HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT

Period: April 01, 2023 to September 30, 2023

For

HALDIA PETROCHEMICALS LIMITED

HALDIA: PURBA MEDINIPUR: WEST BENGAL

Monitoring Agency

Certificate No. :TC-7649

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West Bengal Pollution Control Board (Department of Environment, Govt. of West Bengal) Memo No. 3664-5/WPB-S/99 (Part-VI), Validity: upto 30.06.2024.	*Recognised by National Accreditation Board for Testing and Calibration Laboratories (NABL), Accreditation Standard ISO/IEC 17025:2005, Certificate Number TC-7649, Validity 22.03.2023 to 21.03.2025.*

Recognised by MoEF & CC, Govt. of India for Air, Effluent and Drinking Water Quality Testing up to 11.04.2024 vide The Gazette of India, Extraordinary, Part–II, Section–3, Sub-Section(ii), F. No. Q-15018/61/ 2018 - CPW Dated – 13.12.2019.

Certificate No. :TC-7649

HALDIA PETROCHEMICALS LIMITED
HALF YEARLY ENVIRONMENTAL DATA GENERATION REPORT
APRIL 2023 – SEPTEMBER 2023

PREFACE

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

The scope of the study includes detailed characterisation of the environment in and around HPL complex covering an area of 10-km radius from the center of the HPL plant for Air, Noise, Effluent etc. Scientific Research Laboratory established an Environmental Laboratory in HPL Plant premises for this purpose. All sampling and testing were performed by following well-established and recognized standard procedures.

Scientific Research Laboratory wishes to place on record its deep appreciation for the trust reposed in Scientific Research Laboratory by Haldia Petrochemicals Limited for carrying out this study. Our heartiest thanks go to Shri Manoj Kumar Srivastava, EVP & Head Plant and Mr. Sasthi Mandal, Sr. GM - HSEF for their kind cooperation & help provided during the course of study.

We also appreciate tireless efforts of Mr. Avik Haldar, Sr.Manager – Environment Services & Mr. Saugata Mahindar, DGM -Environment Services without whom it would not have been possible to bring out the final report.

Prepared By	Checked by	Approved by
(Manatosh Samanta) Site In-charge	(Tripti Ghosh) Technical Manager	(Dr. Jyotirmoy Majumdar) Chief Executive

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CHAPTER NO. - 01

INTRODUCTION

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 of Hoogly River. The area has neither rapid industrial growth nor causes serious ecological/environmental imbalance bringing resultant problems. 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. These monitoring will help to assess the environmental scenario after commissioning of HPL also.

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 generated & collected environmental data.
- 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 **April 2023 to September 2023**. 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, waterway 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 (**April 2023 to September 2023**) through out the year comprising of two seasons as per MOEF & CC guidelines such as Sumer & Monsoon season in respect of

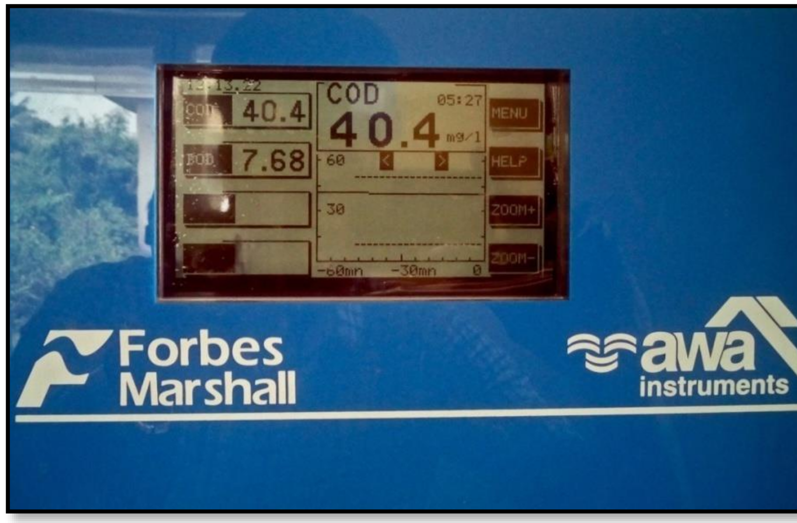
- Effluent Quality
- Stack Emission
- Meteorology
- Ambient Air Quality
- Work Zone Air Quality
- Ambient Noise
- LDAR Program

Monitoring was started in the month of **April 2023**. The purpose of the environmental monitoring was just to know environmental scenario in and around the HPL complex. Results of baseline studies are summarized in relevant chapters.

CHAPTER NO. – 02

EFFLUENT QUALITY

Online Treated Effluent Monitoring System



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 water plant

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 WASTE WATER 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 will be dosed at the inlet of aeration tank to provide nitrogen, phosphorus for microorganisms. 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 will be 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.

<u>Slop Oil Collection System</u>

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.

<u>Sludge Handling System</u>

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

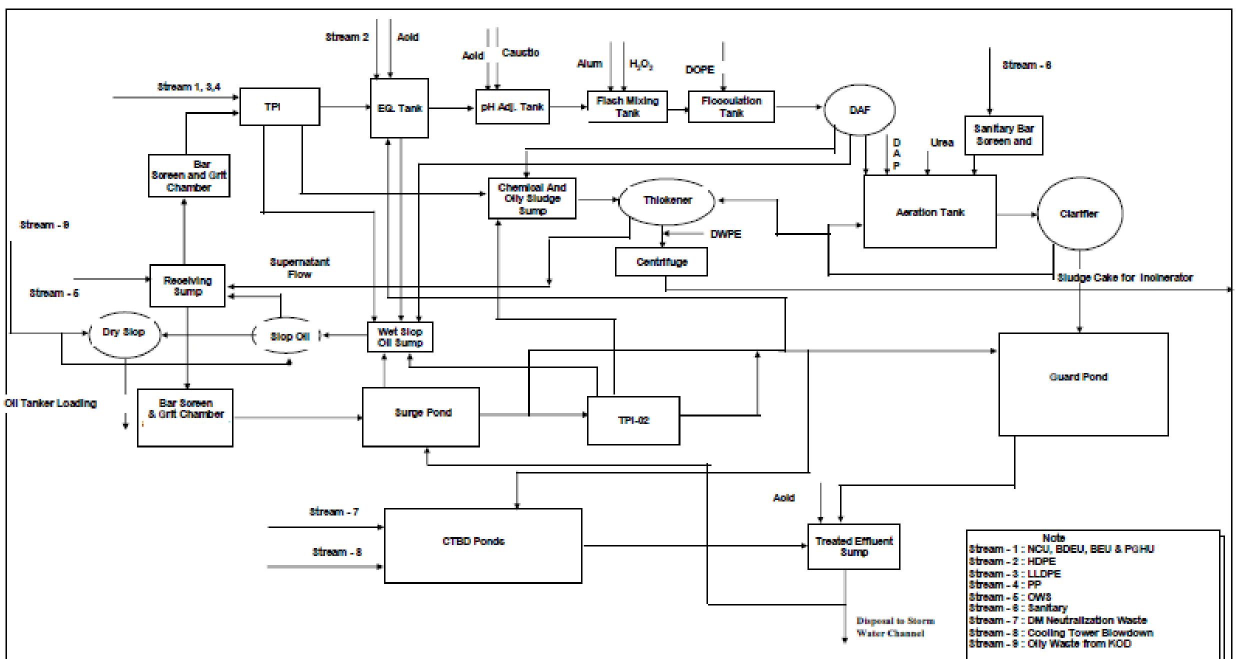
SCIENTIFIC RESEARCH LABORATORY has established an Environmental Laboratory inside HPL in WWTP Laboratory as a third independent party to check the quality of effluent daily as per specifications of effluent standards.

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



Schematic Diagram of WASTE WATER TREATMENT PLANT (WWTP)

2.5 METHODS OF MEASUREMENT

Sl. No.	Parameters	Specification / 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 Spectrophotometeric 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 of April 2023 to September 2023 (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	41825	49203
2	Domestic purpose	1081	1510
3	Processing where by water gets polluted and the pollutants are easily biodegradable	1747	2000
4	*Total Discharge of Effluent (a+b)	6804	8619.4
	a. Treated Effluent from Guard Pond & Surge Pond	3899	
	b. Effluent from CTBD & DM Regeneration Pond (as diluents)	2905	

*Total effluent after expansion will be 8625 KL/Day (as per the condition of Environment Clearance dated 20.03.2018)

2.7 EFFLUENT QUALITY

Half Yearly Average Data of WWTP Outlet
Period of Monitoring: April 2023 to September 2023

Sl. No.	Parameter	Unit	Standards	WWTP Outlet
1.	pH	--	6.5-8.5	7.64
2.	TSS	mg/l	100	15.21
3.	BOD	mg/l	30	8.60
4.	COD	mg/l	250	42.18
5.	Total Oil &Grease	mg/l	10	<5.0
6.	Phenol	mg/l	1	<0.002
7.	Sulphide	mg/l	2	0.70
8.	Cyanide	mg/l	0.2	<0.02
9.	Fluoride	mg/l	5	0.71
10.	Total Chromium	mg/l	2	<0.05
11.	Chromium (Cr^{+6})	mg/l	0.1	<0.01
12.	FRC	mg/l	0.5	<0.1
13.	Iron as Fe	mg/l	1.0	0.38
14.	Zinc as Zn	mg/l	1.0	0.22
15.	Copper as Cu	mg/l	1.0	<0.05
16.	Phosphate as P	mg/l	5.0	0.86

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

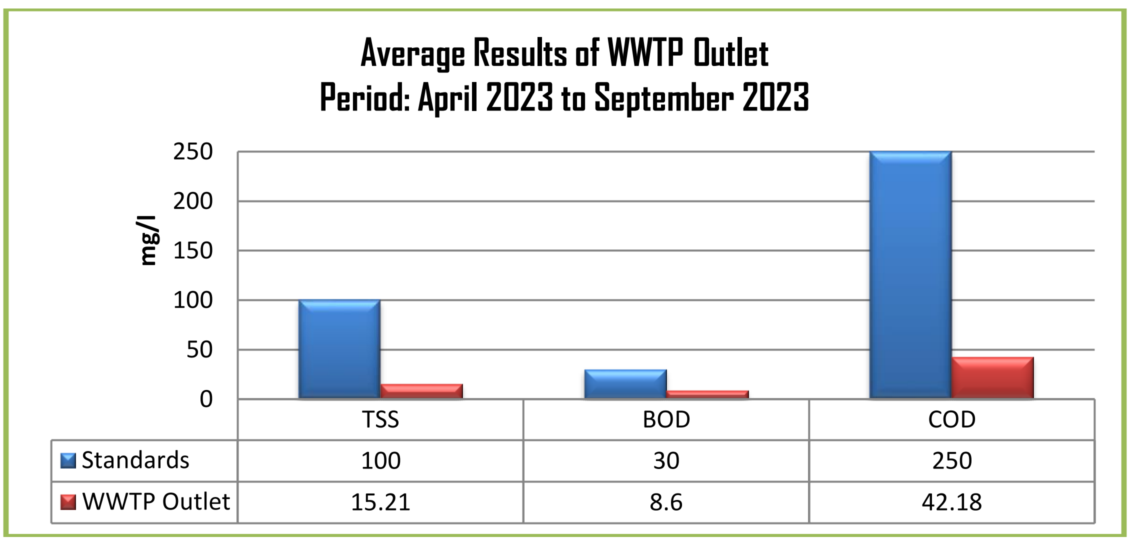
Monthly Average Data of WWTP Outlet

Sl.No.	Parameter	WWTP Outlet					
		Apr'23	May'23	Jun'23	Jul'23	Aug'23	Sept'23
1.	pH	7.67	7.81	7.78	7.86	6.86	7.88
2.	TSS	14.48	14.40	14.95	15.42	15.42	16.60
3.	BOD	8.20	7.97	11.07	8.84	8.87	6.67
4.	COD	41.15	38.52	53.67	43.45	43.19	33.07
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.	Sulphide	<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	0.72	0.69	0.70	0.72	0.73	0.66
10.	Total Chromium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
11.	Chromium (Cr^{+6})	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12.	FRC	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
13.	Temperature	30.0	31.5	31.0	30.0	30.0	30.0
14.	Iron as Fe	0.77	0.20	0.32	0.32	0.33	0.34
15.	Zinc as Zn	0.429	0.251	0.251	0.251	0.053	0.096
16.	Copper as Cu	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
17.	Phosphate as P	0.86	0.21	1.34	1.34	0.26	1.15

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

2) Frequency of monitoring
- **a) Sl. No. 1 – 11 & 14 : Daily**
- **b) Sl. No. 12 & 13 : Weekly**
- **c) Sl. No. 15 – 17 : Monthly**

Graphical Representation of Effluent



WWTP INLET

Sl. No.	Parameter	Unit	WWTP Intlet					
			Apr'23	May'23	Jun'23	Jul'23	Aug'23	Sept'23
1.	pH	--	9.14	10.54	9.91	9.91	10.39	9.14
2.	Total Suspended Solids	mg/l	35.0	49.0	41.0	41.0	61.0	38.0
3.	Chemical Oxygen Demand	mg/l	216.0	173.0	206.0	206.0	204.0	171.0
4.	Biochemical Oxygen Demand (3 days at 27˚C)	mg/l	54.0	40.0	48.0	48.0	51.0	43.0
5.	Oil and Grease	mg/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
6.	Phenol	mg/l	<0.002	3.52	1.98	1.98	1.89	1.95
7.	Sulphide (as S)	mg/l	5.90	7.46	4.55	4.55	4.04	4.08
8.	Cyanide (as CN),	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
9.	Fluoride (as F)	mg/l	1.0	1.14	0.60	0.60	0.65	0.89
10.	Total Chromium (as Cr)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
11.	Hexavalent Chromium (as Cr^{6+})	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
12.	Iron as Fe	mg/l	0.39	0.24	0.91	0.91	0.57	0.42
13.	Zinc as Zn	mg/l	0.225	0.087	0.226	0.226	0.065	0.114
14.	Copper as Cu	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
15.	Phosphate as P	mg/l	0.42	0.15	0.13	0.13	0.19	1.98

Frequency of monitoring
a) Sl. No. 1, 3 & 5 : Daily
b) Others : Monthly

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 mt.	2.3 mt.	3.6 mt.	0.95 mt.	1.06 mt.	2.1 mt.	--
5	Shape of the stack	Circular	Circular	Circular	Circular	Circular	--	Circular
6	Area of the stack		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	Full Load – 315 Liter/KW & ¾ Load - 235 Liter/KW
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.	--
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.

Standards of Stacks

Unit	Standards	SO_2	NO_x	CO	Hg	PM
NCU & PGHU	Standard as per WBPCB	50	350			10
PGDS		50	250			05
CPP Stacks			100 ppm of 15% excess O_2	1% V/V		50
CFB	Standard as per CPCB	100	100	1% V/V	0.03	30
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	Twice 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
(April 2023 to September 2023)

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)	CO (mg/Nm^3)
2F – 201	140.5	6.77	19.57	2.17
2F – 203	122.3	7.59	22.77	3.50
2F – 204	155.0	8.32	20.97	3.17
2F – 205	114.8	7.39	22.45	3.50
2F – 206	151.5	9.11	20.20	3.67
2F – 207	125.7	9.02	23.09	3.83
2F – 208	165.5	7.55	24.07	3.50
2F – 209	144.7	8.47	20.36	3.67

Stack Monitoring Results – Location Wise

Sl.No.	Furnace Heater No.	Unit	Month of Monitoring	Temp. (^0C)	Results in mg / Nm^3		
					SO_2	NO_x	CO
1	2F-201	NCU	April 23	146.0	5.66	23.19	2.0
2			May 23	135.0	6.30	15.60	2.0
3			June 23	135.0	6.72	19.39	2.0
4			July 23	138.0	10.54	23.17	3.0
5			August 23	145.0	5.85	18.84	2.0
6			September 23	144.0	5.55	17.21	2.0
1	2F-203		April 23	111.0	8.14	22.38	3.0
2			May 23	118.0	8.44	23.82	4.0
3			June 23	117.0	8.95	27.81	4.0
4			July 23	112.0	5.91	16.34	3.0
5			August 23	162.0	5.18	21.24	3.0
6			September 23	114.0	8.92	25.01	4.0
1	2F-204		April 23	135.0	9.57	24.44	3.0
2			May 23	185.0	5.86	17.17	3.0
3			June 23	125.0	10.54	21.37	3.0
4			July 23	157.0	9.23	21.76	4.0
5			August 23	126.0	7.03	24.83	3.0
6			September 23	202.0	7.67	16.27	3.0
1	2F-205		April 23	107.0	8.42	20.57	4.0
2			May 23	110.0	7.49	20.04	3.0
3			June 23	104.0	5.88	17.37	3.0
4			July 23	124.0	8.98	28.04	4.0
5			August 23	125.0	8.59	28.48	4.0
6			September 23	119.0	4.98	20.17	3.0
1	2F-206		April 23	158.0	7.05	26.59	3.0
2			May 23	151.0	6.47	16.17	4.0
3			June 23	148.0	6.83	31.17	4.0
4			July 23	147.0	13.48	14.37	3.0
5			August 23	155.0	11.45	15.03	4.0
6			September 23	150.0	9.40	17.85	4.0
1	2F-207		April 23	125.0	5.93	25.34	4.0
2			May 23	127.0	7.95	22.29	4.0
3			June 23	127.0	9.22	23.73	4.0
4			July 23	127.0	15.41	22.87	4.0
5			August 23	128.0	8.20	20.34	3.0
6			September 23	120.0	7.40	23.97	4.0

All values corrected to 3% Oxygen

Stack Monitoring Results – Location Wise

Sl.No.	Furnace Heater No.	Unit	Date of Monitoring	Temp. (^0C)	Results in mg / Nm^3		
					SO_2	NO_x	CO
1	2F-208	NCU	April 23	164.0	4.24	27.12	4.0
2			May 23	157.0	5.90	18.14	3.0
3			June 23	162.0	8.49	38.21	4.0
4			July 23	166.0	12.81	21.24	3.0
5			August 23	174.0	7.67	24.78	4.0
6			September 23	170.0	6.21	14.90	3.0
1	2F-209		April 23	141.0	6.38	24.23	3.0
2			May 23	140.0	8.97	19.10	4.0
3			June 23	136.0	7.80	19.49	3.0
4			July 23	167.0	9.99	19.12	4.0
5			August 23	141.0	9.22	19.48	4.0
6			September 23	143.0	8.43	20.75	4.0

All values corrected to 3% Oxygen

B. Pyrolysis Gasoline Hydrogenation Unit (PGHU 4F-101) (April 2023 to September 2023)

Furnace Heater No.	Temp. (^0c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	CO (mg/Nm^3)	PM (mg/Nm3)
4F - 101	272.3	15.17	53.36	36.29	6.47

Month Wise Report

Sl. No.	Furnace Heater No.	Unit	Date Of Monitoring	Temp. in OC	Results in mg/Nm3			
					SO_2	NOx	CO	PM
1	4F-101	PGHU	April 23	276.5	14.43	68.44	37.0	5.40
3			May 23	275.0	13.75	66.60	34.0	7.84
4			June 23	272.0	10.96	55.14	34.0	6.76
5			July 23	264.0	13.55	42.38	34.0	6.93
6			August 23	272.0	19.46	32.32	42.0	5.73
7			September 23	270.0	19.58	40.17	36.0	7.24

All values Calculated to 3% O_2 dry basis

C. Pyrolysis Gasoline De Sulphurisation Unit (PGDS 4F-201)

(April 2023 to September 2023)

Furnace Heater No.	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	CO (mg/Nm^3)	PM (mg/Nm3)
4F - 201	297.2	16.82	44.36	29.33	4.28

Month Wise Report

Sl. No.	Furnace Heater No.	Unit	Date Of Monitoring	Temp. in OC	Results in mg/Nm3			
					SO_2	NOx	CO	PM
1	4F - 201	PGDS	April 23	300.0	16.35	68.67	29.0	4.67
2			May 23	296.0	11.12	60.79	31.0	4.22
3			June 23	298.0	14.92	44.26	28.0	4.28
4			July 23	297.0	22.09	31.86	29.0	4.86
5			August 23	294.0	20.67	36.50	31.0	4.18
6			September 23	298.0	15.78	24.10	28.0	3.46

All values Calculated to 3% O_2 dry basis

D. Captive Power Plant

(April 2023 to September 2023)

Furnace /Heater Name	Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	CO (mg/Nm^3)	PM (mg/Nm3)
GT & HRSG #1	189.0	8.41	44.02	5.33	6.74
GT & HRSG #2	191.9	7.76	34.76	5.25	7.45
Emergency DG	117.5	10.40	33.37	5.50	12.88

Month Wise Report

Sl. No.	Furnace Heater No.	Date Of Monitoring	Temp. in OC	Results in mg/Nm3			
				SO_2	NOx	CO	PM
1	GT -1 & HRSG - 1	May 23	188.0	8.17	54.20	5.5	6.52
		July 23	191.0	8.88	23.67	5.0	7.17
2.	GT -1 & HRSG - 2	May 23	191.0	7.30	46.24	5.5	7.09
		June 23	189.5	8.47	35.65	5.0	7.18
		July 23	194.0	5.94	28.11	5.0	7.97
		August 23	193.0	6.45	27.74	5.5	7.69
		Sept. 23	194.0	11.64	30.70	5.0	7.69
3.	Emergency DG	May 23	117.0	9.11	35.12	6.0	14.60
		August 23	118.0	11.68	31.61	5.0	11.16

E. Coal Fired Boiler (CFB)

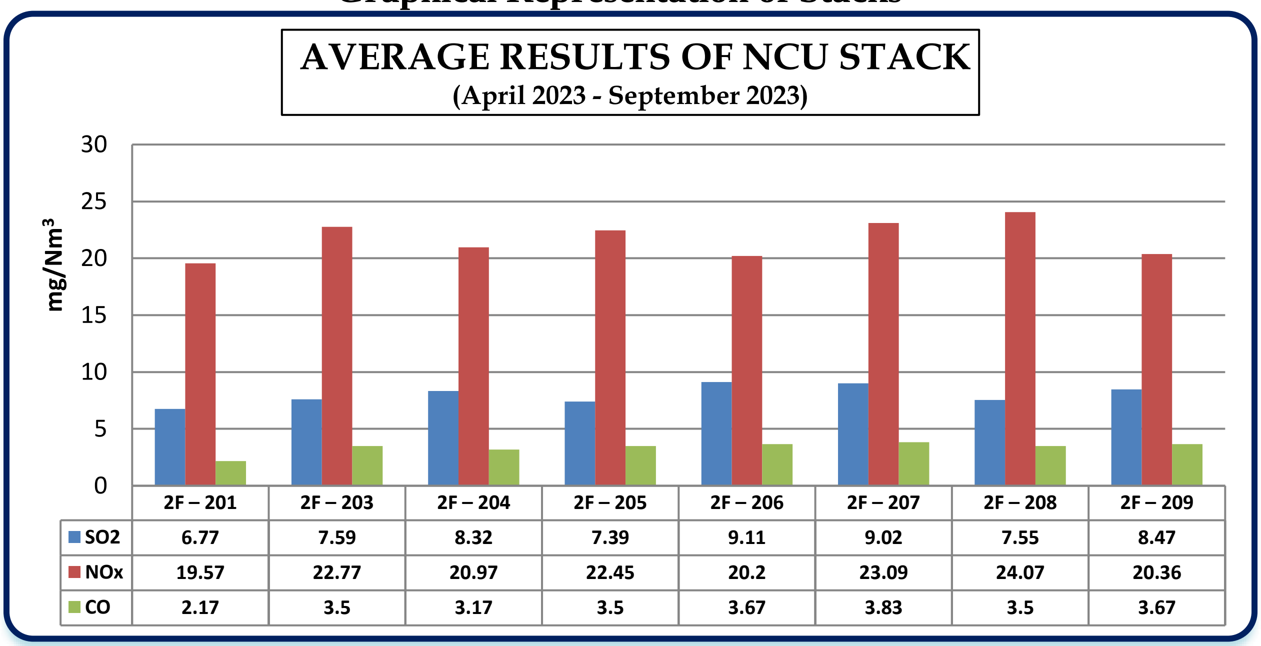
(April 2023 to September 2023)

Temp. (^{0}c)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	CO (mg/Nm^3)	PM (mg/Nm3)
140.3	34.93	48.55	73.33	23.61

Month Wise Report

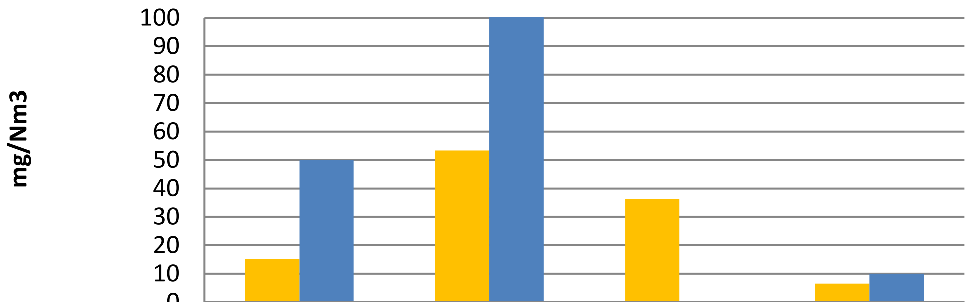
Sl. No.	Date Of Monitoring	Temp. in OC	Results in mg/Nm3			
			SO_2	NOx	CO	PM
1	April 23	134.5	34.355	55.385	80	20.25
3	May 23	138	41.27	53.11	72	21.895
5	June 23	136.5	26.325	53.945	70	19.825
7	July 23	135	22.18	44.88	66	28.54
9	August 23	147	39.185	41.18	82	26.675
11	Sept. 23	149.5	33.04	39.21	68	20.865

Graphical Representation of Stacks



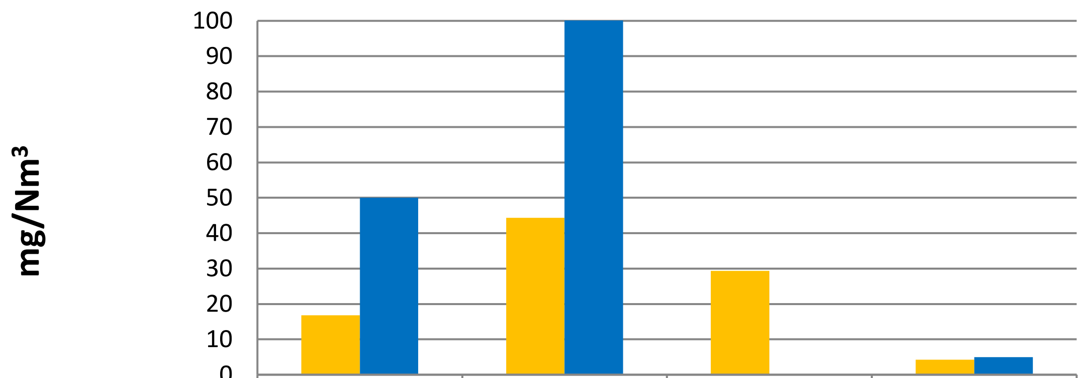
Graphical Representation of Stacks

HALF-YEARLY AVERAGE RESULTS OF PGHU STACK
(April 2023 - September 2023)



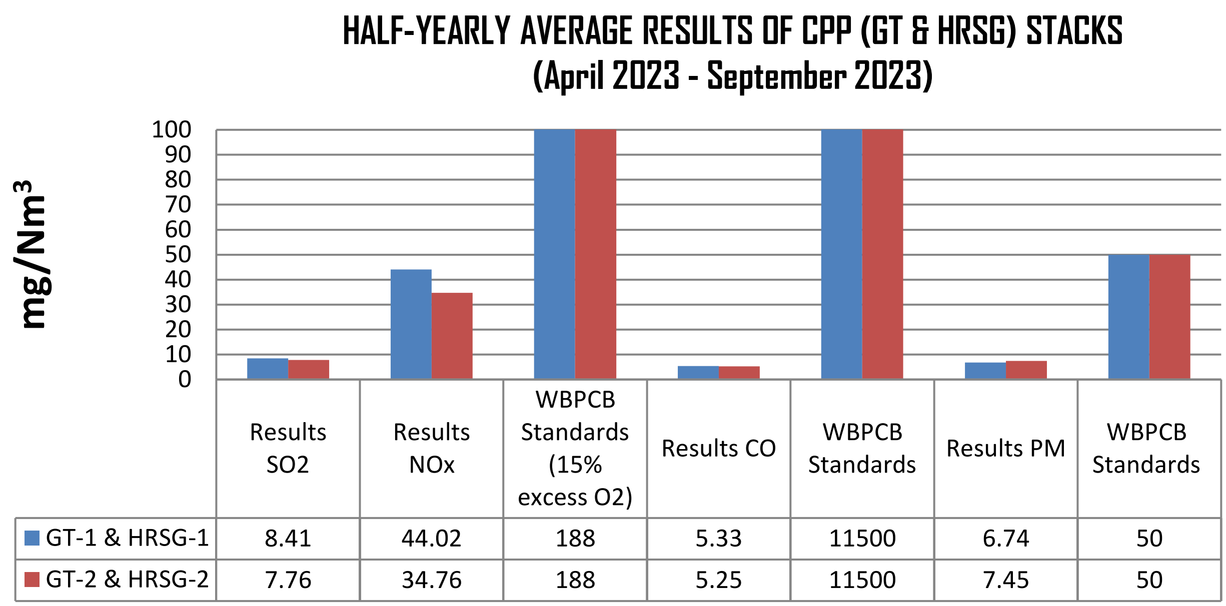
	SO2	NOx	CO	PM
Results @ 3% O2	15.17	53.36	36.29	6.47
Standard as per consent to operate of WBPCB @ 3% O2	50	350		10

HALF-YEARLY AVERAGE RESULTS OF PGDS STACK
(April 2023 - September 2023)

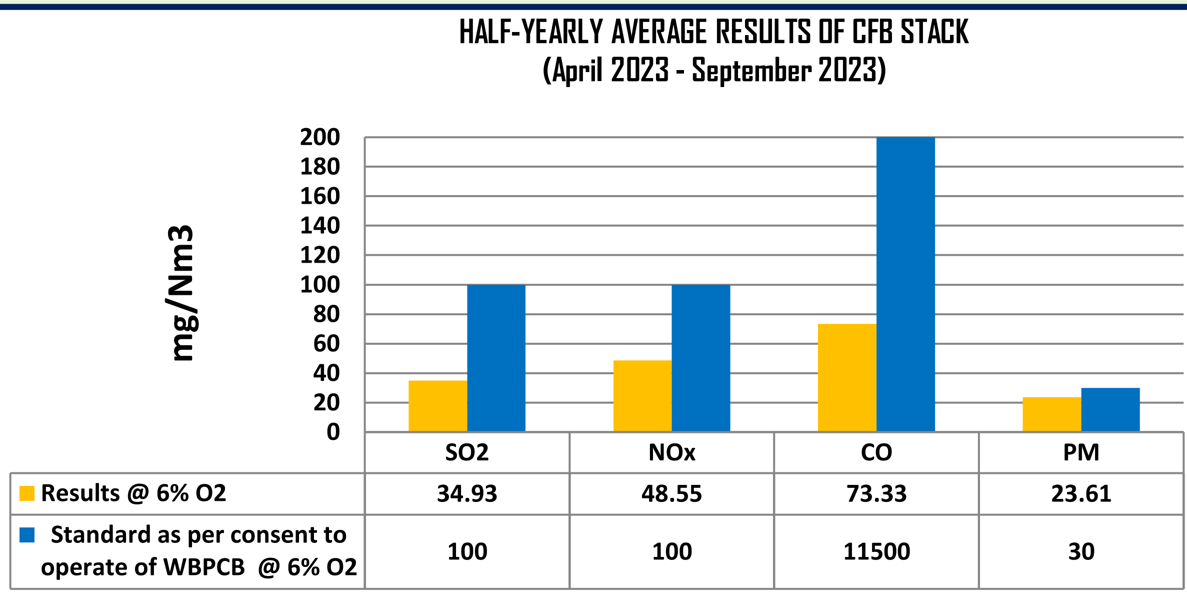


	SO2	NOx	CO	PM
Results @ 3% O2	**16.82**	**44.36**	**29.33**	**4.28**
Standard as per consent to operate of WBPCB @ 3% O2	**50**	**250**		**5**

Graphical Representation of Stacks



	Results SO2	Results NOx	WBPCB Standards (15% excess O2)	Results CO	WBPCB Standards	Results PM	WBPCB Standards
GT-1 & HRSG-1	8.41	44.02	188	5.33	11500	6.74	50
GT-2 & HRSG-2	7.76	34.76	188	5.25	11500	7.45	50



	SO2	NOx	CO	PM
Results @ 6% O2	34.93	48.55	73.33	23.61
Standard as per consent to operate of WBPCB @ 6% O2	100	100	11500	30

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 And Sychrometric 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: April 2023 to September 2023.
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
19.6	1.2	39.0	25.0	96.0	34.0	SSE	SW	1933.80	0.96	0.97

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

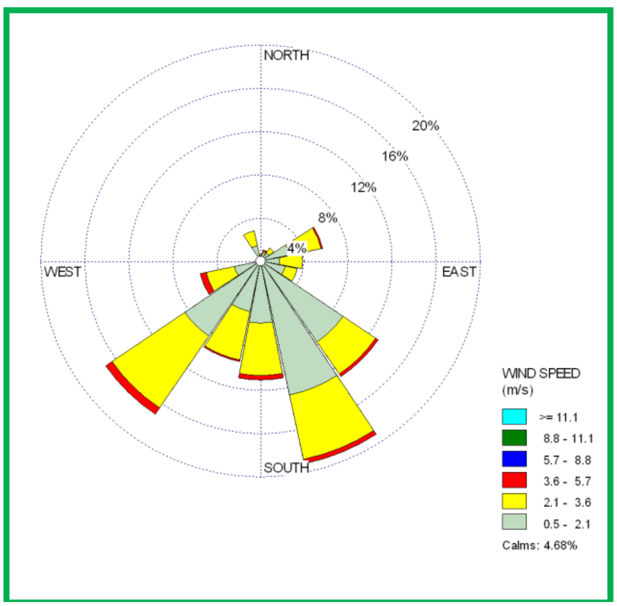
Month	Wind Velocity (Km/hr)		Temperature (^0C)		RH (%)		Predominant Wind Direction		Rainfall (mm)	Calm (%)	
	Max.	Min.	Max.	Min.	Max.	Min.	Day	Night	Monthly	Day	Night
April 2023	16.6	2.4	39.0	25.0	89.0	45.0	WSW	W, WSW	40.60	0.00	1.89
May 2023	19.6	1.4	41.5	30.0	91.0	50.0	SSE	ESE	81.30	0.0	0.94
June 2023	12.8	1.2	37.0	25.0	96.0	38.0	SSE	SSW	537.30	5.51	2.13
July 2023	14.5	2.2	39.0	25.0	96.0	45.0	S	S, SSE	282.50	0.00	0.00
August 2023	14.5	1.2	37.5	25.5	96.0	34.0	S	S	445.70	0.00	0.94
September 2023	12.9	1.6	36.0	26.0	96.0	48.0	SSE	SE	357.0	0.69	0.00

C. Meteorological Observation:

WINDROSE-FREQUENCY TABLE – FULL TIME
(Period: April 2023 to September 2023)

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	0.55	0.14	0.00	0.00	0.00	0.00	**0.69**
NNE	0.83	0.14	0.14	0.00	0.00	0.00	**1.11**
NE	0.96	0.55	0.00	0.00	0.00	0.00	**1.51**
ENE	2.75	2.89	0.14	0.00	0.00	0.00	**5.78**
E	1.79	2.07	0.00	0.00	0.00	0.00	**3.86**
ESE	2.34	1.10	0.00	0.00	0.00	0.00	**3.44**
SE	9.09	3.58	0.28	0.00	0.00	0.00	**12.95**
SSE	12.67	6.06	0.41	0.00	0.00	0.00	**19.14**
S	5.79	4.82	0.41	0.00	0.00	0.00	**11.02**
SSW	4.82	4.55	0.14	0.00	0.00	0.00	**9.51**
SW	8.40	7.98	0.69	0.00	0.00	0.00	**17.07**
WSW	2.48	2.62	0.55	0.00	0.00	0.00	**5.65**
W	0.14	0.14	0.00	0.00	0.00	0.00	**0.28**
WNW	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
NW	0.14	0.27	0.00	0.00	0.00	0.00	**0.41**
NNW	1.52	1.38	0.00	0.00	0.00	0.00	**2.90**
SUM%	**54.27**	**38.29**	**2.76**	**0.00**	**0.00**	**0.00**	**95.32**
CALM	**(0.00<=V<=0.5)**						**4.68**
							100.00

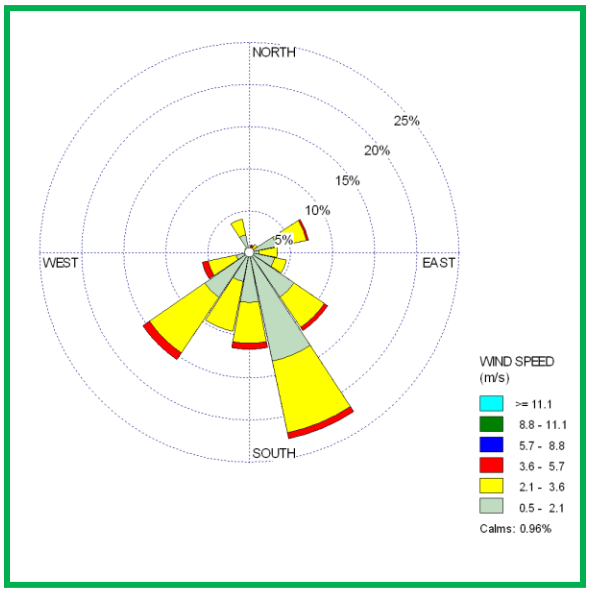
WINDROSE & GRAPH – FULL TIME



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	0.24	0.24	0.00	0.00	0.00	0.00	**0.48**
NNE	0.48	0.24	0.24	0.00	0.00	0.00	**0.96**
NE	0.48	0.72	0.00	0.00	0.00	0.00	**1.20**
ENE	3.42	3.61	0.24	0.00	0.00	0.00	**7.27**
E	1.20	2.17	0.00	0.00	0.00	0.00	**3.37**
ESE	3.13	1.45	0.00	0.00	0.00	0.00	**4.58**
SE	6.51	4.34	0.48	0.00	0.00	0.00	**11.33**
SSE	13.25	8.67	0.72	0.00	0.00	0.00	**22.64**
S	6.02	4.82	0.72	0.00	0.00	0.00	**11.56**
SSW	3.61	6.02	0.00	0.00	0.00	0.00	**9.63**
SW	6.51	7.95	0.96	0.00	0.00	0.00	**15.42**
WSW	1.69	3.37	0.72	0.00	0.00	0.00	**5.78**
W	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
WNW	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
NW	0.24	0.48	0.00	0.00	0.00	0.00	**0.72**
NNW	2.17	1.93	0.00	0.00	0.00	0.00	**4.10**
SUM%	**48.95**	**46.01**	**4.08**	**0.00**	**0.00**	**0.00**	**99.04**
CALM	**(0.00<=V<=0.5)**						**0.96**
							100.00

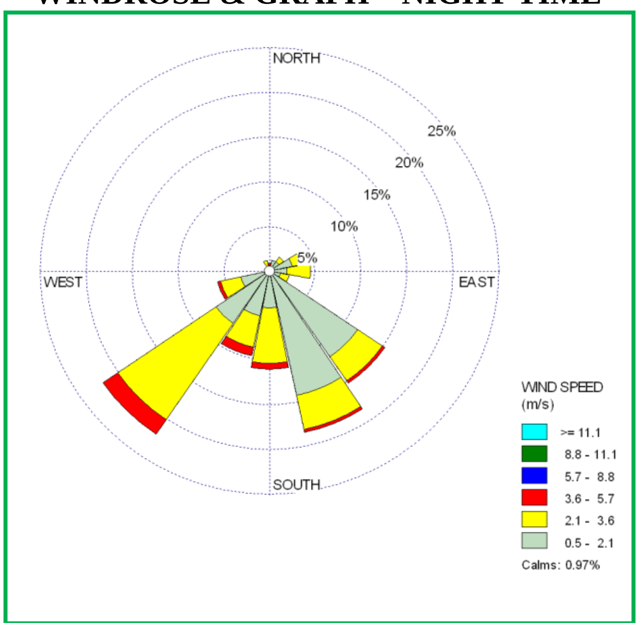
WINDROSE & GRAPH – DAY TIME



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	0.65	0.00	0.32	0.00	0.00	0.00	**0.97**
NNE	1.29	0.00	0.00	0.00	0.00	0.00	**1.29**
NE	1.29	0.65	0.00	0.00	0.00	0.00	**1.94**
ENE	2.59	1.29	0.00	0.00	0.00	0.00	**3.88**
E	1.94	2.59	0.00	0.00	0.00	0.00	**4.53**
ESE	1.29	0.97	0.00	0.00	0.00	0.00	**2.26**
SE	11.66	3.24	0.32	0.00	0.00	0.00	**15.22**
SSE	14.24	3.88	0.32	0.00	0.00	0.00	**18.44**
S	4.21	6.15	0.65	0.00	0.00	0.00	**11.01**
SSW	5.19	3.56	0.97	0.00	0.00	0.00	**9.72**
SW	7.12	12.94	1.94	0.00	0.00	0.00	**22.00**
WSW	3.24	2.27	0.32	0.00	0.00	0.00	**5.83**
W	0.32	0.32	0.00	0.00	0.00	0.00	**0.64**
WNW	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
NW	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
NNW	0.65	0.65	0.00	0.00	0.00	0.00	**1.30**
SUM%	**55.68**	**38.51**	**4.84**	**0.00**	**0.00**	**0.00**	**99.03**
CALM	**(0.00<=V<=0.5)**						**0.97**
							100.00

WINDROSE & GRAPH – NIGHT TIME

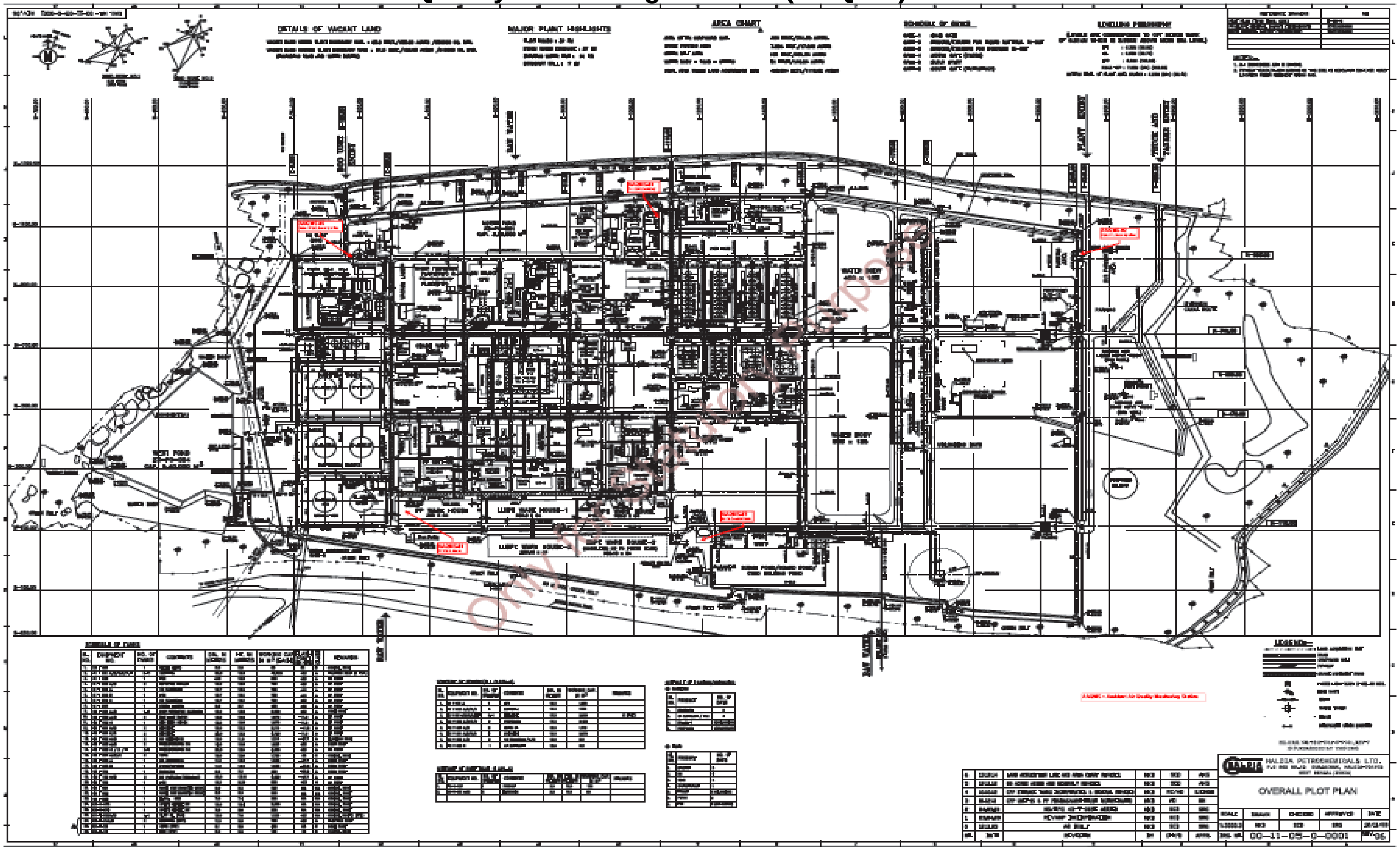


CHAPTER NO. – 05

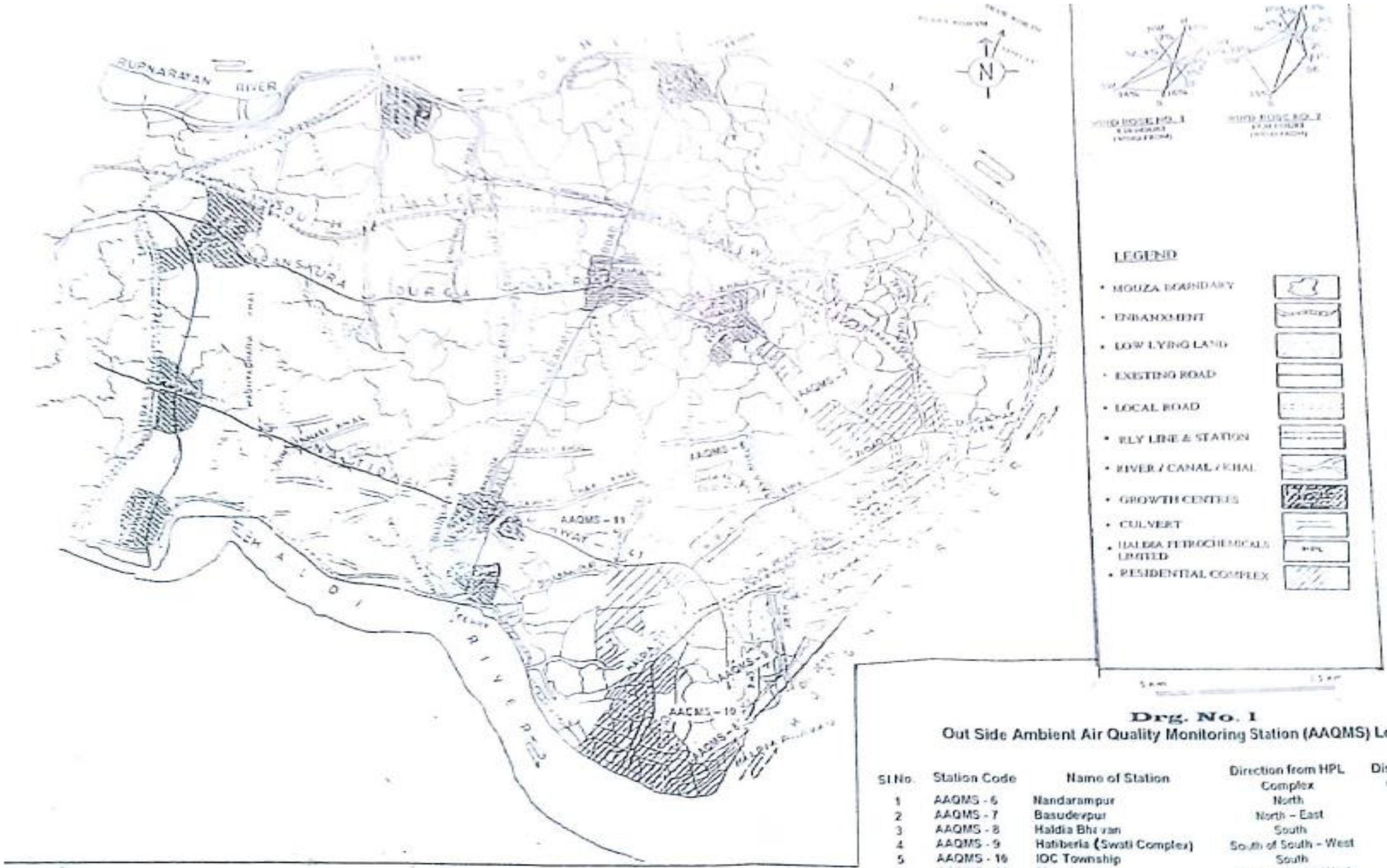
AMBIENT AIR QUALITY

5.0 AMBIENT AIR QUALITY

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



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

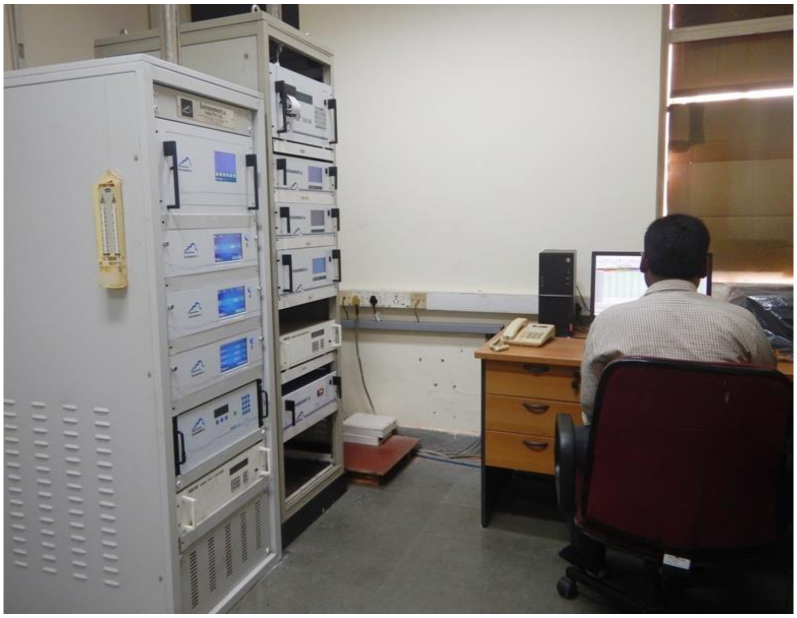


Drg. No. 1

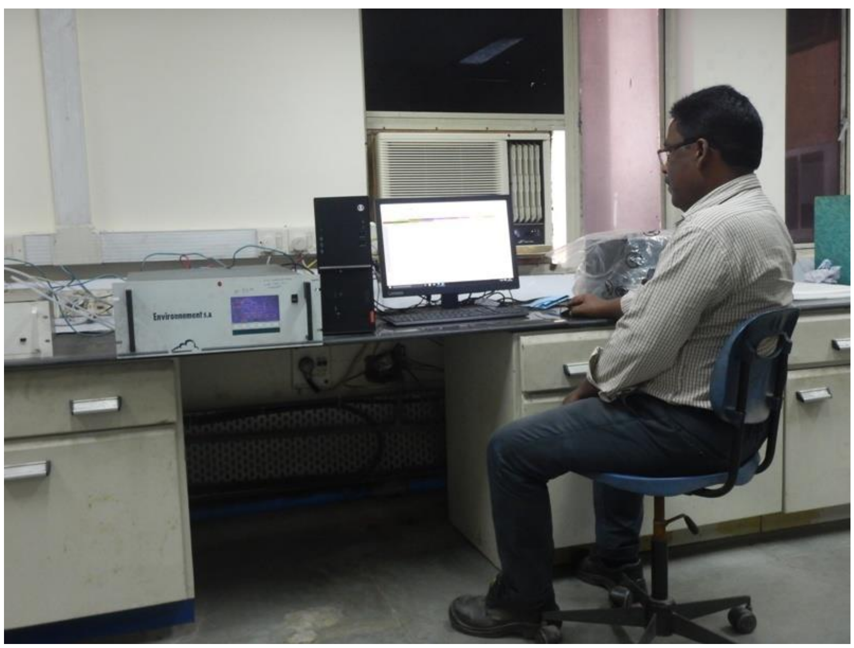
Out Side Ambient Air Quality Monitoring Station (AAQMS) Location

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

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. Out Side 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})	µg/m^3	IS: 5182(Part 23): 2006	1 µg/m^3 & above	Sampling of PM_{10} using Respirable Dust Sampler
2	Particulate Matter ($PM_{2.5}$)	µg/m^3	USEPA 40 CFR Parts 53 & 58	2 µg/m^3 & above	Sampling of $PM_{2.5}$ using Ambient Fine Dust Sampler,
3	Sulphur Dioxide (SO_2)	µg/m^3	IS:5182 (Part-2):2006 (First Revision)	4 µg /m^3 & above	Absorption in Na-tetrachloromercurate solution followed by Spectrophotometric analysis
4	Oxides of Nitrogen (NO_x)	µg/m^3	IS:5182 (Part-6):2006 (First Revision)	10 µg /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 (µg/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 (µg/m³)	
				Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area
8	Ammonia (NH_3)	µg/m³	Annual*	100	100
			24 hours**	400	400
9	Benzene (C_6H_6)		Annual*	05	05
10	Benzo(a)Pyrene (BaP)	ng/m³	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.

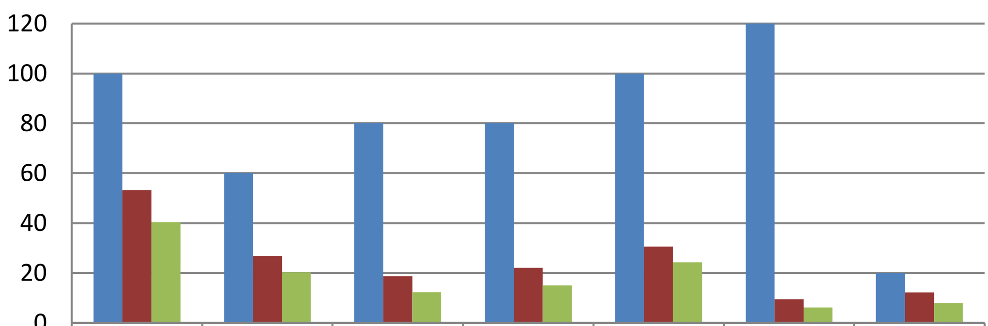
MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (On-site Plant)

Month	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NOx (µg/m³)	C_6H_6 (µg/m³)	CO (mg/m³)	O_3 (µg/m³)	NH_3 (µg/m³)	BaP (ng/m³)	As (ng/m³)	Ni (ng/m³)	Pb (µg/m³)
Apr 23	62.66	31.55	19.18	23.22	2.27	0.667	30.17	9.03	0.25	4.57	12.50	0.143
May 23	60.44	29.70	19.82	23.88	2.08	0.66	29.72	9.18	0.25	4.38	12.29	0.140
Jun 23	54.21	27.30	20.03	23.33	1.88	0.613	31.65	10.10	0.19	4.32	12.23	0.137
Jul 23	50.43	26.23	20.88	22.82	1.62	0.567	31.45	10.50	0.08	4.28	12.17	0.14
Aug 23	45.68	23.58	17.02	20.12	1.52	0.558	29.89	8.98	0.07	4.20	12.02	0.130
Sept 23	45.90	23.12	15.65	19.17	1.60	0.557	30.58	9.20	0.09	4.23	12.03	0.139
Average	**53.22**	**26.91**	**18.76**	**22.09**	**1.83**	**0.604**	**30.58**	**9.50**	**0.16**	**4.33**	**12.21**	**0.138**

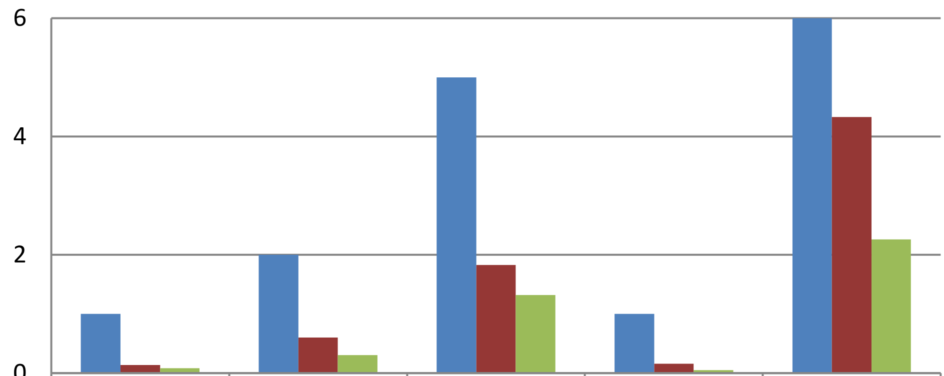
MONTHLY AVERAGE RESULTS OF AMBIENT AIR QUALITY (Off-site Plant)

Month	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NOx (µg/m³)	C_6H_6 (µg/m³)	CO (mg/m³)	O_3 (µg/m³)	NH_3 (µg/m³)	BaP (ng/m³)	As (ng/m³)	Ni (ng/m³)	Pb (µg/m³)
Apr 23	52.34	26.64	13.00	17.59	1.62	0.318	25.31	6.08	0.07	2.25	7.95	0.085
May 23	49.93	24.12	14.71	17.05	1.56	0.301	24.59	6.41	0.05	2.28	7.87	0.082
Jun 23	40.35	20.22	13.81	14.35	1.37	0.298	26.41	6.41	0.05	2.29	8.04	0.078
Jul 23	34.61	18.46	11.56	13.73	1.20	0.260	24.03	6.37	0.05	2.26	7.95	0.081
Aug 23	32.23	16.25	10.73	13.60	1.09	0.263	22.72	6.04	0.05	2.24	7.93	0.079
Sept 23	32.94	16.37	10.43	14.15	1.07	0.375	22.46	6.06	0.05	2.25	8.02	0.082
Average	**40.40**	**20.34**	**12.37**	**15.08**	**1.32**	**0.303**	**24.25**	**6.23**	**0.05**	**2.26**	**7.96**	**0.081**

Graphical Representation of AAQ Data



	PM10 (µg/m3)	PM2.5 (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)	O3 (µg/m3)	NH3 (µg/m3)	Ni (ng/m3)
Standards	100	60	80	80	100	400	20
Results (On-site)	53.22	26.91	18.76	22.09	30.58	9.5	12.21
Results (Off-site)	40.4	20.34	12.37	15.08	24.25	6.23	7.96



	Pb (µg/m3)	CO (mg/m3)	C6H6 (µg/m3)	BaP (ng/m3)	As (ng/m3)
Standards	1	2	5	1	6
Results (On-site)	0.138	0.604	1.830	0.160	4.33
Results (Off-site)	0.081	0.303	1.320	0.050	2.26

On-line Hydrocarbon Analyzer

One no. On-line Hydrocarbon Analyzer was installed & commissioned on January 2007. The On-line Hydrocarbon 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 **April 2023 to September 2023** are given.

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

Month	THC (ppm)	CH_4(ppm)	NMHC (ppm)
Apr 23	2.04	1.36	0.67
May 23	3.15	2.23	0.93
Jun 23	3.52	2.70	0.82
Jul 23	3.48	2.70	0.78
Aug 23	2.48	1.93	0.55
Sept 23	3.95	3.21	0.74
Average	**3.10**	**2.36**	**0.75**

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 **April 2023 to September 2023** are given.

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

Month	PM $_{10}$ (µg/m^3)	PM $_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	H_2S (µg/m^3)	NOx (µg/m^3)	NH_3 (µg/m^3)	O_3 (µg/m^3)	Benzene (µg/m^3)	CO (mg/m^3)
Apr 23	72.00	34.06	9.23	9.28	14.42	13.69	95.18	2.73	0.54
May 23	46.48	20.12	8.35	8.6	11.04	12.21	98.09	4.17	0.54
Jun 23	62.0	26.16	8.12	6.61	18.32	11.59	68.71	1.77	0.62
Jul 23	28.10	15.18	7.97	6.83	15.26	12.01	25.02	0.88	0.67
Aug 23	64.0	25.26	7.88	6.10	14.18	12.19	25.35	1.14	0.62
Sept 23	38.00	16.85	8.57	6.39	12.88	12.22	24.68	1.89	0.50
Average	**51.76**	**22.94**	**8.35**	**7.30**	**14.35**	**12.32**	**56.17**	**2.10**	**0.58**

Month	WS (m/s)	Wind Degree	Temperature(0C)	RH (%)	Pressure (mbar)	THC (PPM)	CH_4 (PPM)	NMHC (PPM)
Apr 23	4.77	348.74	30.98	49.27	702.5	3.52	2.55	0.98
May 23	2.76	2.42	31.11	48.91	702.2	4.59	2.43	2.16
Jun 23	3.911	340.76	31.69	47.29	702.4	3.88	2.53	1.36
Jul 23	4.27	332.67	30.63	50.23	702.5	4.16	2.50	1.68
Aug 23	3.93	351.5	30.44	50.74	702.4	3.49	2.71	0.79
Sept 23	3.69	341.65	29.86	52.37	702.4	4.47	2.68	1.81
Average	**3.89**	**286.29**	**30.79**	**49.80**	**702.40**	**4.02**	**2.57**	**1.46**

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

Work Zone Monitoring Results

Half-Yearly Average Results

(April 2022 to September 2022)

Plant	Standard (ppm)	Average Results (ppm)
Benzene Extraction Unit	1.0	**0.129**
Butadiene Extraction Unit	1.0	**0.190**
Hexane Area	500.0	**9.32**

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

Month-Wise Results

(April 2023 to September 2023)

	BENZENE		BUTADIENE		HEXANE	
	5P – 02 A & B Hartcut Feed Pump(BEU)	Benzene Sampling Point (050-SP-108)& 5P-07 A & B (BEU)	In Front Of Vessel No.-581	Butadiene product sampling point	V- 2405 Draining Point	Flaker House(Ground Floor)
Apr 23	0.072	0.209	0.128	0.248	9.12	10.68
May 23	0.086	0.184	0.112	0.266	7.64	9.58
Jun 23	0.064	0.212	0.136	0.286	8.44	11.24
Jul 23	0.052	0.186	0.098	0.254	7.56	10.62
Aug 23	0.058	0.198	0.122	0.267	8.12	11.08
Sept 23	0.049	0.182	0.114	0.246	7.38	10.41

All results are in ppm.

Month-Wise Benzene Emission from Vent of Benzene Extraction Unit & Benzene Recovery Unit.

(April 2023 to September 2023)

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

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)

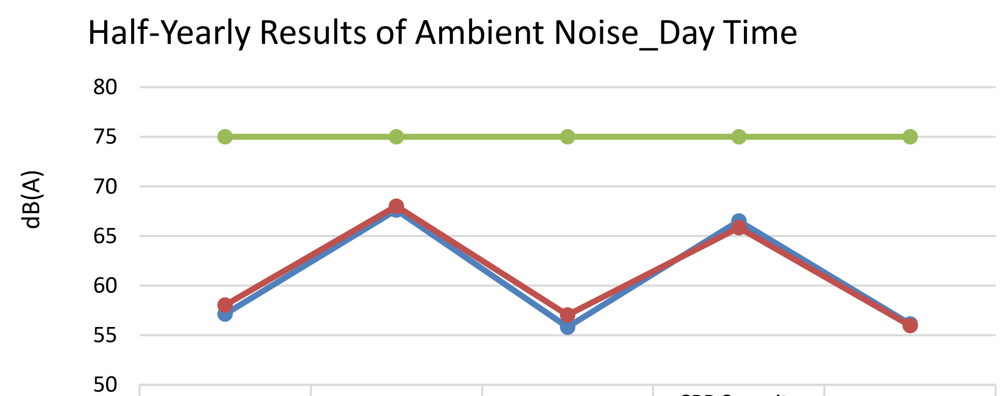
Duration	Unit are dB(A)			
	Industial	Commercial	Residential	Silence
DAY (6 am to 10 pm)	**75**	**65**	**55**	**50**
NIGHT (10 pm to 6 am)	**70**	**55**	**45**	**40**

Ambient Noise Level (Average) Apr 2023 to Sept 2023

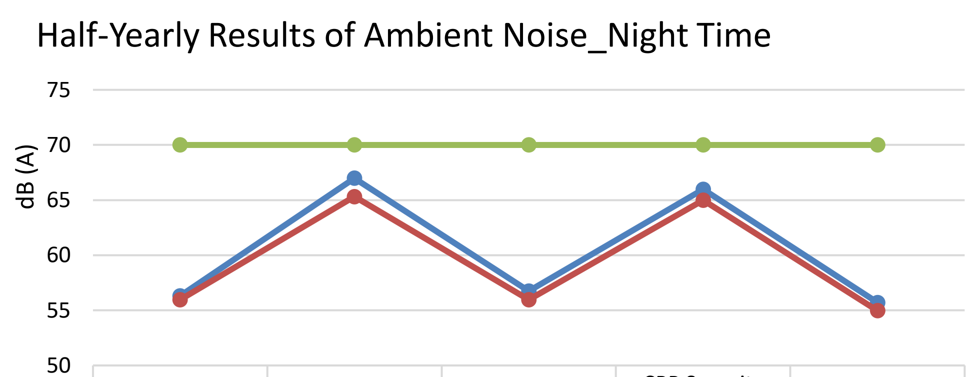
LOCATION	April 2023		July 2023	
	Day	Night	Day	Night
Near Gate No-1	57.12	56.31	58.02	55.96
Near Gate No-3	67.62	66.98	68.01	65.32
Near South Gate	55.82	56.75	57.04	55.96
Near CPP Security Office	66.53	65.99	65.85	64.98
Near North Gate	56.14	55.71	55.97	54.97

Certificate No. :TC-7649

Graphical Representation of Ambient Noise Data



	Gate No 1	Gate No 3	South Gate	CPP Security Office	North Gate
Apr-23	57.12	67.62	55.82	66.53	56.14
Jul-23	58.02	68.01	57.04	65.85	55.97
Statutory Norms	75	75	75	75	75



	Gate No 1	Gate No 3	South Gate	CPP Security Office	North Gate
Apr-23	56.31	66.98	56.75	65.99	55.71
Jul-23	55.96	65.32	55.96	64.98	54.97
Statutory Norms	70	70	70	70	70

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.

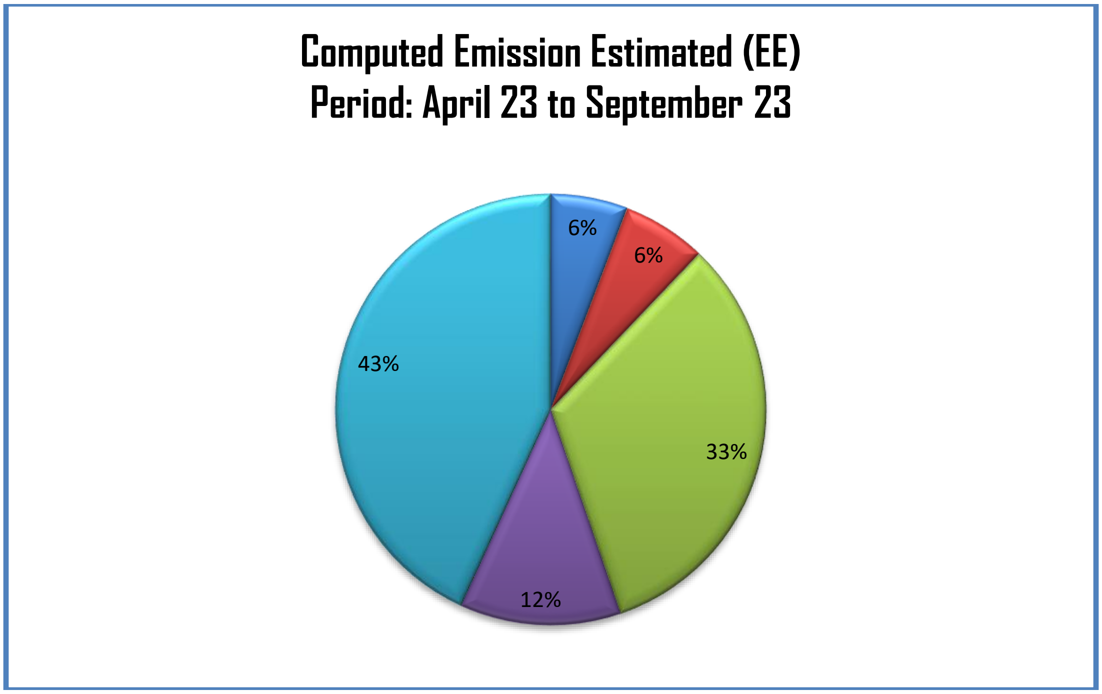
All screening values must be recorded according to the applicable ranges. The product of the appropriate emission factor and the number of components in each screening value range and source type. The total emission rate is the sum of all the emission rates for each value range and source type.

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.

Estimated VOC emission from CPP, PP, HDPE, LLDPE & IOP (ECR)

Location	Computed Emission Estimates (EE) Actual Unit – Ton/Annum	Computed Emission Estimates (EE) in 100%
CPP	0.011	5.79
PP	0.012	6.32
HDPE	0.062	32.63
LLDPE	0.023	12.11
IOP_ECR	0.082	43.16
Total	**0.190**	**100.00**



Total VOC emission from CPP, PP, HDPE, LLDPE & IOP (ECR)

1. Total VOC emission from CPP measured in April 23:

No of points checked: 250
No of leaking (VOC>1ppm) points: 10
No of non leaking points: 240

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	4	0	0	0.00112
	Heavy liquid	0	0	0	0
Flange	All	6	0	0	0.00012
				Total	**0.00124**
					0.89(kg/month) / 0.011 (Ton/Annum)

2. Total VOC emission from PP measured in April 23:

No of points checked: 508
No of leaking (VOC>1ppm) points: 20
No of non leaking points: 488

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	4	0	0	0.00112
	Heavy liquid	0	0	0	0
Flange	All	16	0	0	0.00032
				Total	**0.00144**
					1.04(kg/month) / 0.012 (Ton/Annum)

3. Total VOC emission from HDPE measured in May to June 23:

No of points checked: 1029
No of leaking (VOC>1ppm) points: 79
No of non leaking points: 950

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	1	0	0	0.00198
	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	64	0	0	0.00128
				Total	**0.00718**
					5.17 (kg/month) / 0.062 (Ton/Annum)

4. Total VOC emission from LLDPE measured in July 23:

No of points checked: 510
No of leaking (VOC>1ppm) points: 31
No of non leaking points: 479

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	8	0	0	0.00224
	Heavy liquid	0	0	0	0
Flange	All	23	0	0	0.00046
				Total	**0.0027**
					1.94(kg/month) / 0.023 (Ton/Annum)

5. Total VOC emission from IOP_ECR (Tank Farm & Sphere) measured in Sept. to Oct. 23:

No of points checked: 1301
No of leaking (VOC>1ppm) points: 91
No of non leaking points: 1210

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	1	0	0	0.00198
	Heavy liquid	0	0	0	0
Valve	Gas/Vapor	0	0	0	0
	Light liquid	22	0	0	0.00616
	Heavy liquid	0	0	0	0
Flange	All	68	0	0	0.00136
				Total	**0.0095**
					6.84 (kg/month) / 0.082(Ton/Annum)

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