	3543	2516	1758
5	CT-2 Sump	8.4	3726	2645	1854
6	MCS Sump	8.6	3465	2460	1722
7	Borewell near MCS	8.7	733	520	365
8	DM inlet	8.6	566	402	280
9	CPU inlet	9.2	6.0	4.0	3.0
10	N-pit	10.3	5100	3621	2534
11	Drain to N-pit	3.5	860	611	428
12	SAC outlet	3.1	1537	1091	577
13	Clarifier outlet to Guard Pond	7.9	3910	2780	1840
14	Final discharge	7.6	3850	2720	1790
15	CT B/D Pond	8.6	3650	2600	1710
16	WTP filtered water	8.2	1252	888	552
17	East pond - 4A	7.6	809	575	352
18	East pond - 4B	7.55	1006	712	440
19	DM Regeneration	5.1	4950	3520	2360
20	CTBD pond	5.4	3790	2670	1760
21	CPP-CT makeup	7.8	1226	860	538
22	CPP-CT-1 sump	7.5	4310	3120	2050
23	CPP-CT-2 sump	7.5	4850	3430	2300

The above quality parameters are based on the samples collected during the site visit and may change subjected to the variation in flows received from different processes at different point of time.

5.7. Water Costing

The cost of water is pivotal for industries due to its varied usage. Efficient water management minimizes operational expenses, enhances competitiveness, and leads to significant cost savings, contributing to economic benefits. The cost of the different types of water is illustrated given below in table:

Table 5.4 Water cost

S. No	Type of water	Water cost (Rs. /KL)
1	River Water	23.42
2	Filter Water	30.32
3	DM water	68.28

6. Assessing Use of Technologies and Best Practices

6.1. Adopting use of Technology

Haldia Petrochemicals Limited, located in Haldia, West Bengal, is at the forefront of technological advancements in naphtha-based petrochemical production. By adopting innovative solutions, the company has significantly improved operational efficiency and environmental sustainability. The strategic implementation of automation systems, advanced machinery, and data analytics has streamlined polymer generation, reduced wastewater, and optimized resource consumption. This commitment to technology has not only strengthened the company's industry leadership but has also driven its overall growth and success.

Additionally, the plant's operations are monitored through a SCADA system, which ensures continuous monitoring of the water consumption and distribution.

6.2. Best practices and good initiatives taken by the plant

1. Flowmeter installed at the river intake and other major locations for water accounting.
2. Rainwater collection system in rainwater pond (East Pond).
3. Reuse of RGSF and DMF backwash at RO plant through collection in the backwash tank.
4. Blowdown from the hot side in the cooling towers.

7. Water & Wastewater Treatment and Discharge

This section provides the detailed treatment practices along with the key findings.

7.1. Raw/Fresh water Treatment

Pretreatment Plant (Capacity: 500 m³/hr.)

The pretreatment plant plays a crucial role in the pretreatment of water for a variety of uses within the plant. PTP plant receives water from both the ponds, mostly from North Pond. When the water quality parameters like chloride, hardness etc. increase, then the pretreatment plant takes the water from the west pond in its treatment process. The distribution can be seen in Figure 7.1.

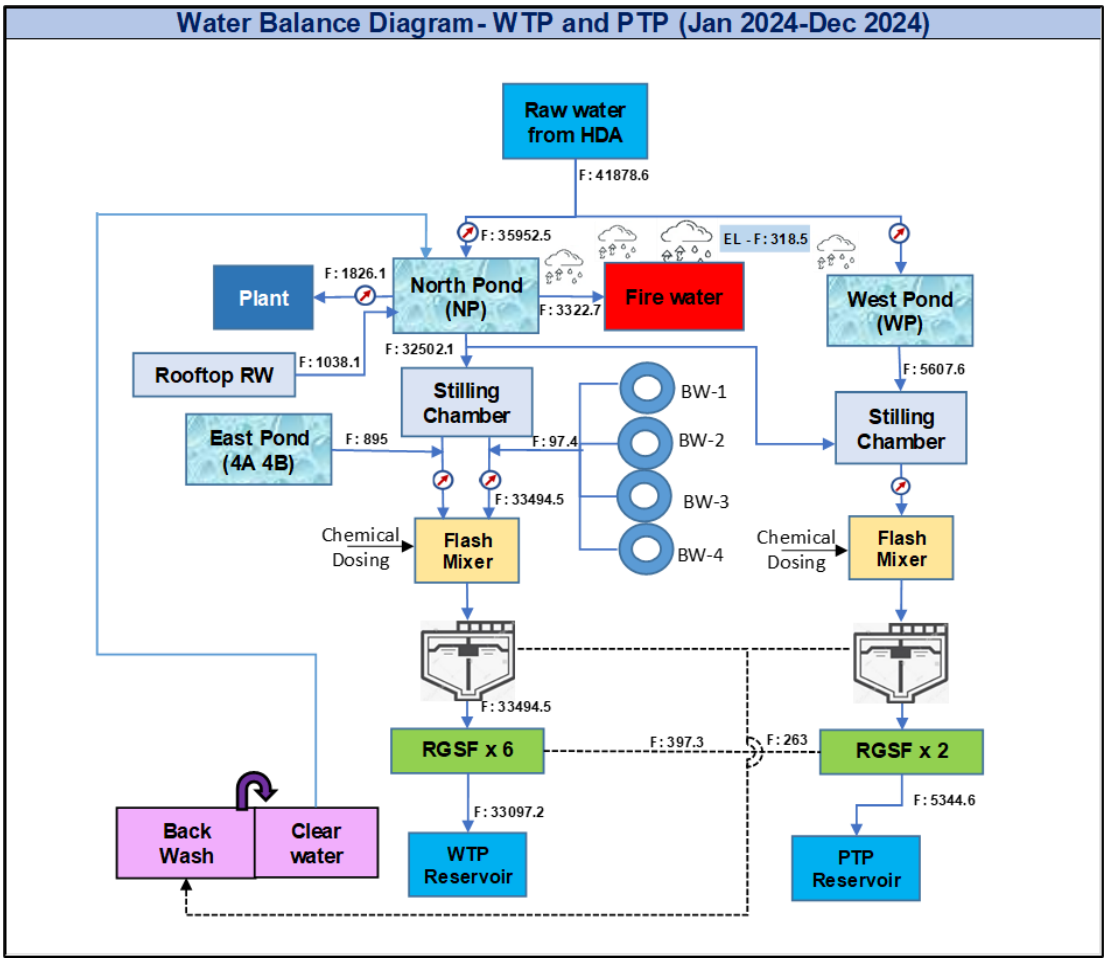


Figure 7.1 Water Balance Diagram for PTP and WTP

Stilling Chamber: After storage, the water is pumped from the reservoirs to a stilling chamber**.** The stilling chamber is the first unit in the pre-treatment process. Its purpose is to allow the raw water to slow down and settle out large debris and particles. This reduces the load on subsequent treatment units and ensures smoother flow through the treatment units.

Flash Mixer: The flash mixer is designed to rapidly mix coagulants or chemicals with water to promote particle aggregation. It creates a rapid turbulence that helps the chemicals disperse evenly, initiating the coagulation process to form flocs from suspended particles.

Clarifier: The water is then directed to the clarifier allowing suspended solids and particulate matter to settle, effectively reducing the turbidity of the water.

Rapid Gravity Sand Filter (RGSF): The clarified water is directed towards two beds of RGSF with a treatment capacity of 250 m^3/hr**.** The purpose of RGSF is to remove finer particles and additional impurities that remain in the water after the clarifying process. This step ensures that the water is further purified and ready for subsequent usage or additional treatment if necessary.

PTP Reservoir: After filtration, the water is stored in the PTP Reservoir Tank, which acts as a reserve for filtered water that can be utilized for various purposes within the plant, essential for different plant processes, including both domestic and industrial uses. It is also used in the RO and DM plant to produce demineralized water for specific applications across the plant, such as for the captive power plant's power generation, NCU for naphtha cracking, and other process-related requirements.

Water Treatment Plant (Capacity: 2600 m^3/hr.)

The Water Treatment Plant (WTP) also plays a crucial role in the pretreatment of water for a variety of uses within the plant. WTP primarily receives water from the North Pond, from rainwater collected in the East Pond and groundwater sourced from four borewells. Below is an overview of the process steps involved in the WTP treatment:

Stilling Chamber: After storage, the water is pumped from the North Pond to the stilling chamber**.** The stilling chamber is the first unit in the water treatment process. Its purpose is to allow the raw water to slow down and settle out large debris and particles. This reduces the load on subsequent treatment units and ensures smoother flow through the treatment units.

In this stage, the stilling chamber water is transferred through two distinct channels, with provisions to either include or exclude water from the borewells and rainwater from East Pond. The water is then dosed with hypochlorite for disinfection**.**

Flash Mixer: The flash mixer is designed to rapidly mix coagulants or chemicals with water to promote particle aggregation. It creates a rapid turbulence that helps the chemicals disperse evenly, initiating the coagulation process to form flocs from suspended particles.

Clarifier: The water is then directed to the clarifier when the turbidity and suspended particles load are high, or it may be bypassed to the RGSF for filtration. Operating on the principle of gravity, the clarifier allows suspended solids and particulate matter to settle, effectively reducing the water's turbidity.

Rapid Gravity Sand Filter (RGSF): The clarified water is directed to six beds of the RGSF, with a treatment capacity of 520 m^3/hr. The RGSF's primary function is to remove finer particles and remaining impurities that persist after the clarification process. This step ensures the water is further purified, making it ready for subsequent use or additional treatment if required**.**

WTP Reservoir: After filtration, the water is stored in the WTP Reservoir Tank, which acts as a reserve for filtered water that can be utilized for various purposes within the plant, including cooling tower makeup, domestic use and industrial uses.

The plant has a provision to use the water for RO feed, domestic applications, gardening applications from both the WTP as well as PTP reservoir. This PTP & WTP process is designed to ensure that the raw water is appropriately treated and purified to meet the standards required for various internal plant operations.

Filters Backwash & Sludge Management: Sludge management is an essential part of water & wastewater treatment, ensuring that the solids are efficiently processed and disposed of in an environmentally safe manner. The following steps outline the sludge management process:

Backwash collection Tanks: The water from the WTP reservoir is transferred to the Backwash Overhead Tank (OHT) of capacity 550 KL in the WTP area. This water is then used for the backwashing of all the filters in both the WTP and PTP areas. The sludge from the PTP and WTP clarifier, DMF filter backwash from the 04 skids of RO Plant and RGSF backwash water is collected in the first backwash collection tank with capacity of 705.6 KL. After a specified retention period, the supernatant water from the first tank is transferred to the second tank with a collection capacity of 204 KL. Finally, the second tank water is redirected to the North Pond for reuse.

Sludge Drying Bed: Settled sludge from the backwash collection tank is directed to the sludge drying bed for safe and dry disposal.

RO Plants: The WTP reservoir water is primarily utilized for RO plants named RO-1, RO-2, RO-3A and RO-3B plant to produce RO permeate, which is stored in a RO permeate tank. This water is then blended with treated PTP water from the PTP reservoir for use in feed for the DM plant.

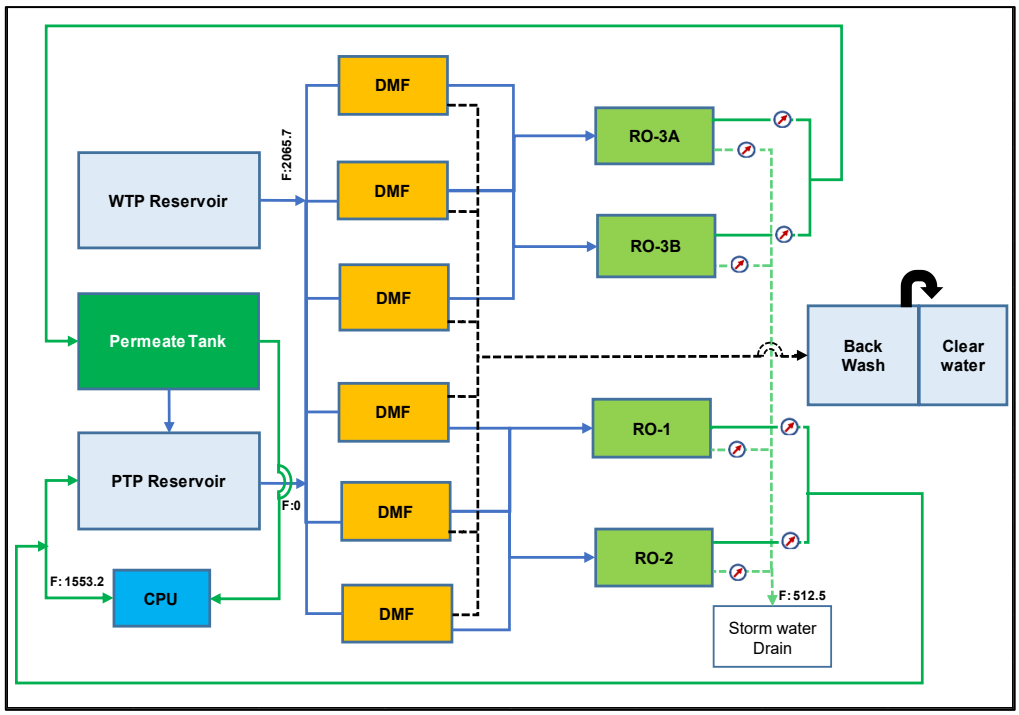


Figure 7.2 Water Balance Diagram for RO Plant

Additionally, some quantity of the RO permeate is directly mixed with condensate and supplied to the CPU Plant for DM water production. This water treatment and blending strategy enhances the efficiency of the cooling tower, DM plant, and CPU plant, while reducing overall freshwater demand and maintaining the desired water quality for utility and process applications. Below is an overview of the process steps involved in the treatment of RO plant:

Dual Media Filter (DMF): The DMF is a crucial pre-treatment component in the RO plant. It consists of two layers of filter media, usually a coarse layer of gravel and a finer layer of sand or anthracite. The purpose of the DMF is to remove large particles, suspended solids, and other impurities from the incoming water before it enters the RO membrane. By removing these larger particles, DMF helps prevent clogging and fouling of the RO membranes, thus enhancing the overall efficiency and lifespan of the RO system. DMFs can handle high turbidity levels in water, ensuring that only clean, pre-filtered water reaches the RO membranes.

Regular backwashing is undertaken to ensure that the DMF remains free from blockages, preventing pressure buildup across the filter and allowing for smooth water flow to the RO membranes. The frequency of backwashing depends on various factors, including feed quality, particle loading, filter design, and desired performance levels. In most systems, backwashing occurs periodically, typically once every 24 hours or based on the pressure differential across the filter. The backwash water is collected in a backwash collection tank for further treatment and reuse.

RO Skid: The RO membrane is the core filtration element in the process. It operates by applying pressure to the water, forcing it through the semi-permeable membrane, which allows only water molecules to pass through while rejecting contaminants like salts, heavy metals, bacteria, and other dissolved solids.

The RO membrane generates two outputs: permeate water and reject water. The RO permeate is stored in two permeate tanks with a capacity of 180 KL each and used for various utility and production process applications, while RO reject is discharged outside the plant through the stormwater drain.

Demineralized (DM) Plant and Condensate Polishing Unit (CPU)

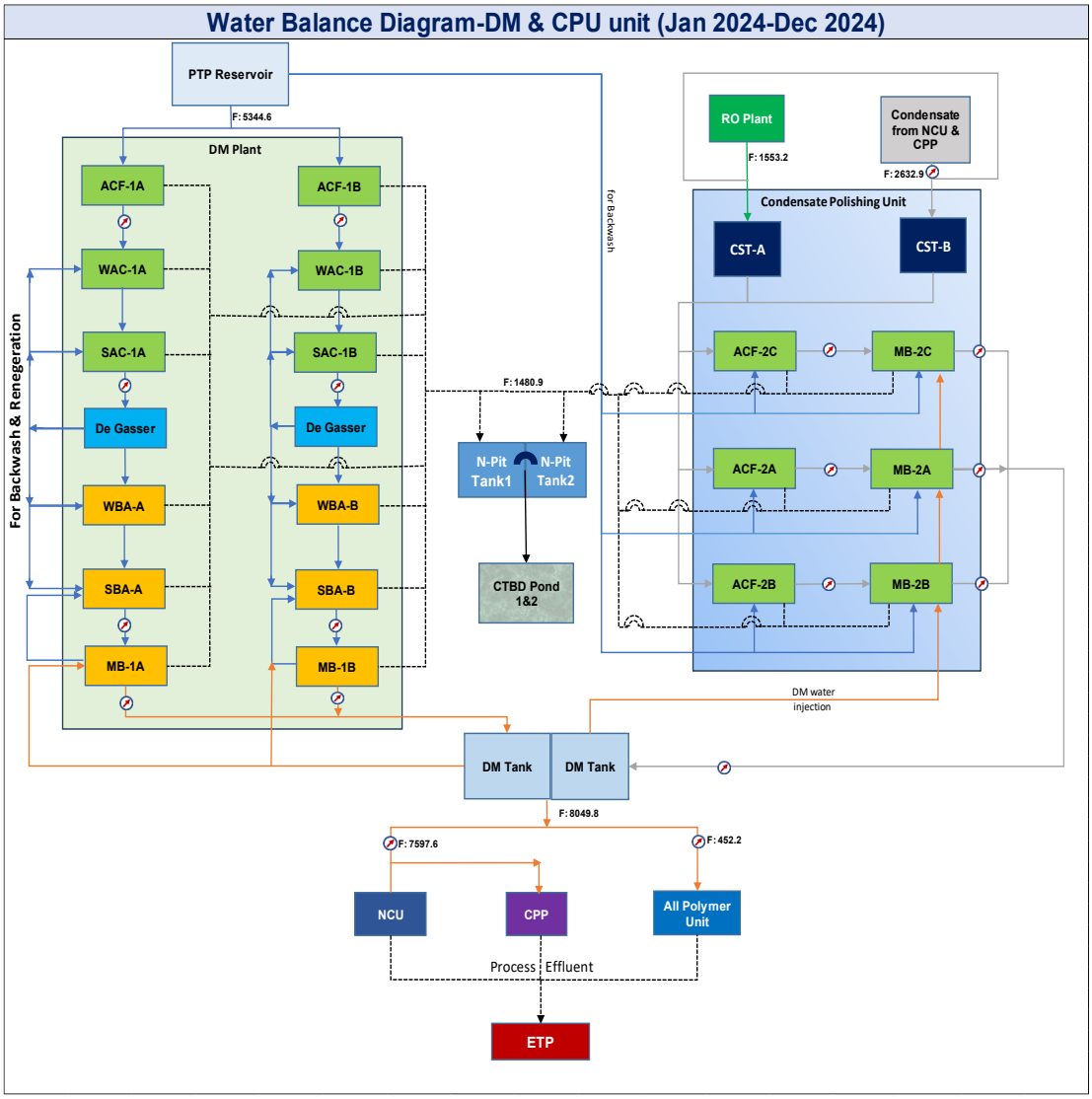


Figure 7.3 Water Balance Diagram DM & CPU Plant

DM Plant (Unit A & B):

The DM Plant with two treatment lines (Unit A & B) is designed for continuous production of demineralized water. With a series of specialized units, such as ACF, WAC, SAC, Degasser, WBA, SBA, and MB, the system ensures thorough removal of contaminants and ions from the feed water. Below is an overview of each unit in both lines, followed by a description of how backwash and regeneration are managed.

ACF (Activated Carbon Filter): The ACF is the first stage in the treatment process, used for removing organic impurities, chlorine, and other contaminants from the feed water. It ensures that the downstream units, such as the WAC and SAC, are protected from damage caused by chlorine or organic fouling.

Both Unit A and Unit B have their own ACF to ensure efficient pre-treatment of water before it moves to the next treatment stages.

WAC (Weak Acid Cation): The WAC unit is designed to remove divalent ions like calcium and magnesium from the feed water. It works by using a cation exchange resin that selectively removes these ions and exchanges them for hydrogen ions, which are later removed during regeneration.

Both unit A and unit B include a WAC to reduce hardness and prepare the water for further treatment in the next units.

SAC (Strong Acid Cation): The SAC unit is used to further remove cations, such as sodium and potassium, from the water. The SAC resin operates under acidic conditions and exchanges cations for hydrogen ions, ensuring a higher degree of demineralization.

This unit follows the WAC and is essential for achieving high purity in the final treated water. Both unit A and unit B include their own SAC.

Degasser: The degasser unit removes dissolved gases, such as carbon dioxide and oxygen, from the water, which can cause corrosion in the downstream equipment.

After the SAC unit, the degasser ensures that the water is free from gases before it enters the next stages of treatment. Both units A and B have their degassers for this purpose.

WBA (Weak Base Anion): The WBA unit removes weakly ionized anions, such as silica, bicarbonates, and some organic ions. The weak base anion resin exchanges hydroxyl ions for anions in the water.

Both unit A and unit B include a WBA unit for further deionization of the water to remove any remaining ions.

SBA (Strong Base Anion): The SBA unit is used to remove strongly ionized anions, such as chloride, sulphate, and nitrate, from the water. It operates with strong base anion resins that exchange hydroxyl ions for anions in the water.

Both treatment lines (A and B) include SBA units to ensure thorough removal of all anions, enhancing the overall quality of demineralized water.

MB (Mixed Bed) Unit: The MB unit combines both cation and anion resins in a single vessel to provide final polishing of the demineralized water. This unit is crucial to produce ultra-pure water, particularly for sensitive applications where any remaining ions could be detrimental.

Both unit A and unit B have their own MB units, ensuring that the final output from each line meets the required quality standards.

Condensate Polishing Unit (CPU)

The CPU is an essential part of water treatment in industrial processes, particularly in power plants and polymer plants. It is designed to remove impurities, such as dissolved minerals and contaminants, from the impure condensate before it is reused in the boiler. The CPU consists of several components to maintain the quality of water and ensure the smooth operation of the plant.

HPL Haldia operates with three parallel CPU lines: 2A, 2B, and 2C. Each line is equipped with the following key components:

Condensate Storage Tank A & B: The two condensate storage tanks (A and B) with a capacity of 1200 KL and 900 KL serve as temporary reservoirs for the condensate water that has been collected from the polymer plants and RO permeate from RO-3A & RO-3B plant. These tanks store the condensate before it undergoes the polishing process.

Activated Carbon Filter (ACF): The ACF is used to remove organic contaminants and trace substances from the condensate. It works by adsorbing impurities onto the surface of activated carbon granules, ensuring the water is purified and free from contaminants.

With three parallel lines (2A, 2B, and 2C), each line is equipped with its own ACF, ensuring continuous operation.

Mixed Bed (MB): The Mixed Bed unit is used to polish the condensate water by removing both cations and anions. It typically consists of a mixture of cation and anion exchange resins, which effectively remove a wide range of dissolved minerals and salts from the water.

DM Water Storage Tank: The DM water from both the DM and CPU unit is collected and stored in two DM tanks of capacity 1800 KL each for use in industrial processes.

DM & CPU units Backwash and Regeneration water management:

The ACF backwash and regeneration from both DM unit A & unit B and CPU are collected in two neutralization pits-01 & 02 with a capacity 1100 KL each.

Neutralization pits are designed to treat acidic or basic water generated during regeneration processes. They neutralize the wastewater, adjusting its pH to a safe level before it is released into the CTBD pond. The water from the CTBD pond is then mixed with treated water from the ETP before being discharged outside the plant premises.

7.2. Wastewater Treatment & Disposal

Table 7.1 Wastewater Discharge Status

S. No.	Description	Mode of Disposal
1	CT Blowdown	Discharge outside through CTBD Reservoir
2	DM Regeneration	
3	Process effluent (DWF)	ETP
4	Sanitary Effluent (Sewage)	
5	Wet Weather Flow (WWF)	

Effluent Treatment Plant

The Effluent Treatment Plant (ETP) has a capacity of 4,090 KLD and includes primary and secondary treatment. However, there is no tertiary treatment available in the ETP. The ETP uses physical, chemical, and biological processes to treat wastewater. Different types of wastewaters are generated from various process areas, as listed below:

Types of Wastewater and Collection Points:

Table 7.2 Wastewater and Collection Points

S. No.	Wastewater Source	Collection Point
1	Rainwater from the process area	Surge Pond
2	Effluent from NCU, LLDPE, PP & AU areas	ETP receiving sump
3	Effluent from the HDPE area	Equalization tank
4	Sanitary water (sewage)	Aeration Tank
5	DM regeneration	CTBD Reservoir
6	Cooling tower blowdown	CTBD Reservoir

ETP Treatment Process:

- **Receiving Sump**: All the effluent first flows into the receiving sump, where large debris and floating materials are removed. This ensures that only wastewater free of large solids moves to the next stage.
- **Tilted Plate Interceptor (TPI):** The wastewater is divided into two streams, TPI 1 & TPI 2, where oil and grease are separated using an inclined plate mechanism. This step helps in the removal of floating and suspended particles.
- **Equalization Tank:** The filtered water from both TPIs is collected in the equalization tank for homogenization. The purpose of this tank is to balance fluctuations in flow and pollutant concentrations, ensuring uniform treatment in the following stages. The tank is not equipped with aeration to prevent settling and anaerobic conditions.
- **Chemical Treatment:** The wastewater then passes through a pH correction tank, where acidic or alkaline nature is adjusted using chemicals like lime, caustic soda, or acid. After pH correction, it moves to the flash mixer, where coagulants (e.g., alum, PAC, or ferric chloride) are added to destabilize suspended particles. In the flocculator, a slow mixing process allows the small particles to clump together into larger flocs for easy removal in the next stage.
- **Dissolved Air Flotation (DAF):** The wastewater enters the DAF system, where fine air bubbles are injected to lift suspended solids and oils to the surface. The floated sludge is skimmed off, and the clear water moves to the biological treatment stage.
- **Biological Treatment:** The DAF outlet enters the aeration tank or biological tank, which operates using the Activated Sludge Process (ASP). Air is supplied using surface aerators to sustain the growth of microorganisms. These microorganisms break down organic matter into simpler compounds like carbon dioxide and water.

- **Clarification (Clarifiers 1 & 2):** The biologically treated water is transferred to two parallel clarifiers (Clarifier 1 & Clarifier 2) to separate suspended biomass. The settled sludge at the bottom is either sent back to the aeration tank (return activated sludge) or removed as waste sludge. The clear supernatant water moves to the guard pond.
- **Guard Pond:** The clarified water is temporarily stored in the two guard ponds, allowing further settling of any remaining solids before final discharge.
- **Final Blending & Discharge:** Water from the guard pond is mixed with CTBD water in the treated sump before final discharge. There is no tertiary treatment available after the clarifiers. The final discharge is monitored for compliance with environmental standards before being released.

Design Parameters For ETP:

The following table presents the designed quality parameters for raw effluent entering the ETP. These parameters help in determining the appropriate treatment process to ensure compliance with environmental discharge standards.

Table 7.3 Designed Quality of Effluent at ETP

S. No.	Parameter	Range
1	pH	6.0 – 11.0
2	Chemical Oxygen Demand	655
3	Biological Oxygen Demand	300
4	Sulphide	20.0 max.
5	Oil & Grease (E + F)	75.0 max.
6	Total Suspended Solids	40.0 max
7	Phenol	7

Discharge Parameters For ETP:

The treated effluent quality must comply with the West Bengal Pollution Control Board (WBPCB) norms to ensure safe discharge into the environment. The following table outlines the permissible limits for key parameters after treatment:

Table 7.4 Discharge Quality of Treated Effluent (WBPCB Norms)

S. No.	Parameter	Max
1	pH	5.5 to 9.0
2	Chemical Oxygen Demand	30
3	Biological Oxygen Demand	30
4	Oil & Grease	10.0
5	Total Suspended Solids	100.0

6	Phenols	1.0
7	Fluoride	5.0
8	Total Chromium as Cr	2.0
9	Cyanides as CN-	0.2
10	Hexavalent Chromium as Cr+6	0.1
11	Sulphides as S	2.0
12	Copper as Cu	1.0
13	Iron as Fe	1.0
14	Zinc as Zn	1.0
15	Phosphates as P	5.0
16	Free available chlorine	0.5

Retention Time:

The retention time (RT) of each tank is calculated based on its capacity and the daily effluent load. Proper retention time ensures efficient treatment and settling before discharge or further processing.

- The surge pond has a retention time of 5.64 days, allowing sufficient time for temporary effluent storage before further treatment.
- Guard ponds operate in parallel, with a combined capacity of 8,180 KLD and RT of 2.44 days.
- The CTBD ponds provide extended retention, ensuring effective handling of blowdown water before discharge.

Side Effects of High Retention Time:

- **Anaerobic Conditions**: Extended retention can lead to oxygen depletion, causing anaerobic conditions that promote foul odors and septic conditions.
- **Increased Sludge Deposition:** Longer retention allows more solids to settle, leading to excess sludge buildup and potential clogging.
- **Algal Growth:** Stagnant water for prolonged periods can encourage algal blooms, which can disrupt treatment processes.
- **Potential for Recontamination**: If effluent remains in storage for too long, microbial regrowth can occur, increasing COD and BOD levels.
- **Higher Evaporation Losses**: Extended retention increases water loss through evaporation, affecting overall water balance.
- **Scaling and Corrosion in Equipment**: If CTBD ponds have prolonged retention, concentrated salts can cause scaling and corrosion in the system.

Table 7.5 Retention time of ETP Reservoir

S. No.	Tank	Tank Capacity	Total Capacity	Load (KLD)	RT (Days)
1	Surge Pond	16700	16700	2962.8	5.64
2	Guard Pond 1	4090	8180	3356.3	2.44
3	Guard Pond 2	4090			
4	CTBD Pond 1	14110	28220	2246.2	12.56
5	CTBD Pond 2	14110			

Schematic of effluent treatment and disposal is shown below.

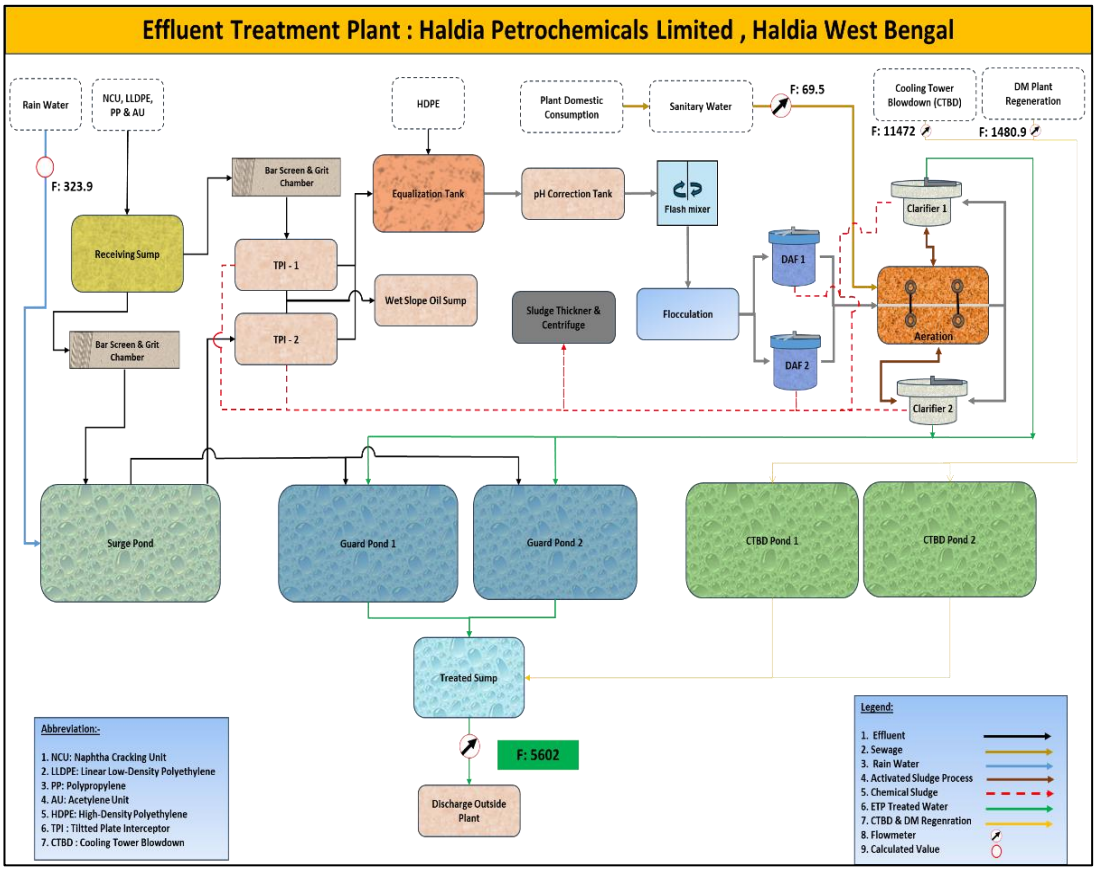


Figure 7.4 Schematic of Effluent Collection & Treatment Plant

8. Data/Information Analysis and Interpretation

Data analysis and recommendations for water & wastewater management based on the secondary data, field observations & measurements, flows from various sources were compiled and analyzed in line and further aspects on water conservation and treatment were recommended in line with the objectives of the study. This includes establishment of water balance of the water supply & distribution system. The key findings of the study are as follows:

- The source of water to the plant is river water. The plant has an agreement with HDA for the withdrawal of 43594 KLD of water from the Haldi river dated 22.02.2019. The plant utilizes river water for its domestic and industrial operations.

- The present water consumption of the plant is approximately 41878.6 KLD from Haldi river based on the data from the period January 2024 to December 2024.

- The plant also has a separate permit from West Bengal Ground Water Resource Authority to withdraw freshwater from the individual borewells. The details of the permission letter are given below:

S. No.	Borewell details (Max. Rate of Withdrawal)	Permit No.	Dated
1	Borewell-1 (100 m^3/day)	P11521720051300000002TLE	05.04.2017
2	Borewell-2 (100 m^3/day)	P11521720059100000001TLE	05.04.2017
3	Borewell-3 (100 m^3/day)	P11521700149500000001TLE	05.04.2017
4	Borewell-4(120 m^3/day)	P11521730031600000001TLE	05.04.2017

- The plant has installed water flowmeter at the intake and several strategic locations to account for the water extraction and consumption at various locations.

- The stage of groundwater extraction as reported by CGWB (assessment year: 2024) is 36.37% which puts East Medinipur district of West Bengal in the category of safe zone.

- Total rainfall received in Haldia district based on the data shared by the plant team shows that average rainfall is around 2643.9 mm. The rainfall varies between 2028.9 mm to 3712.5 mm in the last 5 years (2020 to 2024)

- The plant is equipped with an ETP having a capacity of 4,090 KLD, which comprises both primary and secondary treatment systems. The process

effluent and sanitary wastewater are collectively treated in the ETP. CT blowdown along with DM plant regeneration wastewater is routed to the CTBD reservoir for discharge outside the plant premises.

- The plant has installed real time effluent monitoring system to measure final treated effluent quality parameters such as pH, TSS, COD & BOD and transmits the same to WBPCB & CPCB servers.

- The plant team has shared the latest water quality test data of river water, ETP inlet & outlet water. (Refer Annexure II).

Total water Consumption

- The plant is using 41878.6 m^3/day of freshwater from Haldi river, 1933.1 KLD of rainwater and 97.4 KLD from borewells inside the plant for industrial & domestic purposes.

- Approx 29767.7 m^3/day i.e., 66.8 % of the total freshwater is used for cooling towers makeup.

- Approx 1826.1 m^3/day i.e., 4.1 % of the total freshwater is used for service applications.

- Approx 3322.7 m^3/day i.e., 7.5 % of the total freshwater is used for fire hydrant applications

- Approx 1263.7 m^3/day i.e., 2.8 % of the total freshwater is used for domestic and gardening applications.

- Approx 1553.2 m^3/day i.e., 3.5 % of the total freshwater is produced as RO permeate for DM feed.

- Approx 512.5 m^3/day i.e., 1.1 % of the total freshwater is drained as RO reject to storm water drain.

- Approx 660.3 m^3/day i.e., 1.5 % of the total freshwater is used for RGSF backwash.

- Approx 5344.6 m^3/day i.e., 12.0 % of the total freshwater is used for DM feed for boiler and process applications.

- Approx 318.5 m^3/day i.e., 0.7 % of the total freshwater is lost in the form of evaporation from reservoirs.

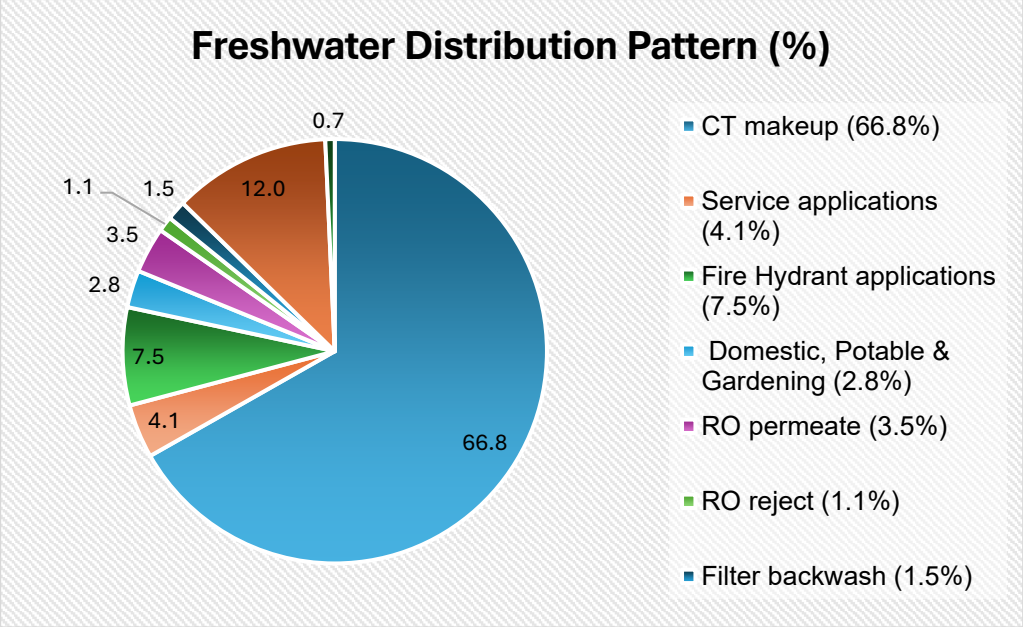


Figure 8.1 Freshwater consumption pattern for the plant

9. Water Conservation Measures, Feasibility and Management Plan

9.1. Water Saving Proposal 1: Reduce domestic water consumption inside the plant by using water efficient faucets and fixtures

9.1.1 Present Status

Presently, as per the data shared by the plant team, domestic water consumption is 1194.1 m^3/day. Domestic water consumption in the plant accounts for applications like drinking, cooking, utensil washing, hand washing and toilet flushing.

The water supply and usage patterns were discussed with plant personnel and the observations are as follows:

- Water closets in the plant are of western type with single flush type.
- Urinals in the plant are of ordinary type.
- Most of the taps for handwashing in the plant are ordinary type.

Calculations: Per Capita water Consumption

- Total number of employees in Plant (Employees + Contractual) = 2500
- Water Consumption = 1194.1 KLD
- Per capita Consumption = 1194.1 X 1000 / 2500 = 477.6 LPCD

As per IS 1172:1993, the recommended domestic water requirement for industry is 30 liters/person/day without bathing facilities (Refer Annexure IV). For plant, per capita water consumption is calculated as 477.6 litres which is much higher than the industrial benchmark.

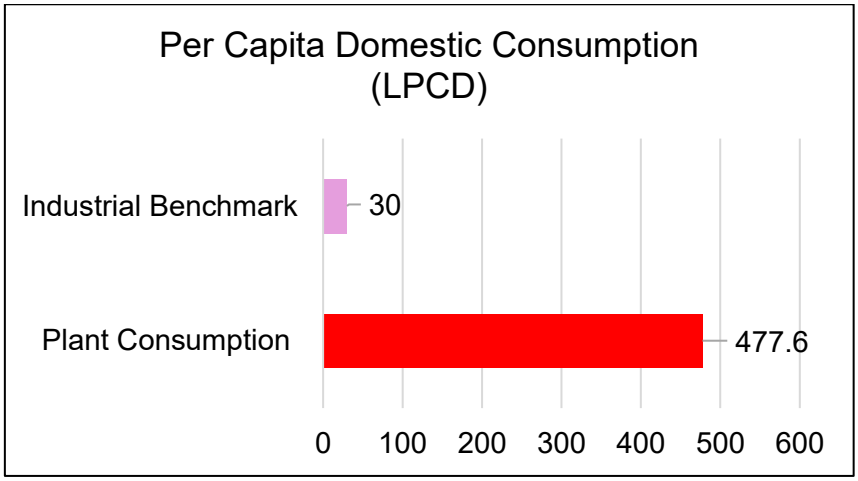


Figure 9.1 Per Capita Water Consumption (LPCD) of the plant

9.1.2 Recommendation

Efficient water saving equipment and devices are now available in the market, which if installed can result in significant water savings. These devices could be installed in phases at the plant to optimize/reduce domestic water consumption. Some of the water saving gadgets are explained in Annexure-V.

We recommend installing the following water saving gadgets in the plant:

- Switch to mist type taps or foam type taps with aerators and shower mode.
- Install low flow taps fitted with aerators/ flow restrictors in hand washing areas.
- Install waterless urinals in Offices and Admin Building.
- Install low flow taps fitted with aerators/ flow restrictors in canteens and in dish washing areas.
- Organize awareness & sensitization programmes for workforce.

Total number of employees (Permanent +Contractual) = 2500
Standard per capita consumption = 30 LPCD
Existing per capita consumption = 477.6 LPCD

Total water saving potential: (477.6 - 30) X 2500 / 1000 = 1119.0 m^3/day

The total water saving potential for the plant is 1119.0 KLD, but we are considering 50% of the total water saving potential in this financial year, which can be achieved in a phase wise manner.

The Continuous awareness is a key factor for successful water conservation program. We recommend creating awareness on water conservation through training, bulletins, posters, competition, and other means at periodic intervals to maintain the momentum on water conservation.

9.1.3 Benefits

The estimated water saving potential is 559.5 m^3/day (50% of total water saving potential) with cost benefit analysis below.

Table 9.1 Cost Benefits: Reduce domestic water consumption inside the plant by using water efficient faucets and fixtures

Estimated Parameters	Units	Based on river water cost @ Rs 23.42/m^3,
Daily water savings	m^3/day	559.5
Annual water savings	m^3/year	204217.5
Annual cost Savings	Rs. Lakhs	47.8
Investment	Rs. Lakhs	10.0
Payback	Months	<3

9.2. Water Saving Proposal 2: Enhance CoC of Cooling Towers

9.2.1 Present Status

Cooling towers are the most important utility in the industry whose purpose is to remove undesirable heat so that optimum temperature is maintained. The major water losses in a cooling tower are evaporation losses, drift losses and blowdown.

The plant currently operates five cooling towers: CT-1, CT-2, CT-3 (Mist Cooling Tower), and two cooling towers for the Captive Power Plant. The total makeup water consumption for all the CTs is 29,506.8 KLD, excluding the makeup for the Nitrogen plant cooling tower, whereas the blowdown which is being discharged to CTBD pond is recorded at 765.2 KLD.

During the site visit and as per discussion with the plant team, it was observed that indirect blowdown from the cooling towers was taking place due to deteriorated condition of CT-1 and CT-2 Sumps, choked Fins in CT-1, once through seal cooling system in CT-1 and CT-2 recirculation pumps and continuous high leakage from the side stream filters valve, resulting in the CoC of 2.2 - 2.5 which is very low. Additionally, maintaining an average CoC of up to 6 has been challenging due to seasonal variations in river water quality, particularly with respect to the chloride levels.

CT blowdown is carried out based on the concentrations of total hardness and chloride. The upper permissible limits for recirculating water are 1,050 mg/L for total hardness and 1,800 mg/L for chloride.

The detail of the present system is as follows:

Table 9.2 Existing Parameters of Cooling Towers

S. No.	Description	Recirculation Rate (m^3/hr.)	Temperature Difference (^{0}C)	COC	Evaporation loss (KLD)	Drift loss (KLD)	Blowdown (KLD)	Makeup (KLD)	Metered reading (KLD)
1	CT-1	35000	8.64	2.38	11365.4	168	8235.8	19769.2	19798.5
2	CT-2	12000	5.00	2.4	2255.0	57.6	1610.7	3923.4	3993.5
3	MCS	12000	4.00	2.5	1804.0	57.6	1202.7	3064.3	3069.4
4	CPP-1	4500	5	6	845.6	21.6	169.1	1036.4	2645.4
5	CPP-2	4500	7.5	6	1268.5	21.6	253.7	1543.8	
Total Quantity (KLD)					**17538.6**	**326.4**	**11472.0**	**29337.0**	**29506.8**

9.2.2 Recommendation

It is recommended that maintenance of the cooling towers be scheduled at regular intervals, along with daily visual inspections, to prevent uncontrolled water losses from the cooling towers sumps or unintended drainage. Additionally, it is also recommended to enhance CoC for the cooling towers in the petrochemical plant area to up to 6.0, the maximum CoC currently achieved by the power plant CTs using the same water quality throughout the year. In this case, the total make-up water requirement is calculated as 21372.7 m^3/day.

Blowdown should be carried out only when the sump water quality approaches the permissible limits for blowdown.

As per the daily river water quality data shared by the plant team, the CT makeup water quality analyzed indicates that 60% of the CT makeup water quality values, in terms of hardness, is below 175 mg/L, and chloride levels are below 300 mg/L. This makes it easy to achieve COC up to 6 in the petrochemical area cooling tower.

The details of the proposed system is as follows:

Table 9.3 Proposed parameters of Cooling Towers

S. No.	Description	Recirculation Rate (m^3/hr.)	Temperature Difference (^{0}C)	COC	Evaporation loss (KLD)	Drift loss (KLD)	Blowdown (KLD)	Makeup (KLD)	Freshwater Savings (KLD)
1	CT-1	35000	8.64	6	11365.4	168	2273.1	13806.5	5962.7
2	CT-2	12000	5.00	6	2255.0	57.6	451.0	2763.6	1159.7
3	MCS	12000	4.00	6	1804.0	57.6	360.8	2222.4	841.9
4	CPP-1	4500	5	6	845.6	21.6	169.1	1036.4	0
5	CPP-2	4500	7.5	6	1268.5	21.6	253.7	1543.8	
Total Quantity (KLD)					**17538.6**	**326.4**	**3507.7**	**21372.7**	**7964.3**

Therefore, reduction in makeup water consumption based on analysis of overall makeup water quality over the year is 4778.6 m^3/day (60% of 7964.3KLD).

The actual blowdown quantity in this scenario would be 3507.7 KLD, which should be discharged into the CTBD pond.

9.2.3 Benefits

The saving potential is 4778.6 m^3/day freshwater which can be utilised by increasing CoC of cooling towers.

Table 9.4 Cost Benefits: Enhance CoC of cooling towers

Estimated Parameters	Units	Based on river water cost @ Rs 23.42/m^3
Daily water savings	m^3/day	4778.6
Annual water savings	m^3/year	1744189
Annual cost Savings	Rs. Lakhs	408.5

9.3. Water Saving Proposal 3: Collect filters backwash and final rinse water at DM & CPU unit into the backwash collection tank

9.3.1 Present Status

Presently, plant has installed a DM Plant to produce DM water and CPU unit for polishing the condensate for boiler feed and other process applications.

To safeguard the WAC and SAC units from chlorine damage and organic fouling, an ACF has been installed as a pre-treatment stage before water enters these units. DM plant consists of two parallel treatment lines - Unit A and Unit B whereas the CPU unit consists of three parallel lines Unit-2A, 2B and 2 C. All units have dedicated ACFs, ensuring efficient filtration before further processing.

Currently, the total quantity of filter backwash and DM regeneration water is 1,480.9 KLD. Of this, approximately 444.3 KLD (30%) is used for filter backwash, which is presently being drained to the N-pit.

9.3.2 Recommendation

The plant already has a filter backwash collection tank in place. It is recommended to collect all filter backwash from the DM and CPU units in the existing backwash tank and subsequently route it to the North Pond. Implementing this measure will lead to freshwater savings of 444.3 KLD and a reduction in the volumetric load on the Effluent Treatment Plant (ETP), enhancing overall water efficiency and wastewater management.

9.3.3 Benefits

The fresh water saving potential is 444.3 m^3/day which can be achieved by collecting filters backwash and final rinse water at DM & CPU unit into the backwash collection tank.

Table 9.5 Cost Benefits: Collect filters backwash and final rinse water at DM & CPU unit into the backwash collection tank

Estimated Parameters	Units	Based on river water cost @ Rs 23.42/m^3
Daily water savings	m^3/day	444.3
Annual water savings	m^3/year	162169.5
Annual cost Savings	Rs. Lakhs	37.98
Investment	Rs. Lakhs	5.0
Payback	Months	<2

9.4 Water Saving Proposal 4: Enhance rainwater harvesting and reuse through Natural Ponds

9.4.1 Present Status

Currently, the plant has significant potential to enhance its rainwater collection and utilization system. Presently, the plant has two rainwater reservoirs, identified as East Pond (Natural Pond 4A & 4B).

Discussions with the plant team revealed that rainwater is being harvested from multiple areas across the facility. Based on the assessment of the available data and the existing stormwater drainage infrastructure, the plant premises have been strategically divided into three distinct zones for efficient rainwater collection mentioned below:

Table 9.6 Rainwater Collection System & Storage

S. No.	Area	Zone	Collection Point
1	Fire Hydrant main Building - Rooftop	Zone 1	Fire Hydrant Reservoir
2	CPP Main Building		North Pond
3	Process Area	Zone 2	ETP (Surge Pond)
4	Remaining Area	Zone 3	East Pond (Natural Pond) 4A & 4B

- **Rainwater Collection Pond (Zone 1)**
  i. Rainwater from the rooftops of the Fire Hydrant Main Building and the CPP Main Building is diverted to the North Pond and fire hydrant reservoir. This collected rainwater is subsequently utilized within the plant operations, along with raw water supplied by the Haldia Development Authority (HDA).

- **Rainwater Collection Pond (Zone 2)**

ii. Rainwater from the process area may contain traces of oil due to surface contamination. To prevent potential environmental impact, this rainwater is directed to ETP for appropriate treatment before any further use or discharge.

- **Unutilized Rainwater (Zone 3)**

iii. Zone 3 comprises the remaining areas of the plant not covered under Zone 1 and Zone 2. Surface runoff from this zone is directed into the Natural Pond. Additionally, any excess rainwater from the East Pond is discharged directly into the external drain, resulting in unutilized rainwater leaving the premises.

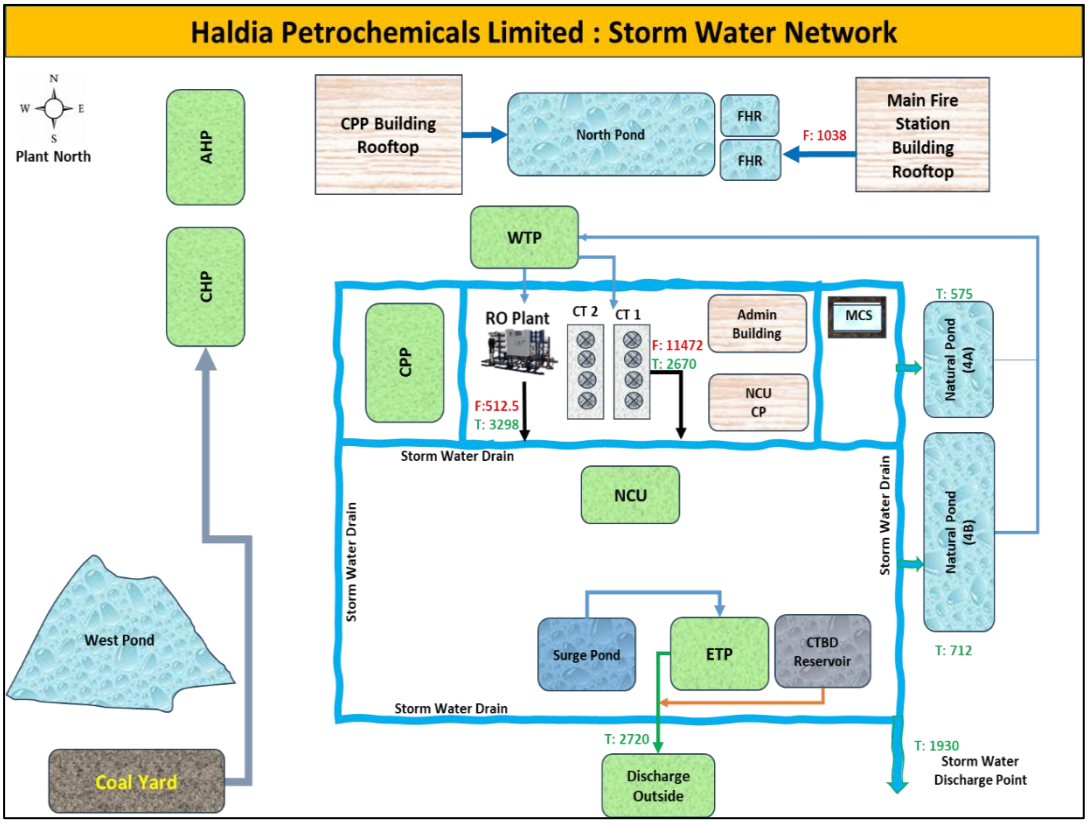


Figure 9.2 Storm Water Network for Haldia Petrochemicals Limited

However, after establishing the water balance and quantifying the withdrawal from the East Pond, it was observed that the plant is not fully utilizing the potential rainwater available in Zone 3 (East Pond 4A & 4B). The underutilization can primarily be attributed to the following factors:

- Presence of dense water weeds
- Encroaching vegetation around the pond area
- Proliferation of water hyacinth
- High Total Dissolved Solids (TDS) levels in the pond water

The key reasons contributing to the contamination and elevated TDS levels in the East Pond include:

- Disposal of Reverse Osmosis (RO) reject water into the stormwater system
- Surface and backwater contamination from external water sources during overflow conditions

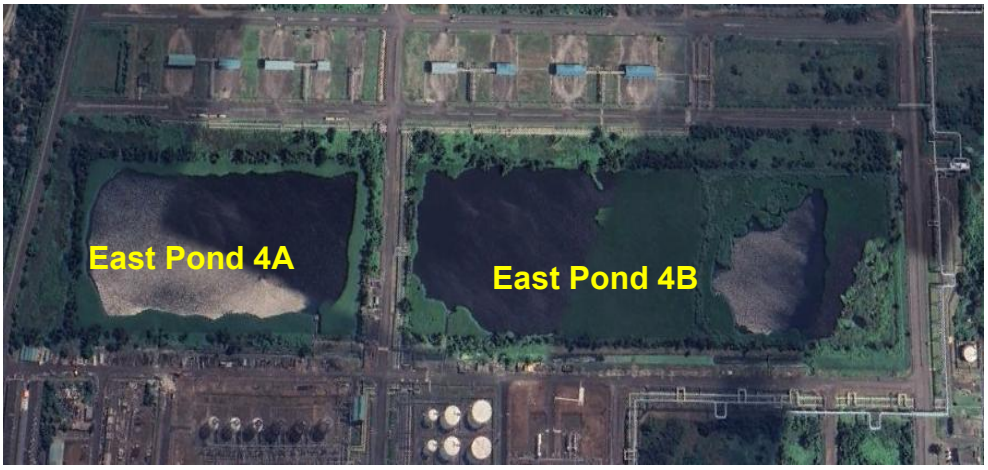
These factors have adversely impacted the quality and usability of the rainwater collected in the East Pond, limiting its application within the plant operations.

The following table provides an overview of the total plant area, segmented into various zones.

Table 9.7 Rainwater harvesting details

S. No.	Description	Details
1	Total area of the plant (m^2)	29,30,000
2	Roof top area (m^2)	NA
3	Paved area (m^2)	NA
4	Garden area (m^2)	NA
5	Unpaved area (m^2)	NA
6	Total CHP Area (m2)	NA
7	Total AHP Area (m2)	NA
8	No of rainwater harvesting ponds	2
9	Capacity of rainwater harvesting ponds (m^3) inside	NA
11	Material of construction of rooftops (Asbestos/concrete/PVC)	NA

The image of the raw water reservoirs and the rainwater collection pond for the zone-3 is shown in the figure below:



Source: Google Earth

Figure 9.3 Natural Pond (4A & 4B) inside Haldia Petrochemicals Limited

- **<u>Calculation for rainwater potential at HPL Haldia:</u>**

  Rainwater Potential = Catchment Area × Rainfall Depth × Runoff Coefficient

  Where:

  - **Catchment Area of Plant (Total Rooftop & Paved Area & Area under Lawns & Unpaved)** = 29,30,000 m^2
  - **Rainfall** = 2376 mm or 2.376 meter (Source: Plant Weather Monitoring)
  - **Runoff Coefficient** = Typically 0.8 (assuming that the runoff coefficient for industrial areas is around 0.8, which accounts for the impervious surfaces like buildings and roads) but as per manual of artificial recharge of ground water by Central Ground Water Board, the value of runoff coefficient with respect to types of surface areas is given below: -
    - For Total Rooftop & Paved Area – 0.8 to 0.9
    - For Area under Lawns & Unpaved – 0.1 to 0.2

Table 9.8 Rainwater Harvesting Potential from zone-1

Rainwater Harvesting: Haldia Petrochemicals Limited, Haldia WB						
Sr. No.	**Detail**	**Area in hectare (ha)**	**Area in m^2**	**Runoff Coefficient**	**Rainfall in meter (Average of 4 Years)**	**Total Rainwater Potential (KL/annum)**
1	Green Belt	103	1030000	0.2	2.376	489456
2	Roof top area	NA	NA	0.8		-
3	Paved area	NA	NA	0.8		-
4	Garden area	NA	NA	0.2		-
5	Unpaved area	NA	NA	0.2		-

Total Plant Area	**293**	**29,30,000**	0.4	**Total Potential (m^3)**	**2784672**
KLD {a}					7629.24
Plant Utilizing (b)					1933
Rainwater In ETP (C)					324
Total Consumption d= (b+c)					2257
Saving Potential e=(a-(b+c)					5372.2
Suggested Rainwater Harvesting (50% of e)					2686.1

The daily rainwater harvesting potential at Haldia Petrochemicals Limited is estimated to be approximately 7,629.2 KLD. Currently, the plant utilizes around 2,257 KLD, which accounts for 29.58% of the total potential. This includes:

- 1,933 KLD from the North Pond (approximately 25.34%)
- 324 KLD treated through the Effluent Treatment Plant (ETP) (approximately 4.24%)

This indicates that approximately 5,372.2 KLD, or 70.42% of the available rainwater harvesting potential, remains unutilized. This presents a significant opportunity to enhance water sustainability by maximizing the use of harvested rainwater and reducing dependence on external water sources.

9.4.2 Recommendation

After discussion with the plant team, it was found that the plant is facing problems when withdrawing water from the East Pond. The team noticed that the RGSF filter at the Water Treatment Plant (WTP) gets choked frequently when using water from the natural pond. This leads to repeated flushing and backwashing, which affects both the water quality and flow at the filter outlet.

To address this concern and improve the water quality of the Natural Pond, the following two suggestions has been recommended. The plant team may evaluate these options based on capital investment and operational feasibility.

Option A:

Installation of Metering System & Proper Transfer

- Install flow meter at the outlet of the rainwater collection pond to accurately measure the volume of water being transferred to the raw water reservoir.
- Ensure structured piping and pumping arrangements to efficiently transfer rainwater from the collection pond to the raw water reservoir without losses.

Enhancement of Rainwater Collection Pond Capacity & Lining

- Increase the storage capacity of the rainwater collection pond to accommodate additional runoff, ensuring better water availability for plant operations.
- Line the pond with HDPE/RCC lining to prevent seepage losses and contamination from surrounding soil.

Periodic Cleaning & Maintenance of Stormwater Drains

- Implement a periodic cleaning schedule for stormwater drains to prevent blockages and ensure proper flow of rainwater towards the collection pond.
- Install silt traps and sedimentation chambers to reduce suspended solids before the water enters the collection pond.

Prevention of uncontrolled discharge from Zone 2

- Identify specific locations where rainwater from Zone 2 (Process) is flowing outside the plant boundary and take corrective actions.
- Modify the drainage system to redirect this rainwater towards the collection pond instead of allowing uncontrolled discharge.

Identification & Management of Contaminated Areas

- Conduct a site survey to pinpoint areas where rainwater is getting contaminated with coal and ash particles before entering the drainage system.
- Implement localized treatment solutions such as oil-water separators, first-flush diversion, or sedimentation pits to improve rainwater quality before collection.

Option B:

Install a new tube settler plant for pretreatment of Natural Pond water

- It is recommended to install a new pre-treatment system for the East Pond (Natural Pond) water before it is directed to the main Water Treatment Plant (WTP). This will help reduce the load of suspended particles from natural pond water intake, allowing for more uniform and efficient treatment at the WTP. A schematic of the proposed pre-treatment unit is outlined below.

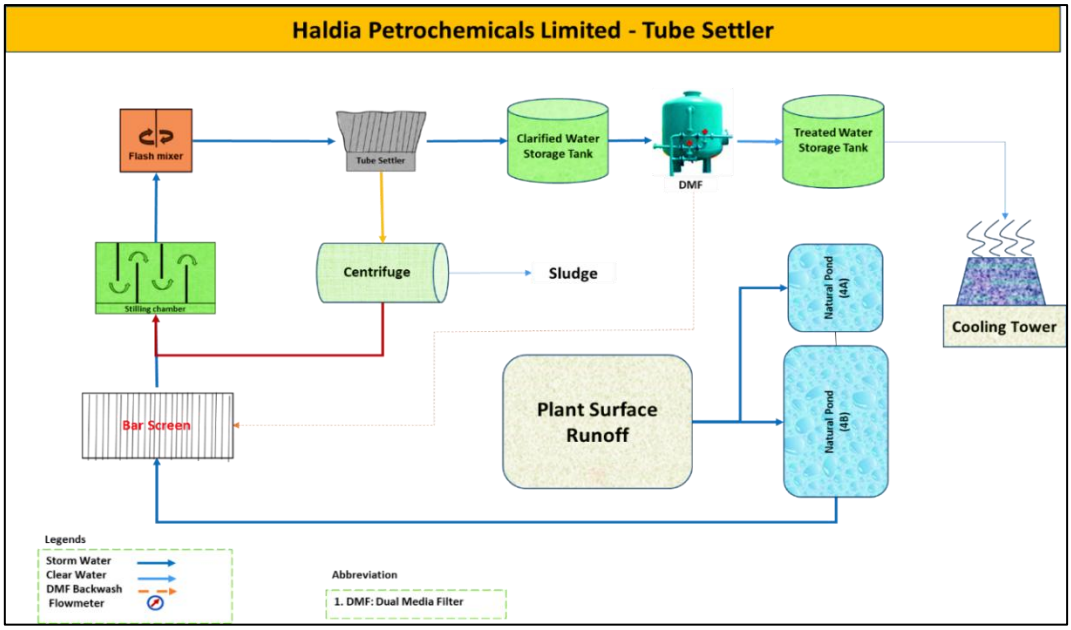


Figure 9.4 Pretreatment plant for rainwater

It is recommended to adopt a phased approach for the utilization of harvested rainwater. Currently, the total unutilized rainwater harvesting potential stands at approximately 5,372.2 KLD. As a practical and achievable initial target, the plant should aim to utilize at least 50% of this potential, i.e., approximately 2,686.1 KLD.

In the long term, the goal should be to maximize utilization by targeting up to 100% of the unutilized potential (5,372.2 KLD), thereby significantly reducing the dependency on external freshwater sources and improving overall water sustainability within the plant.

By implementing the above recommendations, plant can significantly enhance its rainwater harvesting system, reduce water losses, improve rainwater quality, and promote long-term sustainability.

9.4.3 Benefits

The implementation of structured rainwater collection and utilization will lead to a saving potential of 2686.1 m³/day (considering 50% of total rainwater harvesting potential of Zone-3) in freshwater consumption.

Table 9.9 Cost Benefits: Rainwater Harvesting

Estimated Parameters	Unit	Based on River water cost @ Rs 23.42/m^3
Daily water savings	m^3/day	2686.1
Annual water savings	m^3/year	980426.5
Annual cost Savings	Rs. Lakhs	226.67

10. Observations

Observation 1: Plant may explore the option of floating solar system to control evaporation losses from ponds

Present Status

The plant has two ponds for the storage of raw water supplied by HDA. Based on the water balance established, the total evaporation loss from both ponds is calculated as ~318.5 KLD, which results in evaporation loss of approximately 116252.5 KL/annum. Evaporation rate fluctuates due to seasonal climatic variations, including temperature, humidity level, solar radiation and wind velocity. Higher temperature and lower humidity level accelerate water loss, particularly during the summer months, while monsoon and winter conditions lead to relatively lower evaporation rates.

Table 10.1 Reservoir details and evaporation loss

Sr. No	Description	Capacity (Lakhs m^3)	Surface area (m^2)	Depth (m)	Average Evaporation Loss (KLD)
1	North Pond	-			318.5
2	West Pond				

Recommendation

It is recommended that the plant may explore the installation of floating solar photovoltaic (PV) system on the reservoirs to minimize evaporation losses while enhancing renewable energy generation.

Floating solar photovoltaic (PV) systems are an innovative approach to renewable energy generation, where solar panels are installed on water bodies such as reservoirs, lakes, ponds, or industrial water storage tanks. Unlike conventional ground-mounted or rooftop solar systems, floating solar panels utilize unused water surfaces, optimizing land use while providing additional environmental and operational benefits.

Benefits of Floating Solar Panels:

a) **Floating Platform:** Buoyant structures made of high-density polyethylene (HDPE) or other durable materials that keep the panels afloat.
b) **Anchoring and Mooring System:** Ensures system stability against wind, waves, and water level fluctuations.
c) Reduces evaporation loss by up to 70%, which can help conserve significant water volume.
d) Provides clean energy generation, reducing dependence on conventional power sources.
e) Minimizes algal growth by limiting sunlight penetration into the water.

A feasibility study should be conducted to assess the technical and financial viability, considering available space, panel efficiency, structural stability, and regulatory requirements.

Observation 2: Enhance recovery of RO systems

Present Status

At present, the plant operates four ROs - RO-1, RO-2, RO-3A, and RO-3B to produce RO permeate for the DM and CPU plant. Metered readings indicate a combined efficiency of 75%, but on-site flow measurements revealed a lower efficiency of 65.8% across the operational units.

During the site visit and as per the flow measurements conducted, the RO's efficiency were noted as:

S. No.	RO details	Feed (m3/Hr.)	Permeate (m3/Hr.)	Reject (m3/Hr.)	Efficiency (%)
1	RO-1	95.0	64.0	31.0	67.4
2	RO-2	95.0	54.0	41.0	56.8
3	RO-3A	127.0	93.0	34.0	73.2
4	RO-3B	RO was not in operation during the site visit			
				Combined Efficiency	**65.8**

Key Observations:

1. **Reduced Performance in RO-1 and RO-2:** Both units are operating at significantly lower permeate flow rates compared to the designed flow rate of 100 m^3/hr.
2. **High Leakages**: Noticeable leakages were observed from RO membranes, contributing to efficiency losses.

Recommendation

To enhance the recovery and efficiency of the RO system, the following actions are suggested:

1. **Identify causes of Low Permeate Flow in RO-1 and RO-2:**
    - Assess potential issues such as membrane fouling, scaling, or operational inefficiencies affecting performance.

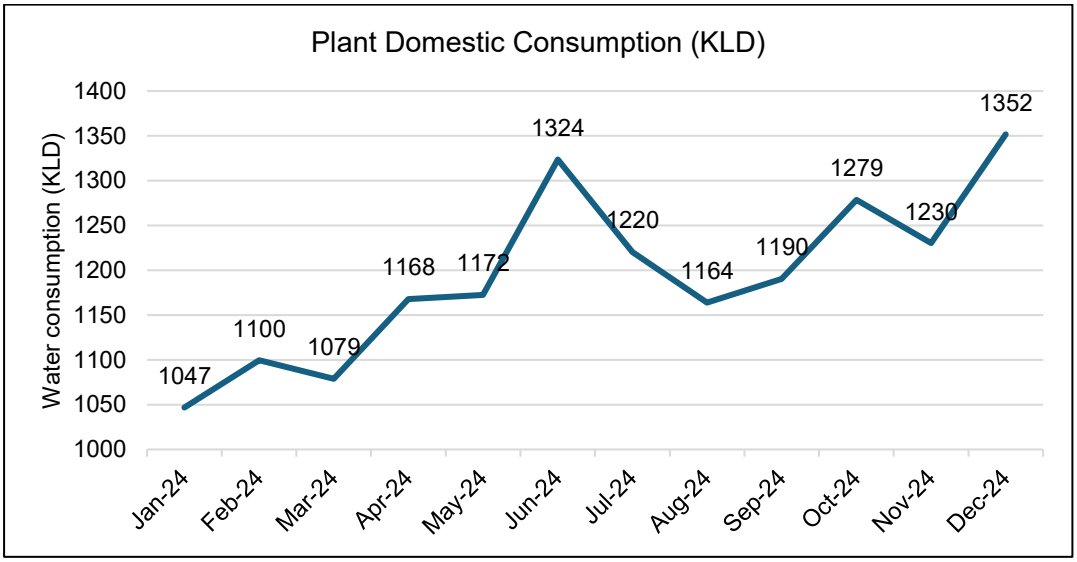
2. **Conduct Maintenance and Cleaning:**
    - Perform thorough chemical cleaning and flushing of RO membranes to remove fouling and scaling deposits.
    - Inspect and clean associated pipelines, valves, and pre-treatment units to ensure smooth water flow.
    - Proper dosing of antiscalant to avoid scaling and fouling in RO membranes
3. **Repair and Replace Faulty RO Membranes:**
    - Identify and repair leaks in the RO port to minimize water losses and maintain the feed pressure.

By implementing these measures, the plant can enhance RO system efficiency, reduce water losses, and optimize freshwater utilization.

Observation 3: Higher domestic water consumption in winter season

Present Status

Analysis of water consumption data indicates a significant increase in domestic water usage during the winter season. This trend suggests that external factors, such as activities other than domestic use, employee behaviour and system inefficiencies, which could be contributing to the higher consumption. Understanding the reasons behind this seasonal variation is essential for implementing effective water conservation measures.



Recommendation

1. **Monitor Domestic Water Usage Trends:** Implement real-time monitoring systems to track domestic water consumption patterns seasonally.

2. **Leak Detection and Prevention:** Conduct regular pipeline inspections to identify leaks caused by winter temperature fluctuations.

3. **Employee Awareness and Behavioral Adjustments:** Educate employees on water-saving practices, such as turning off taps while soaping hands.

By addressing these factors, the plant can effectively reduce domestic water consumption during winter, improve water conservation efforts, and enhance overall operational efficiency.

Observation 4: Proper Recording and Maintenance of Flowmeter Logbooks.

Present Status

During the site visit, it was observed that the flowmeter readings at the RO plant, DM plant, and CPU plant are not being consistently recorded. Additionally, the water consumption data is not maintained in a standardized format.

Recommendation

It is recommended to systematically record and maintain flowmeter readings to ensure accurate tracking of water consumption across various areas. This practice will facilitate precise water balance calculations, helping to determine exact flows and quantities.

Observation 5: Reduce water consumption in urinal flush by using urinal screen/mat

Present Status

It's observed that plant uses significant amount of water in domestic purposes mainly for urinal flushing, handwash etc. for instance, most urinals can use between 2 to 3 liters of water for each flush.

As per the standard, 10 Liters per head per day of water is required in industries for toilet flushing.

Recommendation

We recommend Urinal Screen/mat for water less urinal. Taking all the variables into account, in waterless concept, a single urinal in a workplace with a few dozen employees can save many liters of water per year by using "Urinal Screens". In high-traffic facilities and in situations where providing a water supply may be difficult or where water conservation is desired, the fresh and clean urinal screen can ideally fit the bill. The combination of this product along with good sense odor eliminator which is a blend of non-pathogenic bacteria and enzymes results in a clean and hygienic urinal.

Widespread use of waterless urinals can produce a domino effect of conservation. Since no water is required, water utilities will not need to treat and pump as much water. Also, the absence of flushing means that less wastewater is generated requiring treatment. Smaller quantities of water pumped leads to energy savings. Therefore, water is conserved as we need water to generate electricity.

How it works:

In high-traffic areas, cleaning should occur more frequently. The following steps should be followed:

- Disconnect the water supply from the urinal pot.
- Place Fresh & Clean urinal screen on the pot.
- Do not flush after every use.
- Spray odor eliminator after every 4-6 hours, depending on traffic.
- Replace the urinal pad after four weeks, or when you cannot smell any fragrance, whichever is earlier.
- Do not pour water at any stage.

Benefits:

- Easy and simple to use.
- Saves 60% of water.
- External fragrance system not required.
- Lower bacteria levels

11. Conclusion and Recommendations

To better understand and comprehensively assess the water usage in the various processes and explore possibilities of water saving, M/s Haldia Petrochemicals Limited, Haldia (WB) has undertaken a detailed water audit of the plant.

The previous chapter detailed out the water saving proposals along with the key recommendations and, costs and benefits to the plant from their adoption. This chapter summarizes the key points emerging along with the way forward towards formulation of a Water Efficiency Plan. The summary of total water savings emanating from proposed water saving proposals is shown in table 10.1.

Table 11.1 Water saving projects: summary for recommendations

Proposed Schemes		Water Savings (KLD)	Water Savings (Annual)	Cost Savings (Annual)
I	**Total Water Intake (KLD)**	41878.6		
II	**Savings Achievable (KLD)**	8468.5		
III	**Water Saving Potential (%)**	20.2		
Recommended Projects				
1	Reduce domestic water consumption inside the plant by using water efficient faucets and fixtures	559.5	204217.5	47.8
2	Enhance CoC of Cooling Towers	4778.6	1744189	408.5
3	Collect filters backwash and final rinse water at DM & CPU unit into the backwash collection tank	444.3	162169.5	37.98
4	Enhance rainwater harvesting and reuse through Natural Pond	2686.1	980426.5	226.67
Observations				
1	Plant may explore the option of floating solar system to control evaporation losses from reservoirs			
2	Enhance recovery of RO systems			
3	Higher domestic water consumption in winter season			
4	Proper Recording and Maintenance of Flowmeter Logbooks			
5	Reduce water consumption in urinal flush by using urinal screen/mat			

Conclusions

11.1. Conclusion 1

- Water balance across the plant has been successfully achieved.
- Total water consumption: 41878.6 KLD.

11.2. Conclusion 2

Strategies identified for reduction, reuse and recycle show:

- Around 20.2 % of savings in terms of freshwater can be achieved.
- In monetary terms ~ Rs. 720.95 lakhs/annum cost savings can be achieved.

11.3. Way Forward

- Need to adopt schemes for water management and conservation (Recycle, Reuse and Reduce options)
- Identification of key resource person from concerned departments to lead the water conservation and management activities along with the Water Management department. (immediate)
- Conduct the water conservation awareness program amongst the staff.
- Plan implementation with time and target (management decisions) (strategically to continue)
- Undertake regular water audit for streamlining the activity and sustaining benefits of the study in long run.

References

1. *WRI Aqueduct – For baseline water stress*
2. *National compilation on dynamic ground water resources 2024 – Stage of ground water extraction*

Annexure I – Measured data

Metering Data

S. No.	Flow meter Location	CII Ultrasonic FM (m^3/hr)	Plant meter (m^3/hr)	% Variation
1	6 MGD Old	425	400	5.9
2	8 MGD Old	823	837.2	-1.7
3	WTP Reservoir to all CT makeup	1312.0	1070.0	**18.4**
4	Drinking line feed	68.0	68.0	0.0
5	DM plant ACF Outlet	330.0	301.0	8.8
6	DM plant ACF Outlet	16.4	16.0	2.4
7	DM outlet to Polymer plant	16.4	16.0	2.4
8	DM outlet to (CPP+NCU)	272.0	285.0	-4.8
9	CPU ACF 2B Outlet	104.0	109.0	-4.8
10	Pump house to Plant water	74.0	72.0	2.7
11	WTP Stilling	1280.0	1275.0	0.4
12	WTP Stilling			
13	Cooling tower 1 makeup line	645.0	550.0	14.7
14	Cooling tower 2 makeup line	160.0	105.0	**34.4**
15	RO 1 Feed	95.0	95.0	0.0
16	RO 1 Permeate	64.0	65.0	-1.6
17	RO 1 Reject	31.0	30.0	3.2
18	RO 2 Feed	95.0	No Flowmeter	-
19	RO 2 Permeate	54.0	62.0	**-14.8**
20	RO 2 Reject	31.0	32.0	-3.2
21	RO 3A Feed	127.0	No Flowmeter	-
22	RO 3A Permeate	93.0	94.0	-1.1
23	RO 3A Reject	34.0	32.4	4.7
24	HSF 1	225.0	No Flowmeter	-
25	HSF 2	72.0	No Flowmeter	-
26	HSF 3	68.0	No Flowmeter	-
27	HSF 4	96.0	No Flowmeter	-
28	MCS NCU Recirculation line	3811.0	3988.0	-4.6
29	MCS AU Recirculation line	9107.0	9217.0	-1.2
30	MCS Makeup	221.0	40.0	**81.9**
31	Equalization tank inlet	68.0	63.7	6.3
32	Equalization tank inlet	65.0	62.5	3.8
33	Sanitary Effluent	15.2	14.6	3.9
34	ETP Outlet	208.0	199.9	3.9
35	CPP Makeup	162.0	170.0	-4.9
36	West pond to ETP treatment plant	250.0	255.0	-2.0

Water quality measurement conducted during the site visit

S. No.	Description	pH	Conductivity (Us/cm)	TDS (ppm)	Salinity (ppm)
1	Filtered water	8.8	1155	820	573
2	RO-2 permeate	7.2	90	64	45
3	RO-2 reject	7.8	3461	2457	1713
4	CT-1 Sump	8.8	3543	2516	1758
5	CT-2 Sump	8.4	3726	2645	1854
6	MCS Sump	8.6	3465	2460	1722
7	Borewell near MCS	8.7	733	520	365
8	DM inlet	8.6	566	402	280
9	CPU inlet	9.2	6	4	3
10	N-pit	10.3	5100	3621	2534
11	Drain to N-pit	3.5	860	611	428
12	SAC outlet	3.1	1537	1091	577
13	Clarifier outlet to Guard Pond	7.9	3910	2780	1840
14	Final discharge	7.6	3850	2720	1790
15	CT B/D Pond	8.6	3650	2600	1710
16	WTP filtered water	8.2	1252	888	552
17	East pond - 4A	7.6	809	575	352
18	East pond - 4B	7.55	1006	712	440
19	DM Regeneration	5.1	4950	3520	2360
20	CTBD pond	5.4	3790	2670	1760
21	CPP-CT makeup	7.8	1226	860	538
22	CPP-CT-1 sump	7.5	4310	3120	2050
23	CPP-CT-2 sump	7.5	4850	3430	2300

Annexure II – Data provided by the industry

River water allocation

पश्चिमबङ्गल पश्चिम बंगाल WEST BENGAL 27AB 664568

This Agreement made on the 22nd day of February two thousand Nineteen BETWEEN **Haldia Development Authority,** constituted under the West Bengal Town and Country (Planning and Development) Act, 1979 **(hereinafter called the Authority)** of the ONE PART and Haldia Petrochemicals Limited, a Company within the meaning of Companies Act 2013, having its registered office at Tower 1, Bengal Eco Intelligent Park (Techna), Block EM, Plot No 3, Sector V, Salt Lake, Kolkata 700091, West Bengal, India **(herein called the Consumer)** of the OTHER PART.

Whereas the Authority had decided to supply clear/filtered water to the consumer for the purpose of Industrial/ Commercial/ Domestic use at Plant, located at Durgachak, Haldia, Dist: Purba Midnapore, West Bengal, Pin: 721602.

AND WHEREAS the consumer had agreed to purchase water from the Authority on the terms and conditions hereinafter appearing;

NOW, THEREFORE, the parties hereto, hereby covenant with each other to observe and perform the following that is say :-

1

A. K. GHOSH
Head Plant & Executive Vice President
Haldia Petrochemicals Ltd.
Haldia

1) The Authority will supply filtered/cleared water to the consumer 43594 K.L. per day, at his Premises at Haldia Petrochemicals Limited,P.O. Box No : 12,Durgachak,Haldia, Dist : Purba Medinipur, West Bengal, PIN-721602 for Industrial use @ 17.48(Rupees Seventeen & forty eight paisa only)per K.L. and a monthly Meter rent of Rs. 10/-(Rupees ten only) will be charged by the Authority from the consumer.

2) Filtered / Clear water will be supplied to underground water reservoir to be constructed by the consumer within his premises. In no circumstances water will be drawn directly by pumping from the service connection;

3) Supply will be metered and meter rent @t 10/- (Rupees ten only) per month will be payable by the consumer.

4) A suitable water meter will be supplied and installed by the Haldia Development Authority and the same will be maintained by the Authority or its Agency.

5) Monthly bills will be raised against consumption of water at the rates mentioned in schedule hereunder for payment within the due date, and a penalty charges @ 1.50 (Rupees one point five zero) per 1000 litres per month or part thereof or at any other rate as may be revised by the Authority from time to time will be charged if the bill is not paid within the due date.

6) The Authority shall have the right to revise from time to time the rate of water charges and connection charges mentioned in the schedule as and when considered necessary. The penal rate may also be revised as and when considered necessary.

7) If the bill is not paid within 15 days from the due date, the water connection will be liable to be cut off with a prior notice and re-connection charges as given in the schedule will have to be borne by the consumer. The reconnection charges are also subject to revision from time to time.

8) If no water is consumed or water consumed is less than 50% of the sanctioned quantity, consumer will have to pay the minimum charge at the rate of 50% of the water charge for the quantity of water sanctioned to him at the rate fixed by the Authority from time to time.

9) Maximum 20% in excess of the sanctioned quantity may be drawn. But if the demand exceeds that limits, fresh application is to be given for sanction of additional quantity.

10) The Authority assumes no responsibility in case of failure of water supply due to power failures, major breakdown of supply system or any other reason which is beyond control of the Authority.

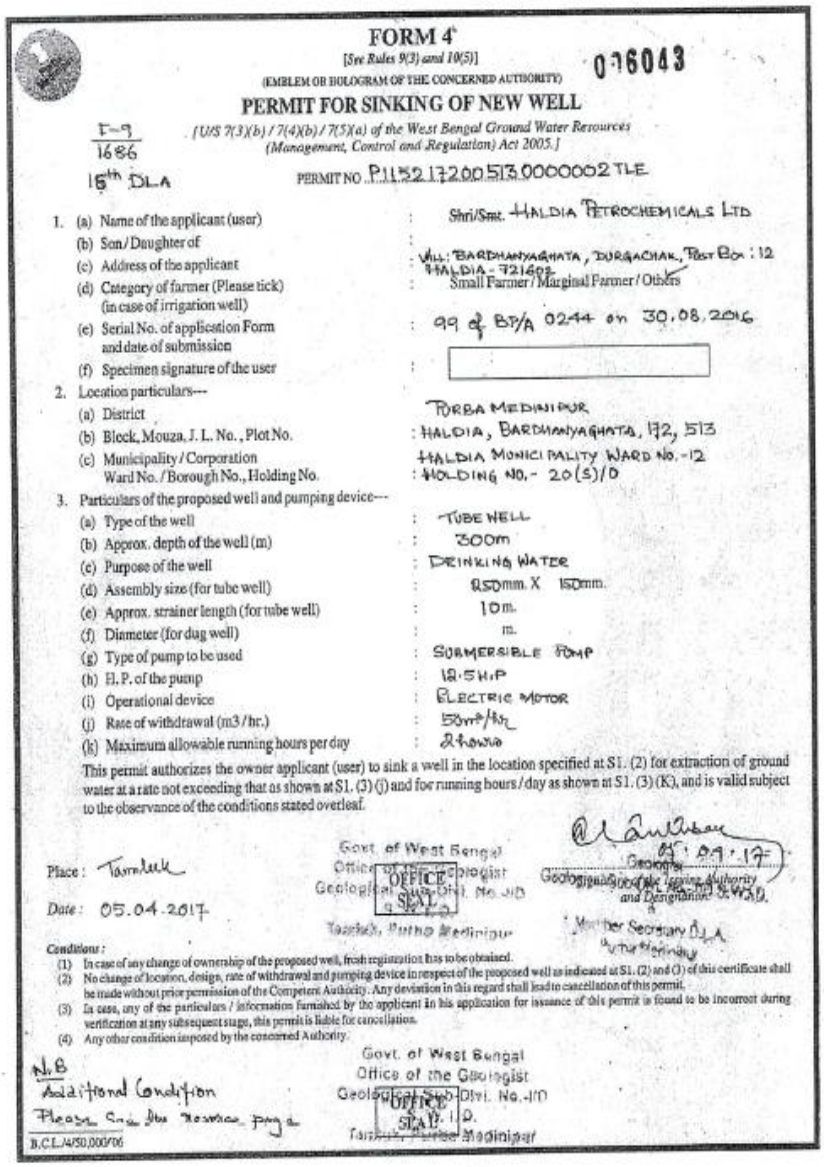
11) If the water meter is out of order or do not function due to any reason during any period, the bill for the said period will be prepared on the basis of average consumption **for three previous bills or other reasonable basis** as may be determined by the Authority and will be binding on consumer.

12) One month's advance water charges calculated on the basis of the sanctioned quantity of water at the rate fixed by the authority from time to time is to be paid as **Security Deposit.** In addition, for new connection,

2

A. K. GHOSH
Head Plant & Executive Vice President
Haldia Petrochemicals Ltd.
Haldia

Borewell NOC



FORM 4
[See Rules 9(3) and 10(5)]
(EMBLEM OR HOLOGRAM OF THE CONCERNED AUTHORITY) 016043

PERMIT FOR SINKING OF NEW WELL

[U/S 7(3)(b) / 7(4)(b) / 7(5)(a) of the West Bengal Ground Water Resources (Management, Control and Regulation) Act 2005.]

E-9/1686
15th DLA

PERMIT NO P1152172005130000002 TLE

1. (a) Name of the applicant (user) : Shri/Smt. HALDIA PETROCHEMICALS LTD
   (b) Son/Daughter of :
   (c) Address of the applicant : VILL: BARDHANYAGHATA, DURGACHAK, Post Box : 12 HALDIA - 721602
   (d) Category of farmer (Please tick) (in case of irrigation well) : Small Farmer / Marginal Farmer / Others
   (e) Serial No. of application Form and date of submission : 99 of BP/A 0244 on 30.08.2016
   (f) Specimen signature of the user :
2. Location particulars---
   (a) District : PURBA MEDINIPUR
   (b) Block, Mouza, J. L. No., Plot No. : HALDIA, BARDHANYAGHATA, 172, 513
   (c) Municipality / Corporation Ward No. / Borough No., Holding No. : HALDIA MUNICIPALITY WARD NO.-12 HOLDING NO.- 20(S)/D
3. Particulars of the proposed well and pumping device---
   (a) Type of the well : TUBE WELL
   (b) Approx. depth of the well (m) : 300m
   (c) Purpose of the well : DRINKING WATER
   (d) Assembly size (for tube well) : 250mm. X 150mm.
   (e) Approx. strainer length (for tube well) : 10m.
   (f) Diameter (for dug well) : m.
   (g) Type of pump to be used : SUBMERSIBLE PUMP
   (h) H. P. of the pump : 12.5HP
   (i) Operational device : ELECTRIC MOTOR
   (j) Rate of withdrawal (m3/hr.) : 15m³/hr
   (k) Maximum allowable running hours per day : 24hours

This permit authorizes the owner applicant (user) to sink a well in the location specified at Sl. (2) for extraction of ground water at a rate not exceeding that as shown at Sl. (3) (j) and for running hours / day as shown at Sl. (3) (K), and is valid subject to the observance of the conditions stated overleaf.

Place : Tamluk
Date : 05.04.2017

Govt. of West Bengal
Office of the Geologist
Geological Sub-Divi. No. VIII
OFFICE SEAL
Tamluk, Purba Medinipur

05.04.17
Geologist
Geological Sub-Divi. No. VIII
Ground Water Resources Authority and Development & W.S.D.

Member Secretary D.L.A.
Purba Medinipur

Conditions :
(1) In case of any change of ownership of the proposed well, fresh registration has to be obtained.
(2) No change of location, design, rate of withdrawal and pumping device in respect of the proposed well as indicated at Sl. (2) and (3) of this certificate shall be made without prior permission of the Competent Authority. Any deviation in this regard shall lead to cancellation of this permit.
(3) In case, any of the particulars / information furnished by the applicant in his application for issuance of this permit is found to be incorrect during verification at any subsequent stage, this permit is liable for cancellation.
(4) Any other condition imposed by the concerned Authority.

N.B
Additional Condition
Please see the reverse page

Govt. of West Bengal
Office of the Geologist
Geological Sub-Divi. No.-III
OFFICE SEAL
Tamluk, Purba Medinipur

B.C.L./450,000/06

FORM 4

[See Rules 9(3) and 10(5)]

006044

(EMBLEM OR HOLOGRAM OF THE CONCERNED AUTHORITY)

PERMIT FOR SINKING OF NEW WELL

[U/S 7(3)(b) / 7(4)(b) / 7(5)(a) of the West Bengal Ground Water Resources (Management, Control and Regulation) Act 2005.]

F-9
1685
16th DLA

PERMIT NO P1152172.00591.0000001TLE

1. (a) Name of the applicant (user) : Shri/Smt. HALDIA PETROCHEMICALS LTD
   (b) Son / Daughter of : VILL: BARDHANYAGHATA, DURGACHAK
   (c) Address of the applicant : P.O Box: 12, DURGACHAK, HALDIA - 721602
   (d) Category of farmer (Please tick) (in case of irrigation well) : Small Farmer / Marginal Farmer / Others
   (e) Serial No. of application Form and date of submission : 98 & BP/A 0244 on 30.08.2016
   (f) Specimen signature of the user :
2. Location particulars---
   (a) District : PURBA MEDINIPUR
   (b) Block, Mouza, J.L. No., Plot No. : HALDIA, BARDHANYAGHATA, 172., 591
   (c) Municipality / Corporation Ward No. / Borough No., Holding No. : HALDIA MUNICIPALITY WARD No.12, HOLDING NO.- 20(S)/0
3. Particulars of the proposed well and pumping device---
   (a) Type of the well : TUBEWELL
   (b) Approx. depth of the well (m) : 300m
   (c) Purpose of the well : DRINKING WATER
   (d) Assembly size (for tube well) : 250 mm. X 150mm.
   (e) Approx. strainer length (for tube well) : 10 m.
   (f) Diameter (for dug well) : m.
   (g) Type of pump to be used : SUBMERSIBLE POMP
   (h) H.P. of the punip : 12.5 H.P
   (i) Operational device : ELECTRIC
   (j) Rate of withdrawal (m3 / hr.) : 50m³/hr
   (k) Maximum allowable running hours per day : 2 hours

This permit authorizes the owner applicant (user) to sink a well in the location specified at S1. (2) for extraction of ground water at a rate not exceeding that as shown at S1. (3) (j) and for running hours / day as shown at S1. (3) (K), and is valid subject to the observance of the conditions stated overleaf.

Govt. of West Bengal
Office of the Geologist
Geological Sub-Div. No.-II/D
OFFICE SEAL
Tamluk, Purba Medinipur

05.04.17
Geologist
Geological Sub-Div. No.-II/D
Signature of the Issuing Authority and Designation.
Member Secretary D.L.A.
Purba Medinipur

Place : Tamluk
Date : 05.04.2017

Conditions :

(1) In case of any change of ownership of the proposed well, fresh registration has to be obtained.
(2) No change of location, design, rate of withdrawal and pumping device in respect of the proposed well as indicated at S1. (2) and (3) of this certificate shall be made without prior permission of the Competent Authority. Any deviation in this regard shall lead to cancellation of this permit.
(3) In case, any of the particulars / information furnished by the applicant in his application for issuance of this permit is found to be incorrect during verification at any subsequent stage, this permit is liable for cancellation.
(4) Any other condition imposed by the concerned Authority.

N.B: Additional Condition Please See the Reverse page

Govt. of West Bengal
Office of the Geologist
Geological Sub-Div. No.-II/D
OFFICE SEAL
Tamluk, Purba Medinipur

B.C.L./4/50,000/'06

FORM 4

[See Rules 9(3) and 10(5)]

006045

(EMBLEM OR HOLOGRAM OF THE CONCERNED AUTHORITY)

PERMIT FOR SINKING OF NEW WELL

[U/S 7(3)(b) / 7(4)(b) / 7(5)(a) of the West Bengal Ground Water Resources (Management, Control and Regulation) Act 2005.]

F-9
1687
16th DLA

PERMIT NO. P1152170014950000001TLE

1. (a) Name of the applicant (user) : Shri/Smt. HALDIA PETROCHEMICALS LTD
   (b) Son / Daughter of :
   (c) Address of the applicant : VILL: DURGACHAK, HALDIA, PO BOX: 12, HALDIA - 721602
   (d) Category of farmer (Please tick) (in case of irrigation well) : Small Farmer / Marginal Farmer / Others
   (e) Serial No. of application Form and date of submission : 100 & BP/A 0214 on 30.08.2016
   (f) Specimen signature of the user :
2. Location particulars---
   (a) District : PURBAMEDINIPUR
   (b) Block, Mouza, J. L. No., Plot No. : HALDIA, TENTULBERIA, 170, 1995
   (c) Municipality / Corporation Ward No. / Borough No., Holding No. : HALDIA MUNICIPALITY WARD NO.- 12 HOLDING NO.- 20(3)10
3. Particulars of the proposed well and pumping device---
   (a) Type of the well : TUBE WELL
   (b) Approx. depth of the well (m) : 300 m
   (c) Purpose of the well : DRINKING WATER
   (d) Assembly size (for tube well) : 250 mm. X 150mm.
   (e) Approx. strainer length (for tube well) : 10m.
   (f) Diameter (for dug well) : m.
   (g) Type of pump to be used : SUBMERSIBLE PUMP
   (h) H.P. of the pump : 12.5 H.P
   (i) Operational device : ELECTRICAL
   (j) Rate of withdrawal (m3 / hr.) : 50m³/hr.
   (k) Maximum allowable running hours per day : 2 hours

This permit authorizes the owner applicant (user) to sink a well in the location specified at S1. (2) for extraction of ground water at a rate not exceeding that as shown at S1. (3) (j) and for running hours / day as shown at S1. (3) (K), and is valid subject to the observance of the conditions stated overleaf.

Govt. of West Bengal
Office of the Geologist
Geological Sub-Divl. No.-II
OFFICE SEAL
Tamluk, Purba Medinipur

05.04.17
Signature of the Issuing Authority and Designation

Place : Tamluk

Date : 05.04.2017

Addl. District Magistrate & Ex-Officio Secretary, DLA
Purba Medinipur

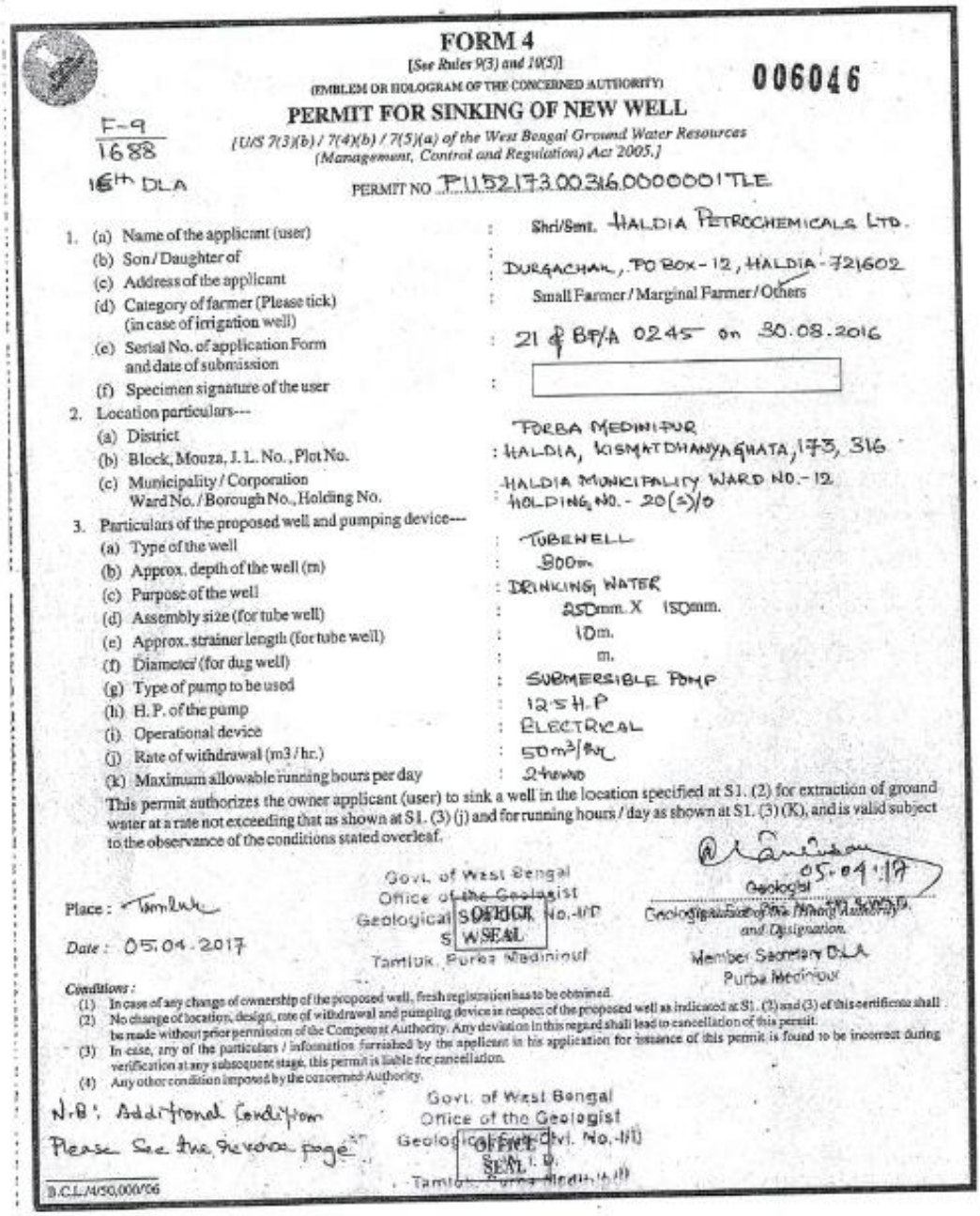
Conditions :

(1) In case of any change of ownership of the proposed well, fresh registration has to be obtained.
(2) No change of location, design, rate of withdrawal and pumping device in respect of the proposed well as indicated at S1. (2) and (3) of this certificate shall be made without prior permission of the Competent Authority. Any deviation in this regard shall lead to cancellation of this permit.
(3) In case, any of the particulars / information furnished by the applicant in his application for issuance of this permit is found to be incorrect during verification at any subsequent stage, this permit is liable for cancellation.
(4) Any other condition imposed by the concerned Authority.

N.B: Additional Conditions
Please See the Reverse Page

Govt. of West Bengal
Office of the Geologist
Geological Sub-Divl. No.-II
OFFICE SEAL
Tamluk, Purba Medinipur

B.C.L./450.000/06



FORM 4

[See Rules 9(3) and 10(5)]

(EMBLEM OR HOLOGRAM OF THE CONCERNED AUTHORITY)

006046

PERMIT FOR SINKING OF NEW WELL

F-9
1688

(U/S 7(3)(b) / 7(4)(b) / 7(5)(a) of the West Bengal Ground Water Resources (Management, Control and Regulation) Act 2005.]

16th DLA

PERMIT NO P1152173003160000001TLE

1. (a) Name of the applicant (user) : Shri/Smt. HALDIA PETROCHEMICALS LTD.
   (b) Son / Daughter of :
   (c) Address of the applicant : DURGACHAK, PO BOX-12, HALDIA-721602
   (d) Category of farmer (Please tick) (in case of irrigation well) : Small Farmer / Marginal Farmer / Others
   (e) Serial No. of application Form and date of submission : 21 of BF/A 0245 on 30.08.2016
   (f) Specimen signature of the user :
2. Location particulars---
   (a) District : PURBA MEDINIPUR
   (b) Block, Mouza, J. L. No., Plot No. : HALDIA, KISMATDHANYAGHATA, 173, 316
   (c) Municipality / Corporation Ward No. / Borough No., Holding No. : HALDIA MUNICIPALITY WARD NO.-12 HOLDING NO.- 20(2)/0
3. Particulars of the proposed well and pumping device---
   (a) Type of the well : TUBEWELL
   (b) Approx. depth of the well (m) : 300m
   (c) Purpose of the well : DRINKING WATER
   (d) Assembly size (for tube well) : 250mm. X 150mm.
   (e) Approx. strainer length (for tube well) : 10m.
   (f) Diameter (for dug well) : m.
   (g) Type of pump to be used : SUBMERSIBLE PUMP
   (h) H.P. of the pump : 12.5 H.P
   (i) Operational device : ELECTRICAL
   (j) Rate of withdrawal (m3 / hr.) : 50m³/hr
   (k) Maximum allowable running hours per day : 24hrs

This permit authorizes the owner applicant (user) to sink a well in the location specified at S1. (2) for extraction of ground water at a rate not exceeding that as shown at S1. (3) (j) and for running hours / day as shown at S1. (3) (K), and is valid subject to the observance of the conditions stated overleaf.

Place : Tamluk
Date : 05.04.2017

Govt. of West Bengal
Office of the Geologist
Geological Sub-Divl. No.-II
SEAL
Tamluk, Purba Medinipur

05.04.17
Geologist
Signature of the Issuing Authority and Designation.
Member Secretary DLA
Purba Medinipur

Conditions :
(1) In case of any change of ownership of the proposed well, fresh registration has to be obtained.
(2) No change of location, design, rate of withdrawal and pumping device in respect of the proposed well as indicated at Sl. (2) and (3) of this certificate shall be made without prior permission of the Competent Authority. Any deviation in this regard shall lead to cancellation of this permit.
(3) In case, any of the particulars / information furnished by the applicant in his application for issuance of this permit is found to be incorrect during verification at any subsequent stage, this permit is liable for cancellation.
(4) Any other condition imposed by the concerned Authority.

N.B: Additional Condition
Please See the reverse page.

Govt. of West Bengal
Office of the Geologist
Geological Sub-Divl. No.-II
OFFICE SEAL
Tamluk, Purba Medinipur

B.C.L./450,000/06

Water Quality data- River water (Jan 2024-Dec 2024)

Month, 2024	Max & Min	Cl (ppm)	pH	Total Hardness (ppm)
Jan	Max	201	8.1	252
	Min	42	7.7	152
Feb	Max	338	8.1	286
	Min	74	7.8	110
Mar	Max	1014	8.2	632
	Min	246	7.8	215
April	Max	1371	8.1	721
	Min	766	7.8	374
May	Max	1665	8.2	651
	Min	835	7.6	383
Jun	max	1208	8.3	524
	Min	403	7.8	242
July	Max	636	8	311
	Min	149	7.8	122
Aug	Max	367	8	225
	Min	26	7.6	64
Sep	Max	43	8	115
	Min	25	7.5	76
Oct	Max	63	8	118
	Min	21	7.7	69
Nov	max	71	8	185
	Min	25	7.6	82
Dec	Max	153	8	186
	Min	41	7.8	136

Water Quality data- ETP outlet

S. No.	Parameter	Range
1	pH	6.5 – 8.5
2	Chemical Oxygen Demand	250
3	Biological Oxygen Demand	30
4	Sulphide	2.0 max.
5	Oil & Grease (E + F)	10.0 max.
6	Total Suspended Solids	100.0 max.
7	Phenol	1.0 max.

Flowmeter data

Sr. No.	Location	Water Consumption (m^3/Month)											
		Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
Raw Water Source													
1	Total Water Received (as per Meter Reading)	12156000.00	1176800	1132700	1221600	1222900	1301500	1321400	1232779	1198506	1486900	1452798	1322200
2	Natural Pond	0	43680	93000	40000	90000	60000	0	0	0	0	0	0
3	Rainwater	5868	4111	10802	0	70308	22800	64104	65038	90268	40368	523	4710
4	Borewell	5950	1000	1000	3120	2000	3290	3280	3420	1110	4170	6990	250
5	WTP Backwash to North Pond	11738.27	11140.06	12286.88	12876.06	12805.97	12644.80	12821.47	12062.30	11432.10	11499.72	11742.82	11987.80
6	PTP Backwash to North Pond	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00
Raw Water Distribution													
5	Water Treatment Plant	968725	882724	1047596	11322.99	1122223	1099053	1124451	1015310	924709	934430	969380	1004599
6	Pretreatment Plant (PTP)	191921	153179	148184	198808	158223	184920	151201	152346	140311	170849	175379	221480
7	Plant Water Consumption (Service Water)	53421	52972	56430	54888	58366	53161	58814	57372	54516	55631	56324	54670
8	Fire Water Makeup	101427	115408	77234	112262	121200	121977	106936	76408	83986	106230	103237	86508
9	Rise in storage pond	-68338	40448	-71655	-212661	-53998	-50876	-31797	19863	105794	283798	175734	-20109
Water Treatment Plant													
10	Water Treatment Plant (Inlet)	968725	882724	1047596	11322.99	1122223	1099053	1124451	1015310	924709	934430	969380	1004599
11	WTP Backwash to North Pond	11738.27	11140.06055656465	12287	12876.06	12805.97	12644.80	12821.47	12062.30	11432	11499.72	11742.82	11987.80
13	WTP Outlet	956987	871584	1035309	11194.23	1109417	1086408	1111630	1003248	913277	922930	957637	992611
14	WTP Outlet to CT makeup	906987	771584	935309	10394.23	1009417	986408	1011630	953248	863277	898930	957637	992611
15	WTP Outlet to RO (1+2+3A+3B) Feed	50000	100000	100000	80000	100000	100000	100000	50000	50000	24000	0	0
WTP To CT Makeup													
16	CT 1	612665	513562	555567	610919	677007	595510	740734	683771	589009	499839	566322	581544
17	CT 2	96064	89959	113215	116185	105114	115216	102967	84138	109532	167486	179392	178393
18	CT 3 (MCS)	95378	92450	186390	158671	76058	125755	55171	63407	38137	80369	77995	70557
19	CPP CT	62786	38224	38224	109239	104923	100744	62888	73938	78888	99857	85279	110601
20	CT N_2 Plant	6395	5561	7177	8400	8952	8037	8756	8843	8512	8325	8410	7805
21	Potable Water & Gardening	33699	31828	34736	36009	37363	41146	41114	39151	39199	43054	40239	43711
CT Blowdown & Loss													
21	CT Blowdown to WWTP	48926	44354	34308	29352	53793	45092	14336	8398	758	0	0	0
22	CT Evaporation Loss & Drift Loss	824362	695402	866265	974062	918261	900170	956180	905699	823320	855876	917398	948900
Domestic Consumption & Sanitary Effluent													
23	Consumption by Human Activities	32451	30786	33448	35031	36346	39706	37833	36084	35714	39638	36906	41903
24	Sanitary Effluent Generation (WWTP)	1248	1042	1288	978	1017	1440	3281	3067	3485	3416	3333	1808
Pretreatment Plant (PTP)													
25	PTP Feed (Inlet)	191921	153179	148184	198808	158223	184920	151201	152346	140311	170849	175379	221480
26	PTP Backwash to North Pond	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00	8000.00
27	PTP to DM Plant	183921.00	145179.00	140184.00	190808.00	150223.00	176920.00	143201.00	144346.00	132311.00	162849.00	167379.00	213480.00

Sr. No.	Location	Water Consumption (m^3/Month)											
		Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24
RO (1+2+3A+3B)													
28	RO Feed From WTP	50000	100000	100000	80000	100000	100000	100000	50000	50000	24000	0	0
29	RO Feed From PTP	0	0	0	0.0000000000	0							
30	RO Permeate	37594	75188	75188	60150	75188	75188	75188	37594	37594	18045	0	0
31	RO Reject to Storm Water drain	12406	24812	24812	19850	28412	24812	24812	12406	12406	5955	0	0
Fire Hydrant Reservoir													
32	Fire Water Makeup from Raw Water	101427	115408	77234	112262	121200	121977	106936	76408	83986	106230	103237	86508
33	Makeup (Consumption)	76427	90408	52234	87262	96200	96977	81936	51408	58986	81230	78237	61508
34	Evaporation & Other Loss	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000
DM Plant													
35	DM Plant Feed from RO (1+2+3A+3B) Permeate + PTP	221515	220367	215372	250958	225411	252108	218389	181940	169905	180894	167379	213480
36	Condensate from NCU & CPP	74975	78005	77896	72636	74960	75888	82044	85862	85860	83478	83523	85898
37	Total DM Water Production	244745	232490	246120	244387	247690	234193	248432	250327	243220	245340	244139	257115
38	DM Water to NCU & CPP	232183	220632	232006	231681	234760	220095	234986	235480	227819	232584	229080	241835
39	DM Water to Polymer Plant	12562	11858	14114	12706	12930	14098	13446	14847	15401	12756	15059	15280
40	DM Water regeneration	51745	65882	47148	79207	52681	93803	52001	17475	12545	19032	6763	42263
WWTP													
41	Effluent (Floor Washings etc.) from All plants.	87484	80461	87263	83520	88742	80907	88513	105790	102245	92925	94085	89501
42	Sanitary Effluent	1248	1042	1288	978	1017	1440	3281	3067	3485	3416	3333	1808
43	Rainwater	2336	0	0	0	27588	5235	16149	7980	40336	18604	0	0
44	DM Regeneration Effluent to WWTP	51745	65882	47148	79207	52681	93803	52001	17475	12545	19032	6763	42263
45	CT Blowdown to WWTP	48926	44354	34308	29352	53793	45092	14336	8398	758	0	0	0
46	From Polymer Plant												
47	Treated Effluent Discharge	191739	191739	170007	193057	223821	226477	174280	142710	159369	133977	104181	133572

Water Cost

S. No	Type of water	Water cost (Rs. /KL)
1	River Water	23.42
2	Filter Water	30.32
3	DM water	68.28

Design details of PTP and WTP plant

S No.	Description	Design Capacity (m^3/hr)

1	Capacity of Pretreatment Plant (PTP) (m^3/hr)	500
2	Capacity of WTP (m^3/hr)	2600
3	Capacity of RGSF(WTP)	520*5 (1 Standby)
4	Capacity of RGSF(PTP)	250*2
5	RO - 1 capacity	100 M3/hr. permeate.
6	RO - 2 capacity	100 M3/hr. permeate.
7	RO - 3A capacity	100 M3/hr. permeate.
8	RO - 3B capacity	100 M3/hr. permeate.
9	Capacity of DM plant	300 m3/hr.
10	Capacity of CPU plant	200 m3/hr.
11	Capacity of NCU CPU plant	190 m3/hr
S No.	**Name of tank**	**Capacity (m3)**
1	WTP reservoir	4000*2
2	PTP reservoir	750*2
3	Backwash overhead tank	550
4	Backwash collection tank -1	705.6
5	Backwash collection tank -2	204
6	RO permeate tank (3A & 3B)	180*2
7	DM tank-1	1800
8	DM tank-2	1800
9	N-pit-1	1100
10	N-pit-2	1100
11	Condensate storage tank-1	1200
12	Condensate storage tank-2	900

Annexure III - Drinking water standard IS 10500 (2012)

Indian Standard

DRINKING WATER — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for drinking water.

2 REFERENCES

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

3 TERMINOLOGY

For the purpose of this standard the following definition shall apply.

3.1 Drinking Water — Drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water (treated or untreated) supplied by any means for human consumption.

4 REQUIREMENTS

Drinking water shall comply with the requirements given in Tables 1 to 4. The analysis of pesticide residues given in Table 3 shall be conducted by a recognized laboratory using internationally established test method meeting the residue limits as given in Table 5.

Drinking water shall also comply with bacteriological requirements (*see* **4.1**), virological requirements (*see* **4.2**) and biological requirements (*see* **4.3**).

4.1 Bacteriological Requirements

4.1.1 *Water in Distribution System*

Ideally, all samples taken from the distribution system including consumers' premises, should be free from coliform organisms and the following bacteriological quality of drinking water collected in the distribution system, as given in Table 6 is, therefore specified when tested in accordance with IS 1622.

4.2 Virological Requirements

4.2.1 Ideally, all samples taken from the distribution

Table 1 Organoleptic and Physical Parameters
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 3025	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Colour, Hazen units, *Max*	5	15	Part 4	Extended to 15 only, if toxic substances are not suspected in absence of alternate sources
ii)	Odour	Agreeable	Agreeable	Part 5	a) Test cold and when heated b) Test at several dilutions
iii)	*p*H value	6.5-8.5	No relaxation	Part 11	—
iv)	Taste	Agreeable	Agreeable	Parts 7 and 8	Test to be conducted only after safety has been established
v)	Turbidity, NTU, *Max*	1	5	Part 10	—
vi)	Total dissolved solids, mg/l, *Max*	500	2 000	Part 16	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 2 General Parameters Concerning Substances Undesirable in Excessive Amounts
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Aluminium (as Al), mg/l, *Max*	0.03	0.2	IS 3025 (Part 55)	—
ii)	Ammonia (as total ammonia-N), mg/l, *Max*	0.5	No relaxation	IS 3025 (Part 34)	—
iii)	Anionic detergents (as MBAS) mg/l, *Max*	0.2	1.0	Annex K of IS 13428	—
iv)	Barium (as Ba), mg/l, *Max*	0.7	No relaxation	Annex F of IS 13428* or IS 15302	—
v)	Boron (as B), mg/l, *Max*	0.5	1.0	IS 3025 (Part 57)	—
vi)	Calcium (as Ca), mg/l, *Max*	75	200	IS 3025 (Part 40)	—
vii)	Chloramines (as Cl_2), mg/l, *Max*	4.0	No relaxation	IS 3025 (Part 26)* or APHA 4500-Cl G	—
viii)	Chloride (as Cl), mg/l, *Max*	250	1 000	IS 3025 (Part 32)	—
ix)	Copper (as Cu), mg/l, *Max*	0.05	1.5	IS 3025 (Part 42)	—
x)	Fluoride (as F) mg/l, *Max*	1.0	1.5	IS 3025 (Part 60)	—
xi)	Free residual chlorine, mg/l, *Min*	0.2	1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be minimum 0.5 mg/l
xii)	Iron (as Fe), mg/l, *Max*	0.3	No relaxation	IS 3025 (Part 53)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xiii)	Magnesium (as Mg), mg/l, *Max*	30	100	IS 3025 (Part 46)	—
xiv)	Manganese (as Mn), mg/l, *Max*	0.1	0.3	IS 3025 (Part 59)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xv)	Mineral oil, mg/l, *Max*	0.5	No relaxation	Clause **6** of IS 3025 (Part 39) Infrared partition method	—
xvi)	Nitrate (as NO_3), mg/l, *Max*	45	No relaxation	IS 3025 (Part 34)	—
xvii)	Phenolic compounds (as C_6H_5OH), mg/l, *Max*	0.001	0.002	IS 3025 (Part 43)	—
xviii)	Selenium (as Se), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 56) or IS 15303*	—
xix)	Silver (as Ag), mg/l, *Max*	0.1	No relaxation	Annex J of IS 13428	—
xx)	Sulphate (as SO_4) mg/l, *Max*	200	400	IS 3025 (Part 24)	May be extended to 400 provided that Magnesium does not exceed 30
xxi)	Sulphide (as H_2S), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 29)	—
xxii)	Total alkalinity as calcium carbonate, mg/l, *Max*	200	600	IS 3025 (Part 23)	—
xxiii)	Total hardness (as $CaCO_3$), mg/l, *Max*	200	600	IS 3025 (Part 21)	—
xxiv)	Zinc (as Zn), mg/l, *Max*	5	15	IS 3025 (Part 49)	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 3 Parameters Concerning Toxic Substances
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cadmium (as Cd), mg/l, *Max*	0.003	No relaxation	IS 3025 (Part 41)	—
ii)	Cyanide (as CN), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 27)	—
iii)	Lead (as Pb), mg/l, *Max*	0.01	No relaxation	IS 3025 (Part 47)	—
iv)	Mercury (as Hg), mg/l, *Max*	0.001	No relaxation	IS 3025 (Part 48)/ Mercury analyser	—
v)	Molybdenum (as Mo), mg/l, *Max*	0.07	No relaxation	IS 3025 (Part 2)	—
vi)	Nickel (as Ni), mg/l, *Max*	0.02	No relaxation	IS 3025 (Part 54)	—
vii)	Pesticides, µg/l, *Max*	See Table 5	No relaxation	See Table 5	—
viii)	Polychlorinated biphenyls, mg/l, *Max*	0.000 5	No relaxation	ASTM 5175*	— or APHA 6630
ix)	Polynuclear aromatic hydro-carbons (as PAH), mg/l, *Max*	0.000 1	No relaxation	APHA 6440	—
x)	Total arsenic (as As), mg/l, *Max*	0.01	0.05	IS 3025 (Part 37)	—
xi)	Total chromium (as Cr), mg/l, *Max*	0.05	No relaxation	IS 3025 (Part 52)	—
xii)	Trihalomethanes:				
	a) Bromoform, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	b) Dibromochloromethane, mg/l, *Max*	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
	c) Bromodichloromethane, mg/l, *Max*	0.06	No relaxation	ASTM D 3973-85* or APHA 6232	—
	d) Chloroform, mg/l, *Max*	0.2	No relaxation	ASTM D 3973-85* or APHA 6232	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 4 Parameters Concerning Radioactive Substances
(*Foreword* and *Clause* 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 14194	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Radioactive materials:				
	a) Alpha emitters Bq/l, *Max*	0.1	No relaxation	Part 2	—
	b) Beta emitters Bq/l, *Max*	1.0	No relaxation	Part 1	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

IS 10500 : 2012

Table 5 Pesticide Residues Limits and Test Method
(*Foreword* and *Table* 3)

Sl No.	Pesticide	Limit µg/l	Method of Test, Ref to	
			USEPA	AOAC/ ISO
(1)	(2)	(3)	(4)	(5)
i)	Alachlor	20	525.2, 507	—
ii)	Atrazine	2	525.2, 8141 A	—
iii)	Aldrin/ Dieldrin	0.03	508	—
iv)	Alpha HCH	0.01	508	—
v)	Beta HCH	0.04	508	—
vi)	Butachlor	125	525.2, 8141 A	—
vii)	Chlorpyriphos	30	525.2, 8141 A	—
viii)	Delta HCH	0.04	508	—
ix)	2,4- Dichlorophenoxyacetic acid	30	515.1	—
x)	DDT (*o, p* and *p, p* – Isomers of DDT, DDE and DDD)	1	508	AOAC 990.06
xi)	Endosulfan (alpha, beta, and sulphate)	0.4	508	AOAC 990.06
xii)	Ethion	3	1657 A	—
xiii)	Gamma — HCH (Lindane)	2	508	AOAC 990.06
xiv)	Isoproturon	9	532	—
xv)	Malathion	190	8141 A	—
xvi)	Methyl parathion	0.3	8141 A	ISO 10695
xvii)	Monocrotophos	1	8141 A	—
xviii)	Phorate	2	8141 A	—

NOTE — Test methods are for guidance and reference for testing laboratory. In case of two methods, USEPA method shall be the reference method.

Table 6 Bacteriological Quality of Drinking Water[1)]
(*Clause* 4.1.1)

Sl No.	Organisms	Requirements
(1)	(2)	(3)
i)	*All water intended for drinking*:	
	a) *E. coli* or thermotolerant coliform bacteria[2), 3)]	Shall not be detectable in any 100 ml sample
ii)	*Treated water entering the distribution system*:	
	a) *E. coli* or thermotolerant coliform bacteria[2)]	Shall not be detectable in any 100 ml sample
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample
iii)	*Treated water in the distribution system*:	
	a) *E. coli* or thermotolerant coliform bacteria	Shall not be detectable in any 100 ml sample
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample

[1)]Immediate investigative action shall be taken if either *E.coli* or total coliform bacteria are detected. The minimum action in the case of total coliform bacteria is repeat sampling; if these bacteria are detected in the repeat sample, the cause shall be determined by immediate further investigation.

[2)]Although, *E. coli* is the more precise indicator of faecal pollution, the count of thermotolerant coliform bacteria is an acceptable alternative. If necessary, proper confirmatory tests shall be carried out. Total coliform bacteria are not acceptable indicators of the sanitary quality of rural water supplies, particularly in tropical areas where many bacteria of no sanitary significance occur in almost all untreated supplies.

[3)]It is recognized that, in the great majority of rural water supplies in developing countries, faecal contamination is widespread. Under these conditions, the national surveillance agency should set medium-term targets for progressive improvement of water supplies.

Annexure IV: IS 1172: 1993 Code of Basic Requirements for water supply, drainage and sanitation

a general rule the following rates per capita per day may be considered minimum for domestic and non domestic needs:

1)	For communities with population up to 20 000 and without flushing system	
	a) water supply through standpost	40 lphd (*Min*)
	b) water supply through house service connection	70 to 100 lphd
2)	For communities with population 20 000 to 100,000 together with full flushing system	100 to 150 lphd
3)	For communities with population above 100 000 together with full flushing system	150 to 200 lphd

NOTE — The value of water supply given as 150 to 200 litres per head per day may be reduced to 135 litres per head per day for houses for Lower Income Groups (LIG) and Economically Weaker Section of Society (EWS), depending upon prevailing conditions.

4.1.1 Out of the 150 to 200 litres per head per day, 45 litres per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes.

4.2 Water Supply for Buildings Other Than Residences

Minimum requirements for water supply for buildings other than residences shall be in accordance with Table 1.

Table 1 Water Requirements for Buildings Other than Residences

Sl No.	Type of Building	Consumption Per Day, litres
(1)	(2)	(3)]
i)	Factories where bath rooms are required to be provided	45 per head
ii)	Factories where no bath rooms are required to be provided	30 per head
iii)	Hospital (including laundry) : a) Number of beds not exceeding 100	340 per head
	b) Number of beds exceeding 100	450 per head
iv)	Nurses' homes and medical quarters	135 per head
v)	Hostels	135 per head
vi)	Hotel	180 per head
vii)	Offices	45 per head
viii)	Restaurants	70 per seat
ix)	Cinemas, concert halls and theatres	15 per seat
x)	Schools:	
	a) Day schools	45 per head
	b) Boarding schools	135 per head

NOTE — For fire demand in buildings refer IS 9668 : 1981.

5 DRAINAGE AND SANITATION REQUIREMENTS

5.1 General

There shall be at least one water tap and arrangements for drainage in the vicinity of each water-closet or group of water-closets in all buildings.

5.2 Residences

5.2.1 Dwellings with individual conveniences shall have at least the following fitments:

a) One bath room provided with a tap,
b) One water-closet, and
c) One nahani or sink either in the floor or raised from the floor with a tap.

Where only one water-closet is provided in a dwelling, the bath and water-closet shall be separately accommodated.

NOTE — Water-closets, unless otherwise indicated, shall be of Indian style (squatting type).

5.2.2 Dwellings without individual conveniences shall have the following fitments:

a) One water tap with draining arrangement in each tenement,
b) One water-closet and one bath for every two tenements, and
c) Water taps in common bath rooms.

5.3 Buildings Other Than Residences

The requirements for fitments for drainage and sanitation in case of buildings other than residences shall be in accordance with Tables 2 to 12.

6 WATER SUPPLY, DRAINAGE AND SANITATION REQUIREMENTS FOR RAILWAY PLATFORMS, BUS STATIONS, BUS TERMINALS AND AIRPORTS

6.1 General

The water supply, drainage and sanitation requirement specified in **6.2** to **6.4** for railway stations, bus stations, bus terminals, sea ports

Annexure V: Water Saving Gadgets

Electronic Taps (e-taps)

The latest trend in industries is to install electronic taps (e-taps). The advantages of using e-taps are as mentioned below:

- Unlike conventional taps, there is no twisting or turning in e-taps. They have a sensor, which cuts off water supply completely when not in use. This helps in saving up to 70% water during hand wash

- E-taps enable hands free operation. No fear of cross contamination or contact with germs. E-taps score very high on hygiene. It is the most ideal choice for multipurpose and multiuser washrooms.

- E-taps can work efficiently up to raw water TDS of 1800 ppm. The raw water TDS of plant is less than 1800 ppm.

- The touch free electronic taps, available in AC and DC models consume minimal power only. The AC model has an efficient battery back-up, while the DC model runs on just 4 alkaline batteries.



Operation of Electronic Taps

This has been successfully implemented in several hotels & restaurants. Of late, several industries have also started implementing this proposal.

Thus, there is a good potential to optimize the freshwater consumption by replacing the existing taps with e-taps.

Electronic flush (e-flush) urinals

The latest trend in industries is to install e-flush urinals. The advantages of using e-flush urinals are as mentioned below:

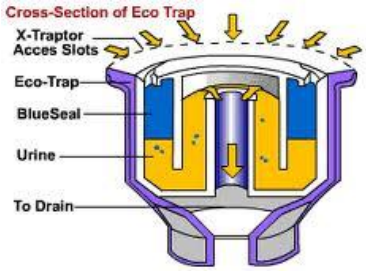
- E-flush urinals are fitted with a sensor, which senses the usage and flush with water for few seconds after use. This helps in saving 70% water during urinal flush
- E-flush urinals enable hands free operation and score very high on hygiene. It is the most ideal choice for multipurpose and multiuser washrooms.
- E-flush urinals can work efficiently up to raw water TDS of 1800 ppm. The raw water TDS of plant is less than 1800 ppm.
- The touch free e-flush urinals available in AC and DC models consume minimal power only. The AC model has an efficient battery back-up, while the DC model runs on just 4 alkaline batteries.

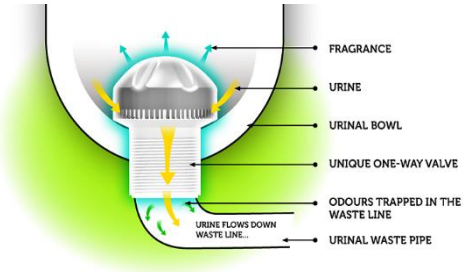


Photographs: Electronic flush urinals

Waterless urinals

Waterless urinals eliminate 100% water usage in urinal flush. The concept is based on blue seal technology. The patented blue seal density is lesser than urine and hence allows the passage of urine and acts as a protective layer. The blue seal also eliminates odour emanating from urine. The blue seal is bio-degradable and has to be replaced once in 5000-7000 usages.



Photographs: waterless urinals

Hand wash
NEERR nozzles

Demonstration conducted at a site showed a water saving of 92.18% in the mist mode, 85% in the foam mode and 60% with the normal aerator nozzle.

Photographs: Basic Aerator, NEERR nozzle: Foam Mode and NEERR nozzle: Mist Mode

Thus, 85% water saving can be assumed though installation of these NEERR nozzles.

Technical details about the product:NEERR[1] nozzles are based on water A.R.T. (Atomizer Reduction Technology)[2], which atomizes the water and creates a heavy mist, hence reducing the consumption in any washing application by up to 95%. There are two modes available in the same nozzle:

Mist Mode: Saves up-to 95% water (at 3 bar pressure). It is perfect for daily utility activities like brushing, washing dishes etc.

Normal Mode: With a twist, Neerr switches to normal mode, which still saves up to 75% water (at 3 bar pressure). It is more useful while filling glasses, pots etc.

Installation: Retrofits into the existing tap**;** Unscrew the existing aerator and insert the Neerr Nozzle.

Dimensions: Fits Standard (20.8 mm), Junior (18.1 mm) and Tom Thumb (15 mm) sized taps (inner socket dimension)

Material: Lead Free Brass (Chromed Handles)

Water Pressure: 1.2 – 8bar. (Suitable for low pressure water systems).

Water Temperature: Max 192 degree F / 89 degree C

[1] NEERR™ is a product innovated by ZeFi Labs with RETAS as Marketing Partner
[2]It is a patent pending technology by ZeFi Labs

Foam taps

Conventional taps are used in the hand wash areas which results in large quantity of fresh water. Foam taps are a better fit in these high consumption areas. They consume 25-30% less than the conventional taps.

Photographs: Foam taps

Spring loaded Push taps

Spring loaded push type tap is an alternate device for minimizing hand wash Water. The spring-loaded push taps operate with the simple mechanism of pressing the knob for water. The knob automatically released back to close position in 5-7 seconds. This saves about 30-40% of water compared to the conventional taps

Photographs: Spring loaded push taps

Low flush cistern

The latest model closets are water efficient and operate in dual mode with single flush releases 2 liters and dual flush releases 4 liters per flush. This results in large quantity of water savings.

Photographs: Low flush cisterns

Annexure VI: Guidelines for installation of Flow meter on Borewells/Tube wells

Digital Water Flow Meter with Telemetry for Groundwater extraction monitoring as per CGWA notification

Technical specifications

1. Specification of Tamper proof Electronic water meter with telemetry

Metering Technology	: Ultrasonic or Electromagnetic
Communication type	: LAN (for internet connectivity) or LoRa WAN and/or Cellular (GPRS / 3G / 4G)
Tamper proof:	
a) Power source	: The meter shall be battery operated or UPS powered supply with provision of power OFF detection. The telemetry system units shall be battery operated or through external power supply. The metering data should be stored in the meter even if the telemetry system is off due to power failure.
b) Sealing	: The meter and telemetry system shall have proper mechanical and electronic sealing (through software) arrangement. Any attempt to open the meter or system enclosure should physically damage the tag.
Compliance	: The meter shall preferably be manufactured as per ISO 4064: 2014 Standards and shall have IP 68 ingress protection.
Accuracy	: The meter shall be of accuracy better than ± 2% for the operating flow range (from 10 % to 100 % of maximum flow rate).
Test certificate	: The meter manufacturer shall submit the latest test/calibration certificate of the meter, from Fluid Control Research Institute (FCRI) / National Physical Laboratory (NPL) or any third party laboratory accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL), for every meter.
Parameters to monitor	: The meter (since installation of the requisite water meter) shall transmit the following parameters to a

	secure cloud • Timestamp • Cumulative forward flow volume • Cumulative reverse flow volume • Cumulative Net volume • Cumulative pump working hours • Meter serial number • Device last calibration date • Borewell id (Provided by CGWA)
Cloud	: The Communication / telemetry data should be directly captured in a secure cloud. The cloud service provider should be empaneled with The Ministry of Electronics and Information Technology (MeitY).
Transmission frequency	: The data shall be transmitted minimum 2 times in a day
Battery life	: In case of battery operated meters the battery shall run at least for a period of 3 years with 2 transmissions per day. The battery shall be replaceable without any data loss.
Data acquisition	: The meter shall be supplied with complete AMR / AMI system with Data Management software. The Data Management Software must be capable of running on a standard PC. The Data Management Software should be cloud based and should have web portal access so that user can view customer data through browser. In addition to above, Data Management Software will be installed on Server placed in Central Data Base/Control Room, and the software may have option for individual customer to view their meter consumption data through Web portal. Consumer, engineer and manager screens shall be available separately. Data Collection Unit shall be capable of taking data from meter, pump etc. and should be posted in Data Management Software.
Real-time data to CGWA	: The un-tampered data from the secure cloud shall be sent to Central Ground Water Authority (CGWA) real-time data management platform once it is ready. Proper cyber security measures shall be taken in the secure cloud.

2. Installation of meter

Location	: The meter shall be installed at the bore-well pump discharge line before any branching and preferably as shown in Figure. 1
Bypassing	: There shall be no bypassing of pipe prior to the installed flow meter.
Full flow	: The installation of the meter shall ensure the pipe shall have full of water at all times. Sufficient upstream and downstream straight length shall be provided for the meter (Refer to Figure 1.)

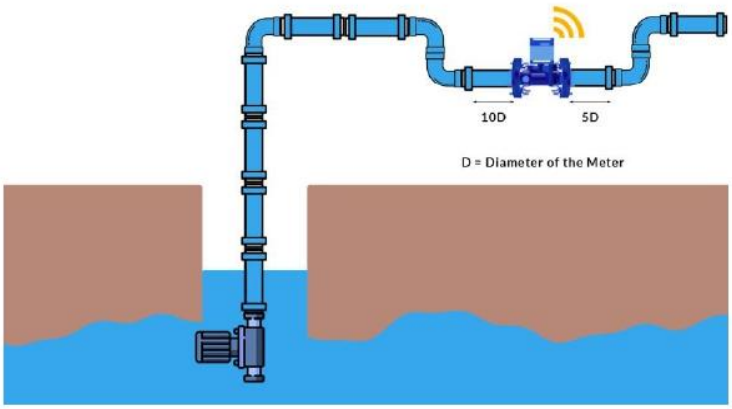


Figure. 1
Installation position of tamper proof flow meter with telemetry at groundwater abstraction structures.

3. DETAILED TECHNICAL SPECIFICATIONS OF AMR / AMI WATER FLOW METERS

3.1 Specification of flow meter

Flow meters shall meet the following metrological specification:

Turndown ratio of 10 or above
Accuracy ± 2%
Technology: electromagnetic or ultrasonic

3.1.1 Size:

1. DN40 - Flow range: 0.5 lps to 5 lps
2. DN100 - Flow range: 3 to 30 lps
3. DN150 - Flow range: 13 to 130 lps

Meter performance shall not get affected by external magnetic field, as specified in ISO4064.

Meters must be able to retain their accuracy, when installed in either horizontal and/or vertical planes.

3.1.2 Material of Construction:

The manufacturer shall provide specific details of materials used for various parts of the meter which must meet the specifications for the material of construction of the individual parts of the meters as per applicable standards (referred above).

- The water meter and accessories shall be manufactured from materials of adequate strength and durability.
- The body of the meter shall be of Brass/Bronze/MS/CI/SS/Engineering Plastic and compact enough to avoid tampering of meter. The manufacturer shall specifically mention in the offer, the material used in manufacturing.
- The materials, which come in contact with the potable water, shall not create a toxic hazard, shall not support microbial growth, and shall not give rise to unpleasant taste, odor or discoloration in the water supply.
- The painting material used should be free from toxic constituents and safe for human uses and should not affect human health (Health Certificate should be attached/provided).
- Each meter should be supplied in separate individual box with its accessories, test/ calibration Certificate (for accuracy parameter) and Guarantee Card for free repair/replacement during the warranty period.

3.1.3 Markings on the Body of the Meter:

- Make/Brand, Size / Nominal Dia.
- Sl. No. / Year of Manufacture, Metrological specifications etc.

3.1.4 Meter indicator

The digital indicator shall be designed in such a way that if the protective glass is broken for a reason or another, the indicator cannot be removed from its place. The protective cover of the indicator shall be made of sturdy glass/PP/PC.

- It shall be of straight reading type.
- No. of digits and verification scale interval shall be as sufficient enough to meet the required accuracy.
- Totalizer shall be made of suitable material required to maintain IP 68 protection class.

3.2 Telemetry System

- The AMR/AMI system should have the facility to detect and communicate any abnormalities, i.e. high consumption, tampering etc. along with necessary alarms.
- The system will communicate in real time for battery and tamper alarms, in order to provide relevant monitoring and management data for operational purposes.
- The battery shall be replaceable without any data loss.
- The meters should report an alarm to the server as and when tampered.
- All Water Meter readings should be time stamped.
- The meter should have the capability to detect and record reverse flow separately.
- The meter should be capable of to detect Leak, Zero (No) Flow, High Flow.
- The AMR/AMI should operate even in electrically noisy environments with electromagnetic interference. The AMR/AMI should function even in the presence of high voltage power lines.
- Battery usage has to be indicated at the server. Provision should be provided to replace batteries if required.
- The communication shall be encrypted to avoid tampering.
- The meter should be configurable either using the DTU or from the server.
- Loss of communication should be indicated in the server within 48 hours.
- The meter should be able to log the daily flow data with a timestamp which is supposed to be sent to the cloud via telemetry for at least 2 years.
- In case the telemetry is non-functional because of power cut or weak cellular signals, the meter should be able to store the data and transmit to the cloud as soon as the telemetry system is live.
- This data shall also be used for retrieval in case of any dispute between meter data and online data.

3.3 Data Management Software

- The web based Data Management Software must be capable of running on a standard PC compatible with minimum Pentium Processor; in addition, the software must run under Windows XP Professional, Windows Vista, Windows 7 and / or latest version of Windows Operating System and HP Unix, Linux, Solaris, etc.

- The Data Management Software should be cloud base and should have web portal access so that user can view customer data through browser. In addition to above, Data Management Software will be installed on Server placed in Central Data Base / Control Room, and the software may have option for individual customer to view their meter consumption data through Web portal.
- The Data Management Software shall provide database backup/restore functions and must have real-time data access. The software should be web-enabled and alerts to be provided through email/SMS to the user.

- The Data Management Software shall post the reading from the communication infrastructure on to appropriate accounts within the Database.
- The Data Management Software should be able to display all kind of data on screen at any time.
- The Data Management Software should have capability to add additional customer information and create customizable data fields.

3.4 Lab Testing / calibration:

Testing or Calibration of meters shall be performed at ISO 17025: 2017 accredited laboratory. The accuracy of meter shall be within ± 2 % in the operating range. The meter shall have valid model approval certificate.

The meter shall have model approval from India or abroad. Every meter should be calibrated / tested for accuracy in the operating flow range (10% to 100%). At least 4 point calibration at 10%, 40%, 70% and 100% of maximum/rated flow shall be performed.

Annexure VII: Suggestive List of Vendors for providing water saving equipment/technology/consultancy

a. Supplier Addresses of Water &Wastewater Treatment Systems and Water Saving Devices

1. **Hitech Enviro Engineers & Consultants Pvt. Ltd.**
   Address: Plot No: A-1, Ground Floor,
   Kaushambi, Ghaziabad – 201010
   Tel: 0120– 4294461-63,
   Fax: 0120- 4294462
   Email: projects@heecpl.com
   Website: www.heecpl.com
   Contact Person: Mr. Hitesh Mittal (Director)

2. **Arvind Envisol Ltd.,**
   Contact Person: Mr. Vivek Vishal
   Contact Number: 9643406635
   E-mail ID: vivek.vishal@arvind.in

3. **HYDROLOG ENGINEERS**
   Contact Person: Gundeep Singh (CEO)
   Contact Number: 9891011096
   E-mail ID: gundeep.singh@hydrologengineers.org

4. **Ion Exchange India Ltd**
   Contact Person: Mr. Manish Gandhi (VP-North & East)
   Contact Number: 9350474255
   E-mail ID: manish.gandhi@ionexchange.co.in

b. Water Saving Devices

1. **Retas Infra Solutions**
   Address: Mayur Vihar Phase 1 Extension, Mayur Vihar Phase 1, New Delhi, Delhi 110091
   M + 91 97110 74119
   Email: retasinfra@gmail.com
   Contact Person: Mr. Ankit Magan

c. Flow Meters (Fixed/Portable)

1. **Forbes Marshall Pvt. Ltd.**
   Address: A-34/35, MIDC, H Block,
   Pimpri, Pune-411018, Maharashtra
   Telephone: 020-2744 2020
   Fax: 020-2744 2420, 2040
   Mobile: 98505 67714

E-mail: rmishra@forbesmarshall.com
Website: www.forbesmarshall.com
Contact Person: Mr. Rakesh Mishra,
Head - Water Business

2. **Iota Flow Systems Pvt Ltd**
   Address: A-2/13 Phase II, Industries Area,
   Maya Puri, New Delhi - 1100 064
   Tel.: 91-11-46254601-08 Extn 17
   Mobile: 09958609393
   Fax: 91-11-46880020
   Email: sunil@iotaflow.com
   Contact Person: Mr. Sunil Yadav

3. **GE India Industrial Pvt. Ltd**
   Address: Building No 7A, 5th Floor DLF Cyber City,
   DLF Phase III, Sector 25A, Gurgaon
   Haryana – 122002
   Tel: 0124 4808016
   Email: Srikanth.Kommu@ge.com

   Contact Person: Mr. Srikanth Kommu

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, with around 9,000 members from the private as well as public sectors, including SMEs and MNCs, and
an indirect membership of over 365,000 enterprises from 294 national and regional sectoral industry bodies.

For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness, and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Through its dedicated Centres of Excellence and Industry competitiveness initiatives, promotion of innovation and technology adoption, and partnerships for sustainability, CII plays a transformative part in shaping the future of the nation. Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes across diverse domains including affirmative action, livelihoods, diversity management, skill development, empowerment of women, and sustainable development, to name a few.

For 2024-25, CII has identified "Globally Competitive India: Partnerships for Sustainable and Inclusive Growth" as its Theme, prioritizing 5 key pillars. During the year, it would align its initiatives and activities to facilitate strategic actions for driving India's global competitiveness and growth through a robust and resilient Indian industry.

With 70 offices, including 12 Centres of Excellence, in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with about 300 counterpart organizations in almost 100 countries, CII serves as a reference point for Indian industry and the international business community.

Confederation of Indian Industry
The Mantosh Sondhi Centre
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HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT

Period: October 01, 2025 to March 31, 2026

For

HALDIA PETROCHEMICALS LIMITED

HALDIA: PURBA MEDINIPUR: WEST BENGAL

Envirotech East Pvt. Limited
100, Kalikapur, Madurdaha,
Kolkata – 700 107, West Bengal, India
Tel:(033) 40635011/ 24438127,email: eeplkol@gmail.com

Scientific Research Laboratory
90, Lake East (4th Road), Santoshpur,
Jadavpur, Kolkata-700075,West Bengal
Tel: (033) 24161311 E Mail: jyotirmoysrl@gmail.com

Accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in Accordance with the Standard ISO/IEC 17025:2017, Certificate Number TC-12649, Validity 24.11.2023 to 23.11.2025

Accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in Accordance with the Standard ISO/IEC 17025:2017, Certificate Number TC-17162, Validity 25.11.2025 to 24.11.2029.

Recognised by CPCB, Govt. of India under the Environmental (Protection) Act-1986 up to 16.12.2027 vides F. No. LB/99/7/2021-INST-LAB-HO-CPCB-HO/Pvt./1873 Dated-19th December 2024

Recognised by West Bengal Pollution Control Board (Department of Environment, Govt. of West Bengal) Memo No. 1554-5/WPB-S/99 (Part-VII), Dated-26.06.2025, Validity: 30.06.2026.

MEMORANDUM OF UNDERSTANDING (MoU)

Between
Envirotech East Pvt. Ltd.
and
Scientific Research Laboratory

This Memorandum of Understanding was made on this **23rd day of March 2025** between **Envirotech East Pvt. Ltd** and **Scientific Research Laboratory (SRL)**. Both parties have mutually agreed to collaborate in carrying out environmental monitoring, and reporting activities, related to statutory requirements for **Haldia Petrochemicals Ltd.**

The understanding between the two parties covers the period from **April 2025 to October 2025**, both parties have mutually agreed to collaborate in conducting **environmental monitoring and reporting activities** related to the statutory requirements of **Haldia Petrochemicals Ltd.** The monitoring and reporting shall be carried out **jointly by Envirotech East Pvt. Ltd. and SRL**, while all **analytical testing and laboratory analysis** shall be performed at the facilities of **Envirotech East Pvt. Ltd.**

Both Envirotech East Pvt. Ltd. and Scientific Research Laboratory acknowledge this cooperation as a joint effort towards reliable and compliant environmental reporting. All professional and administrative arrangements shall be based on mutual understanding. This MoU signifies goodwill and collaboration between the two organizations for the said period.

For Envirotech East Pvt. Ltd.
Name: **Mr. Sudeep Sengupta**
Designation: **Managing Director**

Signature: _____
Date: 23.03.2025

ENVIROTECH EAST PVT. LTD. 100, Kalikapur, Madurdaha Kolkata 700107

For Scientific Research Laboratory
Name: **Mr. Riddhi Majumder**
Designation: **Partner**

Signature: _____
Date: Date: 23.03.2025

SCIENTIFIC RESEARCH LABORATORY KOLKATA

TC- 12649

HALDIA PETROCHEMICALS LIMITED
HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT
OCTOBER 2025 – MARCH 2026

Envirotech

PREFACE

Haldia Petrochemicals Limited, one of the largest petrochemical complexes in India and the only one of its kind in the eastern region, produces ethylene, propylene, and associated liquid stream products for downstream processing into polymers and chemicals.

The scope of the study includes detailed characterization of the environment in and around the HPL complex, covering an area of 10 km radius from the center of the HPL plant for air, noise, effluent, and other environmental parameters. For this purpose, **Scientific Research Laboratory (SRL)**, in association with **Envirotech East Pvt. Ltd**. performed the environmental monitoring, sampling, and reporting, while all analytical testing and laboratory analysis were performed at the facilities of Envirotech East Pvt. Ltd., following well-established and recognized standard procedures and regulatory guidelines.

Scientific Research Laboratory wishes to place on record its deep appreciation for the trust reposed in it by Haldia Petrochemicals Limited for carrying out this study. Our heartiest thanks go to **Mr. Sandeep Balkrishna Vipra**, VP & Head Plant, and **Mr. Parmindar Singh**, Chief GM and Head – HSEF, for their kind cooperation and assistance during the course of the study.

We also appreciate the tireless efforts of **Mr. Subandhu Bhattacharya**, Sr. Manager – Environment Services, **Mr. Saugata Mahindar**, DGM – Environment Services and **Rishita Chowdhury**-Environment Services, without whom it would not have been possible to bring out the final report.

Note: This report represents a collaborative effort between Scientific Research Laboratory (SRL) and Envirotech East Pvt. Ltd. following and adhering to esthablished protocols in compliance with CPCB/NABL guidelines.

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TC- 12649

HALDIA PETROCHEMICALS LIMITED
HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT
OCTOBER 2025 – MARCH 2026

Envirotech

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CHAPTER NO. - 01

INTRODUCTION

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HALDIA PETROCHEMICALS LIMITED – SATELLITE IMAGE

1.0 INTRODUCTION

1.1 General

Haldia Petrochemicals limited (HPL), Haldia, West Bengal is an integrated Petrochemicals production unit and only petrochemical complex in West Bengal. HPL mainly comprises of Naphtha Cracker Unit (NCU), Pyrolysis Gasoline Hydrogenation unit (PGHU), Py-gas Desulfurisation (PGDS), Butene-1, Benzene Extraction Unit (BEU), Butadiene Extraction Unit (BDEU). The down stream units comprise of Linear Low Density Poly Ethylene (LLDPE), High Density Poly Ethylene (HDPE) and Poly Propylene (PP).

HPL is located at about 58 nautical miles by waterways and 130 Km by roadways from Calcutta and lies in the Haldia Industrial area. Haldia is in Purba Medinipur district, West Bengal between at latitudes 21^0 56' 10" (N) and longitude 88^0 5' 47" (E). The site lies adjacent to the road linking SH 4 and NH 41. Nearest railway, station is Durgachak on the Panskura – Haldia branch line of SE railway.

A comprehensive Environmental Impact Assessment Studies for the Haldia Petrochemicals Complex was carried out in 1991. Due to the rapid urbanisation and industrialisation, the environmental scenario of this area has changed in many respects. HPL started commercial production from the month of August 2001. HPL has entrusted Scientific Research Laboratory, Kolkata, the job of Environmental Data Generation in respect of air, water, noise and solid waste after commissioning of their petrochemical complex at Haldia.

1.2 Study Area

Keeping in view the nature and size of the complex, the various guidelines available, past experience and the original EIA report, it was decided to cover an area of 10 km. radius for the purpose of ambient air monitoring from the center of the plant. Study area covers 196 villages. Field data collection are restricted within the 10 km. radius of the plant center.

1.3 Objective of The Study

The purpose of the present study is to assess the effect of industrial activity on the environment at Haldia. The availability of resources in this area is the result of the interaction between the physical occurrence and the amount of requirement and economic means of their exploitation. Haldia is one of the most industrialized zones in the Bank ofHoogly River. Ambient air quality with respect to $PM_{2.5}$, PM_{10}, SO_2, NOx, CO, Benzene, B(a)P, As, Ni, Pb, NH3 & O3 has been monitored to evaluate the environmental conditions in and around the complex.

The Environmental Data Generation work has been undertaken by Laboratory of **Scientific Research Laboratory**, **Kolkata** for the following:

- Evaluation of present environmental status through comprehensive analysis of various environmental parameters.
- Predict the probable impact on the various environmental factors due to the HPL operation.
- Analysis of the predicted impact vis-à-vis the regulatory environmental standards.
- Assessments of efficacy in process and pollution control systems.

1.4 Contents of the Report

Environmental monitoring for generation of data on meteorology, ambient air and effluent were carried out for the months of**October 2025 to March 2026**. This report contains the data of meteorology during the ambient air monitoring, analysis report of ambient air quality, work zone monitoring results, stack monitoring data, ambient Noise monitoring report, LDAR and effluent analysis report with respect to MoEF& CC and WBPCB parameter specified for Petrochemical industries and HPL respectively.

1.5 Location of the Site

Haldia Petrochemicals complex is in the industrial area of Haldia, which is developed by Haldia Development Authority. Haldia is situated at latitudes 21^0 56’ 10” (N) and longitude 88^0 5’ 47” (E) on the confluence of Hoogly and Haldi river in Purba Medinipur district, West Bengal. It is about 58 nautical miles by waterways and 130 km. by roadways from Calcutta. The area is well connected with roads, waterways and railways.

The site is flat and plain, typical of the Ganges’s of the delta region. Up to the late 1960s, what is now Haldia was a very rural area. There was small set up of the Calcutta port from sand Heads and back. This was called the “Anchorage Camp” and was near the mouth of the Haldi River. With adequate favorable infrastructure such as roads, railways, waterways, port and power, Haldia has now become a major industrial township in west Bengal, after Durgapur – Asansol region. Haldia planning area is governed by Haldia Notified Area and is bounded by Hooghly, Haldi and Hijli river tidal canal. The total area of Haldia Notified Area is about 326.85 sq. km.

1.6 Major details of industries, which are contributing to pollution load in Haldia, its distance and location with respect to HPL Complex, are as follows:

Sl. No.	Name of the Industry	Distance from HPL complex	Direction with respect to HPL
1	Adani Wilmer Ltd.	1.0 km	North- West
2	Dhunseri Petrochem & Tea Ltd.	1.0 km	North-East
3	DPM Net Pvt. Ltd.	1.5Km	North
4	Exide Industries Ltd.	2.6 km	East
5	Emani Biotech Ltd.	2.0 km	East
6	Ennore Coke Private Ltd.	4.0 km	East, North-East
7	Electrosteel Casting Ltd.	0.8 Km	North
8	Gokul Refoils& Solvent Ltd.	2.0 km	North- West
9	Greenways Shipping Agencies Pvt. Ltd.	3.5 km	North- West
10	Hindustan Unilever Ltd.	3.5 km	East
11	Hooghly Met Coke & Power Company	1.7 Km	South
12	Indian Oil Corporation Ltd., Haldia Refinery	3.6 km	South
13	IOC Petronas Ltd.	0.6 km	North
14	KoPT/Haldia Dock Complex	4.5 km	South
15	Lalbaba Seamless Tubes Pvt. Ltd.	1.5 km	North- West
16	MCC PTA India Corp. Private Limited	4.0 km	East, North-East
17	M/S West Bengal Waste Management Ltd.	2.5 Km	North-East
18	Manaksia Ltd.	4.2km	East, North-East
19	Marcus Oils Chemical Pvt. Ltd.	0.5 km	North
20	Ruchi Soya Industries Limited	0.5 km	South
21	Reliance Petroleum Ltd.	1.0 km	North
22	R.D.B. Rasayans Ltd.	0.5 km	East
23	SWAL Corporation Ltd.	2.5 km	East
24	Shamon Ispat Ltd.	2.3 km	North- West
25	Shree Renuka Sugars Ltd.	1.5 Km	South- West
26	Sanjana Cryogenic Storages Ltd.	3.5 km	East
27	Tata Chemicals Ltd.	3.0 km	East
28	URAL India Ltd.	2.5 Km	West

Industrial map

1.7 Site Environmental Monitoring

Site Environmental monitoring was carried out for six months **(October 2025 to March 2026)**through out the year comprising of two seasons as per MOEF & CC guidelines such as Summer & Monsoon season in respect of

- Effluent Quality
- Stack Emission
- Meteorology
- Ambient Air Quality
- Work Zone Air Quality
- Ambient Noise Quality
- Leak Detection And Repair (LDAR)Program

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CHAPTER NO. – 02

EFFLUENT QUALITY

Online Treated Effluent Monitoring System

Online BOD & COD analyser

Online TSS analyser

2.0 EFFLUENT QUALITY

HPL generates liquid waste water from Naphtha Cracker Unit, Butadiene Extraction Unit, Pyrolysis Gasoline Hydrogenation Unit, Benzene Extraction Unit, HDPE, LLDPE, PP, Cooling Tower, DM Water Plant, utilities and off-site buildings. The waste-water generated requires suitable treatment before disposal and a comprehensive waste water management system comprising of collection, treatment, and disposal facilities are provided.

The treatment facilities are divided into two distinct sections, namely, pre- treatment section inside battery limits (ISBL) of the respective units and final treatments in Waste Water Treatment Plant (WWTP)

ISBL Treatment is provided for the following streams

- Spent caustic stream from Naphtha Cracker Units (NCU)
- Neutralization / free oil removal in NCU.
- Polyethylene Plants/Polypropylene Plant ISBL units for removal of Polymers and oil.
- Neutralization for Demineralisation of waterplant

WWTP has been broadly designed for following treatment systems

- Oil Recovery System
- Contaminated Rain Water Treatment System
- Sanitary Sewer Treatment System
- Biological Treatment System
- Slop Oil Collection System
- Sludge Handling System
- Final Discharge System

2.1 PRETREATMENT FACILITIES

Spent Caustic from Cracker Unit

Spent caustic stream emerging from cracker unit are highly alkaline and contains high oxygen demand. In the spent caustic treatment plant, Na_2S is converted to sodium thiosulphate by oxidation process. After this treatment the stream is sent to WWTP.

Polyethylene Plants/ Poly Propylene Plant

Wash water and effluent streams from process contain trace hydrocarbon and polymers, which are collected in ISBL and then sent to WWTP after oil skimming and removal.

2.2 DETAILS OF WASTEWATER TREATMENT PLANT

The treatment facilities are designed for treating process water for reduction of free and emulsified oil, sulphide, phenol, thiosulphate, total suspended solids (TSS), bio-chemical oxygen demand (BOD), chemical oxygen demand (COD) and the contaminated rain water for removal of oil and suspended solids. The treated effluents from WWTP are meeting the discharge standards stipulated by West Bengal Pollution Control Board.
The wastewater treatment plant consists of Physical, Chemical and Biological treatment facilities for removal of oil, suspended solids and biodegradable organic.

Treatment Scheme of WWTP

The physical and chemical treatment scheme consists of the following units:

- Bar Screen and Grit Chamber
- Tilted Plate Interceptor (TPI)
- Equalization Tank
- pH Adjustment Tank
- Flash Mixing Tank
- Flocculation Tank
- Dissolved Air Flotation System

The biological treatment scheme consists of following units:

- Aeration tank
- Secondary Clarifier

The slop oil handling facility consists of the following units:

- Oil Skimmer
- Slop Oil Tank
- Wet slop oil sump

The sludge, handling facility consists of the following units:

- Chemical & Oily Sludge Sump
- Bio-Sludge Sump
- Thickener
- Thickened Sludge Sump
- Centrifuge

The treatment scheme for treating contaminated rainwater during wet weather flow consists the following units:

- Wet Weather Flow (WWF) Receiving sump
- Screen Chamber
- Grit Chamber
- Surge Pond
- Contaminated Rain Water (CRW) Transfer Sump
- TPI

WWTP has been broadly designed for following treatment systems:

Oil Removal / Recovery system

Pretreated effluent streams from various units are routed to TPI Separators for removal of free oil and suspended solids. The free oil removed from the TPI Separators, is being collected in the wet slop oil sump. The oily sludge from the bottom of TPI separators is routed to the chemical and oily sludge sump. Then the effluent from TPI units is routed (by gravity) to the equalization tank for equalization of flow and modulation of characteristics. Floating oil skimmer is provided to remove the free-oil layer formed in equalization tank. This free oil is being routed to the wet slop oil sump.

HDPE process effluent is directly received to the equalization tank for equalization of flow and its characteristics. An additional facility has been provided at the inlet of equalization tank for pH neutralization. When the equalization tank effluents will be pumped to the pH Adjustment tank where the pH of the effluent is maintained in-between 7.0 to 8.0 by dosing H_2SO_4 or Caustic solution. After achieving the desired level of the pH, the effluent is routed to Flash Mixing Tank where alum solution is added as a coagulant. It requires hydrogen peroxide solution dosing which ensures the low load of sulphides in effluent. The effluent is then routed to Flocculation Tank where addition of de- oiling Polyelectrolyte helps in breaking the oil – water emulsion and formation of alum flocks.

The effluent from flocculation tank is routed to the dissolved air floatation (DAF) tank. Oil skimmer skims off the oily scum generated in the floating tank top. Sludge settled at the bottom of the tank will be removed on periodically. The oily scum and the bottom sludge are routed to the chemical and oily sludge sump and a provision is also made to route the oily scum to wet slop through wet slop oil sump. Finally, DAF effluent is routed to the aeration tank for biological treatment.

Contaminated Rain Water Treatment System

During wet weather, the contaminated rainwater streams of HPL complex will be received in the surge pond. Floating oil skimmer is provided to remove the free oil layer formed in the surge pond and routed to the wet slop oil sump. Provision is made to send the wastewater from the surge pond to TPI separator as and when required.

Effluent in surge pond is received after passing through Bar Screen & Grit Chamber. The effluent can be routed to equalization tank for processing after passing through TPI-02. If effluent quality is fit for disposal, it can be routed to guard pond via TPI-02.

Sanitary Sewer Treatment System

A dedicated underground sanitary sewer network is provided for entire HPL complex including the captive power plant of HPL Co-generation Ltd. and Nitrogen Plant of M/s Praxair India Pvt. Ltd. Sanitary effluent after collection in various suitable pits, is pumped to Bar screening chambers and then the grit chamber for physical removal of scum and suspended solids. Finally, sewer effluent is pumped to Aeration tank of WWTP for Biological Treatment along with other process effluents.

Biological Treatment System

An integrated biological treatment system has been adopted by HPL for reducing the biodegradable organic content of the effluents. The effluent from the DAF tank is routed to aeration tank operating in extended aeration mode for removal of biodegradable organic matter, resulting in reduction of BOD & COD. Aeration conditions are maintained in the tank by entrapment of the atmospheric air with the help of surface aerators.

The nutrients i.e. urea solution & DAP solution are dosed at the inlet of aeration tank to provide nitrogen, phosphorus for micro-organisms. The overflow from the aeration tank will contain a high concentration of microorganisms. A secondary clarifier helps in separating the microorganism from the liquid streams from the bottom sludge and the over flow is the treated effluent. Then aeration tank effluent is routed under gravity to the clarifier. The clarifier is provided with a sludge scraper, which moves slowly to scrap the bio-solids, which settle at the bottom. The collected sludge is routed to the bio-sludge sump (activated sludge sump).

Bio – sludge sump flow is divided into two streams; one is routed to aeration tank and the other going to a sludge thickener. The excess sludge is sent to the thickened sludge sump and the balance stream is recycled back to the aeration tank to maintain the range. The overflow from the clarifier is the treated effluent, which is routed to the guard pond. Two Guard ponds (effluent holding capacity of approx. 8,180 m^3) are provided to take care of all types of functional eventualities of the Waste Water Treatment Plant (WWTP). If the effluent does not meet the norms, it can be routed to equalization tank via surge pond for re-processing.

Co-generation power plant, cooling tower, nitrogen plant and DM water plant effluent are being collected in Cooling Tower Blow Down (CTBD) and DM waste pond. CTBD and DM waste pond overflow which is totally free of any organics or oil is routed to treated effluent sump along with treated effluent from guard pond for final disposal through a channel.

Effluent from LLDPE, PP, BDEU and PGHU units are received in receiving sump tank from where overflow of the tank is routed to bar screen, grit chamber, surge pond, respectively. Finally, effluent goes to TPI separator for further treatment and there is provision for pumping the effluent directly to the guard pond if effluent quality remains up to the desired level.

Slop Oil Collection System

The slop oil is collected in wet slop oil tank from various units e.g. TPI separators (I and II), equalization tank, floatation tank and surge ponds. Then slop oil is pumped to slop oil tank. The dry slop oil retained in the tank after decantation of water will be disposed as low-grade fuel to external agencies. The decanted water from slop oil tank bottom will be routed to receiving sump by gravity.

Sludge Handling System

The oily sludge from the TPI separator and DAF tank are collected in chemical and oily sludge sump from, where it is routed to sludge thickener. The under flow of the sludge thickener is routed to the thickened sludge sump from where it is pumped to the centrifuged. Dewatering Polyelectrolyte is being dosed in centrifuge to achieved better sludge consistency. Periodically sludge will be collected from centrifuge and is shifted to secure on site storage pit. Latter on the accumulated bio-sludge will be incinerated in incinerator.

2.3 TREATED EFFLUENT QUALITY CHECK

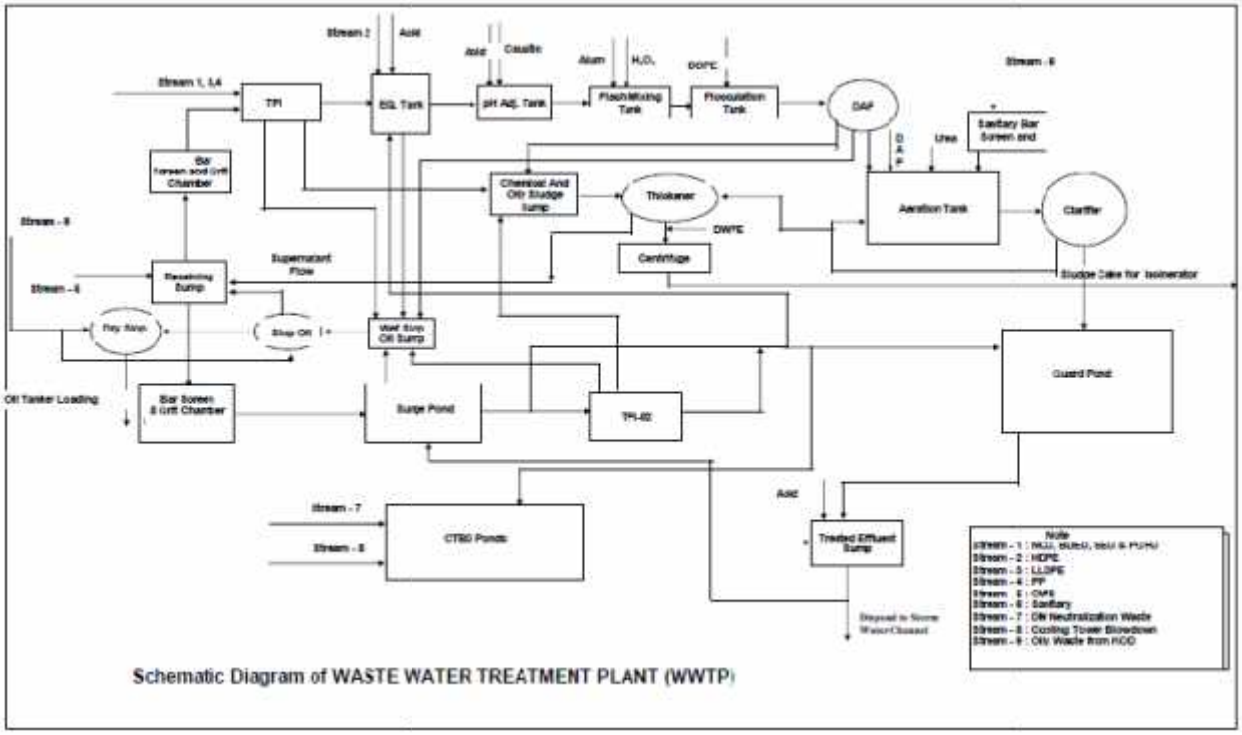
SCIENTIFIC RESEARCH LABORATORY has established an Environmental Laboratory inside HPL in WWTP Laboratory as a third independent party to check the quality of effluent daily as per specifications of effluent standards.

ON-LINE EFFLUENT MONITORING SYSTEM -The On-line effluent monitoring system was installed & successfully commissioned by M/s. Forbes Marshal in Treated Effluent Discharge line for monitoring of flow, pH, TSS, BOD & COD as per the guideline of CPCB. The online data is sent to CPCB/WBPCB server.

2.4 FINAL DISCHARGE SYSTEM

The treated effluent from WWTP will be discharged into the river Hooghly through Green Belt Canal and the treated effluent maximum extent possible will be utilized for irrigation of green belt developments. The final out fall effluents confirm that there is immense dilution i.e. nearly 20,000 times adjacent to the green belt Canal and more than 25,000 times at the confluence of river Haldi. Since Hooghly and Haldi rivers are tidal in nature, the buffering capacity of the green belt canal will be ensured to hold the treated effluent discharged (via green belt canal) during the high tide period. The final effluent is meeting the WBPCB (MINAS) standards.

Flow diagram of WWTP



2.5 METHODS OF MEASUREMENT

Sl. No.	Parameters	Specifiction / Standard (method) or technique used	Range of Testing	Methodology
1.	pH	Standard method (APHA)	0.1-14	pH is determined electrometrically using pH meter provided with pH electrode.
2.	TSS	Filtration Standard Method (APHA)	Min. 0.4 – 1000.0 mg/l	Measured Gravimetrically by filtering through GF/C filter paper.
3.	BOD	BOD Incubator method (APHA)	-	The dissolved oxygen content of the sample with or without dilution is measured before and after incubation at 27°C for 3 days.
4.	COD	Dichromate Reflux Method	-	Sample is refluxed in acid solution with known excess of potassium dichromate. After digestion, the remaining $K_2Cr_2O_7$ is titrated with ferrous ammonium sulphate to determine the amount of $K_2Cr_2O_7$ consumed and the oxidizable organic matter is calculated in terms of oxygen equivalent.
5.	Oil & Grease	Non-dispersive Infrared Analysis Method	0.0-200.0 mg/l	Extracted into Carbon tetrachloride after acidification of the sample and Measured Gravimetrically
6.	Phenol	Chloroform Extraction Method (APHA)	0.001-0.25mg/l	Steam distilled sample react with 4 – aminoantipyrine in presence of potassium ferricyanide at pH 7.9 and form a coloured antipyrine dye. The dye is extracted from aqueous solution with $CHCl_3$ and the absorbance is measured at 460 nm using a UV –VIS spectrophotometer.
7.	Sulphide	Iodometric Method (APHA)	0.1-10.0 mg/l	Iodometric titration with Sodium thiosulphate solution using starch as an indicator.

Sl. No.	Parameters	Specifiction / Standard (method) or technique used	Range of Testing	Methodology
8.	Fluoride	SPADNS Method (APHA)	0.0-1.4 mg/l	Sample mixed with Zirconyl -SPADNS solution and the concentration was measured by the UV-VIS recording spectrophotometer
9.	Cyanide	Colorimetric Method (APHA)	0.02-0.2 mg/l	The alkaline distilled of cyanide is measured by pyridine – barbituric acid reagent using an UV –VIS spectrophotometer
10.	Chromium (cr^{+6})	Colorimetric Method (APHA)	0.01-1.0 mg/l	Determined colorimetrically by reaction with di-phenyl carbazide in acidic solution using spectrophotometer
11.	Total Chromium	Colorimetric Method (APHA)	0.01-1.0 mg/l	Sample is oxidized with potassium permanganate and determined colorimetrically by reaction with di-phenyl carbazide in acidic solution spectrophotometer.
12.	Total Iron	Phenanthroline Method (APHA)	0.05-10.0 mg/l	Iron is reduced to ferrous state by Hydroxyl amine hydrochloride and treated with 1,10-phenanthroline at pH 3.2 to 3.3 and measured spectrophotometrically
13.	Total Zinc	Atomic Absorption Spectrophotometeri c Method (APHA)	0.005-2.0 mg/l	Zinc is determined by atomic absorption spectrophotometer using air-acetylene flame
14.	Total Copper	Atomic Absorption Spectrophotometric Method (APHA)	0.01-10.0 mg/l	Copper is determined by atomic absorption spectrophotometer using air-acetylene flame
15.	Phosphate (as P)	Stannous Chloride Method (APHA)	0.003-1.0 mg/l	Ammonium molybdate reacts with water sample to form Molybdophosphoric acid and reduced by stannous chloride to intensely coloured molybdenum blue and measured spectrophotometrically.

2.6 WATER CONSUMPTION AND EFFLUENT DISCHARGE

Sl. No.	Water Consumption	Average Data fromOctober 2025 to March 2026 (KL/Day)	Conditions as per WBPCB's CTOs (700 KTA Ethylene + Coal Fired Boiler + AdPer Ma (butene – 1 Plant) (KL/Day)
1	Industrial cooling + Boiler feed water + Fire water makeup	31009	50693
2	Domestic purpose	1841	1910
3	Processing where by water gets polluted and the pollutants are easily biodegradable	1706	2096
4	*Total Discharge of Effluent (a+b)	5098	8620
	a. Treated Effluent from Guard Pond & Surge Pond	3074	
	b. Effluent from CTBD & DM Regeneration Pond (as diluents)	2024	

*Total effluent after expansion will be 8620 KL/Day (as per the condition of Environment Clearance dated 02.04.2024)

2.7EFFLUENT QUALITY

Half Yearly Average Data of WWTP Outlet
Period of Monitoring: October2025 to March 2026

Sl. No.	Parameter	Unit	Standards	WWTP Outlet
1.	pH	--	6.5-8.5	7.61
2.	TSS	mg/l	100	15.84
3.	BOD	mg/l	30	8.96
4.	COD	mg/l	250	45.33
5.	Oil & Grease	mg/l	10	<2.0
6.	Phenol	mg/l	1	<0.002
7.	Sulphide	mg/l	2	<0.5
8.	Cyanide	mg/l	0.2	<0.02
9.	Fluoride	mg/l	5	0.88
10.	Total Chromium	mg/l	2	<0.05
11.	Chromium (Cr^{+6})	mg/l	0.1	<0.01
12.	Iron as Fe	mg/l	1.0	0.29
13.	Zinc as Zn	mg/l	1.0	0.04
14.	Copper as Cu	mg/l	1.0	<0.05
15.	Phosphate as P	mg/l	5.0	0.15
16.	FRC	mg/l	0.5	<0.1
17.	Temperature	^{0}C	Not>10^{0}C higher than intake	26.23

Note: All values are in mg/l except pH.

Monthly Average Data of WWTP Outlet

Sl.No.	Parameter	WWTP Outlet					
		Oct'25	Nov'25	Dec'25	Jan'26	Feb'26	Mar'26
1.	pH	7.65	7.78	7.61	7.57	7.53	7.53
2.	TSS	18.33	17.00	15.20	15.50	14.20	14.80
3.	BOD	8.67	8.20	8.00	9.50	11.00	8.40
4.	COD	44.83	41.00	40.40	47.33	51.80	46.60
5.	Oil & Grease	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6.	Phenol	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
7.	Sulfide	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8.	Cyanide	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
9.	Fluoride	0.78	0.75	0.90	0.99	0.93	0.92
10.	Total Chromium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
11.	Hexavalent Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12.	Iron as Fe	0.46	0.42	0.25	0.14	0.33	0.16
13.	Zinc as Zn	0.023	0.023	0.060	0.051	0.046	0.062
14.	Copper as Cu	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
15.	Phosphate as P	0.10	0.20	0.11	0.15	<0.01	0.21
16.	FRC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
17.	Temperature	27.60	26.60	26.60	18.40	26.00	32.20

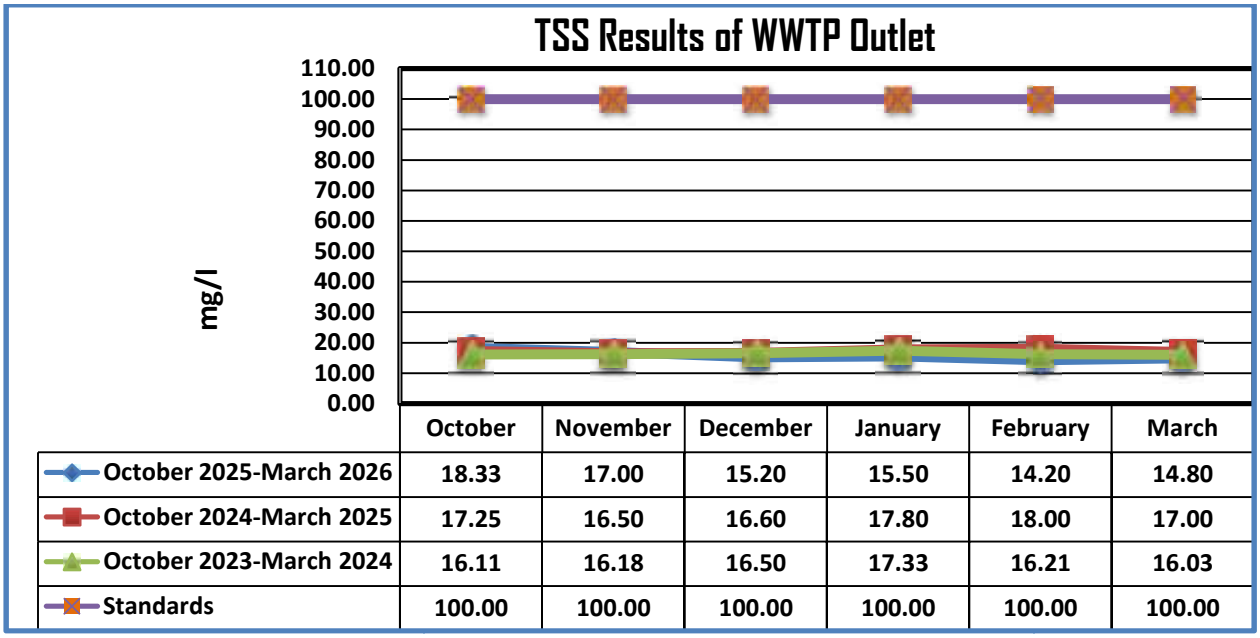
Note: 1) All values are in mg/l except pH& Temperature.

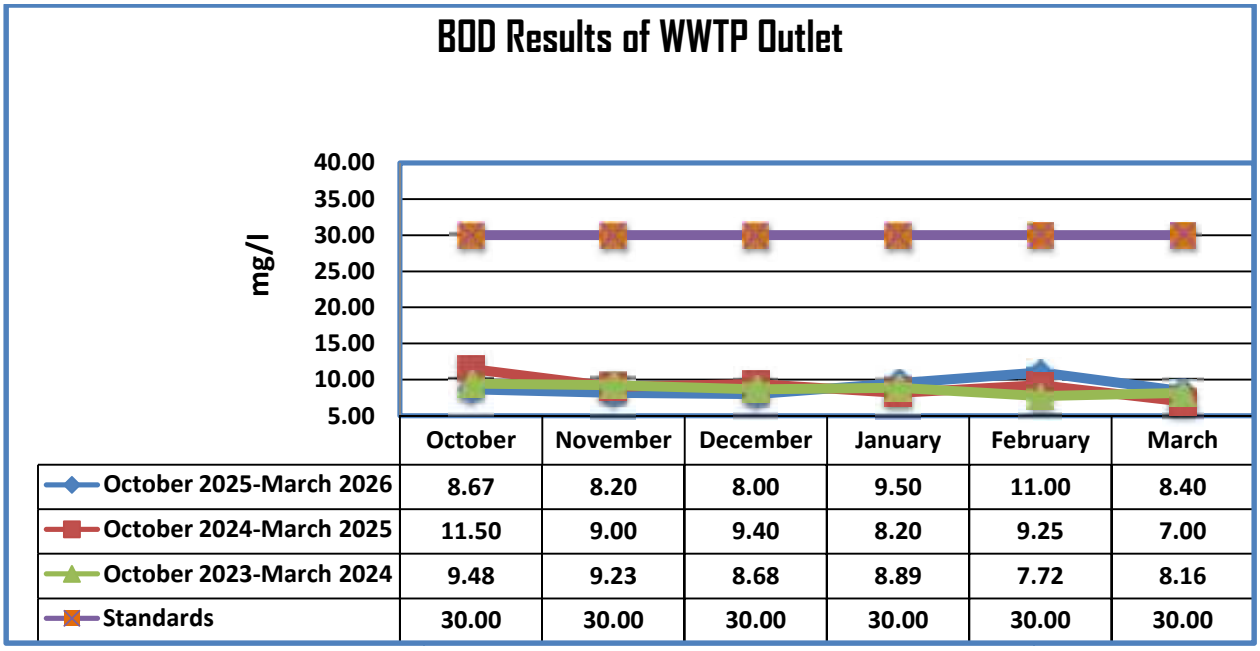
2) Frequency of monitoring

a) Sl. No. 1 – 11 :Weekly

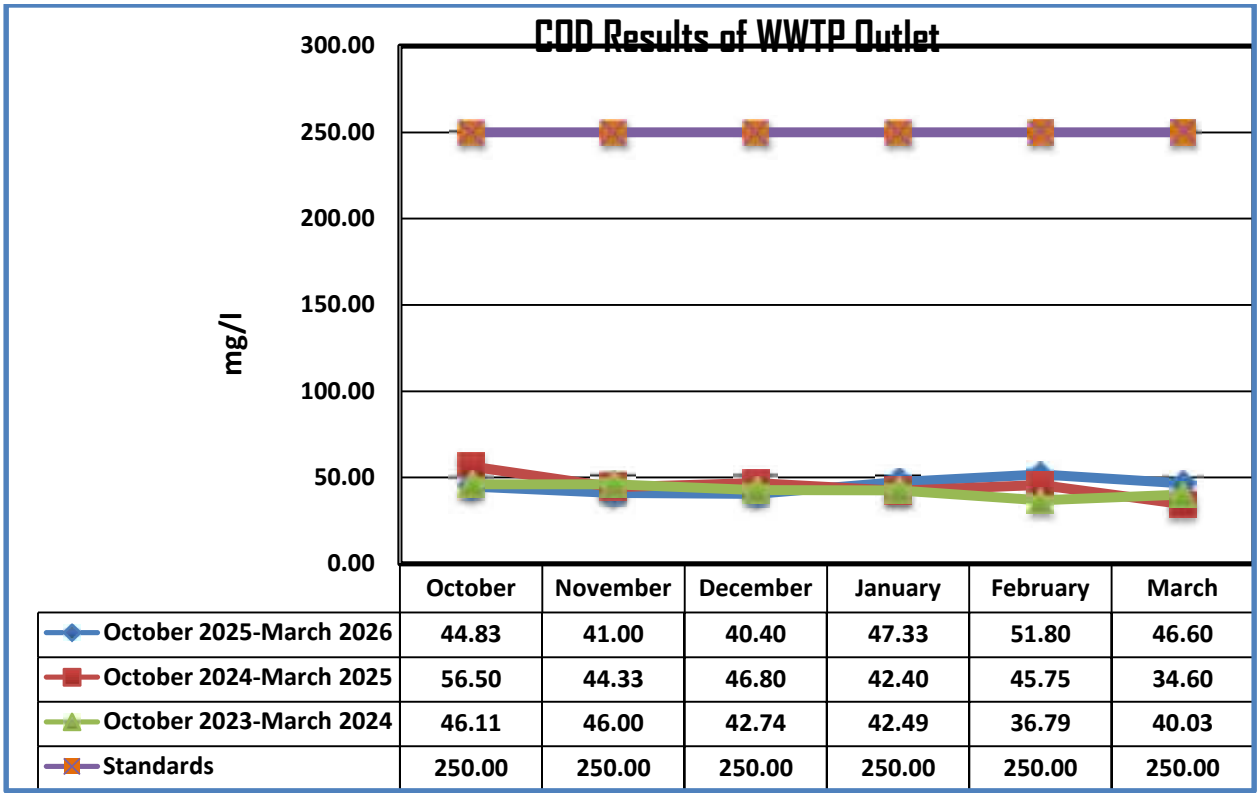
a) Sl. No. 12 - 17 :Monthly

Graphical Representation of Effluent





	October	November	December	January	February	March
October 2025-March 2026	8.67	8.20	8.00	9.50	11.00	8.40
October 2024-March 2025	11.50	9.00	9.40	8.20	9.25	7.00
October 2023-March 2024	9.48	9.23	8.68	8.89	7.72	8.16
Standards	30.00	30.00	30.00	30.00	30.00	30.00



	October	November	December	January	February	March
October 2025-March 2026	44.83	41.00	40.40	47.33	51.80	46.60
October 2024-March 2025	56.50	44.33	46.80	42.40	45.75	34.60
October 2023-March 2024	46.11	46.00	42.74	42.49	36.79	40.03
Standards	250.00	250.00	250.00	250.00	250.00	250.00

TC- 12649

HALDIA PETROCHEMICALS LIMITED
HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT
OCTOBER 2025 – MARCH 2026

Envirotech

CHAPTER NO. – 03

GASEOUS EMISSION

(STACK MONITORING)

Online Stack Monitoring System at CPP

Online SOx, NOx & CO analyser

Online Stack Monitoring System at CFB

Online PM analyser (CPP)

3.0 GASEOUS EMISSION

GENERAL INFORMATION ABOUT STACK									
Sl. No.	**Particulars**	**CFB**	**Auxiliary Boiler (2 Nos.)**	**GT & HRSG (2 Nos.)**	**PGHU**	**PGDS**	***NCU (9 Nos.)**	**EDG**	
1	Stack height from ground level	140.00 mt.	54.3 mt.	45 mt.	33 mt.	30 mt.	40 mt.	17.2 mt.	
2	Sampling port from ground level	81.50 mt.	36.5 mt.	30.5 mt.	24.95 mt.	19.70 mt.	--	16.4	
3	Stack made by	Concrete	MS	MS	MS	MS	MS	MS	
4	Diameter of the stack at sampling point	7.21 m	2.3 m	3.6 m	0.95 m	1.06 m	2.1 m	0.30 m	
5	Shape of the stack	Circular	Circular	Circular	Circular	Circular	--	Circular	
6	Area of the stack	40.81 m^2	4.1527 m^2	10.17 m^2	0.7091 m^2	0.883 m^2	--	0.0707 m^2	
7	Whether stack is attached with permanent ladder & platform	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
8	Type of Fuel	Coal	CBFS, RFG & Naphtha	Naphtha & RFG	RFG	RFG	RFG	HSD	
9	Fuel consumption (Rated)	3 x 28.27 t/hr.	7.2 (Naphtha)	9.65(Naphtha)	---	1.44 KTA (0.16T/Hr.)	2F-201 – 1440 & 2F-202 to 2F-209 – 3202 T/Month	800 lt./hr.	
10	Capacity (Rated)	3 x 120 TPH	120 TPH	GT-34.5 MW; HRSG-120 TPH SHP & 22 TPH MP	60 TPH	30 TPH	2F-201 – 13.50 & 2F-202 to 2F-209 – 32.00 T/Hrs.	1500 KVA	
12	Whether stack is attached with emission control device	Bag Filter, ESP	No	No	No	No	No	NO	

*CPCB Emission Regulations Part-Three for stack is not applicable for NCU. The Licensor did not provide any provision for Iso-Kinetic sampling of flue gas for measurement of PM. However, gas sampling can be done for SO_2, NOx & CO.

Emission Standards of Stacks

Unit	Standards	SO_2	NO_x	CO	Hg	PM
NCU	MoEF& CC notification 9th November'2012	50	350	150		
PGHU	Standard as per WBPCB					10
PGDS			250	100		05
CPP Stacks	Standard as per WBPCB		100 ppm of 15% excess O_2			50
CFB	Standard as per CPCB	100	100		0.03	30
EDG						150

All units are expressed as mg/Nm^3
Correction Factor: (a) 3 % O_2 for NCU, PGHU & PGDS, (b) 6% O_2 for CFB

Methodology of Stack Sampling & analysis

Sl. No.	Parameters	Specifiction / Standard (method) or technique used	Range of Testing	Methodology
1.	Particulate matter	Emission Regulations, Part – Three, COINDS/18/1984-85 (chapter 2 & 3)	1 mg/m^3& above	Sampling using stack kit
2.	Nitrogen Oxides	EPA method-7	2-400 mg/m^3	Absorption in hydrogen peroxide- sulphuric acid solution using EPA flask & spectrophotometric analysis
3.	Sulfur-di-oxide	Emission Regulations, Part – Three, COINDS/18/1984-85 (chapter 4)/EPA method-6	3.4mg-80,000 mg/m^3	Absorption in hydrogen peroxide solution & titration using Ba-perchlorate
4.	Carbon Monoxide (CO)	IS: 5182 (Part 10): 1999 (First Revision)	0.05 – 200 ppm	Sampling of CO in gas sampling tubes & analysis by Non-dispersive Infrared Absorption Method.
5.	Mercury (Hg)	EPA Method – 29	0.1 µg	Analysis by VGA.

Monitoring Frequency

Major source of pollutants from various stacks and parameters monitored are as follows:

Sl. No.	Unit	No.of Stack	Parameters	Frequency of Monitoring
1.	Naphtha Cracker Unit	09	SO_2, NO_x, CO	Once in a month
2.	Pyrolysis Gasoline Hydrogenation Unit	01	SO_2, NO_x, CO, PM	Once in a month
3.	Py-gas Desulfurisation Unit	01	SO_2, NO_x, CO, PM	Once in a month
4.	CFB	01	SO_2, NO_x, CO, PM	Once in a month
5.	CPP – Auxiliary Boiler& HRSG	04	SO_2, NO_x, CO, PM	Once in a month
6.	CPP – Emergency DG	01	SO_2, NO_x, CO, PM	Quarterly

STACK MONITORING RESULTS
(October 2025 to March 2026)

Half-Yearly Average Results

NCU (Naphtha Cracker Unit)	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)
	137	10.48	21.91

A.Naphtha Cracker Unit (NCU)

Half-Yearly Average Results

Furnace Heater No.	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)
2F – 201	154	9.66	19.92
2F – 202	119	9.55	22.84
2F – 203	126	9.96	22.84
2F – 204	134	12.31	21.85
2F – 205	112	11.46	23.96
2F – 206	148	9.44	20.58
2F – 207	133	10.83	22.20
2F – 208	178	10.92	20.24
2F – 209	127	9.75	22.97

Stack Monitoring Results – Location Wise

Sl.No.	Furnace Heater No.	Unit	Month of Monitoring	Temp. (^{0}C)	Results	
					SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)
1	2F-201	NCU	October 25	153	7.00	19.00
2			November 25	154	9.00	17.00
3			December 25	150	10.22	21.12
4			January 26	154	8.71	17.13
5			February 26	155	15.06	17.23
6			March 26	157	7.46	27.51
1	2F-202		October 25	120	7.00	26.00
2			November 25	115	8.00	19.00
3			December 25	115	9.86	23.30
4			January 26	120	9.48	26.14
5			February 26	118	11.07	21.38
6			March 26	124	12.26	21.71
1	2F-203		October 25	111	11.00	24.00
2			November 25	102	7.00	22.00
3			December 25	162	13.63	17.43
4			January 26	133	9.04	23.01
5			February 26	115	9.03	27.81
6			March 26	130	10.94	24.34
1	2F-204		November 25	148	12.00	20.00
2			December 25	122	10.79	13.45
3			January 26	122	10.48	24.39
4			February 26	148	15.56	30.57
5			March 26	128	14.57	18.68
1	2F-205		October 25	109	6.00	18.00
2			November 25	106	12.00	25.00
3			December 25	112	14.44	23.32
4			January 26	119	11.52	29.14
5			February 26	114	14.27	24.34
6			March 26	114	10.94	23.80
1	2F-206		October 25	147	10.00	22.00
2			November 25	148	8.00	17.00
3			December 25	154	10.78	22.36
4			January 26	146	8.62	22.06
5			February 26	151	10.73	13.76
6			March 26	144	9.37	26.09

1	2F-207	NCU	October 25	134	8.00	22.00
2			November 25	130	8.00	20.00
3			December 25	134	14.37	21.90
4			January 26	132	7.54	19.30
5			February 26	135	16.07	27.55
6			March 26	133	11.29	22.63
1	2F-208		October 25	178	11.00	22.00
2			November 25	174	8.00	19.00
3			December 25	178	16.41	18.64
4			January 26	176	7.16	19.73
5			February 26	183	12.78	21.24
1	2F-209		October 25	126	8.00	26.00
2			November 25	122	11.00	21.00
3			December 25	126	8.90	15.76
4			January 26	130	9.58	25.50
5			February 26	129	12.09	17.68
6			March 26	131	9.29	32.01

All values are corrected with 3% Oxygen

B. Pyrolysis Gasoline Hydrogenation Unit (PGHU - 4F-101)
(October 2025 to March 2026)

Half-Yearly Average Results

Furnace Heater No.	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	PM(mg/Nm 3)
4F - 101	274	36.41	61.50	4.65

Month Wise Report

Sl. No.	Furnace Heater No.	Unit	Date Of Monitoring	Temp. (^{0}C)	Results		
					SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	PM (mg/Nm^3)
1	4F-101	PGHU	October 25	263	41.00	77.00	4.29
2			November 25	272	35.00	56.00	4.87
3			December 25	274	37.10	70.12	4.73
4			January 26	273	38.87	72.38	4.85
5			February 26	278	37.38	53.07	4.89
6			March 26	281	29.01	40.06	4.27

All values are calculated to 3% O_2 dry basis

C. Pyrolysis Gasoline De Sulphurisation Unit (PGDS - 4F-201) (October 2025 to March 2026)

Half-Yearly Average Results

Furnace Heater No.	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	PM(mg/Nm 3)
4F - 201	311	37.32	50.74	4.01

Month Wise Report

Sl. No.	Furnace Heater No.	Unit	Date Of Monitoring	Temp. (^{0}C)	Results		
					SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	PM (mg/Nm^3)
1	4F - 201	PGDS	October 25	314	44.00	48.00	3.86
2			November 25	320	42.00	56.00	4.23
3			December 25	327	30.39	57.91	3.88
4			January 26	297	37.53	66.48	3.95
5			February 26	306	34.43	41.35	4.29
6			March 26	300	34.88	34.66	3.87

All values Calculated to 3% O_2 dry basis

D. Captive Power Plant (October 2025 to March 2026)

Half-Yearly Average Results

Furnace /Heater Name	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	PM (mg/Nm3)
Auxiliary Boiler # 01	147	15.62	27.19	19.16
GT & HRSG #1	193	18.00	45.00	9.34
GT & HRSG #2	193	19.45	38.24	8.86
Emergency DG	118	21.73	31.25	21.48

Month Wise Report

Sl. No.	Furnace Heater No.	Date Of Monitoring	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	PM (mg/Nm3)
1	Auxiliary Boiler # 01	October 25	147	15.00	24.00	19.63
		November 25	145	16.00	27.00	18.65
		December 25	149	15.08	27.02	19.88
		January 26	147	16.07	30.41	21.34
		February 26	146	13.91	27.56	17.38
		March 26	150	18.22	26.59	18.10
2	GT & HRSG #1	Oct-25	193	18.00	45.00	9.34
3	GT & HRSG #2	October 25	196	21.00	40.00	8.92
		November 25	195	20.00	41.00	8.14
		December 25	195	17.05	38.57	7.85
		January 26	195	18.10	36.53	9.02
		February 26	191	17.84	37.87	9.24
		March 26	184	22.64	35.54	9.99
4	Emergency DG	October 25	117	21.00	27.00	22.45
		January 26	119	22.79	35.39	20.50

NOx value calculated to 15% O_2 dry basis

E. Coal Fired Boiler (CFB)
(October 2025 to March 2026)

Half-Yearly Average Results

Temp. (^{0}c)	SO_2 (mg/Nm3)	NO_x (mg/Nm^3)	PM (mg/Nm3)
139	47.20	59.58	15.76

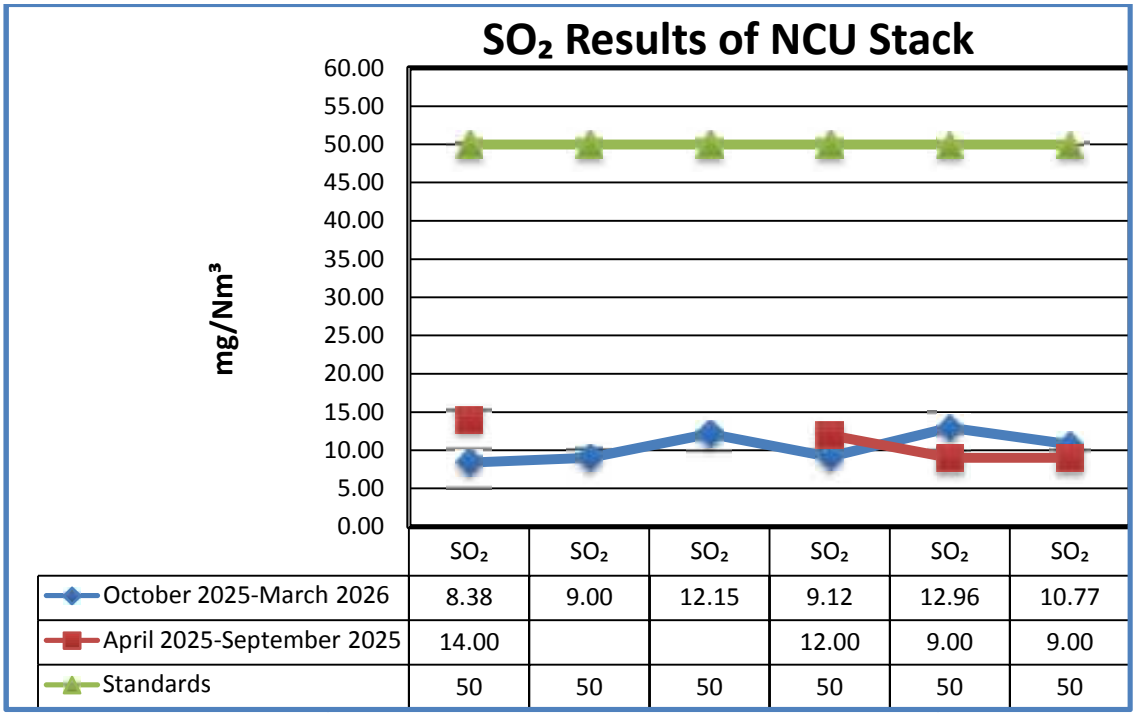
Month Wise Report

Sl. No.	Date Of Monitoring	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	PM (mg/Nm3)	Hg (mg/Nm^3)	
						Particulate	Gaseous
1	November 25	138	50.00	55.00	16.06	0.0105	0.0082
2	December 25	138	41.67	55.95	9.60		
3	January 26	139	45.84	58.38	14.17		
4	February 26	139	47.81	65.80	17.31	0.0084	0.0142
5	March 26	142	50.72	62.85	21.67		

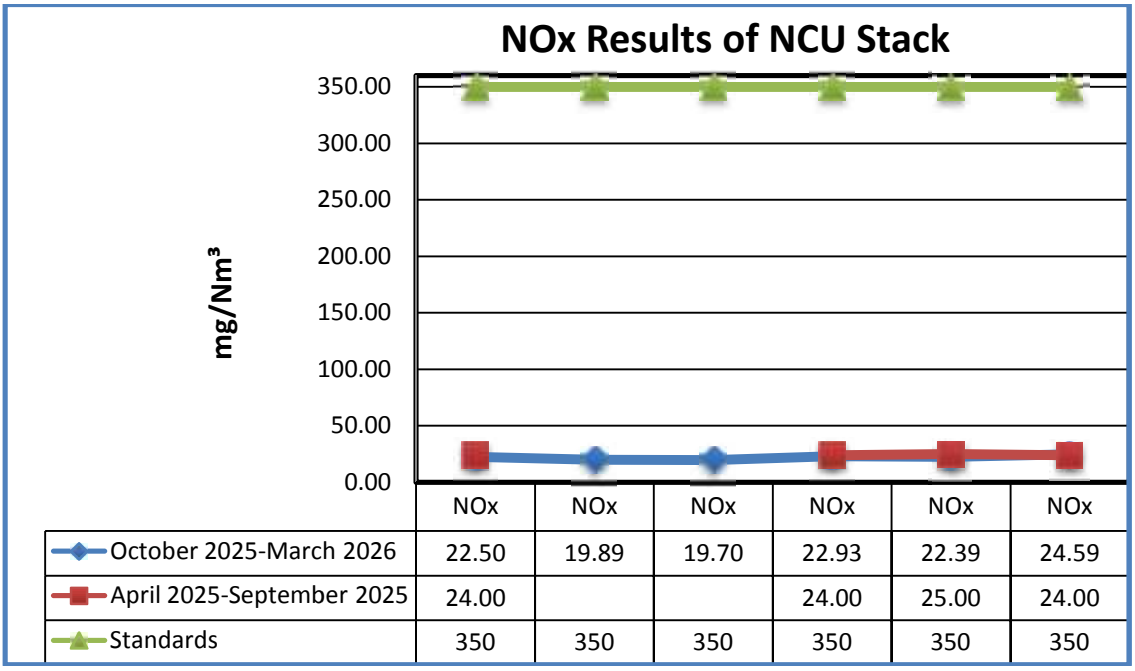
All values Calculated to 6% O_2 dry basis

Graphical Representation of Stack

A. NCU Stack

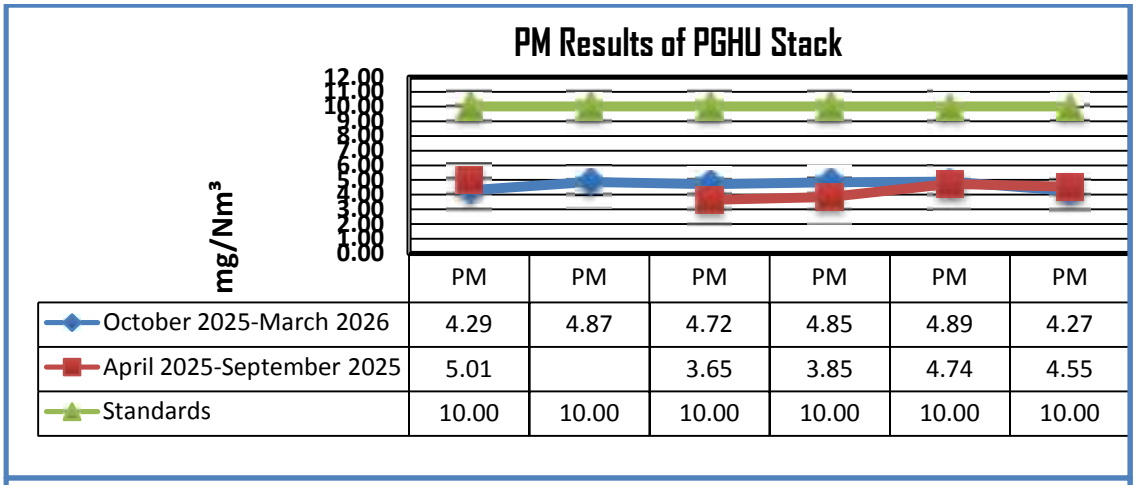


	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
October 2025-March 2026	8.38	9.00	12.15	9.12	12.96	10.77
April 2025-September 2025	14.00			12.00	9.00	9.00
Standards	50	50	50	50	50	50

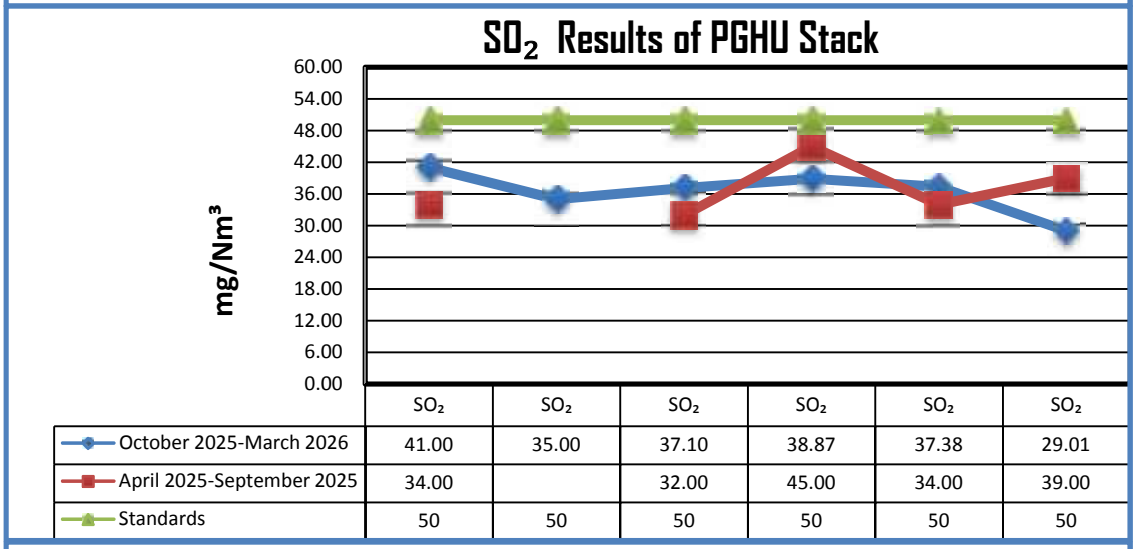


	NOx	NOx	NOx	NOx	NOx	NOx
October 2025-March 2026	22.50	19.89	19.70	22.93	22.39	24.59
April 2025-September 2025	24.00			24.00	25.00	24.00
Standards	350	350	350	350	350	350

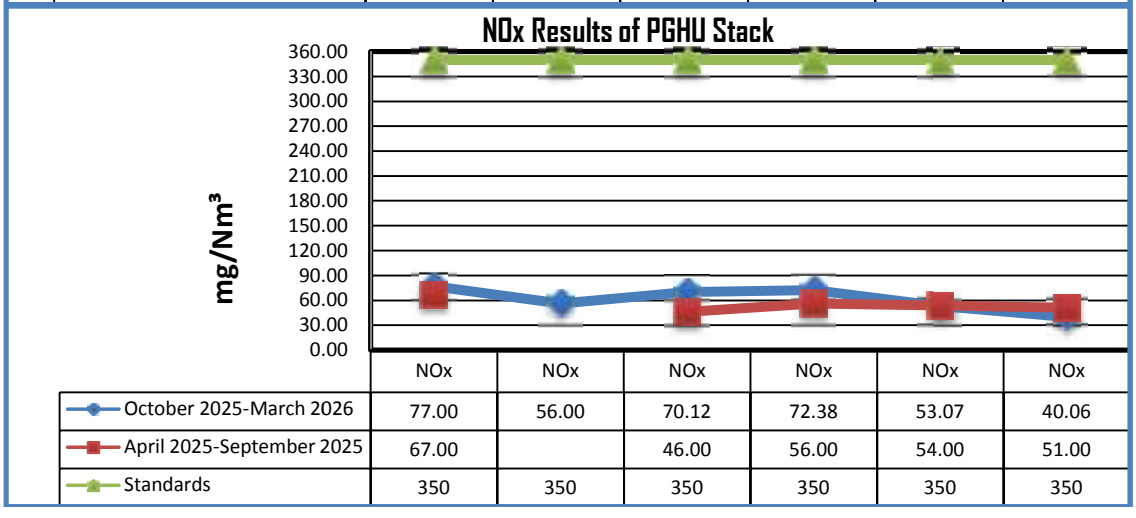
B. PGHU Stack



	PM	PM	PM	PM	PM	PM
October 2025-March 2026	4.29	4.87	4.72	4.85	4.89	4.27
April 2025-September 2025	5.01		3.65	3.85	4.74	4.55
Standards	10.00	10.00	10.00	10.00	10.00	10.00

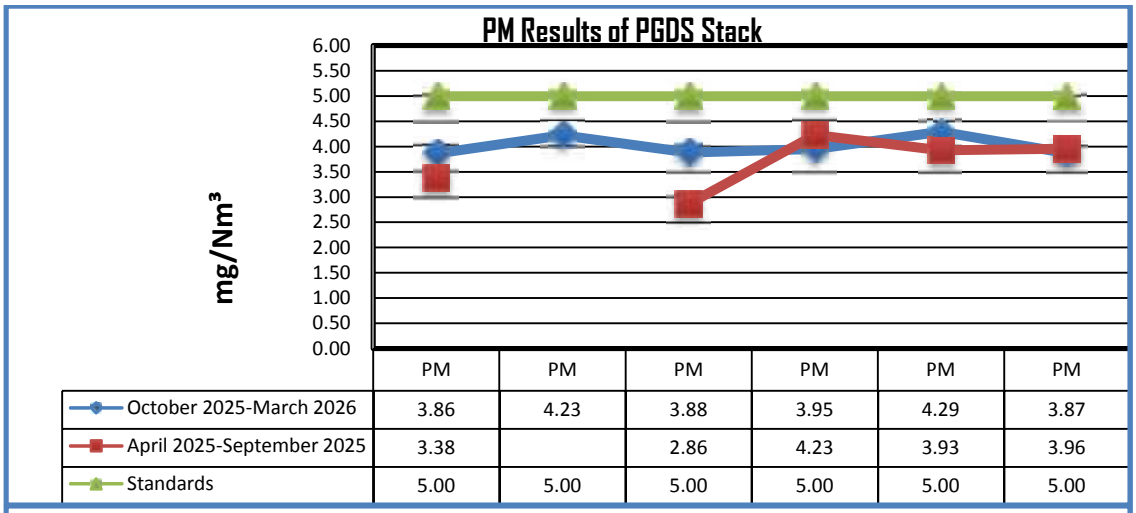


	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
October 2025-March 2026	41.00	35.00	37.10	38.87	37.38	29.01
April 2025-September 2025	34.00		32.00	45.00	34.00	39.00
Standards	50	50	50	50	50	50

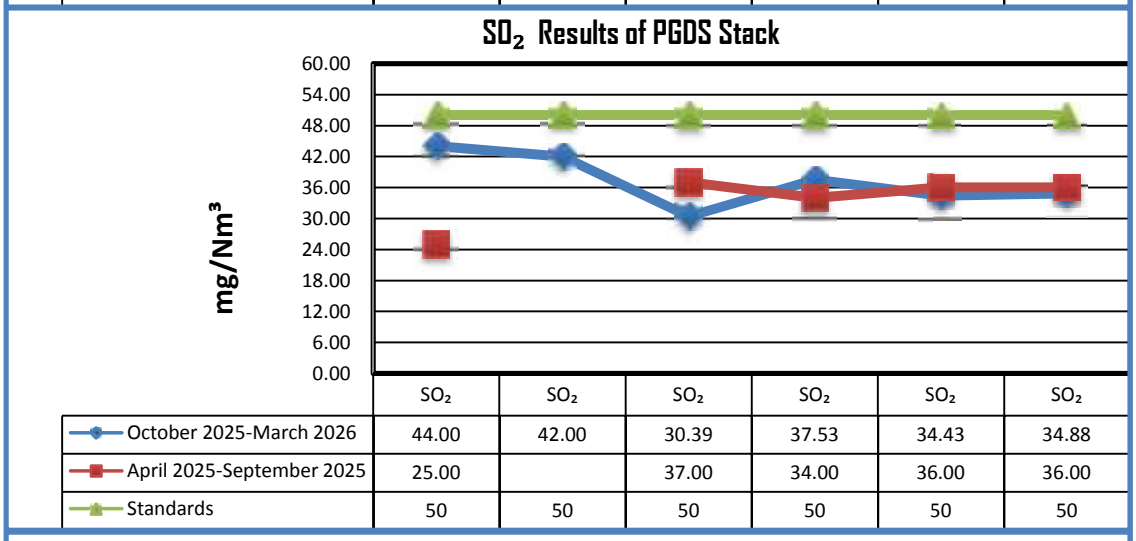


	NOx	NOx	NOx	NOx	NOx	NOx
October 2025-March 2026	77.00	56.00	70.12	72.38	53.07	40.06
April 2025-September 2025	67.00		46.00	56.00	54.00	51.00
Standards	350	350	350	350	350	350

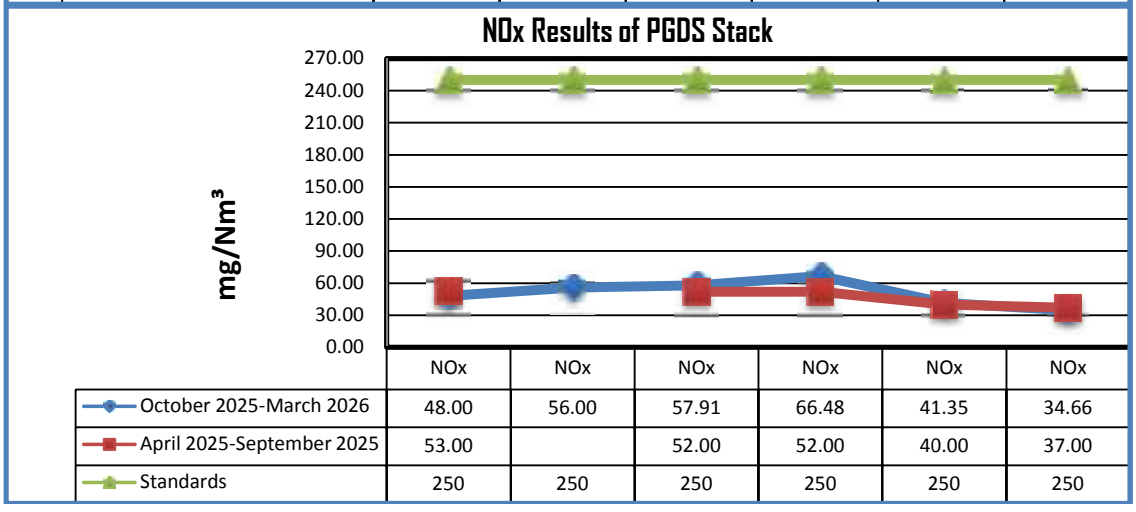
C. PGDS Stack



	PM	PM	PM	PM	PM	PM
October 2025-March 2026	3.86	4.23	3.88	3.95	4.29	3.87
April 2025-September 2025	3.38		2.86	4.23	3.93	3.96
Standards	5.00	5.00	5.00	5.00	5.00	5.00

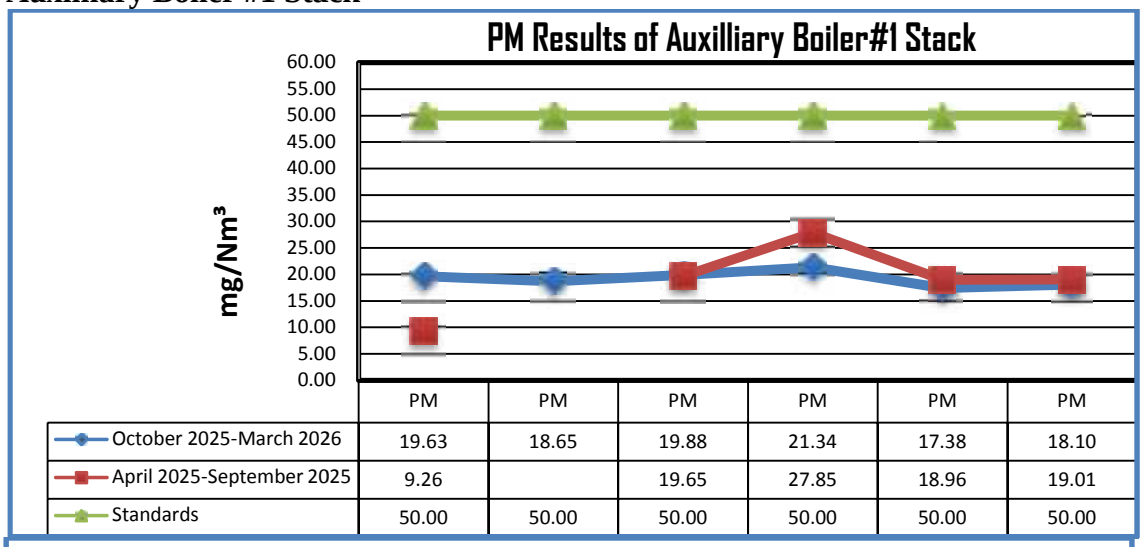


	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
October 2025-March 2026	44.00	42.00	30.39	37.53	34.43	34.88
April 2025-September 2025	25.00		37.00	34.00	36.00	36.00
Standards	50	50	50	50	50	50

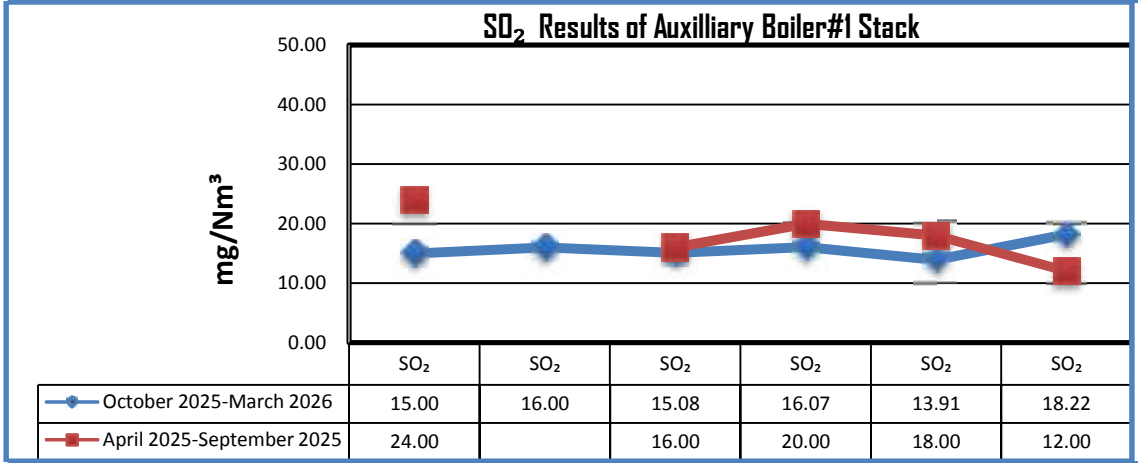


	NOx	NOx	NOx	NOx	NOx	NOx
October 2025-March 2026	48.00	56.00	57.91	66.48	41.35	34.66
April 2025-September 2025	53.00		52.00	52.00	40.00	37.00
Standards	250	250	250	250	250	250

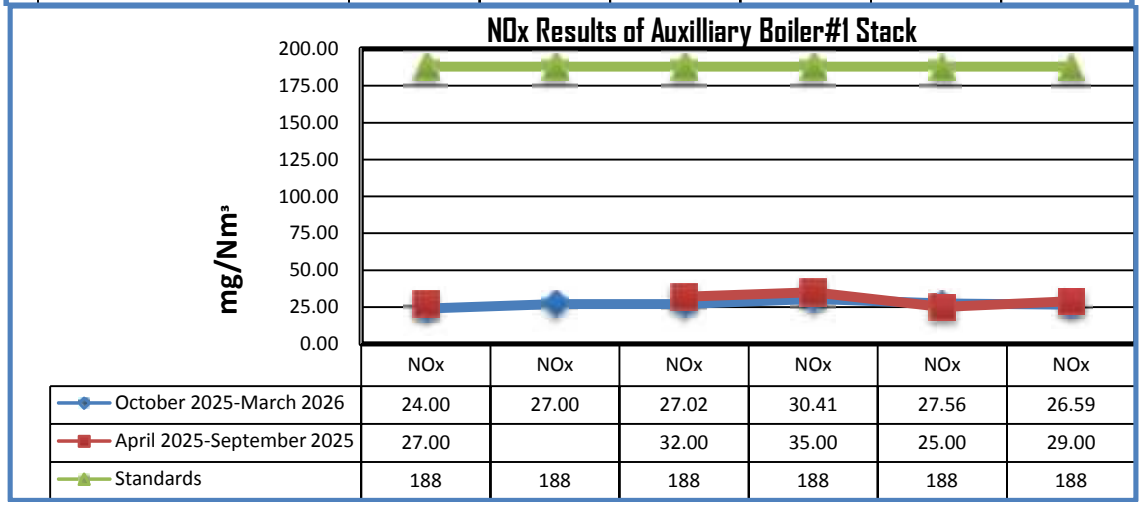
D. Auxilliary Boiler #1 Stack



	PM	PM	PM	PM	PM	PM
October 2025-March 2026	19.63	18.65	19.88	21.34	17.38	18.10
April 2025-September 2025	9.26		19.65	27.85	18.96	19.01
Standards	50.00	50.00	50.00	50.00	50.00	50.00

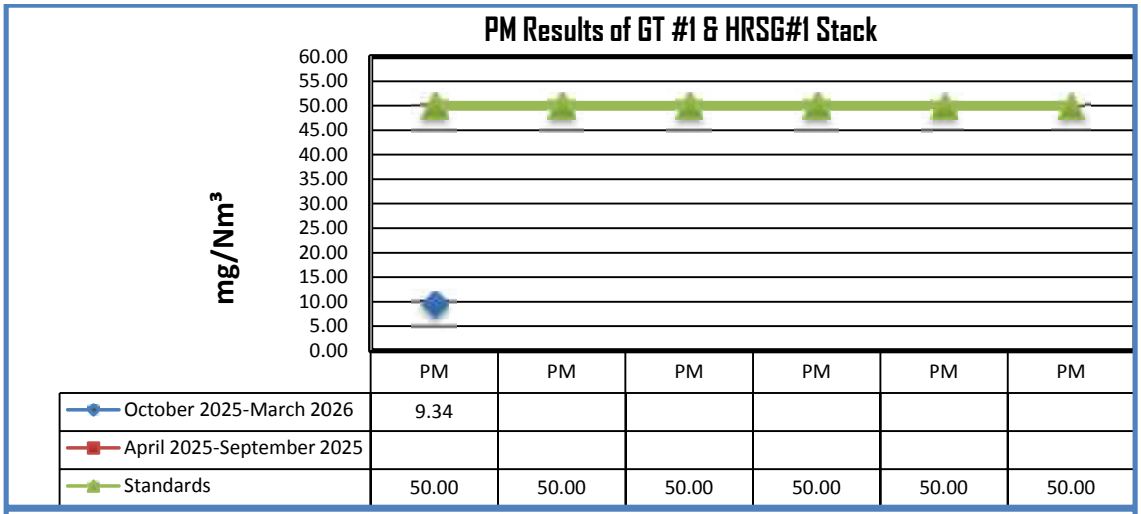


	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
October 2025-March 2026	15.00	16.00	15.08	16.07	13.91	18.22
April 2025-September 2025	24.00		16.00	20.00	18.00	12.00

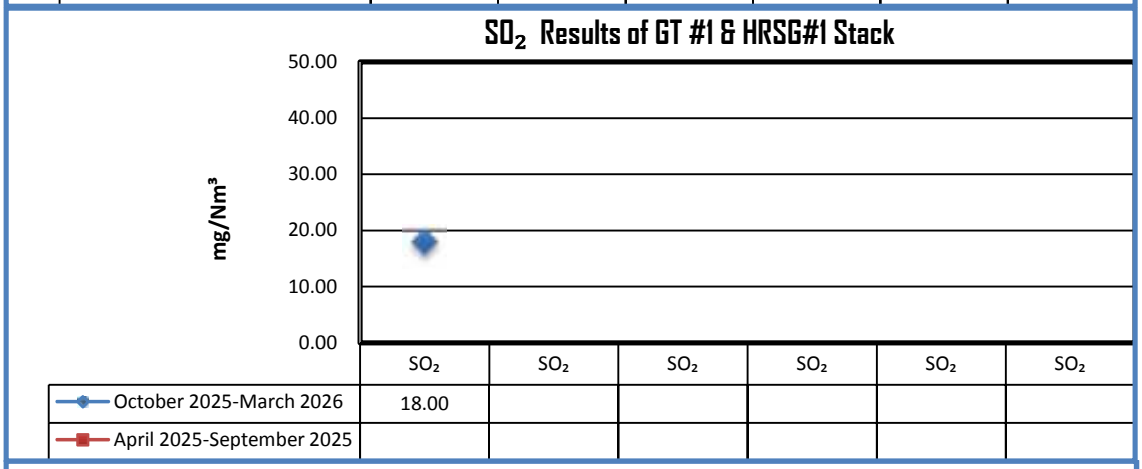


	NOx	NOx	NOx	NOx	NOx	NOx
October 2025-March 2026	24.00	27.00	27.02	30.41	27.56	26.59
April 2025-September 2025	27.00		32.00	35.00	25.00	29.00
Standards	188	188	188	188	188	188

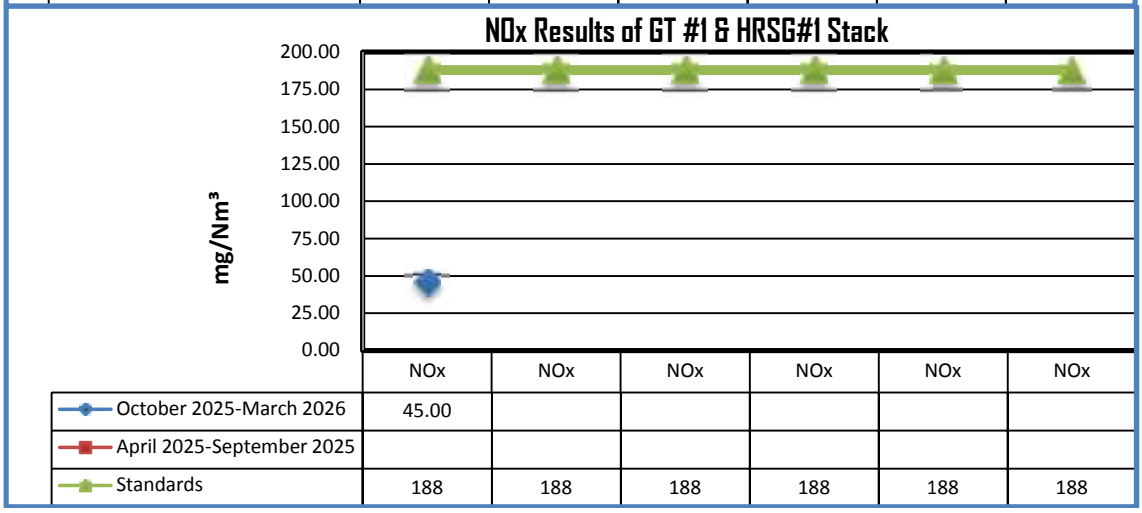
E. GT#1& HRSG #1 Stack



	PM	PM	PM	PM	PM	PM
October 2025-March 2026	9.34					
April 2025-September 2025						
Standards	50.00	50.00	50.00	50.00	50.00	50.00

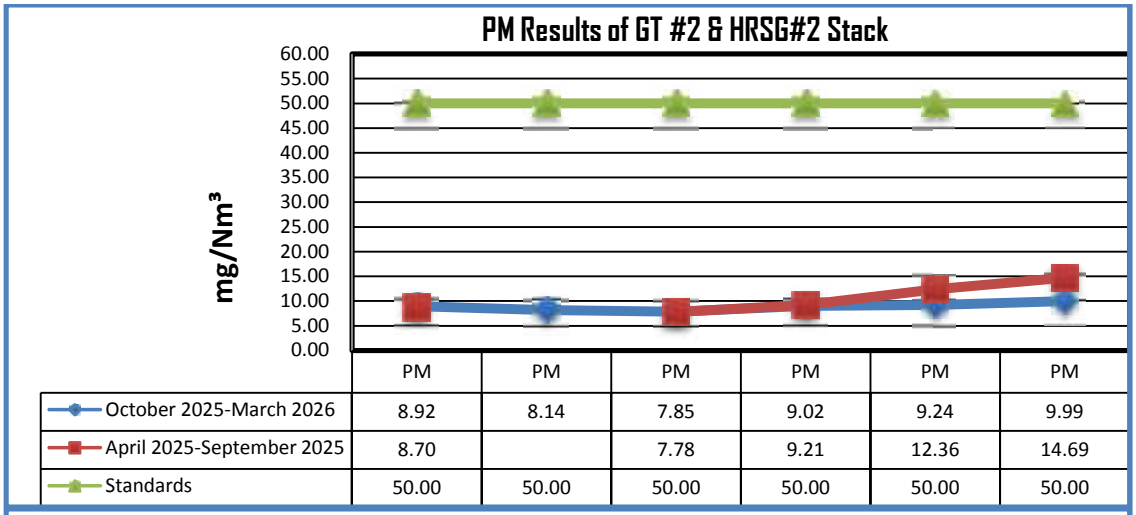


	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
October 2025-March 2026	18.00					
April 2025-September 2025						

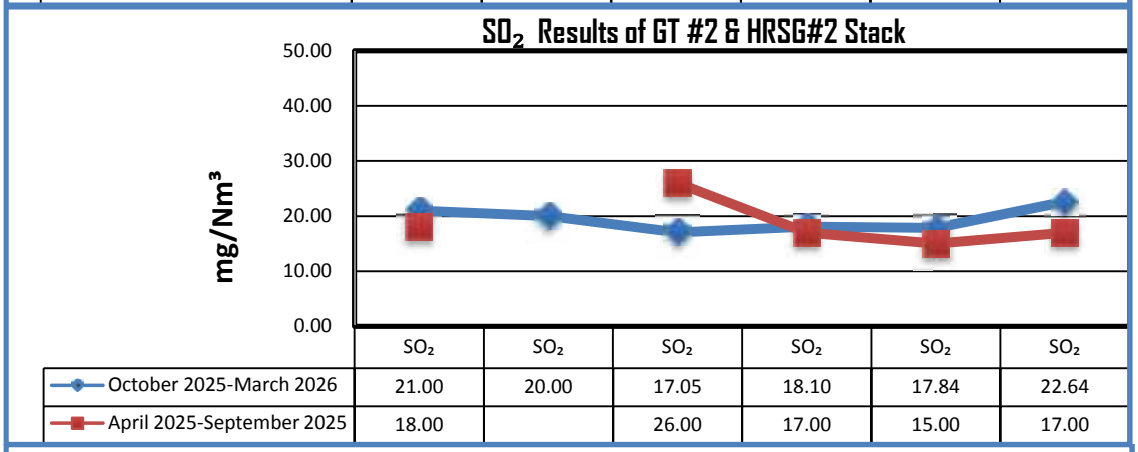


	NOx	NOx	NOx	NOx	NOx	NOx
October 2025-March 2026	45.00					
April 2025-September 2025						
Standards	188	188	188	188	188	188

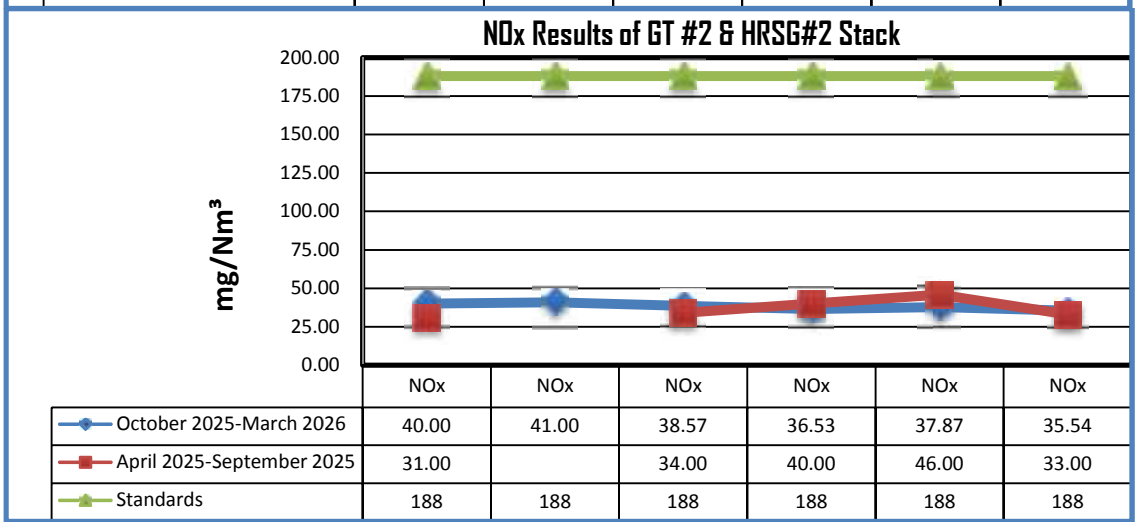
F. GT#2 & HRSG #2 Stack



	PM	PM	PM	PM	PM	PM
October 2025-March 2026	8.92	8.14	7.85	9.02	9.24	9.99
April 2025-September 2025	8.70		7.78	9.21	12.36	14.69
Standards	50.00	50.00	50.00	50.00	50.00	50.00

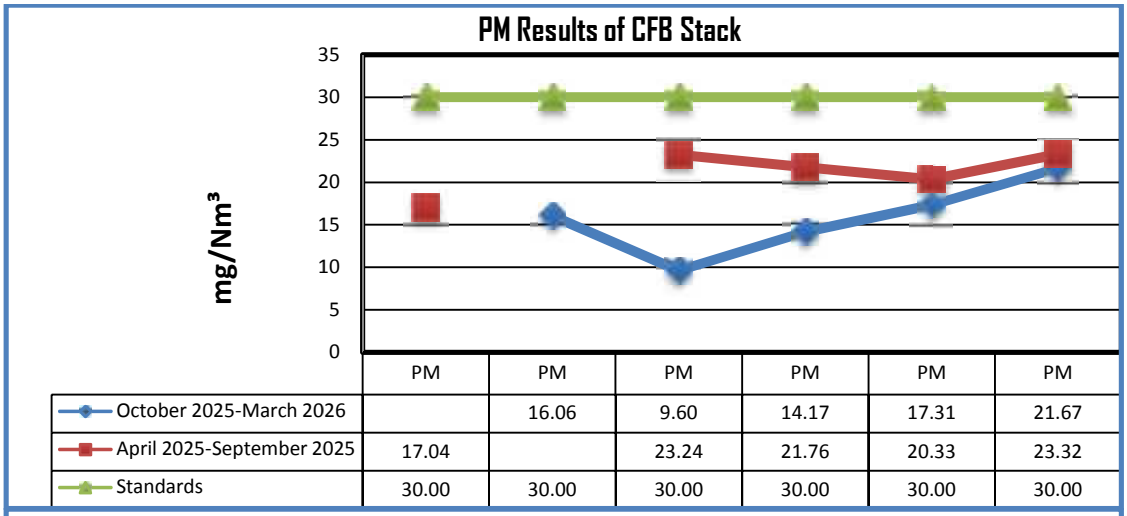


	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
October 2025-March 2026	21.00	20.00	17.05	18.10	17.84	22.64
April 2025-September 2025	18.00		26.00	17.00	15.00	17.00

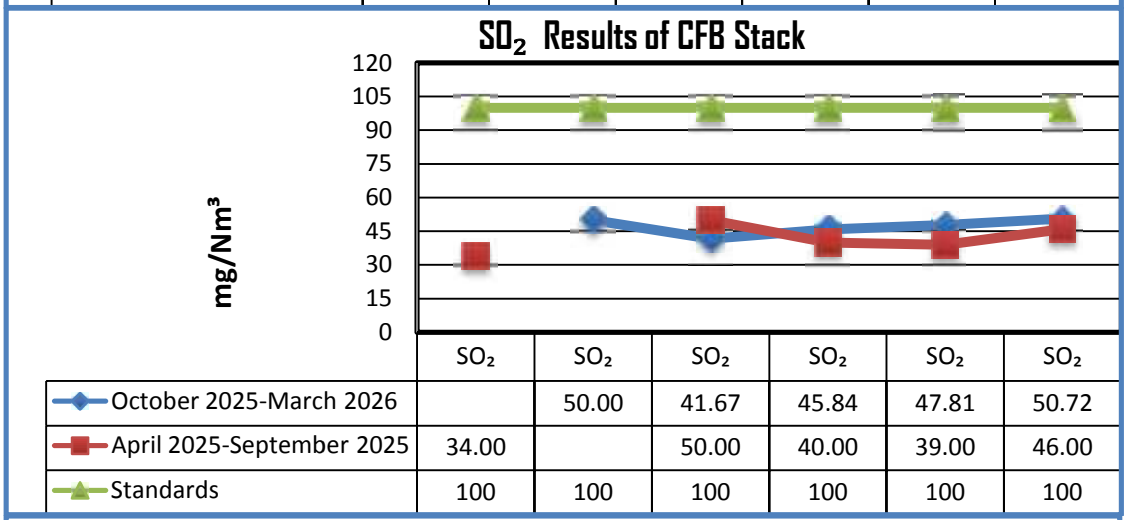


	NOx	NOx	NOx	NOx	NOx	NOx
October 2025-March 2026	40.00	41.00	38.57	36.53	37.87	35.54
April 2025-September 2025	31.00		34.00	40.00	46.00	33.00
Standards	188	188	188	188	188	188

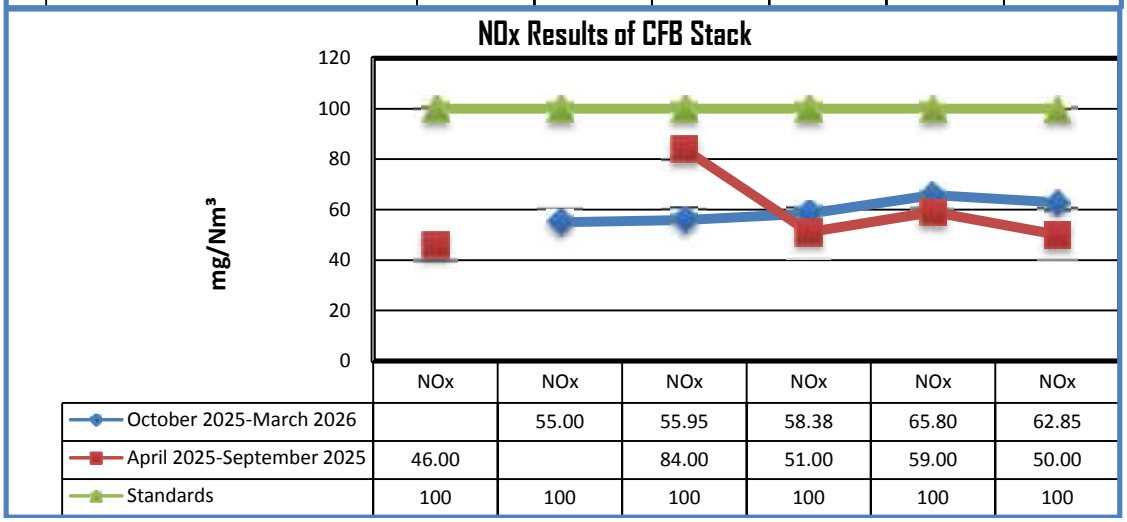
G. CFB Stack



	PM	PM	PM	PM	PM	PM
October 2025-March 2026		16.06	9.60	14.17	17.31	21.67
April 2025-September 2025	17.04		23.24	21.76	20.33	23.32
Standards	30.00	30.00	30.00	30.00	30.00	30.00



	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
October 2025-March 2026		50.00	41.67	45.84	47.81	50.72
April 2025-September 2025	34.00		50.00	40.00	39.00	46.00
Standards	100	100	100	100	100	100



	NOx	NOx	NOx	NOx	NOx	NOx
October 2025-March 2026		55.00	55.95	58.38	65.80	62.85
April 2025-September 2025	46.00		84.00	51.00	59.00	50.00
Standards	100	100	100	100	100	100

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CHAPTER NO. – 04

METEOROLOGY

4. METEOROLOGY

The following Meteorological parameters:

- Temperature (Dry & Wet Bulb),
- Relative Humidity
- Wind Speed And Direction
- Atmospheric Pressure
- Cloud Cover (Visual Inspection)
- Rainfall

Following instruments are used for conducting meteorological data recording:

Temperature and relative humidity : Dry & Wet Bulb Thermometer andSychrometric Chart
Wind direction and wind velocity : Wind - Vane and Cup Counter Anemometer
Rainfall : Rain Gauge
Atmospheric Pressure : Barometer

Wind direction was recorded in all the sixteen directions.

A. Abstract of monitored meteorological data (Half-Yearly Max. & Min.):

Location: WWTP (Roof of Environmental Laboratory), HPL Plant
Monitoring Period: October 2025 to March 2026
Monitoring Frequency: Twice in a week

Wind Velocity (Km/hr)		Temperature (O^0C)		RH (%)		Predominant Wind Direction		Rainfall (mm)	Calm (%)	
Max.	Min.	Max.	Min.	Max.	Min.	Day	Night		Day	Night
24.7	**1.3**	**36.0**	**12.0**	**92.0**	**30.0**	**NNE**	**WNW**	**61.03**	**0.12**	**0.00**

B. Abstract of monitored meteorological data (Monthly Max. & Min.):

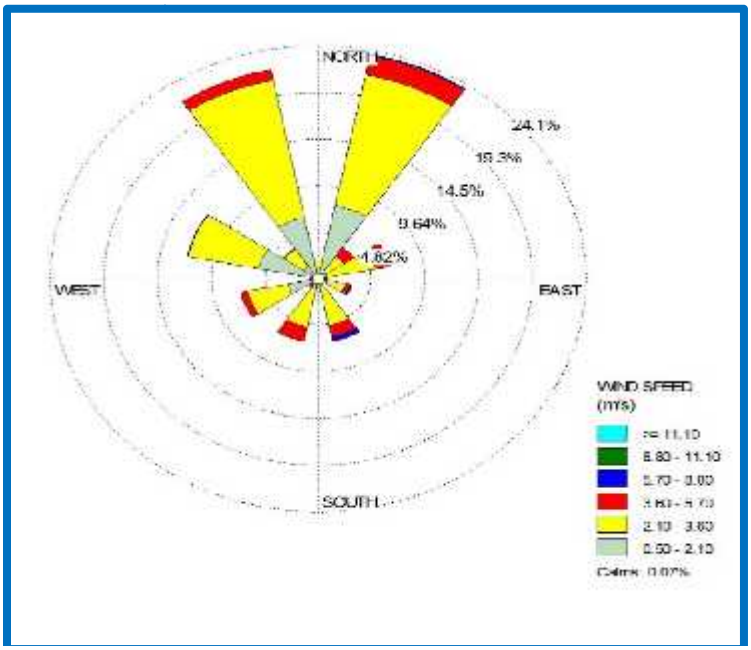
Month	Wind Velocity (Km/hr)		Temperature (^0C)		RH (%)		Predominant Wind Direction		Rainfall (mm)	Calm (%)	
	Max.	Min.	Max.	Min.	Max.	Min.	Day	Night	Monthly	Day	Night
October 25	24.7	3.3	36.0	24.5	92.0	46.0	NNE	ENE	247.80	0.0	0.0
November 25	13.1	3.5	31.0	17.0	80.0	39.0	NNW	WNW	0.00	0.0	0.0
December 25	17.9	3.2	28.5	13.0	86.0	35.0	NNW	NNE	0.00	0.0	0.0
January 26	17.4	1.3	28.0	12.0	83.0	34.0	NNE	WNW	0.00	0.7	0.0
February 26	17.4	5.2	32.5	16.0	87.0	30.0	NNE	WNW	0.00	0.0	0.0
March 26	15.7	4.3	34.0	20.0	88.0	45.0	SSE	WSW	118.40	0.0	0.0

C. Meteorological Observation:

WINDROSE-FREQUENCY TABLE – FULL TIME
(Period: October 2025 to March 2026)

WIND DIRECTION	VELOCITY (in m/sec) RANGES						
	0.5<V<=2.1	2.1<V<=3.6	3.6<V<=5.7	5.7<V<=8.8	8.8<V<=11.1	V>=11.1	SUM%
N	1.32	0.83	0.00	0.00	0.00	0.00	**2.15**
NNE	7.76	13.72	2.01	0.14	0.00	0.00	**23.63**
NE	0.90	1.94	1.11	0.00	0.00	0.00	**3.95**
ENE	0.97	4.37	1.32	0.00	0.00	0.00	**6.65**
E	0.21	0.00	0.00	0.00	0.00	0.00	**0.21**
ESE	0.90	1.66	0.42	0.14	0.00	0.00	**3.12**
SE	0.29	0.35	0.00	0.00	0.00	0.00	**0.63**
SSE	0.96	4.23	1.18	0.49	0.00	0.00	**6.85**
S	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
SSW	1.18	3.95	1.53	0.00	0.00	0.00	**6.65**
SW	0.00	0.76	0.35	0.00	0.00	0.00	**1.11**
WSW	2.84	3.67	0.62	0.00	0.00	0.00	**7.14**
W	0.00	0.07	0.00	0.00	0.00	0.00	**0.07**
WNW	5.48	6.45	0.07	0.00	0.00	0.00	**11.99**
NW	1.59	2.15	0.07	0.00	0.00	0.00	**3.81**
NNW	6.51	14.35	1.11	0.00	0.00	0.00	**21.97**
SUM%	**30.91**	**58.49**	**9.77**	**0.76**	**0.00**	**0.00**	**99.93**
CALM	**(0.00<=V<=0.5)**						**0.07**
							100.00

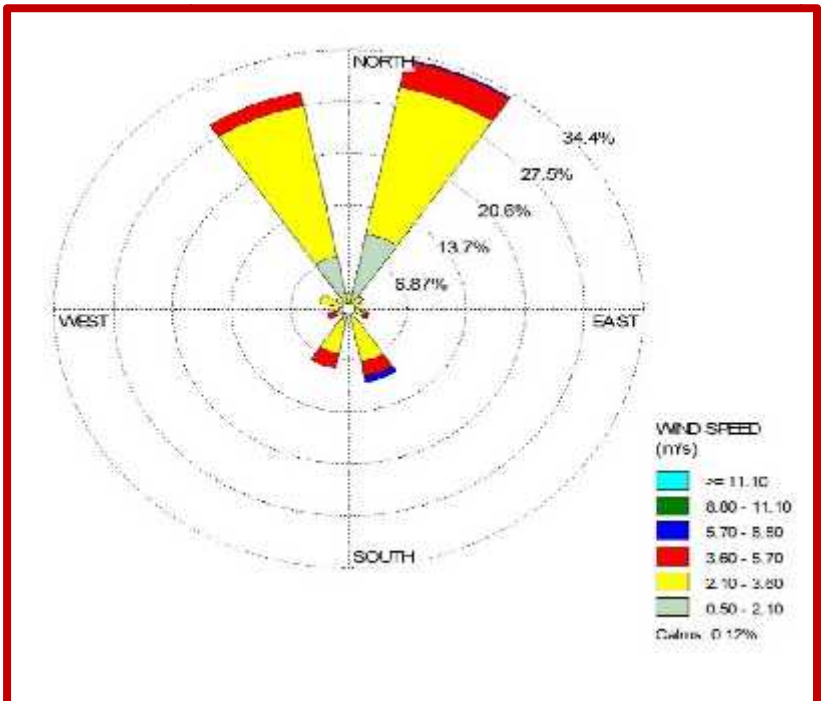
WINDROSE & GRAPH – FULL TIME



WINDROSE-FREQUENCY TABLE – DAY TIME

WIND DIRECTION	VELOCITY (in m/sec) RANGES						
	0.5<V<=2.1	2.1<V<=3.6	3.6<V<=5.7	5.7<V<=8.8	8.8<V<=11.1	V>=11.1	SUM%
N	0.73	1.45	0.00	0.00	0.00	0.00	**2.18**
NNE	10.17	19.73	3.51	0.24	0.00	0.00	**33.66**
NE	0.36	1.70	0.12	0.00	0.00	0.00	**2.18**
ENE	0.24	1.45	0.00	0.00	0.00	0.00	**1.70**
E	0.39	0.00	0.00	0.00	0.00	0.00	**0.39**
ESE	0.71	1.33	0.48	0.12	0.00	0.00	**2.64**
SE	0.24	0.36	0.00	0.00	0.00	0.00	**0.61**
SSE	0.97	6.30	1.94	0.85	0.00	0.00	**10.05**
S	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
SSW	1.82	4.36	1.94	0.00	0.00	0.00	**8.11**
SW	0.00	0.73	0.24	0.00	0.00	0.00	**0.97**
WSW	0.24	1.45	0.97	0.00	0.00	0.00	**2.66**
W	0.00	0.12	0.00	0.00	0.00	0.00	**0.12**
WNW	0.48	3.03	0.00	0.00	0.00	0.00	**3.51**
NW	0.36	1.57	0.00	0.00	0.00	0.00	**1.94**
NNW	7.14	20.22	1.82	0.00	0.00	0.00	**29.18**
SUM%	**23.85**	**63.80**	**11.02**	**1.21**	**0.00**	**0.00**	**99.88**
CALM	**(0.00<=V<=0.5)**						**0.12**
							100.00

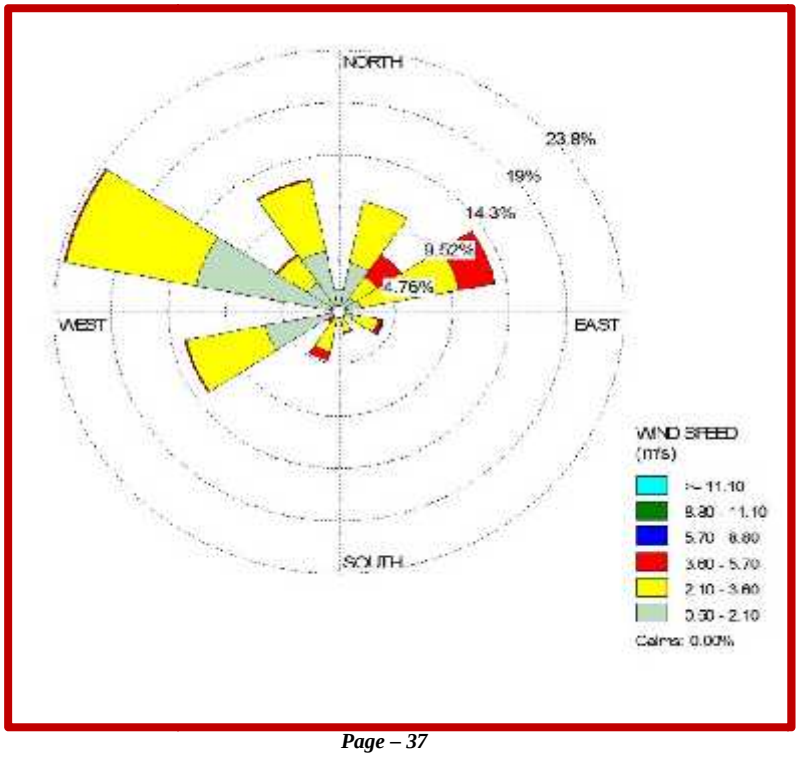
WINDROSE & GRAPH – DAY TIME



WINDROSE-FREQUENCY TABLE – NIGHT TIME

WIND DIRECTION	VELOCITY (in m/sec) RANGES						
	0.5<V<=2.1	2.1<V<=3.6	3.6<V<=5.7	5.7<V<=8.8	8.8<V<=11.1	V>=11.1	SUM%
N	2.11	0.00	0.00	0.00	0.00	0.00	**2.11**
NNE	4.54	5.67	0.00	0.00	0.00	0.00	**10.21**
NE	1.62	2.27	2.43	0.00	0.00	0.00	**6.32**
ENE	1.95	8.27	3.08	0.00	0.00	0.00	**13.29**
E	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
ESE	1.30	2.11	0.32	0.16	0.00	0.00	**3.89**
SE	0.00	0.32	0.00	0.00	0.00	0.00	**0.32**
SSE	0.49	1.46	0.16	0.00	0.00	0.00	**2.11**
S	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
SSW	0.32	3.40	0.81	0.00	0.00	0.00	**4.54**
SW	0.00	0.81	0.49	0.00	0.00	0.00	**1.30**
WSW	6.32	6.65	0.97	0.00	0.00	0.00	**13.94**
W	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
WNW	12.16	11.02	0.16	0.00	0.00	0.00	**23.34**
NW	3.24	2.92	0.16	0.00	0.00	0.00	**6.32**
NNW	5.67	6.48	0.16	0.00	0.00	0.00	**12.32**
SUM%	**39.71**	**51.38**	**8.75**	**0.16**	**0.00**	**0.00**	**100.00**
CALM	**(0.00<=V<=0.5)**						**0.00**
							100.00

WINDROSE & GRAPH – NIGHT TIME



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OCTOBER 2025 – MARCH 2026

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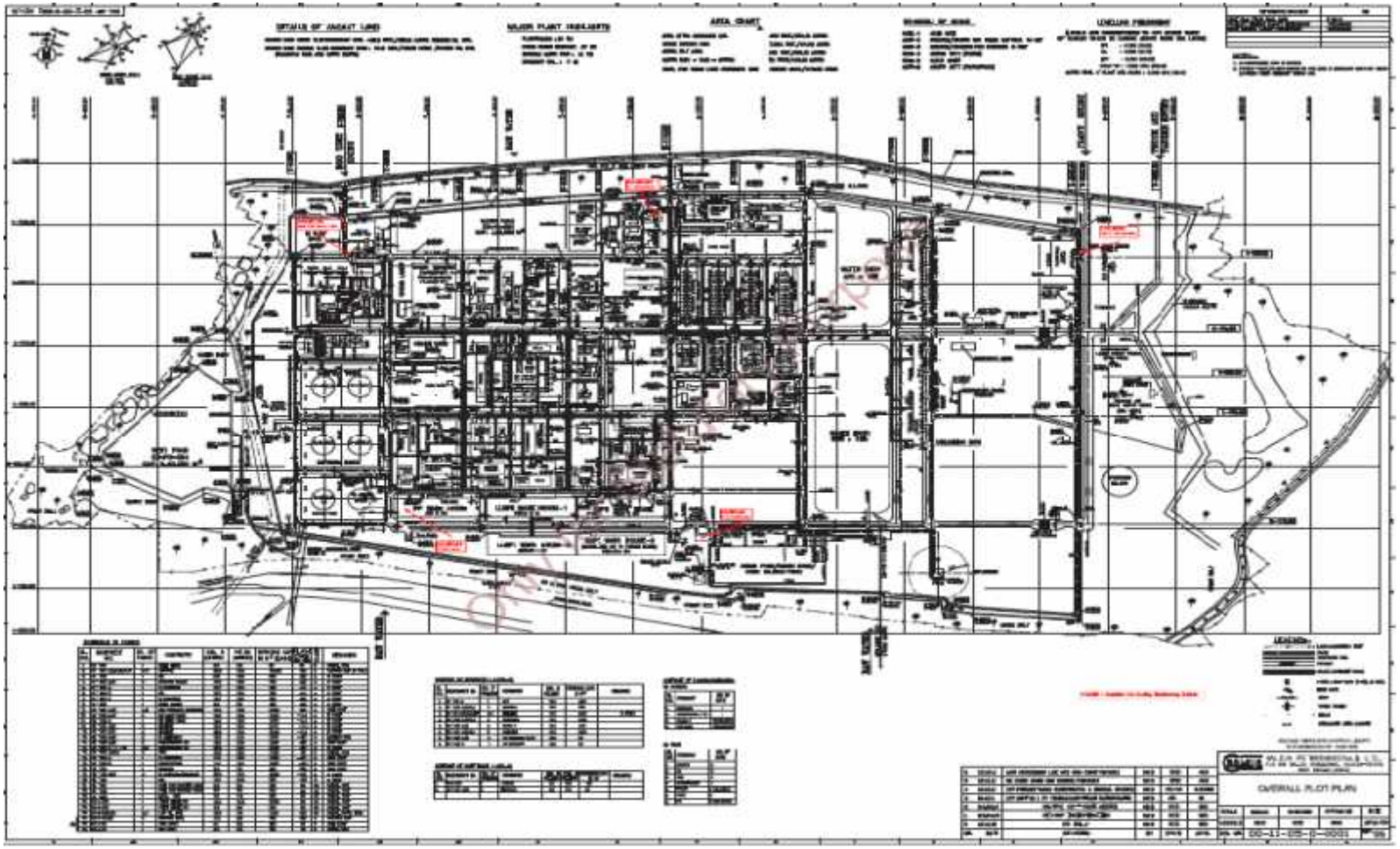
CHAPTER NO. – 05

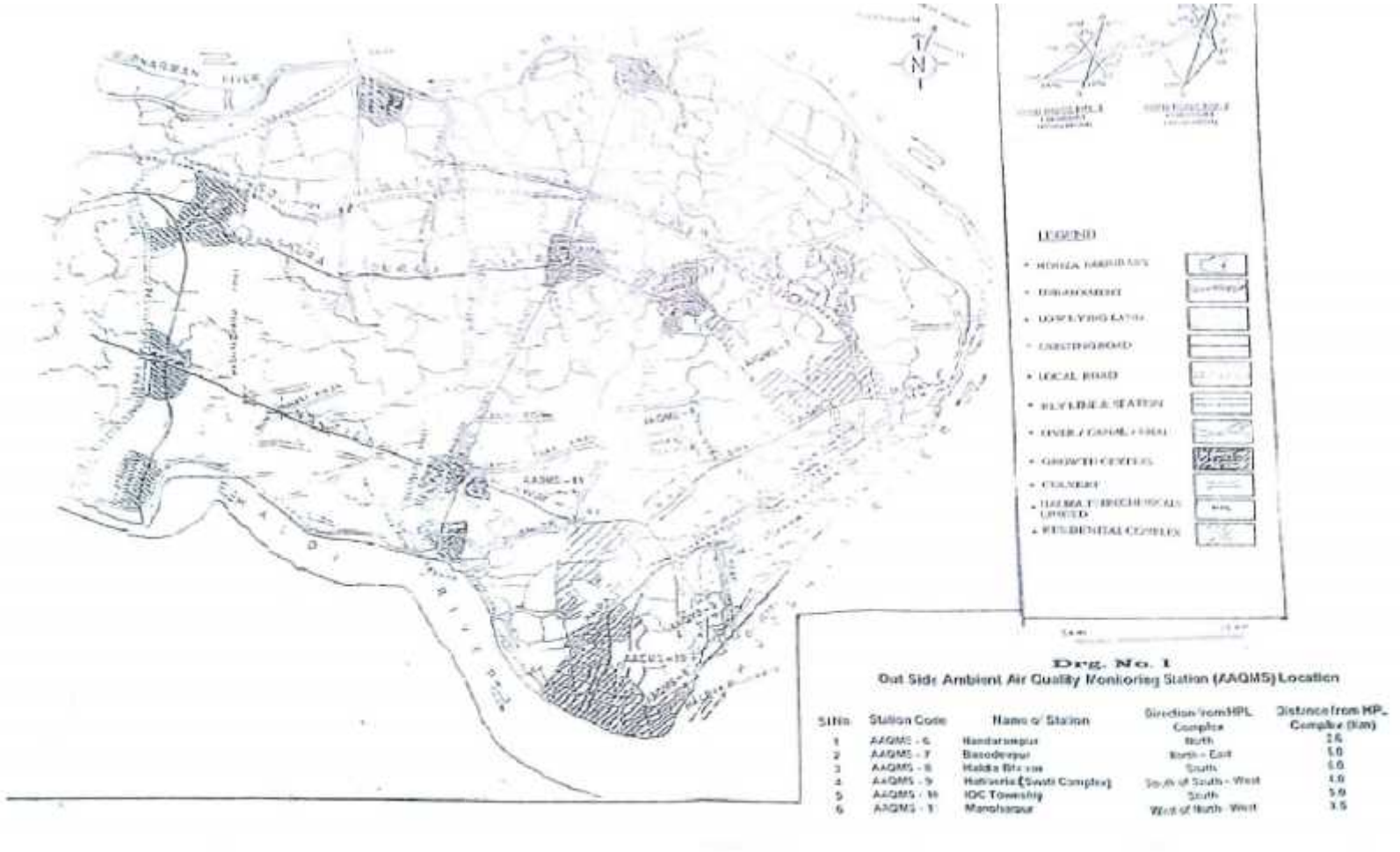
AMBIENT AIR QUALITY

5.0 AMBIENT AIR QUALITY

Ambient Air Quality Monitoring stations (AAQMS) In-side 5 Location



Ambient Air Quality Monitoring stations (AAQMS) Out-side 6 Locati



On-Line Ambient Air Quality Monitoring Station at South Control Room

On-Line Hydrocarbon Analyzer at Central Laboratory

Ambient Air Quality Monitoring stations (AAQMS)

A. In Side Ambient Air Quality Monitoring stations (Five locations):

Sl. No.	Station Code	Station Name	Direction from the center of the plant
1	AAQMS - 1	Central Laboratory	North
2	AAQMS - 2	Gate No. 1	East
3	AAQMS - 3	South Control Room	South
4	AAQMS - 4	PP Ware House	South – West
5	AAQMS - 5	CPP Entry Gate	North - West

B. OutSide Ambient Air Quality Monitoring stations (Six locations):

Sl. No.	Station Code	Name of Station	Direction from HPL Complex	Distance from HPL Complex (km)
1.	AAQMS – 6	Nandarampur	North	2.6 Km
2.	AAQMS – 7	Basudevpur	North- East	5.0 Km
3.	AAQMS – 8	Haldia Bhavan	South	6.0 Km
4.	AAQMS – 9	Hatiberia (Swati Complex)	South of South-West	4.0 Km
5.	AAQMS – 10	IOC Township	South	5.0 Km
6.	AAQMS – 11	Manaharpur	West of North-West	3.5 Km

C. Methodology of Ambient Air Sampling & Analysis

Sl. No.	Parameters	Unit	Specifiction / Standard (method) or technique used	Range of Testing	Methodology
1	Particulate Matter (PM_{10})	$\mu g/m^3$	IS: 5182(Part 23): 2006	1 $\mu g/m^3$ & above	Sampling of PM_{10} using Respirable Dust Sampler
2	Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	USEPA 40 CFR Parts 53 & 58	2 $\mu g/m^3$ & above	Sampling of $PM_{2.5}$ using Ambient Fine Dust Sampler,
3	Sulphur Dioxide (SO_2)	$\mu g/m^3$	IS:5182 (Part-2):2006 (First Revision)	4 $\mu g /m^3$ & above	Absorption in Na-tetrachloromercurate solution followed by Spectrophotometric analysis
4	Oxides of Nitrogen (NO_x)	$\mu g/m^3$	IS:5182 (Part-6):2006 (First Revision)	10 $\mu g /m^3$ & above	Absorption in sodium hydroxide & Na-arsenite solution followed by Spectrophotometric analysis

Sl. No.	Parameters	Unit	Specifiction / Standard (method) or technique used	Range of Testing	Methodology
5	Ozone (O_3)	µg/m^3	Methods of air sampling and examination, Third Edition, Edited by James P. Lodge, Method 411.	8.2 µg /m^3& above	Micro-amounts of O_3 liberate iodine when absorbed in a 1% solution of potassium iodide buffered at pH 6.8($\pm$ 0.2). The liberated iodine is determined Spectrophotometrically by measuring the absorption of triiodide ion at 352 nm.
6	Ammonia (NH_3)	µg/m^3	Method of Air Sampling & examination, Third Edition, Edited by James P. Lodge, Method 401	5 µg /m^3& above	Ammonia is absorb in dilute H_2SO4 & measured colorimetrically by reaction with phenol & alkaline sodium hypochlorite to produce indophenols, a blue dye.
7	Lead (Pb)	µg/m^3	Method of Air Sampling & examination, Third Edition, Edited by James P. Lodge, Method 303A, 822	0.01 µg /m^3& above	Lead is determined by Atomic Absorption Spectrophotometer using air-acetylene flame.
8	Benzene (C_6H_6)	µg/m^3	IS: 5182(Part 11): 2006	0.042 µg /m^3& above	Absorption on activated charcoal, desorption by carbon disulphide& analysis by GC using FID.
9	Arsenic (As)	ng/m^3	Standard Method-APHA, 20th Edition,	0.14 ng /m^3& above	Standard Method-APHA, 20th Edition, 1998 by Atomic Absorption Spectrophotometer using vapour generation assembly (VGA)
10	Nickel (Ni)	ng/m^3	Method of Air Sampling & examination, Third Edition, Edited by James P. Lodge, Method 303A, 822	2.8 ng /m^3& above	Nickel is determined by Atomic Absorption Spectrophotometer using air-acetylene flame

Sl. No.	Parameters	Unit	Specifiction / Standard (method) or technique used	Range of Testing	Methodology
11	Benzo (a) Pyrene (BaP), Particulate phase only	ng/m^3	IS: 5182(Part 12): 2009	0.11 ng $/m^3$& above	Benzo(a)pyrene and other polynuclear hydrocarbons are extracted from the particulate matter using a non-polar solvent cyclohexane, which extracts less extraneous material than a more polar solvent. The extract is concentrated and analyzed by Gas Chromatograph – Mass Spectrometer.
12	Carbon Monoxide (CO)	mg/m^3	IS: 5182 (Part 10): 1999 (First Revision)	0.01 mg $/m^3$& above	Sampling of CO in gas sampling tubes & analysis by NDIR

D. National Ambient Air Quality Standards

Sl. No.	Parameters	Unit	Time Weighted Average	Ambient air concentration («g/m^3)	
				Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area
1	Sulphur Dioxide (SO_2)	µg/m^3	Annual*	50	20
			24 hours**	80	80
2	Nitrogen Dioxide (NO_2)		Annual*	40	30
			24 hours**	80	80
3	Particulate Matter (PM_{10})		Annual*	60	60
			24 hours**	100	100
4	Particulate Matter ($PM_{2.5}$)		Annual*	40	40
			24 hours**	60	60
5	Ozone (O_3)		8 hours**	100	100
			1 hours**	180	180
6	Lead (Pb)		Annual*	0.50	0.50
			24 hours**	1.0	1.0
7	Carbon monoxide (CO)	mg/m^3	8 hours**	02	02
			1 hours**	04	04

Sl. No.	Parameters	Unit	Time Weighted Average	Ambient air concentration («g/m^3)	
				Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area
8	Ammonia (NH_3)	µg/m^3	Annual*	100	100
			24 hours**	400	400
9	Benzene (C_6H_6)		Annual*	05	05
10	Benzo(a)Pyrene (BaP)	ng/m^3	Annual*	01	01
11	Arsenic (As)		Annual*	06	06
12	Nickel (Ni)		Annual*	20	20

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note.-Whenever and wherever monitoring v results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

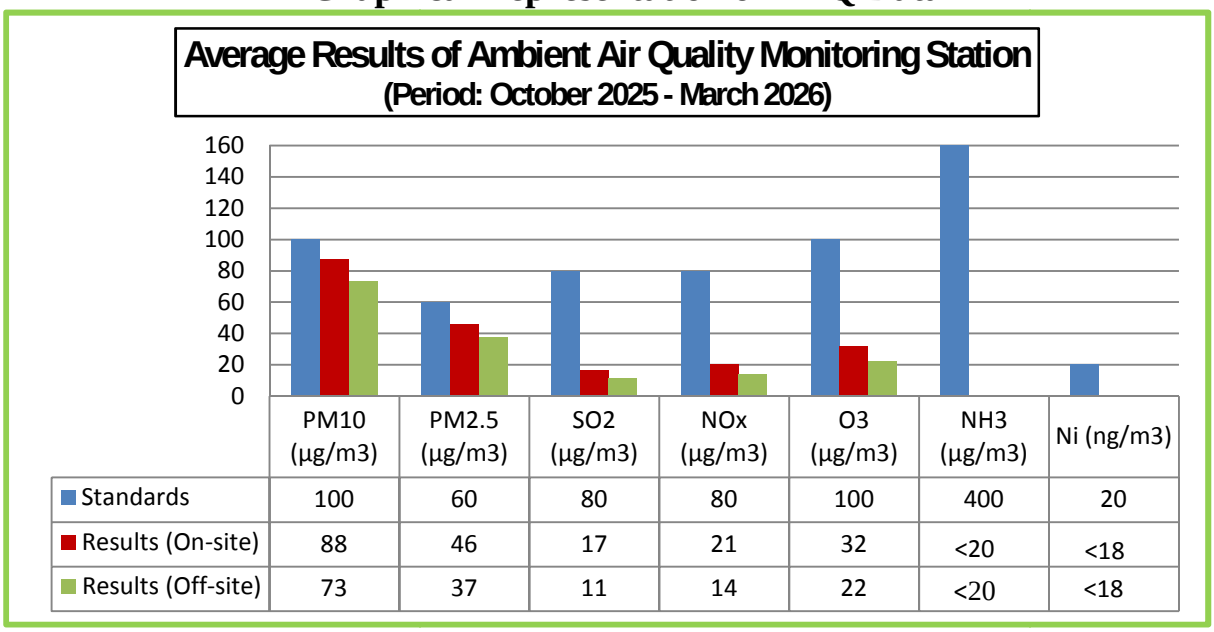
MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (On-site Plant)

Month	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	Pb ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	BaP (ng/m^3)	Ni (ng/m^3)	CO (mg/m^3)
Oct- 25	67	35	18	21	33	<20	0.15	1.7	4.6	<0.8	<18	0.57
Nov- 25	88	45	16	23	32	<20	0.15	2.6	4.5	<0.8	<18	0.60
Dec- 25	90	44	16	20	32	<20	0.15	2.8	4.6	<0.8	<18	0.60
Jan- 26	95	52	17	20	31	<20	0.15	3.2	4.7	<0.8	<18	0.61
Feb- 26	95	52	17	20	31	<20	0.14	3.5	4.6	<0.8	<18	0.60
Mar- 26	91	49	17	21	31	<20	0.14	3.3	4.5	<0.8	<18	0.59
Average	**88**	**46**	**17**	**21**	**32**	**<20**	**0.15**	**2.9**	**4.6**	**<0.8**	**<18**	**0.59**

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)

Month	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	Pb ($\mu g/m^3$)	C_6H_6 ($\mu g/m^3$)	As (ng/m^3)	BaP (ng/m^3)	Ni (ng/m^3)	CO (mg/m^3)
Oct- 25	55	29	11	14	23	<20	0.11	1.3	2.3	<0.8	<18	0.45
Nov- 25	75	37	12	15	22	<20	0.08	2.0	2.2	<0.8	<18	0.58
Dec- 25	77	37	12	14	22	<20	0.08	2.0	2.3	<0.8	<18	0.58
Jan- 26	79	42	11	13	22	<20	0.08	2.1	2.0	<0.8	<18	0.58
Feb- 26	79	41	11	13	22	<20	0.08	1.8	2.2	<0.8	<18	0.55
Mar- 26	73	38	11	14	22	<20	0.08	1.6	2.4	<0.8	<18	0.56
Average	**73**	**37**	**11**	**14**	**22**	**<20**	**0.09**	**1.8**	**2.2**	**<0.8**	**<18**	**0.55**

Graphical Representation of AAQ Data



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OCTOBER 2025 – MARCH 2026

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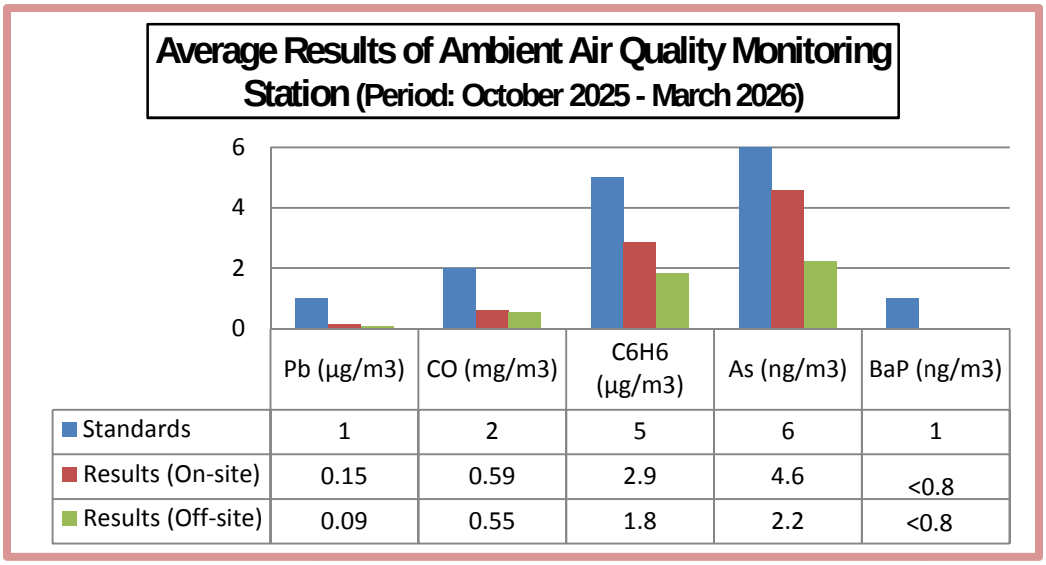

Monthly wiseReport of Ambient Air Quality Monitoring Station

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (On-site Plant)
Station Name & Code: Central Laboratory (AAQMS-1)

Month	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)	O_3 (µg/m³)	NH_3 (µg/m³)	Pb (µg/m³)	C_6H_6 (µg/m³)	As (ng/m³)	BaP (ng/m³)	Ni (ng/m³)	CO (mg/m³)
Oct- 25	65	34	18	21	34	<20	0.15	1.7	4.6	<0.8	<18	0.57
Nov- 25	85	42	17	23	33	<20	0.15	2.4	4.4	<0.8	<18	0.59
Dec- 25	88	43	15	19	32	<20	0.14	2.5	4.5	<0.8	<18	0.59
Jan- 26	91	50	16	19	31	<20	0.15	2.8	4.9	<0.8	<18	0.60
Feb- 26	95	51	17	19	32	<20	0.15	3.5	4.9	<0.8	<18	0.59
Mar- 26	91	49	17	20	31	<20	0.14	3.3	4.5	<0.8	<18	0.59
Average	**86**	**45**	**17**	**20**	**32**	**<20**	**0.15**	**2.7**	**4.6**	**<0.8**	**<18**	**0.59**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (On-site Plant)
Station Name & Code: Gate No.1 (AAQMS-2)

Month	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)	O_3 (µg/m³)	NH_3 (µg/m³)	Pb (µg/m³)	C_6H_6 (µg/m³)	As (ng/m³)	BaP (ng/m³)	Ni (ng/m³)	CO (mg/m³)
Oct- 25	70	36	19	21	33	<20	0.15	1.8	4.7	<0.8	<18	0.57
Nov- 25	90	46	15	22	33	<20	0.15	2.9	4.7	<0.8	<18	0.61
Dec- 25	92	45	16	20	32	<20	0.15	3.1	4.7	<0.8	<18	0.60
Jan- 26	98	52	18	21	32	<20	0.16	3.5	4.7	<0.8	<18	0.61
Feb- 26	96	52	18	21	32	<20	0.14	3.5	4.7	<0.8	<18	0.60
Mar- 26	92	49	17	21	33	<20	0.14	3.2	4.4	<0.8	<18	0.59
Average	**90**	**47**	**17**	**21**	**32**	**<20**	**0.15**	**3.0**	**4.7**	**<0.8**	**<18**	**0.60**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (On-site Plant)												
Station Name & Code: SCR (AAQMS-3)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Oct- 25	65	34	18	20	33	<20	0.14	1.7	4.5	<0.8	<18	0.57
Nov- 25	85	43	15	24	31	<20	0.14	2.3	4.3	<0.8	<18	0.59
Dec- 25	90	44	16	20	32	<20	0.14	2.7	4.6	<0.8	<18	0.60
Jan- 26	95	52	16	19	31	<20	0.15	3.2	4.8	<0.8	<18	0.61
Feb- 26	93	52	16	19	30	<20	0.14	3.3	4.4	<0.8	<18	0.60
Mar- 26	90	48	17	20	31	<20	0.14	3.2	4.3	<0.8	<18	0.59
Average	**86**	**45**	**17**	**20**	**31**	**<20**	**0.14**	**2.7**	**4.5**	**<0.8**	**<18**	**0.59**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (On-site Plant)												
Station Name & Code: PPWH (AAQMS-4)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Oct- 25	67	35	17	21	33	<20	0.15	1.7	4.5	<0.8	<18	0.58
Nov- 25	87	45	16	21	32	<20	0.14	2.4	4.2	<0.8	<18	0.60
Dec- 25	89	43	17	21	32	<20	0.14	2.7	4.5	<0.8	<18	0.59
Jan- 26	93	50	16	21	29	<20	0.15	3.3	4.6	<0.8	<18	0.61
Feb- 26	96	54	17	20	31	<20	0.15	3.6	4.7	<0.8	<18	0.60
Mar- 26	89	47	16	20	30	<20	0.14	3.1	4.3	<0.8	<18	0.59
Average	**87**	**46**	**17**	**21**	**31**	**<20**	**0.14**	**2.8**	**4.5**	**<0.8**	**<18**	**0.60**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (On-site Plant)												
Station Name & Code: CPP Entry Gate (AAQMS-5)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Oct- 25	68	35	18	21	33	<20	0.15	1.8	4.7	<0.8	<18	0.57
Nov- 25	93	47	16	23	32	<20	0.16	3.1	4.9	<0.8	<18	0.61
Dec- 25	93	46	17	21	32	<20	0.15	3.0	4.9	<0.8	<18	0.60
Jan- 26	95	53	17	19	31	<20	0.15	3.4	4.6	<0.8	<18	0.61
Feb- 26	94	52	17	20	31	<20	0.14	3.5	4.4	<0.8	<18	0.59
Mar- 26	95	51	17	20	31	<20	0.15	3.5	4.9	<0.8	<18	0.60
Average	**90**	**48**	**17**	**21**	**31**	**<20**	**0.15**	**3.0**	**4.7**	**<0.8**	**<18**	**0.60**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)												
Station Name & Code: IOC Township (AAQMS-10)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Oct- 25	55	29	11	15	22	<20	0.08	1.3	2.4	<0.8	<18	0.45
Nov- 25	76	37	12	15	22	<20	0.08	2.1	2.3	<0.8	<18	0.58
Average	**65**	**33**	**12**	**15**	**22**	**<20**	**0.08**	**1.7**	**2.3**	**<0.8**	**<18**	**0.52**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)												
Station Name & Code: Manaharpur (AAQMS-11)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Oct- 25	55	29	11	13	23	<20	0.14	1.3	2.2	<0.8	<18	0.45
Nov- 25	75	36	11	15	22	<20	0.07	1.9	2.1	<0.8	<18	0.59
Average	**65**	**33**	**11**	**14**	**22**	**<20**	**0.11**	**1.6**	**2.1**	**<0.8**	**<18**	**0.52**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)												
Station Name & Code: Nandarampur (AAQMS-6)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Dec- 25	75	37	13	14	22	<20	0.08	1.9	2.2	<0.8	<18	0.58
Jan- 26	79	42	11	14	22	<20	0.08	2.0	1.9	<0.8	<18	0.58
Average	**77**	**39**	**12**	**14**	**22**	**<20**	**0.08**	**1.9**	**2.0**	**<0.8**	**<18**	**0.58**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)												
Station Name & Code: Near CPT Hospital (AAQMS-8)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Dec- 25	79	38	12	14	23	<20	0.08	2.1	2.4	<0.8	<18	0.57
Jan- 26	80	42	10	13	23	<20	0.09	2.2	2.0	<0.8	<18	0.57
Average	**80**	**40**	**11**	**14**	**23**	**<20**	**0.08**	**2.1**	**2.2**	**<0.8**	**<18**	**0.57**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)												
Station Name & Code: Basudebpur (AAQMS-7)												
Month	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_2**	**O_3**	**NH_3**	**Pb**	**C_6H_6**	**As**	**BaP**	**Ni**	**CO**
	($\mu g/m^3$)	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($\mu g/m^3$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**($ng/m^{3)}$)**	**(mg/m^3)**
Feb- 26	79	41	11	13	23	<20	0.08	1.9	2.3	<0.8	<18	0.55
Mar 26	74	39	11	14	22	<20	0.08	1.7	2.5	<0.8	<18	0.56
Average	**77**	**40**	**11**	**13**	**23**	**<20**	**0.08**	**1.8**	**2.4**	**<0.8**	**<18**	**0.56**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)												
Station Name & Code: Hatiberia Swati Complex (AAQMS-9)												
Month	**PM_{10} ($\mu g/m^3$)**	**$PM_{2.5}$ ($\mu g/m^3$)**	**SO_2 ($\mu g/m^3$)**	**NO_2 ($\mu g/m^3$)**	**O_3 ($\mu g/m^3$)**	**NH_3 ($\mu g/m^3$)**	**Pb ($\mu g/m^3$)**	**C_6H_6 ($\mu g/m^3$)**	**As ($ng/m^{3)}$)**	**BaP ($ng/m^{3)}$)**	**Ni ($ng/m^{3)}$)**	**CO (mg/m^3)**
Feb- 26	79	41	12	13	22	<20	0.07	1.8	2.1	<0.8	<18	0.55
Mar 26	73	37	12	13	22	<20	0.07	1.5	2.3	<0.8	<18	0.56
Average	**76**	**39**	**12**	**13**	**22**	**<20**	**0.07**	**1.7**	**2.2**	**<0.8**	**<18**	**0.56**

Note: All parameters are 24 hrs. sampling basis except CO & Ozone 8 hrs. sampling basis.

On-line Hydrocarbon Analyzer

One no. On-lineHydrocarbon Analyzer was installed & commissioned on January 2007. The On-lineHydrocarbon Analyzer was located at Central Laboratory. Monitoring of ambient air quality has been carried out at Central Laboratory (Inside the plant). The identified location monitoring is carried out every one hour for Total Hydrocarbon, Methane &Non Methane Hydrocarbon. The study area has been considered as an industrial area. The results for the month of**October 2025 to March 2026**are given.

Average results of On-line Hydrocarbon Analyzer
Location : Central Laboratory

Month	THC (ppm)	CH_4(ppm)	NMHC (ppm)
Oct- 25	2.15	1.38	0.77
Nov- 25	2.86	1.84	1.02
Dec- 25	3.65	2.22	1.43
Jan- 26	2.48	1.43	1.06
Feb- 26	2.58	1.35	1.25
Mar- 26	0.44	0.12	0.32
Average	**2.36**	**1.39**	**0.98**

On–line Ambient Air Quality Monitoring Station (AAQMS)

One On-line Ambient Air Quality Monitoring station was installed & commissioned on 29 February 2008.The on-line AAQMS was located at South Control Room. AAQMS contains four analyzers ($PM_{2.5}$, SO_2& H_2S, NOx, and Hydrocarbon analyzer) for ambient air quality analysis and five sensors (Wind Speed, Wind Direction, Relative Humidity, Pressure and Temperature) for monitoring of meteorological parameters. AAQMS contains five analyzers (PM_{10}, NH_3, O_3, CO & Benzene) was installed on August 2018. The study area has been considered as an industrial area. The results for the month of**October 2025 to March 2026**are given.

Average results of On–line Ambient Air Quality Monitoring Station (AAQMS)
Location : South Control Room

Month	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	H_2S ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	CO (mg/m^3)
Oct- 25	84.00	33.94	11.04	5.01	21.56	12.23	37.33	2.76	0.43
Nov- 25	117.00	66.55	13.87	4.99	24.40	12.23	33.69	2.41	0.40
Dec- 25	142.00	85.97	14.71	5.02	25.02	12.27	22.91	2.31	0.41
Jan- 26	143.00	66.19	14.60	4.98	25.25	12.24	15.80	2.31	0.84
Feb- 26	128.00	55.52	14.62	5.65	25.30	12.25	30.54	2.31	0.86
Mar- 26	74.00	43.17	14.64	5.98	21.47	12.46	37.00	2.31	0.86
Average	**114.67**	**58.56**	**13.91**	**5.27**	**23.83**	**12.28**	**29.55**	**2.40**	**0.63**

Month	WS (m/s)	Wind Degree	Temperature (°C)	RH (%)	Pressure (mbar)	THC (PPM)	CH_4 (PPM)	NMHC (PPM)
Oct- 25	4.44	163.88	28.93	81.68	714.50	4.56	2.38	2.22
Nov- 25	1.69	342.94	24.89	65.08	713.60	2.39	1.59	0.82
Dec- 25	1.95	24.83	20.21	68.46	712.60	4.20	1.94	2.26
Jan- 26	2.21	40.80	19.82	61.41	712.40	5.68	1.92	3.78
Feb- 26	3.01	345.62	23.85	58.71	713.40	3.53	1.71	1.82
Mar- 26	0.96	214.40	26.99	80.69	714.00	2.78	1.77	1.01
Average	**2.38**	**188.75**	**24.11**	**69.34**	**713.42**	**3.86**	**1.89**	**1.99**

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HALDIA PETROCHEMICALS LIMITED
HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT
OCTOBER 2025 – MARCH 2026

Envirotech

CHAPTER NO. – 06

VENT EMISSION & WORK ZONE AIR QUALITY

6.0 VENT EMISSION AND WORK ZONE AIR QUALITY

A. Methods of measurement

Sl. No.	Parameters	Standards of measurement	Range of Testing	Methodology
1.	Benzene	Method no. 12, OSHA	0.04 ppm & above	Absorption on activated charcoal, desorption by carbon disulphide& analysis by GC using FID
2.	Butadiene	Method no. 56, OSHA	0.09 ppm & above	Absorption on activated charcoal, desorption by carbon disulphide& analysis by GC using FID
3.	Hexane	Methods of Air Sampling and Examination, Third Edition. Edited by James P. Lodge, Method 109	0.05 ppm & above	Absorption on activated charcoal, desorption by carbon disulphide& analysis by GC using FID

Benzene Emission from Vent of Benzene Extraction Unit.
(October 2025 to Match 2026)

Plant	Location	Standard	Month
BEU	PCV-60142B	5.0 mg/Nm^3	All results are well below the standards in all months (<0.1µg/m^3)

Work Zone Monitoring Results
Half-Yearly Average Results
(October 2025 to March 2026)

Plant	Standard (ppm)	Average Results (ppm)
Benzene Extraction Unit	1.0	**0.174**
Butadiene Extraction Unit	1.0	**0.257**
Hexane Area	500.0	**11.172**

Standards as per OSHA (TWA for 8 hrs. exposure)

Work Zone Monitoring Results
Monthly Wise Report

Month			Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Half-Yearly Average
Sl. No.	Plant	Location	Results (ppm)						
BENZENE									
1	BEU	5P – 02 A & B Hartcut Feed Pump(BEU)	0.056	0.074	0.079	0.087	0.096	0.081	**0.079**
2		Benzene Sampling Point (050-SP-108)& 5P-07 A & B(BEU)	0.205	0.251	0.267	0.295	0.328	0.274	**0.270**
BUTADIENE									
4	BDEU	Butadiene Extension Unit	0.118	0.152	0.165	0.181	0.207	0.178	**0.167**
5		BDEU Sampling Point	0.261	0.332	0.348	0.374	0.397	0.365	**0.346**
HEXANE									
6	HDPE	V- 2405 Draining Point	8.35	9.26	9.71	9.95	10.18	9.58	**9.51**
7		Flaker House(Ground Floor)	11.06	12.68	13.07	13.39	13.86	12.97	**12.84**

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HALDIA PETROCHEMICALS LIMITED
HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT
OCTOBER 2025 – MARCH 2026

Envirotech

CHAPTER NO. – 07

AMBIENT NOISE

7.0 AMBIENT NOISE

In order to establish ambient noise levels for the Study Area, measurement of noise levels were performed at seven locations. i.e 5 (Five) Nos. of identified main noise generation units and 5 (Five) locations at the boundary wall (1 meter away from the boundary walls). Noise monitoring was measured in decibel unit i.e. Leq dB(A) where A denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear and Leq is an energy mean of the noise level, over a specified period. Monitoring was carried out once in a season in each location.

The monitoring locations in plant boundary for ambient noise level are as follows:

Sl.No.	Location Details	Location Code	Direction from the plant Center
1.	Near Gate No.-1	AN 1	East of north east
2.	Near Gate No.-3	AN 2	East of south east
3.	South Gate	AN 3	South
4.	CPP	AN4	North of north west
5.	North Gate	AN5	North

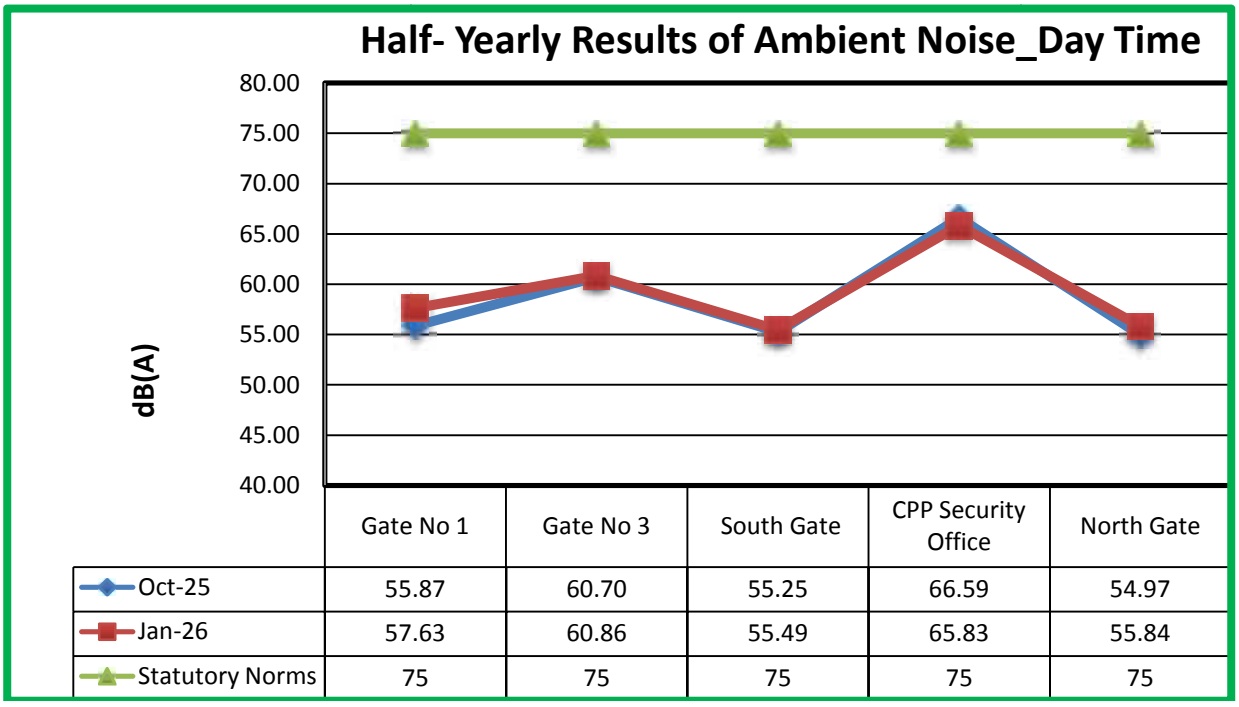
24 hours Noise (Ambient Noise) Standards
(CPCB & WBPCB Standards)

Duration	Unit are dB(A)			
	Industial	Commercial	Residential	Silence
DAY (6 am to 10 pm)	75	65	55	50
NIGHT (10 pm to 6 am)	70	55	45	40

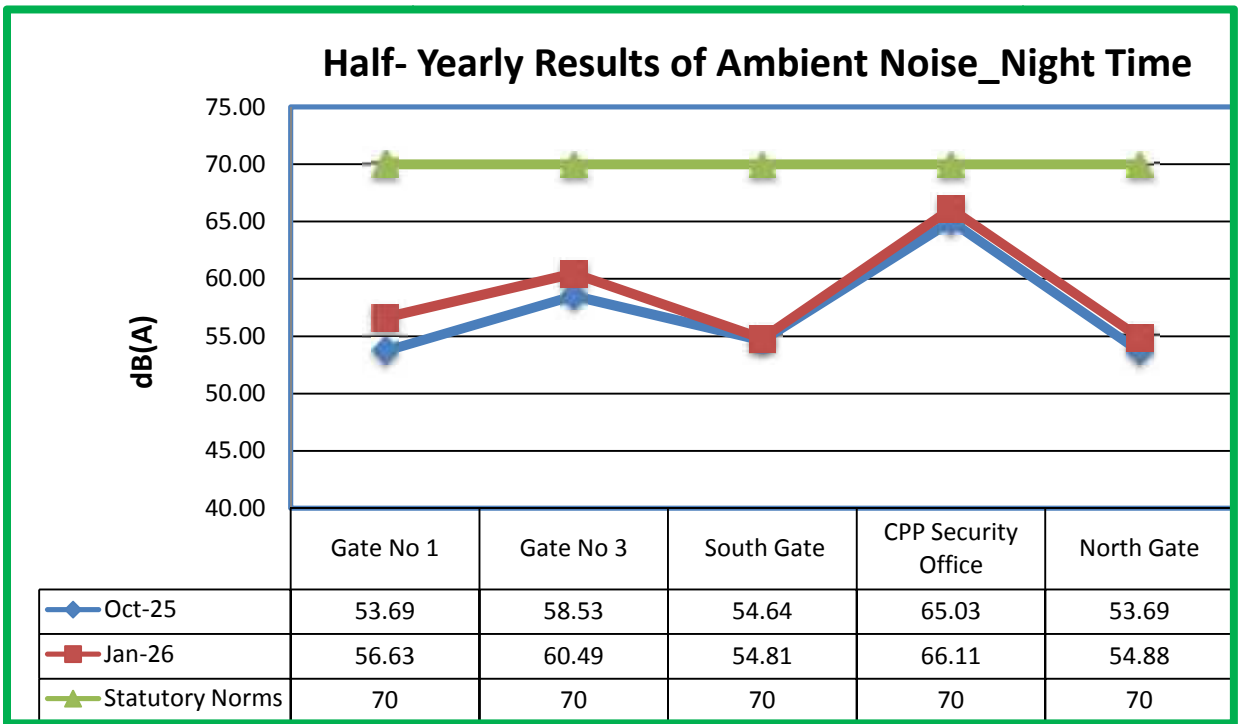
Ambient Noise Level (Average)October 2025 to March 2026

LOCATION	October 2025		January 2026	
	Day	Night	Day	Night
Near Gate No-1	55.87	53.69	57.63	56.63
Near Gate No-3	60.70	58.53	60.86	60.49
Near South Gate	55.25	54.64	55.49	54.81
Near CPP Security Office	66.59	65.03	65.83	66.11
Near North Gate	54.97	53.69	55.84	54.88

Graphical Representation of Ambient Noise Data



	Gate No 1	Gate No 3	South Gate	CPP Security Office	North Gate
Oct-25	55.87	60.70	55.25	66.59	54.97
Jan-26	57.63	60.86	55.49	65.83	55.84
Statutory Norms	75	75	75	75	75



	Gate No 1	Gate No 3	South Gate	CPP Security Office	North Gate
Oct-25	53.69	58.53	54.64	65.03	53.69
Jan-26	56.63	60.49	54.81	66.11	54.88
Statutory Norms	70	70	70	70	70

TC- 12649

HALDIA PETROCHEMICALS LIMITED
HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT
OCTOBER 2025 – MARCH 2026

Envirotech

CHAPTER NO. – 08

LEAK DETECTION UNDER LDAR PROGRAM

8.0 LDAR PROGRAM

Fugitive emission monitoring

Fugitive Emission Sources:

Fugitive emission sources include leaks of hydrocarbon vapors from process equipment and evaporation of hydrocarbons from open areas, rather than through a stack or vent. Fugitive emission sources include valves of all types, flanges, pump seals, process drains, cooling towers, and oil/water separators. Normally, control of fugitive emissions involves minimizing leaks and spills through equipment changes, procedure changes, and improved monitoring, housekeeping, and maintenance practices.

Fugitive emission monitoring:

The technique which has been used to detect and control emissions from equipment leaks is known as Leak Detection and Repair (LDAR) Programme. The method which is used in LDAR program is Stratified Emission Factor Method. In this method the screening values are distributed in different ranges, like

- 0-1000 ppmv
- 1001-10,000 ppmv
- Over 10,000 ppmv

Emission factors for each screening value range have been generated from data gathered during previous EPA studies. These stratified emission factors represent the leak rate measured during fugitive emission testing. Their development incorporated the statistical methods used by EPA in developing other emission factors. The emission factor for each discrete interval, by equipment type and service, is presented in the table.

Emission Factors(kg/hr/source) for Screening value range (ppmv)				
Source	**Service**	**0-1000**	**1001-10000**	**Over- 100000**
Valves	Gas/Vapor	0.00014	0.00165	0.0451
	Light liquid	0.00028	0.00963	0.0852
	Heavy liquid	0.00023	0.00023	0.00023
Pump	Light liquid	0.00198	0.0335	0.437
	Heavy liquid	0.0038	0.0926	0.3885
Compressor seals	Gas/Vapor	0.01132	0.264	1.608
Pressure relief devices	Gas/Vapor	0.0114	0.279	1.691
Source	Service	0-1000	1001-10000	Over- 100000
Flanges, connections	All	0.00002	0.00875	0.0375
Open-ended lines	All	0.00013	0.00876	0.01195

Reference: USEPA Handbook on Control Techniques for Fugitive VOC Emissions from Chemical Process Facilities. EPA/625/R-93/005, March 1994.

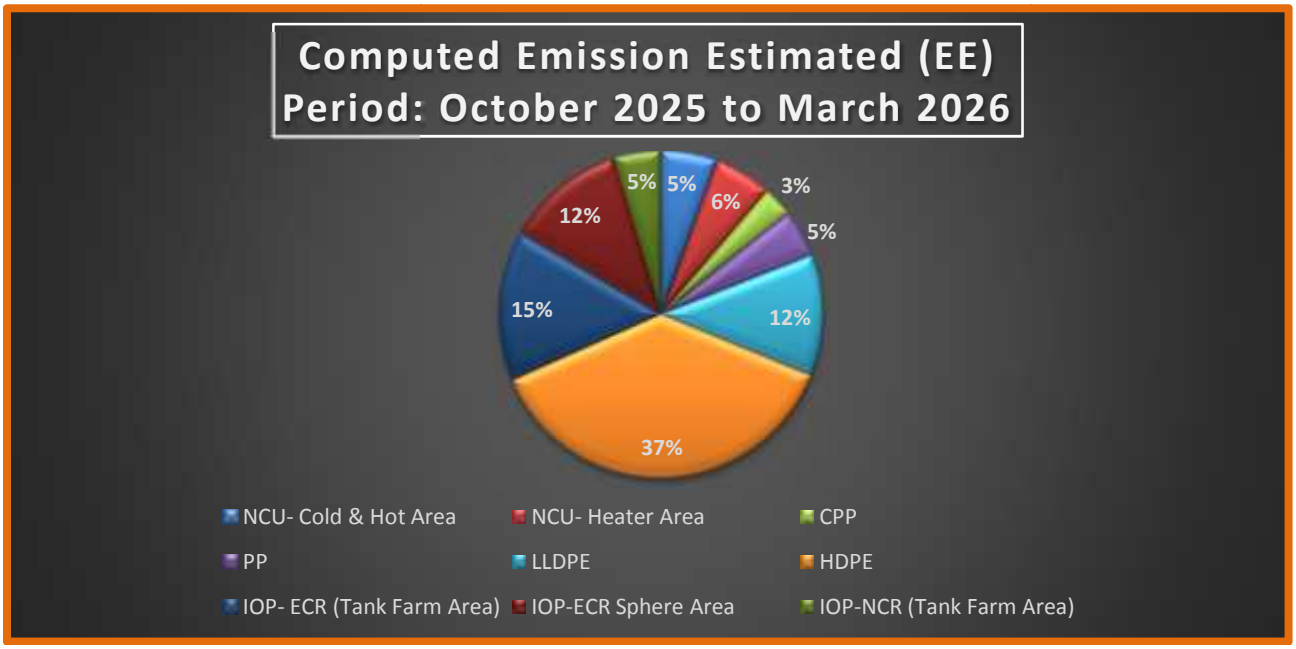
All screening values must be recorded according to the applicable ranges. The product of the appropriate emission factor and the number of components in each screening value range and source type. The total emission rate is the sum of all the emission rates for each value range and source type.

EE=(NL1*SEF1)+(NL2*SEF2)+(NL3*SEF3)
EE=emission estimate
NL1= number leaking in first range (0-1000)
NL2= number of leaking in second range (1001-10,000)
NL3= number of leaking component in third range(over 10,000)
SEF1= stratified emission factor for first range
SEF2= stratified emission factor for second range
SEF3= stratified emission factor for third range

LDAR program has been adopted for identifying the leakage valves, pumps and flanges and quantifying the total VOC emitted from those equipments of different units. The points where the emission is over 1 ppm are considered as leaking points. Based on those identified points the total VOC emission will be estimated for each unit.

Total VOC emission from NCU- Cold & Hot Area, NCU-Heater Area, CPP, PP, LLDPE, HDPE, IOP-ECR Tank Farm Area, IOP-ECR Spere Area & IOP-NCR Tank Farm Area

Location	Computed Emission Estimates (EE) Actual Unit – Ton/Annum	Computed Emission Estimates (EE) in 100%
NCU- Cold & Hot Area	0.049	5.63
NCU- Heater Area	0.050	5.75
CPP	0.026	2.99
PP	0.041	4.71
LLDPE	0.105	12.07
HDPE	0.324	37.24
IOP- ECR _Tank Farm Area	0.130	14.94
IOP-ECR _Sphere Area	0.104	11.95
IOP-NCR_Tank Farm Area	0.041	4.71
Total	**0.870**	**100**



Total VOC emission from NCU- Cold & Hot Area, NCU-Heater Area, CPP, PP, LLDPE, HDPE, IOP-ECR Tank Farm Area, IOP-ECR Spere Area & IOP-NCR Tank Farm Area

1. Total VOC emission from NCU- Cold & Hot Area in October 2025:

No of points checked: 1073
No of leaking (VOC>1ppm) points: 181
No of non leaking points: 892

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	0	0	0	0
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	18	0	0	0.00504
	Heavy liquid	0	0	0	0
Flange	All	34	0	0	0.00068
				Total	**0.00572**
					4.118 (kg/month) / 0.049 (Ton/Annum)

2. Total VOC emission from NCU- Heater Area in October 2025 & November 2025:

No of points checked: 464
No of leaking (VOC>1ppm) points: 57
No of non leaking points: 407

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	0	0	0	0
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	18	0	0	0.00504
	Heavy liquid	0	0	0	0
Flange	All	39	0	0	0.00078
				Total	**0.006 (kg/hr)**
					4.190g/month) / 0.050 (Ton/Annum)

3. Total VOC emission from CPP in November 2025:

No of points checked: 270
No of leaking (VOC>1ppm) points: 20
No of non leaking points: 250

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	0	0	0	0
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	10	0	0	0.0028
	Heavy liquid	0	0	0	0
Flange	All	10	0	0	0.0002
				Total	**0.003 (kg/hr)**
					2.160(kg/month) /0.026 (Ton/Annum)

4. Total VOC emission from PP in November 2025:

No of points checked: 543
No of leaking (VOC>1ppm) points: 53
No of non leaking points:490

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	0	0	0	0
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	14	0	0	0.00392
	Heavy liquid	0	0	0	0
Flange	All	39	0	0	0.00078
				Total	**0.005 (kg/hr)**
					3.384(Kg/month) / 0.041 (Ton/Annum)

5. Total VOC emission from LLDPE in December 2025:

No of points checked: 720
No of leaking (VOC>1ppm) points: 127
No of non leaking points:593

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	0	0	0	0
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	37	0	0	0.01036
	Heavy liquid	0	0	0	0
Flange	All	90	0	0	0.0018
				Total	**0.012 (kg/hr)**
					8.755 (Kg/month) / 0.105 (Ton/Annum)

6. Total VOC emission from HDPE in January & February 2026:

No of points checked: 1200
No of leaking (VOC>1ppm) points: 160
No of non leaking points:1040

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	8	0	0	0.01584
	Heavy liquid	3	0	0	0.0114
Valve	Gas/Vapor	0	0	0	0
	Light liquid	28	0	0	0.00784
	Heavy liquid	0	0	0	0
Flange	All	121	0	0	0.00242
				Total	**0.038 (kg/hr)**
					27.000 (kg/month) / 0.324 (Ton/Annum)

7. Total VOC Emission from IOP-ECR (Tank Farm Area) in February 2026:

No of points checked: 796
No of leaking (VOC>1ppm) points: 147
No ofnon leaking points: 649

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	0	0	0	0.00198
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	39	0	0	0.01092
	Heavy liquid	0	0	0	0
Flange	All	107	0	0	0.00214
				Total	**0.015 (kg/hr)**
					10.829 (kg/month) / 0.130 (Ton/Annum)

8. Total VOC emission from IOP-ECR Sphere Area in March 2026:

No of points checked: 594
No of leaking (VOC>1ppm) points: 87
No of non leaking points: 507

Number of Source Screened (ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	3	0	0	0.00594
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	17	0	0	0.00476
	Heavy liquid	0	0	0	0
Flange	All	67	0	0	0.00134
				Total	**0.012 (kg/hr)**
					8.669 (kg/month) / 0.104 (Ton/Annum)

9. Total VOC Emission from IOP-NCR (Tank Farm Area) in March 2026:

No of points checked: 309
No of leaking (VOC>1ppm) points: 53
No of non leaking points: 256

Number of Source Screened(ppmv)					Computed Emission Estimates (EE)
Source	Service	0-1000	1001-10000	Over 10,000	Per Source Type(kg/hr)
Pump	Light liquid	0	0	0	0
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	14	0	0	0.00392
	Heavy liquid	0	0	0	0
Flange	All	39	0	0	0.00078
				Total	**0.005 (kg/hr)**
					3.384 (kg/month) / 0.041 (Ton/Annum)

Annexure IV

Awareness Program on 'Utility and Eco friendliness of Plastic and Plastic Waste Management'

Background of Statutory Stipulation: MoEF&CC has mentioned the undermentioned condition in the Expansion EC for Phenol,

SL. No. 1.25 - PP shall sensitize and create awareness among the people working within the project area as well as its surrounding area on the ban of Single Use Plastic in order to ensure the compliance of Notification published by MOEFCC on 12th August 2021.

Awareness Program at Poura Patha Bhavan School, Haldia on 24th March 2026:

As part of our continual endeavors to create awareness on Plastic Waste Management, Haldia Petrochemicals Limited and AdPlus Chemicals and Polymers Pvt Limited (step down subsidiary of Haldia Petrochemicals Limited) organized a session on ***Utility and Eco friendliness of Plastic and Plastic Waste Management*** at Poura Patha Bhaban School, Haldia.

Mr. Pritam Ghoshal, DGM – Manufacturing delivered the presentation and exhibited different grades of polymers and polymer products followed by an interactive question answer session attended by Mr. Saugata Mahindar, DGM- Environment Services, Mr. Subandhu Bhattacharya, Sr. Manager- Environment Services and Ms. Rishita Chowdhury, MT- Environment Services which witnessed encouraging learning and active participation of around 60 students and 10 teachers.

The session was aimed to educate students as well as teaching staffs about different types of plastics, statutory regulations on single use plastic , appropriate applications and end use management. It was inspiring to see young minds showing curiosity and interest towards responsible plastic usage and plastic waste management.

Awareness Program in Haldia Petrochemicals Limited:

On 31.03.2025, Mr. Subandhu Bhattacharya, Sr. Manager- Environment Services delivered a knowledge sharing interactive session with Contractual employees of HPL on Utility of Plastic, Plastic Waste Management and Restrictions on single use plastic.

Annexure IV


Together,
We Can
End Global
Plastic
Pollution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Pollution
Questions...

Annexure IV

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ANNEXURE - V

ENVIRONMENTAL EXPENDITURE DETAILS FROM OCTOBER '25 TO MARCH '26

Sl. No.	Item	Expenditure in Lakh
1	**Environmental Monitoring Cost**	
	[Rate Contract for Environmental & Process Monitoring Job at HPL Complex]	22.97
2	**Greening Drive Activities**	
	[Green Belt Development & Up-keepment Cost Beautification (Horticultural) Work (inside plant)]	32.10
3	**Statutory Fees & Insurance Expenses**	
	[Analysis charges & PLI]	12.807
4	**Hazardous Wastes Disposal Expenses**	
	Disposal cost for TSDF and Co processing in cement plant	65.00
5	**Biomedical Wate Disposal Expenses**	1.17
6	**Municipal Waste Disposal Expenses**	0.90
7	**Operational, Maintenance & Installation Cost of Environment protection system:**	
7.1	Operational cost of WWTP	265.70
7.2	Operational cost of Flare Stack Emission System	778.14
7.3	Operation cost of Benzene Recovery Unit	0.40
7.4	CMC for the Hydrocarbon Analyser, AAQMS	8.21
7.5	CMC for Online Effluent & Stack Monitoring system	1.55
7.6	CMC for Online Flue Gas Monitoring system	17.20
7.7	O& M Cost of Electrostatic Precipitator, bag filters	8.70
7.8	Operational Expenditure of Limestone Dosing in Boiler	559.65
	Total Cost	**1774.497**