ENVIRONMENTAL MONITORING REPORT

HALDIA DOCK COMPLEX
SYAMA PRASAD MOOKERJEE PORT, KOLKATA

1ST QUARTER REPROT
Dec 2023 – Feb 2024

श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता
SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Formerly Kolkata Port Trust

HUBERT ENVIRO CARE SYSTEMS (P) Ltd
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CONTENTS

ABBREVIATIONS

CPCB	Central Pollution Control Board
HDC	Haldia Dock Complex
HECS	Hubert Enviro Care Systems (P) Ltd
KDS	Kolkata Dock System
SMPK	Syama Prasad Mookerjee Port, Kolkata
MoEF & CC	Ministry of Environment, Forest & Climate Change
WBPCB	West Bengal Pollution Control Board
APHA	American Public Health Association
NAAQ	National Ambient Air Quality
PM	Particulate Matter
NO	Nitrogen Oxide
CO	Carbon Monoxide
SO_2	Sulfur Dioxide
NO_2	Nitrogen Dioxide

FOREWORD

Syama Prasad Mookerjee Port, Kolkata (SMPK)has Port Operation in West Bengal State. Syama Prasad Mookerjee Port, Kolkata comprises two dock systems namely Kolkata Dock System (KDS) and Haldia Dock Complex (HDC). SMP, Kolkata has planned to monitor the current environmental status at the Haldia Dock Complex. They entrusted the work of environmental quality monitoring to M/s. Hubert Enviro Care Systems (P) Ltd., Chennai having an Environmental Laboratory approved by the Central Pollution Control Board (CPCB)/Ministry of Environment, Forest & Climate Change (MoEF & CC) through their Work Order No. I&CF/IZ&R/T/398/539.A comprehensive environmental monitoring program has been planned to monitor data for the Quarter of Dec2023 – Feb 2024. The monitored data on Ambient Air Quality, Ambient Noise Quality, Water Quality, Sediment Quality in river and Green Belt Development are collected and presented in this report.

Our sincere thanks to **Haldia Dock Complex, SMP, Kolkata** for awarding this work and Haldia Dock Complex Authorities for their kind co-operation during the study period.

Date: 15/03/2024

Place: Chennai – 600 083

HUBERT ENVIRO CARE SYSTEMS (P) LTD. Chennai 600 032

(M.Sivaprakasam)

Laboratory Manager

EXECUTIVE SUMMARY

1.0 **Syama Prasad Mookerjee Port, Kolkata (SMPK)** has port operations at Kolkata and Haldia of West Bengal State.

2.0 SMP, Kolkata has planned to monitor the current environmental status of the entire Haldia Dock Complex as a part of regular monitoring. Hence, they entrusted the work of environmental quality monitoring to **M/s. Hubert Enviro Care Systems (P) Ltd., Chennai**.

3.0 Study

The samples were collected from the Haldia Dock Complex with proper preserved condition, after that it was transported to HECS laboratory, Chennai within 48 hours and immediately commenced to analysis process as per letter no. **I&CF/IZ&R/T/398/539**.The data collection programme is given below:

3.1 Ambient Air Quality Monitoring

Ambient air quality was monitored at four locations namely **3rd Oil Jetty office building, Marine House office building, Electrical Maintenanceoffice buildingat Haldia Township and ChiranjibpurOperational Building.**

The air quality monitoring locations are detailed in **Table 1**.

Table 1. Details of Ambient Air Quality Monitoring Locations

S. No.	Name of Location and Code	Code
1	3rd Oil Jetty office building	AAQ 1
2	Marine House office building	AAQ 2
3	Electrical Maintenance office building at Haldia Township	AAQ 3
4	ChiranjibpurOperational Building	AAQ 4

Particulate Matter less than 10 µm (PM_{10}), Particulate Matter less than 2.5 µm ($PM_{2.5}$), Sulphur dioxide (SO_2), Oxides of Nitrogen oxide (NO_x), Carbon monoxide (CO), Ozone (O_3), Amonia (NH_3), Benzene (C_6H_6), Benzo (a) Pyrene (BaP), Lead (Pb) Arsenic (As) and Nickel (Ni).

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1st AAQM stationwas set up at **3rd Oil Jetty.**The 2nd and 3rd AAQM station were set up at **Marine House** andat **Electrical Maintenanceoffice building** at Haldia Township.The 4th location was collectedat**Chiranjibpur Operational Building.** The air quality status is presented in this report. While comparing with NAAQ norms for industrial and mixed-use environment for PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, NH_3, O_3, C_6H_6, BAP, Pb, As and Ni values were well within the limits.

3.2 Noise Monitoring

Ambient noise monitoring was conducted using Extech sound level meter during day time and night time at four locations. Noise level recorded at all locations was within the day time and night time noise criteria as per CPCB (Central Pollution Control Board) norms.

3.3 Water Quality Monitoring

3.3.1 Marine / Riverine Water:

Marine water samples collected from four locations namely **near1stOil Jetty (upstream), near Outer Terminal – II, near Lock Approach and near HFTPL Jetty (downstream).** One sample collected at 0.3meter below from the surface water level and another sample collected at 7 meter below surface water level at each location and tested as per IS: 3025 and APHA 23rd Edition. In general, Water Quality of 8 samples of 4 locations were within the prescribed limits with respect to Primary Water Quality Criteria for Class SW-IV (for Harbour Waters).

3.4 Marine / Riverine Water Biological Quality

Marine water samples from four locations namely **near1stOil Jetty (upstream), near Outer Terminal – II, near Lock Approach and near HFTPL Jetty (downstream)**were collected and tested as per APHA method and the results recorded. Further, biological parameters such as light penetration, chlorophyll and primary productivity were measured and the results are recorded. Phytoplankton and Zooplankton species were also reported in various locations and results are reported.It is inferred from the test results that all the tested marine water quality parameters from four locations were within the marine water quality standards.

3.5 Sediment Quality

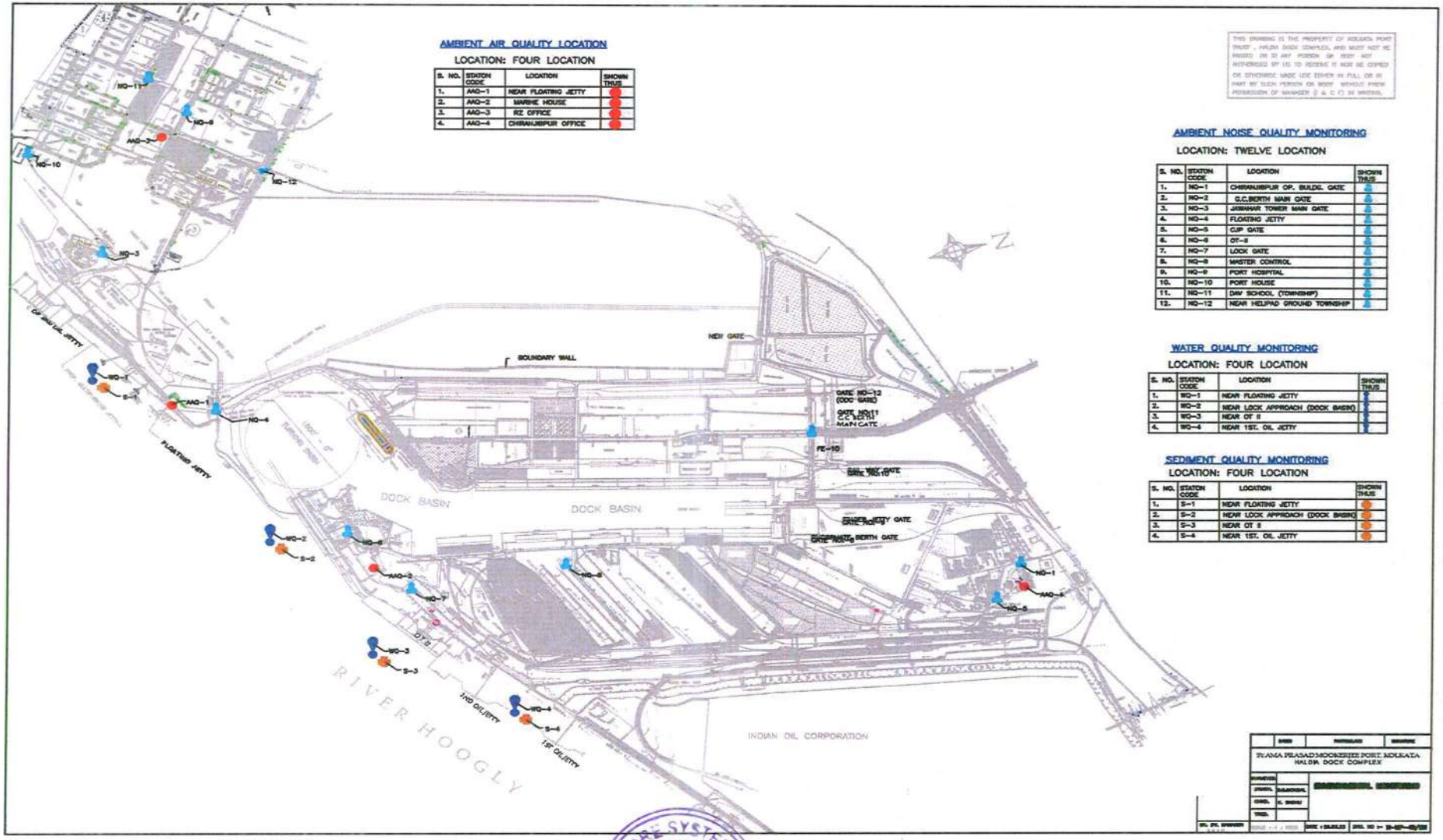
Marine sediment samples were collected from four locations namely **near1st Oil Jetty (upstream), near Outer Terminal – II, near Lock Approach and near HFTPL Jetty (downstream)**,tested for the given parameters and results recorded. Benthos organisms were identified in the marine sediment samples and recorded in the report.

3.6 Green Belt Development

Green belt surveys were conducted within the township area of Haldia Dock Complex. The main objective of the green belt development is to absorb the dust and gaseous pollutants; ultimately it increases CO_2 absorption and releasing of O_2 for a better environment besides providing an aesthetic view.

3.7 Conclusion

Ambient air quality values recorded were within the stipulated NAAQ/ CPCB norms for industrial and mixed-use environment. Marine water quality was within the prescribed limits as per Primary Water Quality Criteria for ClassSW-IV (for Harbour Waters). All tested marine sediments adhered to the marine sediment quality standards. The recorded noise level in the day time and night time were compared with the CPCB standards and the results found – were within the limit. Biodiversity in green belt area was observed. Species diversity, richness, abundance and evenness values were Calculated.



1.0 INTRODUCTION

1.1 Background

Syama Prasad Mookerjee Port, Kolkata is the only river line port and one of the major ports in the country. Syama Prasad Mookerjee Port, Kolkata is established in 1870 and is presently serving a vast hinterland that comprises the entire Eastern India including Bihar, Jharkhand, Uttar Pradesh, Madhya Pradesh, Assam, Chhattisgarh, North-East Hill states and the land-locked countries of Nepal & Bhutan. Syama Prasad Mookerjee Port, Kolkata is often called the gateway to Eastern India. Syama Prasad Mookerjee Port, Kolkata comprises of two dock systems viz. Kolkata Dock System (KDS) and Haldia Dock Complex (HDC). The pilotage distance from Haldia to sand heads is 130 km and from HDC to Kolkata is 104 km upstream.

In order to assess the efficacy of the present environmental management particularly at Haldia Dock Complex and to further improve the air and water quality, Syama Prasad Mookerjee Port, Kolkata desired to carry out a detailed study on environmental management at Haldia Dock Complex. Haldia Dock Complex (HDC) is located on the western bank of river Hooghly at about 104 km downstream of Kolkata and 130 km upstream of sand heads.

1.2 Environmental Management Plan

Being concerned towards Environmental Protection, Syama Prasad Mookerjee Port, Kolkata has prepared an extensive Environmental Management Plan for port operations. The work was entrusted to **Hubert Enviro Care Systems Pvt. Ltd, Chennai** vide **work order no.I&CF/IZ&R/T/398/539 dated 27.12.2023.**The field monitoring studies were carried out for ambient air quality, ambient noise level, water quality, sediment quality, and green belt development, and their results are presented in this report.

1. Ambient Air Quality Monitoring
2. Noise Level Monitoring
3. Marine / Riverine Water Analysis: Physio-Chemical Parameters
4. Marine / Riverine Water Analysis: Biological Parameters
5. Marine / Riverine Sediment Analysis: Physio-Chemical parameters
6. Marine/Riverine Sediment Analysis: Biological Parameters
7. Green Belt Study

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2.0 SCOPE AND METHODOLOGY

2.1 Scope & Methodology

The scope of the study and the present report covers the detailed characterisation of the existing environmental status in the project area for major environmental components namely Ambient Air Quality, Ambient Noise Level, Marine / Riverine Water Quality, Sediment Quality including Marine Biological analysis and Green Belt Development.

3.0 AMBIENT AIR QUALITY STATUS

3.1 Selection of Monitoring Stations

Ambient Air Quality Monitoring (AAQM) stations were set up at four locations with due consideration of Meteorological conditions on synoptic basis, Topography of the study area Representatives of regional background air quality for obtaining baseline status Representatives of likely impact areas and consultation with Halia Dock Complex officials. The monitoring locations are given in **Table 3.1**.

Table 3.1: Details of Ambient Air Quality Monitoring Locations

S. No.	Name of Location and Code	Code
1	3rd Oil Jetty Office Building	AAQ 1
2	Marine House Office Building	AAQ 2
3	Electrical Maintenance Office Building at Haldia Township	AAQ 3
4	ChiranjibpurOperational Building	AAQ 4

3.2 Sampling and Analytical Techniques:

With a view to collecting the samples, Envirotech make calibrated Respirable Dust Samplers (RDS-APM 460 BL) along with Gaseous attachment and Fine Particulate Sampler (FPS-APM 550) have been used. The RDS is capable of drawing air at a flow rate of 0.95 to 1.3 m^3/min with very little pressure drop for RDS and FPS is designed to operate at an air flow rate of 1m^3/hr. Filter papers (EPM 2000, Whattmann & Whattmann 46.2 dia) were used for the collection of particulate matters and heavy metals. SO_2& NOx were collected by drawing air at a flow-rate of 0.5 liters per minute (lpm) through an absorbing solution for the duration of 24 hrs. Details procedures are discussed below.

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Table-3.2: Sampling & Analysis Methodology

Sl. No.	Parameter	Methodology
1	Particulate Matter 10 (PM_{10}) ($\mu g/m^3$)	IS: 5182 (Part -23):2006
2	Particulate Matter 2.5 ($PM_{2.5}$) ($\mu g/m^3$)	IS: 5182 (Part -24):2019
3	Sulphur Dioxide SO_2 ($\mu g/m^3$)	IS: 5182 (Part -2):2001 West and Gaeke Method
4	Oxides of Nitrogen ($\mu g/m^3$)	IS: 5182 (Part - 6):2006, Jacob & Hochheiser modified Method
5	CO(mg/m^3)	IS: 5182 (Part - 10):1999
6	NH_3($\mu g/m^3$)	IS: 5182 (Part - 25):2018
7	Ozone($\mu g/m^3$)	IS: 5182 (Part - 9):1974
8	Benze(a)pyrene(ng/m^3)	IS: 5182 (Part - 12):2004
9	Benzene($\mu g/m^3$)	IS: 5182 (Part - 11):2006
10	Lead($\mu g/m^3$)	IS: 5182 (Part - 22):2004
11	Arsenic (ng/m^3)	IS: 5182
12	Nickel(ng/m^3)	IS: 5182 (Part - 26):2020

PM_{10}: A calibrated RDS (Respirable Dust Sampler) is used for the determination of PM_{10}. PM_{10} is a measure of particulate matter having size up to 10 µ.Air is sampled isokinetically through a cyclone where particles greater than 10 µ are separated and then passed through a glass microfiber filter. The difference in weight before and after sampling is determined and is divided by the volume of air.

$PM_{2.5}$: $PM_{2.5}$ is a measure of particulate matter having size up to 2.5 µ. APM 550 fine particles sampler is based on Wind Impactor design standardized by USEPA for ambient air quality monitoring. Calibrated APM 550 fine particle sampler with PTFE 47 mm diameter filter media was used for the determination of fine particulate matter, $PM_{2.5}$.

SO_2: Modified West-Geake Spectrophotometric Method: Sulphur dioxide (SO_2) was absorbed in a scrubbing solution of potassium tetrachloro-mercurate (K_2HgCl_4) and was allowed to react with HCHO and then with Pararosaniline Hydrochloride ($C_{19}H_{18}ClN_3$). The absorbance of the product, red-violet dye was measured using Digital Spectrophotometer (Agilent – cary60) at a wavelength of 560 nm.

NO_2: Jacob and Hochheiser modified Method: Nitrogen oxides as NO_2 (Nitrogen dioxide) were collected by bubbling air through sodium arsenate solution to form a stable solution of sodium nitrite. The nitrite ion produced during sampling is converted into a colour complex and by reaction of the exposed absorbing reagent with phosphoric acid, sulfanilamide and N

(1-naphthyl) ethylamine dihydrochloride, and nitrogen dioxide concentration is determined using digital spectrophotometer (Agilent – cary 60) at a wavelength of 540 nm.

Carbon monoxide (CO): Carbon monoxide is collected in a Teddler bag and CO was determined using Serinus 30 NDIR CO analyzer.

Particulate Lead : The exposed EPM 2000 filter papers were cut into small pieces put into a glass beaker, poured 100 ml distilled water 10 ml nitric acid were added and digested on a hot plate in simmering heat. The clear solutions obtained after digestion was filtered and made up to 25ml and were analyzed by AAS for lead and arsenic. Concentration of lead was calculated by taking the result obtained from the analysis and dividing it with the volume of air sampled.

Nickel : The Inductively coupled plasma mass spectrometry (ICP-MS) technique is used to assess the concentration of an analyte in the sample. The method is based on active sampling using RDS (Respirable Dust Sample) Sampler and then sample analysis is done by ICP-MS.

Benzene : Ambient air is sucked through charcoal tube using low flow sampler. Benzene is adsorbed by activated charcoal in the charcoal tube. Desorption of the adsorbed Benzene is done using Carbon Di Sulphide. The substance desorbed in CS_2 is analyzed by capillary Gas Chromatography using a flame ionization Detector.

Benzo (a) pyrene : Particulate phase Poly Aromatic Hydrocarbons in ambient air and fugitive emission is collected by a RDS (Respirable Dust Sample) range (~1.2 m^3/min) on a glass fiber filter and subsequent analysis by Gas Chromatograph using a Flame Ionisation Detector. It is capable of detecting sub nanogram concentration of PAH (Poly Aromatic Hydrocarbon) with a total sample of ~480 m^3 of air over a period of 8 hrs.

Arsenic : The Inductively Coupled Plasma Mass Spectrometry (ICP-MS) technique is used to assess the concentration of an analyte in the sample. The method is based on active sampling using RDS (Respirable Dust Sample) Sampler and then sample analysis is done by ICP-MS.

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Ammonia : Ammonia is collected in dilute Sulphuric acid solution in midget impingers to form Ammonium Sulphate. The solution is treated with Nesslers reagent to produce a yellow brown complex. The Ammonia concentration is determined by reading the absorption of the complex at 440 nm and comparing with a standard curve.

Ozone : Micro-amounts of ozone and the oxidants liberate iodine when absorbed in a 1% solution of potassium Iodide buffered at pH 6.8 ± 0.2. The iodine is determined spectrophotometrically by measuring the absorption of tri-iodide ion at 352 nm.

3.3 Analytical Result and Interpretation

The ambient air quality monitoring analytical results and interpretation are given in the following **Test Report and Figure.**

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TEST REPORT-1

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Ambient Air Quality**
Sample Mark : **AAQ 1 - 3rd Oil JettyOffice Building**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**

S.No.	Sampling Date	Concentration of parameters monitored											
		SO_2 ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	CO (mg/m^3)	NH_3 ($\mu g/m^3$)	Ozone ($\mu g/m^3$)	Benzo(a) Pyrene (ng/m^3)	Benzene ($\mu g/m^3$)	Lead ($\mu g/m^3$)	Arsenic (ng/m^3)	Nickel (ng/m^3)
1	08.02.2024 to 09.02.2024	13.48	16.15	71.35	32.17	0.08	5.63	11.79	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
2	10.02.2024 to 11.02.2024	11.87	20.45	85.56	43.76	0.07	7.23	11.43	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
3	16.02.2024 to 17.02.2024	10.23	19.12	80.64	31.23	0.06	5.29	10.23	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
4	17.02.2024 to 18.02.2024	12.97	22.90	76.67	44.38	0.06	8.89	12.98	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
5	21.02.2024 to 22.02.2024	9.86	21.79	81.91	39.43	0.07	7.23	11.84	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
6	23.02.2024 to 24.02.2024	13.14	22.61	73.36	37.63	0.08	6.81	13.17	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
7	26.02.2024 to 27.02.2024	12.76	20.39	75.43	34.85	0.09	7.49	12.57	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
8	27.02.2024 to 28.02.2024	11.17	18.76	76.74	30.84	0.08	7.91	13.91	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
	Min	**9.86**	**16.15**	**71.35**	**30.84**	**0.06**	**5.29**	**10.23**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
	Max	**13.48**	**22.90**	**85.56**	**44.38**	**0.09**	**8.89**	**13.91**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
	Avg	**11.94**	**20.27**	**77.71**	**36.79**	**0.07**	**7.06**	**12.24**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
NAAQS –National Ambient Air Quality Standards (2009)		**80**	**80**	**100**	**60**	**2**	**400**	**100**	**1**	**5**	**1**	**6**	**20**

Note: SO_2–Sulphur dioxide, NO_x- Nitrogen oxide, PM_{10} - (Particulate Matter size less than 10 µm), $PM_{2.5}$ - (Particulate Matter size less than 2.5 µm) CO - Carbon monoxide; NAAQ Norms-National Ambient Air Quality Stipulated by CPCB for Industrial Areas 2009. 2. Sampling time: SO_2, NO_x, PM_{10}, $PM_{2.5}$, NH_3, Benzo(a) Pyrene, Benzene, Lead, Arsenic, Nickel for 24 Hrs. monitoring, CO and Ozone for 8 Hrs. Monitoring

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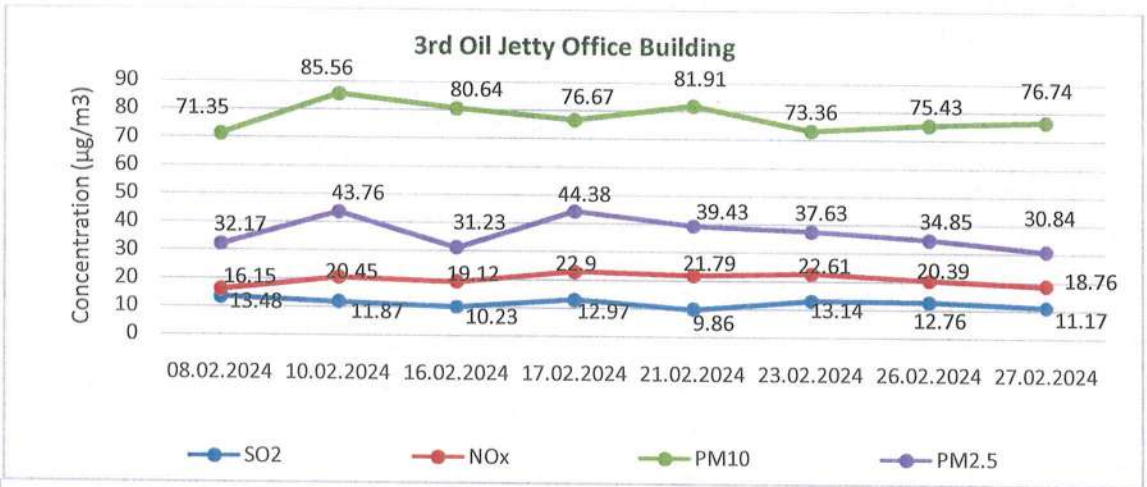
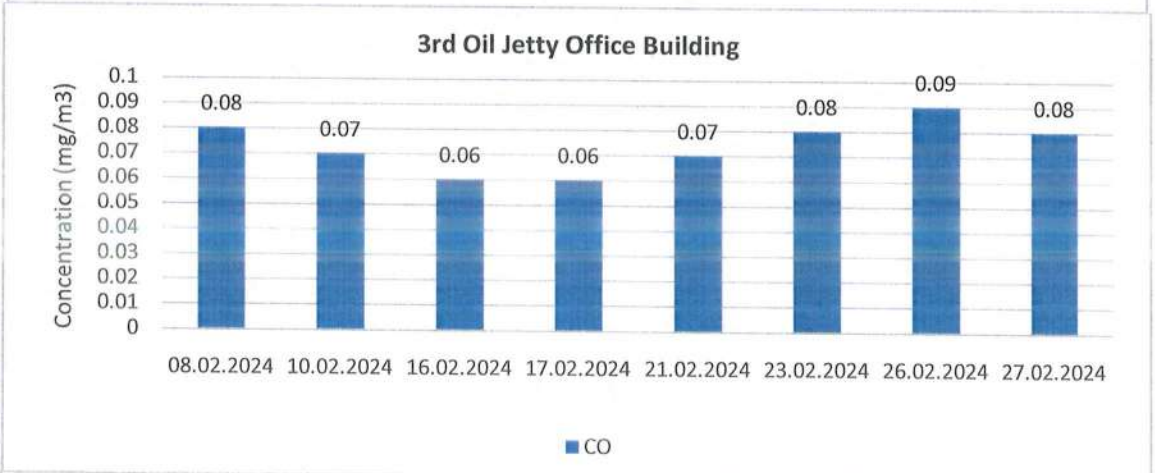
Authorized Signatory

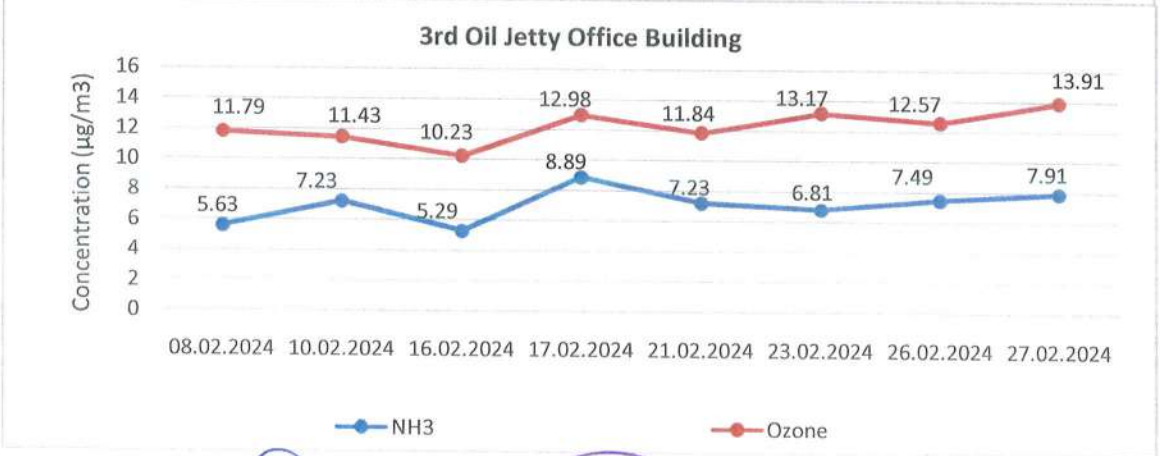
Hubert Enviro Care Systems (P) Ltd

FIGURE 1

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Ambient Air Quality**
Sample Mark : **AAQ 1 - 3rd Oil JettyOffice Building**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**







Analyst

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Authorized Signatory

TEST REPORT-2

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Ambient Air Quality**
Sample Mark: : **AAQ 2 –Marine HouseOffice Building**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**

S.No.	Sampling Date	Concentration of parameters monitored											
		SO_2 ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	CO (mg/m^3)	NH_3 ($\mu g/m^3$)	Ozone ($\mu g/m^3$)	Benzo(a) Pyrene (ng/m^3)	Benzene ($\mu g/m^3$)	Lead ($\mu g/m^3$)	Arsenic (ng/m^3)	Nickel (ng/m^3)
1	08.02.2024 to 09.02.2024	11.54	25.45	86.12	35.45	0.06	5.71	10.78	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
2	10.02.2024 to 11.02.2024	13.12	26.35	78.65	32.37	0.08	6.94	13.43	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
3	16.02.2024 to 17.02.2024	12.46	27.45	86.42	39.65	0.07	5.78	11.86	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
4	17.02.2024 to 18.02.2024	10.79	26.73	84.68	32.18	0.08	7.91	11.51	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
5	21.02.2024 to 22.02.2024	11.45	25.81	76.47	30.89	0.07	6.81	13.28	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
6	23.02.2024 to 24.02.2024	12.73	24.39	86.16	49.19	0.08	7.23	13.96	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
7	26.02.2024 to 27.02.2024	12.81	23.76	88.49	48.27	0.07	6.49	11.81	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
8	27.02.2024 to 28.02.2024	10.30	22.81	89.35	41.02	0.07	6.23	11.34	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
	Min	**10.30**	**22.81**	**76.47**	**30.89**	**0.06**	**5.71**	**10.78**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
	Max	**13.12**	**27.45**	**89.35**	**49.19**	**0.08**	**7.91**	**13.96**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
	Avg	**11.90**	**25.34**	**84.54**	**38.63**	**0.07**	**6.64**	**12.25**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
NAAQS –National Ambient Air Quality Standards (2009)		**80**	**80**	**100**	**60**	**2**	**400**	**100**	**1**	**5**	**1**	**6**	**20**

Note: SO_2–Sulphur dioxide, NO_x- Nitrogen oxide, PM_{10} - (Particulate Matter size less than 10 µm), $PM_{2.5}$ - (Particulate Matter size less than 2.5 µm) CO - Carbon monoxide; NAAQ Norms-National Ambient Air Quality Stipulated by CPCB for Industrial Areas 2009. 2. Sampling time: SO_2, NO_x, PM_{10}, $PM_{2.5}$, NH_3, Benzo(a) Pyrene, Benzene, Lead, Arsenic, Nickel for 24 Hrs. monitoring, CO and Ozone for 8 Hrs. Monitoring

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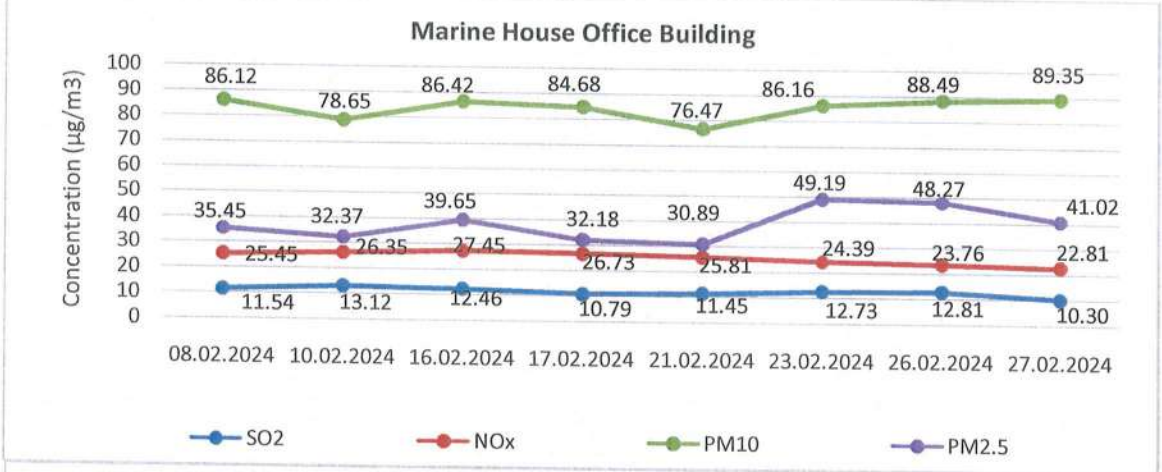
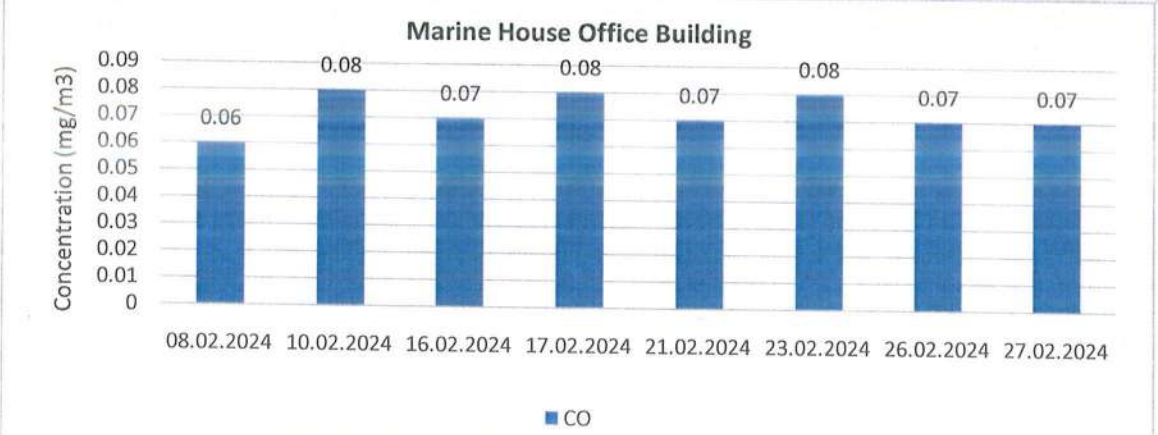
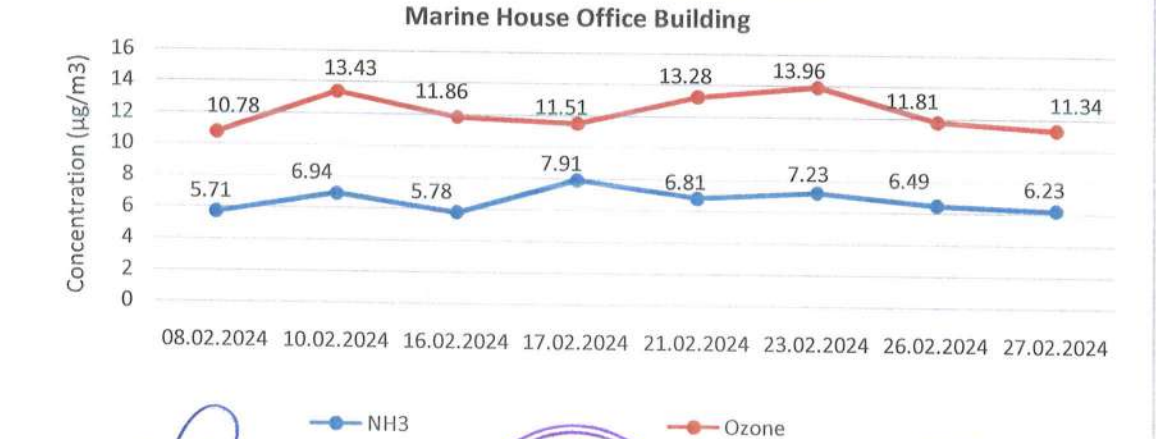
FIGURE 2

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Ambient Air Quality**
Sample Mark :**AAQ 2 –Marine House Office Building**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**







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TEST REPORT-3

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Ambient Air Quality**
Sample Mark : **AAQ3 - Electrical Maintenance Office Building at HaldiaTownship**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**

S.No.	Sampling (hrs)	Sampling Date	Concentration of parameters monitored											
			SO_2 ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	CO (mg/m^3)	NH_3 ($\mu g/m^3$)	Ozone ($\mu g/m^3$)	Benzo(a) Pyrene (ng/m^3)	Benzene ($\mu g/m^3$)	Lead ($\mu g/m^3$)	Arsenic (ng/m^3)	Nickel (ng/m^3)
1	24	08.02.2024 to 09.02.2024	12.85	20.79	86.59	43.24	0.05	7.89	12.61	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
2	24	10.02.2024 to 11.02.2024	12.45	18.35	78.56	30.56	0.06	5.87	13.79	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
3	24	16.02.2024 to 17.02.2024	9.36	23.68	73.98	37.57	0.07	7.91	12.76	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
4	24	17.02.2024 to 18.02.2024	11.74	21.86	80.35	35.31	0.07	6.24	11.23	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
5	24	21.02.2024 to 22.02.2024	13.17	23.79	79.81	32.48	0.05	5.67	13.19	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
6	24	23.02.2024 to 24.02.2024	12.89	20.73	88.43	41.63	0.07	6.13	12.51	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
7	24	26.02.2024 to 27.02.2024	10.79	19.81	74.16	32.49	0.05	8.59	13.73	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
8	24	27.02.2024 to 28.02.2024	10.81	21.98	84.76	33.45	0.06	7.45	11.57	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
		Min	**9.36**	**18.35**	**73.98**	**30.56**	**0.05**	**5.67**	**11.23**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
		Max	**13.17**	**23.79**	**88.43**	**43.24**	**0.07**	**8.59**	**13.79**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
		Avg	**11.76**	**21.46**	**80.83**	**35.84**	**0.06**	**6.97**	**12.67**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
NAAQS –National Ambient Air Quality Standards (2009)			**80**	**80**	**100**	**60**	**2**	**400**	**100**	**1**	**5**	**1**	**6**	**20**

Note: SO_2–Sulphur dioxide, NO_x- Nitrogen oxide, PM_{10} - (Particulate Matter size less than 10 µm), $PM_{2.5}$ - (Particulate Matter size less than 2.5 µm) CO - Carbon monoxide; NAAQ Norms-National Ambient Air Quality Stipulated by CPCB for Industrial Areas 2009. 2. Sampling time: SO_2, NO_x, PM_{10}, $PM_{2.5}$, NH_3, Benzo(a) Pyrene, Benzene, Lead, Arsenic, Nickel for 24 Hrs. monitoring, CO and Ozone for 8 Hrs. Monitoring

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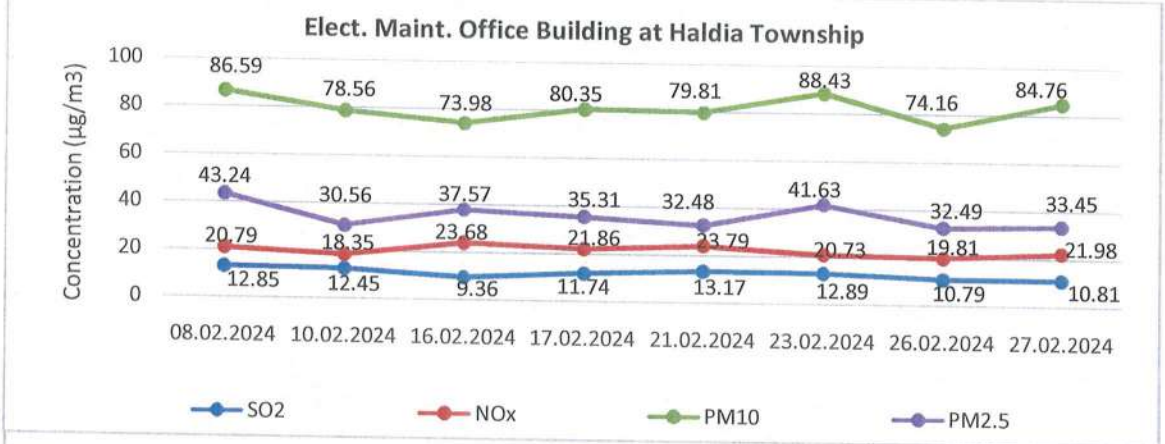
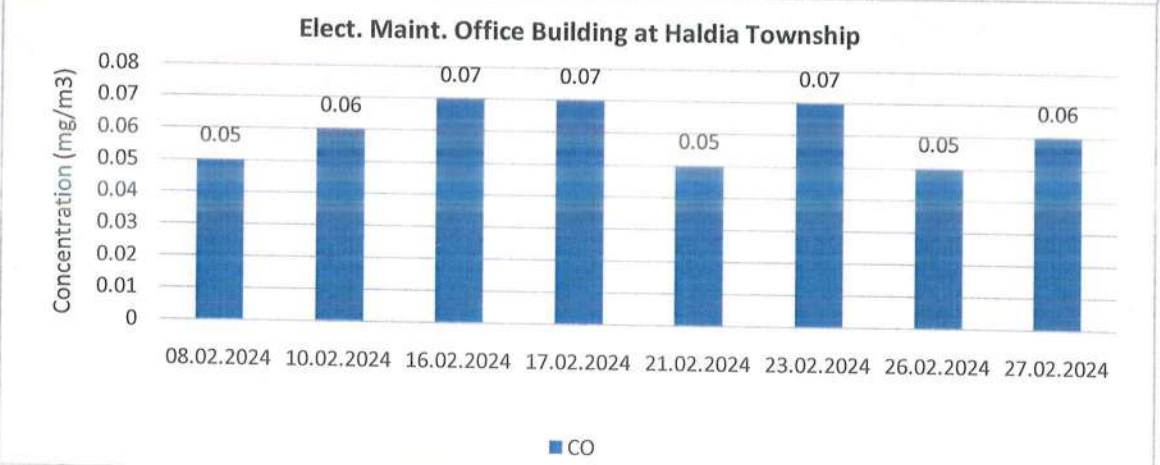
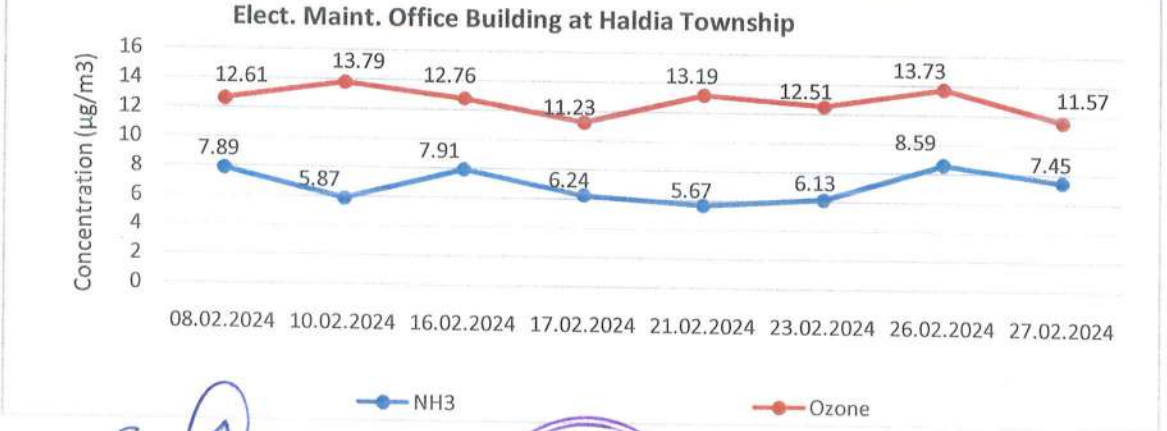
FIGURE 3

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Ambient Air Quality**
Sample Mark : **AAQ3 - Electrical Maintenance office building at HaldiaTownship**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**







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TEST REPORT-4

Name of the Client :Haldia Dock Complex, SMP, Kolkata
Sample Description : Ambient Air Quality
Sample Mark : AAQ 4 - Chiranjibpur Operational Building
Sample Drawn By : Hubert Enviro Care Systems Private Limited

S.No.	Sampling Date	Concentration of parameters monitored											
		SO_2 ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	CO (mg/m^3)	NH_3 ($\mu g/m^3$)	Ozone ($\mu g/m^3$)	Benzo(a) Pyrene (ng/m^3)	Benzene ($\mu g/m^3$)	Lead ($\mu g/m^3$)	Arsenic (ng/m^3)	Nickel (ng/m^3)
1	08.02.2024 to 09.02.2024	10.12	18.42	95.05	43.51	0.06	6.78	12.41	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
2	10.02.2024 to 11.02.2024	11.64	23.78	85.25	44.12	0.07	8.12	11.79	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
3	16.02.2024 to 17.02.2024	13.34	21.54	78.75	41.68	0.07	6.87	10.79	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
4	17.02.2024 to 18.02.2024	12.79	20.79	89.59	40.65	0.06	8.76	12.58	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
5	21.02.2024 to 22.02.2024	10.96	21.59	80.43	39.51	0.07	7.45	13.19	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
6	23.02.2024 to 24.02.2024	12.98	22.91	81.39	42.65	0.06	5.98	12.43	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
7	26.02.2024 to 27.02.2024	13.58	20.17	86.43	45.17	0.06	7.48	13.81	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
8	27.02.2024 to 28.02.2024	11.04	19.24	77.21	36.64	0.07	7.18	13.26	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.002)	BLQ(LOQ 2)	BLQ(LOQ 2)
	Min	**10.12**	**18.42**	**77.21**	36.64	**0.06**	**5.98**	**10.79**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
	Max	**13.58**	**23.78**	**95.05**	45.17	**0.07**	**8.76**	**13.81**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
	Avg	**12.06**	**21.06**	**84.26**	41.74	**0.07**	**7.33**	**12.53**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.1)**	**BLQ(LOQ 0.002)**	**BLQ(LOQ 2)**	**BLQ(LOQ 2)**
NAAQS –National Ambient Air Quality Standards (2009)		80	80	100	60	2	400	100	1	5	1	6	20

Note: SO_2–Sulphur dioxide, NO_x- Nitrogen oxide, PM_{10} - (Particulate Matter size less than 10 µm), $PM_{2.5}$ - (Particulate Matter size less than 2.5 µm) CO - Carbon monoxide; NAAQ Norms-National Ambient Air Quality Stipulated by CPCB for Industrial Areas 2009. 2. Sampling time: SO_2, NO_x, PM_{10}, $PM_{2.5}$, NH_3, Benzo(a) Pyrene, Benzene, Lead, Arsenic, Nickel for 24 Hrs. monitoring, CO and Ozone for 8 Hrs. Monitoring

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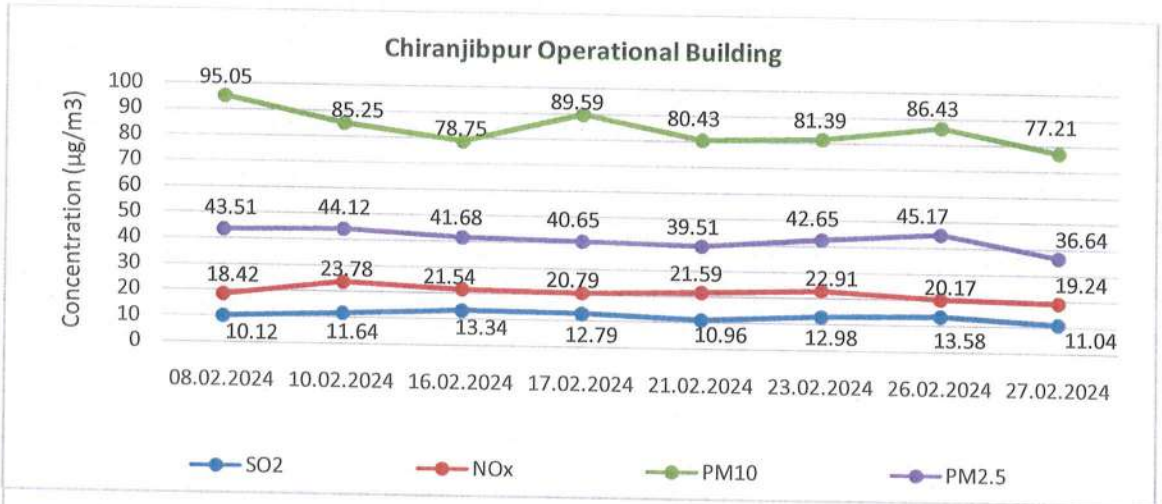
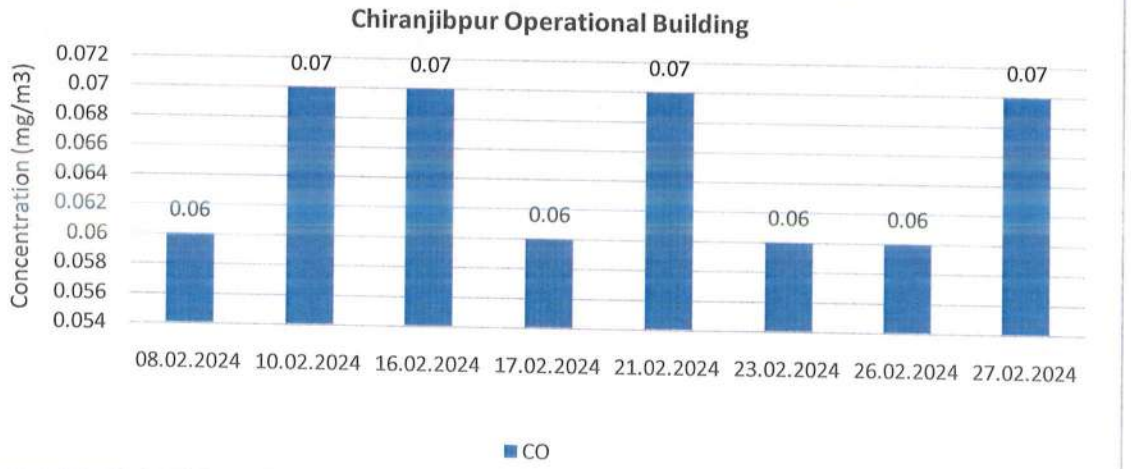
FIGURE 4

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Ambient Air Quality**
Sample Mark : **AAQ 4 - Chiranjibpur Operational Building**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**





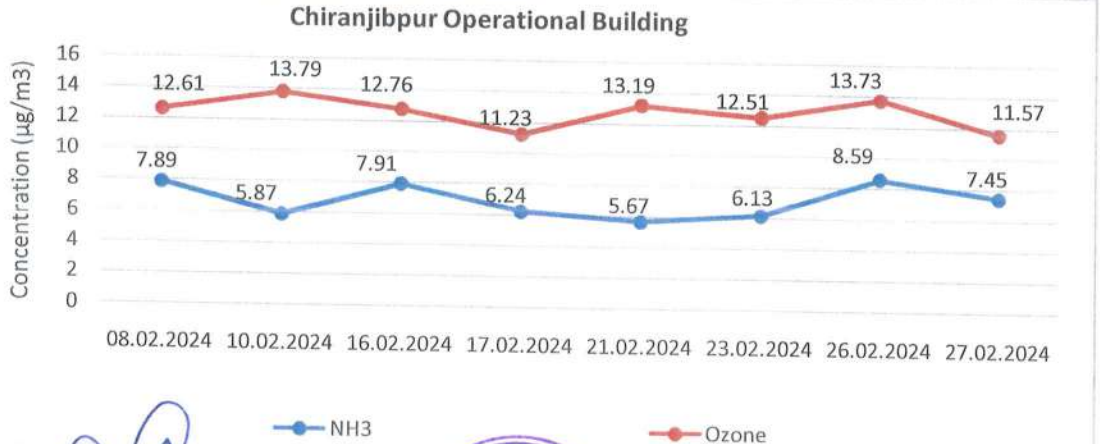


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Table-3.4: Sulphur Dioxide(SO_2)(µg/m^3)

Location & Location Code	Minimum	Maximum	Standard Deviation	98th Percentile	Mean
AAQ 1 - 3rd Oil Jetty Office Building	9.86	13.48	1.38	13.43	11.94
AAQ 2 –Marine House Office Building	10.30	13.12	1.03	13.08	11.90
AAQ3 - Electrical Maintenance Office Building at Haldia Township	9.36	13.17	1.34	13.13	11.76
AAQ 4 - Chiranjibpur Operational Building	10.12	13.58	1.28	13.54	12.06

Table-3.5: Nitrogen Dioxide (NO_2)(µg/m^3)

Location & Location Code	Minimum	Maximum	Standard Deviation	98th Percentile	Mean
AAQ 1 - 3rd Oil Jetty Office Building	16.15	20.90	2.25	22.85	20.27
AAQ 2 –Marine House Office Building	22.81	27.45	1.58	27.35	25.34
AAQ3 - Electrical Maintenance Office Building at Haldia Township	18.35	23.79	1.86	23.77	21.46
AAQ 4 - Chiranjibpur Operational Building	18.42	23.78	1.79	23.66	21.06

Table-3.6: Particulate Matter (PM_{10}) (µg/m³)

Location & Location Code	Minimum	Maximum	Standard Deviation	98th Percentile	Mean
AAQ 1 - 3rd Oil Jetty Office Building	71.35	85.56	4.70	85.05	77.71
AAQ 2 –Marine House Office Building	76.47	89.35	4.59	89.22	84.54
AAQ3 - Electrical Maintenance Office Building at Haldia Township	73.98	88.43	5.40	88.57	80.33
AAQ 4 - Chiranjibpur Operational Building	77.21	95.05	6.02	94.29	84.26

Table-3.7: Particulate Matter ($PM_{2.5}$) (µg/m³)

Location & Location Code	Minimum	Maximum	Standard Deviation	98th Percentile	Mean
AAQ 1 - 3rd Oil Jetty Office Building	30.84	44.38	5.41	44.29	36.79
AAQ 2 –Marine House Office Building	30.89	49.19	7.19	49.06	38.63
AAQ3 - Electrical Maintenance Office Building at Haldia Township	30.56	43.24	4.59	43.01	35.84
AAQ 4 - Chiranjibpur Operational Building	36.64	45.17	2.77	45.02	41.74

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Table-3.8: Carbon monoxide (CO)(mg/m^3)

Location & Location Code	Minimum	Maximum	Standard Deviation	98th Percentile	Mean
AAQ 1 - 3rd Oil Jetty Office Building	0.06	0.09	0.010	0.09	0.07
AAQ 2 –Marine House Office Building	0.06	0.08	0.007	0.08	0.07
AAQ3 - Electrical Maintenance Office Building at Haldia Township	0.05	0.07	0.009	0.07	0.06
AAQ 4 - Chiranjibpur Operational Building	0.06	0.07	0.005	0.07	0.07

Table-3.9: Ammonia (NH_3)(µg/m^3)

Location & Location Code	Minimum	Maximum	Standard Deviation	98th Percentile	Mean
AAQ 1 - 3rd Oil Jetty Office Building	5.29	8.89	1.16	8.75	7.06
AAQ 2 –Marine House Office Building	5.71	7.91	0.78	7.82	6.69
AAQ3 - Electrical Maintenance Office Building at Haldia Township	5.67	8.59	1.11	8.49	6.96
AAQ 4 - Chiranjibpur Operational Building	5.98	8.76	0.91	8.68	7.34

Table-3.10: Ozone (µg/m^3)

Location & Location Code	Minimum	Maximum	Standard Deviation	98th Percentile	Mean
AAQ 1 - 3rd Oil Jetty Office Building	10.23	13.91	1.15	13.80	12.24
AAQ 2 –Marine House Office Building	10.78	13.96	1.17	13.89	12.37
AAQ3 - Electrical Maintenance Office Building at Haldia Township	11.23	13.79	0.92	13.78	12.67
AAQ 4 - Chiranjibpur Operational Building	10.79	13.81	0.96	13.73	12.42

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4.0 AMBIENT NOISEQUALITY

4.1 Monitoring Station Selection Criteria

The 12 monitoring stations were selected as per the noise source identified with reference to previous EIA study and discussion to official person of Haldia Dock Complex. The monitoring locations are given in Table 4.1.

Table 4-1: Noise Quality Monitoring Stations

S. No.	Location	Code
1	Chiranjibpur Operational Building	N1
2	Jawahar Tower	N2
3	Township Gate No - 04	N3
4	Port Hospital	N4
5	DAV School	N5
6	Port House	N6
7	GCBerth Main Gate	N7
8	HFTPL (MBC) Jetty	N8
9	Chiranjibpur Operational Building Gate	N9
10	Lock Gate	N10
11	Marine House	N11
12	Master Control	N12

4.2 Monitoring Methodology

Ambient noise level measurements in four identified cardinal directions were carried out using Extech sound level meter during daytime and night time. Noise measurements were made at 1.5 m above ground and about 3 m away from walls, buildings or other sound reflecting sources. In order to reduce the disturbances from standing waves, the noise level measured were averaged over + 0.5 m each of at least three positions. The mean values were taken for reporting.

Instrument The noise was monitored by digital sound level meter, MakeExtech, Model/ SL: 407780/100813422

Sound Level Meter is an instrument designed to respond to sound in approximately the same way as the human ear and to give objective reproducible measurements of sound pressure level. The system consists of a microphone, a processing section and a readout unit.

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Procedure

- Press → **DATE TIME** + **POWER** → Hold for 3 Seconds
  - Display → Date 11-07-01
- Press → **DATE TIME**
  - Display → Time 00 in minutes
- Press → **INTEG TIME**
- Press → Adjust Minute using ↓↑ → to set required time in minutes (10sec to 24hrs)
  - Display → 00
- Press → **LEQ SEL SPL** → to set SPL
- Press → **RECORD**
- Press → **PLAY** → to save the data
- Connect the meter to a pc via the RS - 232 cable
- Open to isound software
- Press → **DATA LOGGER**
- Press → **I I I**
- Press → **READ / SAVE**
- Press → **ERASE**

4.3 Analytical Result:

The noise levels in different locations were recorded and compared to the specifications of CPCB norms and the results are shown in following **Test Reports and Figures.**

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TEST REPORT-5

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Noise Monitoring**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **06/02/2024 09/02/2024 25/02/2024 27/02/2024**

S. No		Monitoring Location & Hourly Leq Noise Level in dB(A)			
		HFTPL Jetty Area	Master Control Area	Marine House	CJP Gate
	Monitoring Date / Time (Hrs)	06/02/2024	09/02/2024	25/02/2024	27/02/2024
1	06-07	58.8	67.5	59.9	57.3
2	07-08	62.1	63.6	60.2	66.5
3	08-09	62.2	64.1	64.7	67.5
4	09-10	63.7	63.4	65.6	68.4
5	10-11	65.8	71.2	68.6	60.4
6	11-12	69.9	69.9	70.4	71.1
7	12-13	66.9	73.8	70.9	67.5
8	13-14	65.4	70.5	70.7	71.6
9	14-15	69.6	74.5	65.4	68.0
10	15-16	68.9	67.2	68.7	63.2
11	16-17	72.1	69.1	67.5	68.8
12	17-18	66.4	71.1	71.4	63.7
13	18-19	67.0	69.8	70.1	60.6
14	19-20	72.0	72.2	72.9	69.3
15	20-21	71.2	68.3	68.8	63.8
16	21-22	70.2	71.6	66.7	59.0
17	22-23	66.4	65.5	65.9	58.2
18	23-24	62.0	63.3	64.5	56.2
19	00-01	62.6	65.7	61.0	62.6
20	01-02	64.4	62.1	58.3	54.7
21	02-03	62.2	61.2	61.1	64.8
22	03-04	61.1	59.3	54.0	57.5
23	04-05	61.7	61.2	63.3	56.7
24	05-06	62.3	61.5	54.7	57.4
I	**Ld**	**68.2**	**70.3**	**68.9**	**67.1**
II	**Ln**	**62.4**	**63.0**	**62.0**	**59.9**
II	**Ldn**	**67.2**	**69.0**	**67.5**	**65.8**
Category		**Industrial Area (Haldia Dock)**			
CPCB Norms		**Day: 75 & Night: 70**			

Note:MonitoringDaterepresents24hoursfrom6:00amnextday. Legend:Leq-EquivalentNoiseLevel(hourly);
Ld– DayTimeEquivalentNoiseLevel(06:00-22:00hrs);Ln– NightTimeEquivalentNoiseLevel (22:00-06:00hrs);and
Ldn – 24hourlyEquivalentNoiseLevel.
*:CPCB-Norms– AmbientNoiseNorms(Leq);Daytimeisrecordedinbetween6amand10pmandNight timeisrecordedinbetween10 pmand6am.
Awarningli mitof85dB(A)issetasthelevelbelowwhichverylittlerisktounprotectedearofearringimpairmentexistsforaneight hourexposure

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FIGURE-5

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Noise Monitoring**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **06/02/2024 09/02/2024 25/02/2024 27/02/2024**

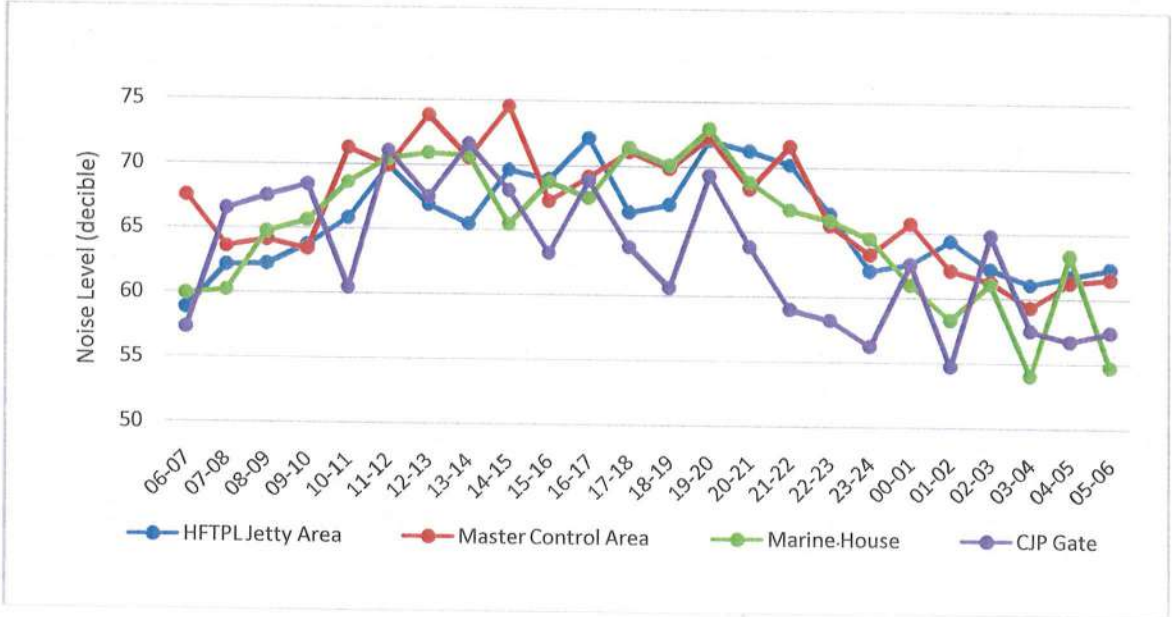

Figure 5: Graphical representation of Monitoring Location & Hourly Leq Noise Level in dB (A)

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TEST REPORT-6

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Noise Monitoring**
Sample Drawn By : **Hubert Enviro Care Systems PvtLtd**

S.No	Location	Day Time (06.00 – 22.00 hrs.)						Night Time (22.00 – 06.00 hrs)						Ldn
		Noise Level, dB (A)						Noise Level dB (A)						
		Lmin	L10	L50	L90	Lmax	Ld*	Lmin	L10	L50	L90	Lmax	Ln	
1	HFTPL Jetty Area	58.8	61.1	67.0	72.0	72.1	68.2	61.1	61.1	62.3	65.3	66.4	62.4	67.2
2	Master Control Area	63.4	63.5	69.9	74.0	74.5	70.3	59.3	59.3	61.8	65.5	65.7	63.0	69.0
3	Marine House	59.9	60.1	68.7	71.9	72.9	68.9	54.0	54.0	61.1	64.3	64.5	63.7	67.5
4	CJP Gate	57.3	58.5	67.0	71.3	71.6	67.1	54.7	54.7	57.5	63.6	64.8	59.9	65.8

Legend: Lmin- Minimum Level; L10, L50, L90 – Noise Level exceed for 10%, 50% & 90% of times and Lmax. – Maximum Level. Ld- Day Time Equivalent Noise Level (06:00-22:00); Ln-Night Time Equivalent Noise Level (22:00-06:00 hrs) and Ldn-24-hourly Equivalent Noise Level.

Noise Standards - CPCB:

Industrial Area : Day Time-75 dB (A); Night Time-70 dB (A).
Commercial Area : Day Time-65 dB (A); Night Time-55 dB (A).
Residential Area : Day Time-55 dB (A); Night Time-45 dB (A).
Silence Zone : Day Time-50 dB (A); Night Time-40 dB (A).

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5.0 WATER QUALITY STATUS

5.1 Monitoring Station Selection Criteria

The water monitoring stations were selected as per the water source of marine water is identified with reference to previous EIA study and discussion to official person of Haldia Dock Complex. The monitoring locations are given in Table 5.1.

Table 5.1: Water Quality Monitoring Stations

Sl. No.	Water Sampling Station	Sample Code
	Marine Water	
1	Near HFTPL Jetty–Surface (0.3 m)	MW1
2	Near HFTPLJetty –Bottom (7m)	MW2
3	Near Lock Office– Surface (0.3 m)	MW3
4	Near Lock Office – Bottom (7m)	MW4
5	Near Outer Terminal – II- Surface (0.3 m)	MW5
6	Near Outer Terminal – II- Bottom (7m)	MW6
7	Near 1st Oil Jetty - Surface (0.3 m)	MW7
8	Near 1st Oil Jetty - Bottom (7m)	MW8

5.2 Monitoring Methodology

Water samples were collected and analyzed as per the procedures outlined in IS: 3025/ APHA. Sterilized bottles were used for collection of water samples for bacteriological analysis, stored in ice box and transported to the laboratory for analyses. Parameters like pH, Temperature, Dissolved Oxygen, Conductivity, Free Ammonia, were measured in the field while collecting the samples. MPN index (APHA Standard Method, 1992) of coliforms was determined in the laboratory as per standard methods. The other parameters was analyzed within stipulated time.

Table 5.2: Analytical Procedure

S.No.	Parameters	Analytical Methods	Reference
1	pH (at 25 °C)	By pH meter	IS 3025 (Part - 11):1983
2	Colour	Visual comparison using Platinum - Cobalt	IS 3025(Part - 4):1983
3	Total Hardness as $CaCO_3$	Titrometric Method	IS 3025 (Part - 21):1983
4	Calcium as Ca	Titrometric Method	IS 3025 (Part - 40):1991
5	Chloride as Cl	Argentometric Titration	IS 3025 (Part - 32):1988
6	Magnesium as Mg	EDTA Method	IS 3025 (Part - 46) 1994
7	Total Dissolved Solids	By Gravimetric	IS3025(Part-16):1984(Reaff:2014)
8	Sulphate as SO_4	By UV- Spec	IS 3025(Part - 24):1986
9	Fluoride	By UV- Spec	IS 3025 (Part - 60):2008
10	Nitrate as NO_3	By UV- Spec	ASTM(Part - 31)1978
11	Iron as Fe	By UV- Spec	IS 3025 (Part - 53):2003
12	Hexavalent Chromium as Cr 6+	By UV- Spec	IS3025Part(52):2003(Reaff:2014)
13	Zinc as Zn	ICPMS	IS 3025 (Part49)-1994(Reaff 2009)
14	Copper as Cu	ICPMS	IS 3025 (Pt 42)-1992(Reaff :2009)
15	Manganese as Mn	ICPMS	IS 3025:(Part - 59):2006
16	Cadmium as Cd	ICPMS	IS 3025 (Part - 41)1991
17	Lead as Pb	ICPMS	IS 3025(Part - 47)1994(Reaff 2009)
18	Arsenic as As	ICPMS	IS 3025:(Part-37):1988(Reaff 2009)
19	Mercury as Hg	ICPMS	IS3025(Part48):1994RA1999
20	Sodium as Na	Flame Photometer	IS3025 (Part - 45):1993
21	Potassium as K	Flame Photometer	IS3025 (Part - 45):1993
22	BOD, 5 days @ 20°C as O_2	BOD Incubator	IS 3025 (Part - 44):1993
23	Dissolved Oxygen	Titrimetric Method	IS 3025 (Part - 38):1989
24	Nitrite as NO_2	By UV- Spec	IS 3025(Part- 34):1988
25	Salinity	Argentometric Titration	2520AAPHA22ndEdn.2012

Table 5.3: Onsite parameters for analysis

S.No.	Parameters	Analytical Methods	Reference
1	pH (at 25 °C)	By Hand Meter	IS 3025 (Part - 11):1983
2	Dissolved oxygen	Iodimetry (Fixing & Titration)	IS 3025 (Part - 38):1989
3	Electrical Conductivity	Conductivity meter	IS 3025(Part-14):2013
4	Total Dissolved Solids	By Hand TDS Meter	IS3025(Part-16):1984(Reaff:2014)
5	**Temperature**		
6	**Free Ammonia**		

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5.3 Sampling

Any adverse impact of water pollution will have serious effect on the environment. Hence, it becomes important to monitor the water quality periodically in the port area. The samples were analyzed **as per IS: 3025** and others standard methodsand compared to the specifications Primary Water Quality Criteria for Class SW- IV (For Harbour Waters).

5.4 Analytical Result:

The water levels in different locations were recorded and compared to the specifications of CPCB norms and the results are shown in Test report.

TEST REPORT-11

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Marine Water Quality**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date :**29/02/2024**

S. No.	Parameters	Units	Primary Water Quality Criteria for Class SW- IV (for Harbour Waters)	Near HFTPL Jetty (Upstream)		Near Lock Approach	
				Surface at 0.3m	Bottom at 7m	Surface at 0.3m	Bottom at 7m
1	pH (at 25 °C)	-	6.5 – 9.0	8.02	7.86	8.10	8.12
2	Colour	Hazen Unit	No visible colour	2.0	BLQ(LOQ:1.0)	BLQ(LOQ:1)	BLQ(LOQ:1)
3	Temperature	°C	-	25.3	24.8	25.9	25.3
4	Turbidity	NTU	-	421.0	258	213.6	302.0
5	Odour	-	No offensive odour	Agreeable	Agreeable	Agreeable	Agreeable
6	Chloride as Cl	mg/l	-	3761	3884.82	3167.24	3290.96
7	Total Suspended Solids	mg/l	-	419.0	630	858	650.0
8	Salinity	ppt	-	6.79	7.01	7.72	7.24
9	Total Dissolved Solids	mg/l	-	6740	7030	5988	6132
10	Sulphate as SO_4	mg/l	-	511.23	559.6	461.25	472.6
11	Nitrate as NO_3	mg/l	-	4.60	4.59	5.15	5.31
12	Iron as Fe	mg/l	-	0.65	0.478	0.45	0.365
13	Zinc as Zn	mg/l	-	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
14	Chromium as Cr	mg/l	-	BLQ(LOQ0.01)	BLQ(LOQ0.01)	BLQ(LOQ0.01)	BLQ(LOQ0.01)
15	Copper as Cu	mg/l	-	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
16	Cadmium as Cd	mg/l	-	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)
17	Lead as Pb	mg/l	-	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)
18	Manganese as Mn	mg/l	-	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)
19	Arsenic as As	mg/l	-	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)
20	Mercury as Hg	mg/l	-	BLQ(LOQ0.0005)	BLQ(LOQ0.0005)	BLQ(LOQ0.0005)	BLQ(LOQ0.0005)
21	Phosphate as PO_4	mg/l	-	0.204	0.127	0.230	0.194
22	BOD, 3 days @ 20°C as O_2	mg/l	5 mg/l	7.0	6.0	5.0	7.0
23	Oil and Grease	mg/l	-	BLQ(LOQ:4.0)	BLQ(LOQ:4.0)	BLQ(LOQ 4.0)	BLQ(LOQ:4)
24	Dissolved Oxygen	mg/l	3.0 mg/l or 40% saturation value whichever is higher	6.3	6.9	6.5	6.8
25	Nitrite as NO_2	mg/l	-	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)
26	Ammonical Nitrogen as NH_3-N	mg/l	-	0.17	2.13	1.37	1.56
27	Petroleum Hydrocarbons	mg/l	-	BLQ(LOQ 0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
28	Floating Matters	mg/l	10 mg/l	BLQ(LOQ:1.0)	BLQ(LOQ:1.0)	BLQ(LOQ:1.0)	BLQ(LOQ:1)
29	Electrical Conductivity	µS/cm	-	12720	12970	11090	11440
30	COD	mg/l	-	44	42	48	56
31	Alkalinity as CaCO3	mg/l	-	234	255	287	242
32	Total Hardness as CaCO3	mg/l	-	654	637	707	586
33	Calcium as Ca	mg/l	-	184	149	221	164
34	Magnesium as Mg	mg/l	-	73	68	78	62
35	Sodium as Na	mg/l	-	997	980	1078	936
36	Potassium as K	mg/l	-	92	88	98	82
37	Flouride as F	mg/l	-	0.68	0.64	0.658	0.57
38	Phenolic compound as C6H5OH	mg/l	-	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)
39	Cyanide	mg/l	-	Absent	Absent	Absent	Absent
40	Aluminium	mg/l	-	7.38	8.12	9.78	7.42
41	Total coliforms	MPN/100 ml	-	1100	1000	1200	900
42	Faecal coliforms	MPN/100 ml	-	800	900	800	900

Note: BLQ- Below the Limit of Quantification; LOQ- Limit of Quantification.

Analyst

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TEST REPORT-12

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Marine Water Quality**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No.	Parameters	Units	Primary Water Quality Criteria for Class SW- IV (for Harbour Waters)	Near Outer Terminal – II		Near 1st Oil Jetty (Downstream)	
				Surface at 0.3m	Bottom at 7m	Surface at 0.3m	Bottom at 7m
1	pH (at 25 °C)	-	6.5 – 9.0	8.08	8.04	8.03	8.10
2	Colour	Hazen Unit	No visible colour	BLQ(LOQ:1)	BLQ(LOQ:1)	BLQ(LOQ:1)	BLQ(LOQ:1)
3	Temperature	°C	-	25.3	24.8	25.9	25.3
4	Turbidity	NTU	-	189.0	356.0	65.3	244.0
5	Odour	-	No offensive odour	Agreeable	Agreeable	Agreeable	Agreeable
6	Chloride as Cl	mg/l	-	3895.06	3969.29	3678.50	3692.74
7	Total Suspended Solids	mg/l	-	632	751	658	574
8	Salinity	ppt	-	7.75	7.88	7.23	7.36
9	Total Dissolved Solids	mg/l	-	6342	6670.0	6038.0	6315
10	Sulphate as SO_4	mg/l	-	445.2	405.8	373.85	313.85
11	Nitrate as NO_3	mg/l	-	5.61	4.29	4.05	4.61
12	Iron as Fe	mg/l	-	0.304	0.423	1.23	0.841
13	Zinc as Zn	mg/l	-	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
14	Chromium as Cr	mg/l	-	BLQ(LOQ0.01)	BLQ(LOQ0.01)	BLQ(LOQ0.01)	BLQ(LOQ0.01)
15	Copper as Cu	mg/l	-	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
16	Cadmium as Cd	mg/l	-	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)
17	Lead as Pb	mg/l	-	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)
18	Manganese as Mn	mg/l	-	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)
19	Arsenic as As	mg/l	-	BLQ(LOQ0.0005)	BLQ(LOQ0.005)	BLQ(LOQ0.005)	0.021
20	Mercury as Hg	mg/l	-	BLQ(LOQ0.0005)	BLQ(LOQ0.0005)	BLQ(LOQ0.0005)	BLQ(LOQ0.0005)
21	Phosphate as PO_4	mg/l	-	0.580	0.189	0.23	0.155
22	BOD, 3 days @ 20°C as O_2	mg/l	5 mg/l	3.0	6.0	5.0	6.0
23	Oil and Grease	mg/l	-	BLQ(LOQ:4)	BLQ(LOQ:4)	BLQ(LOQ:4)	BLQ(LOQ:4)
24	Dissolved Oxygen	mg/l	3.0 mg/l or 40% saturation value whichever is higher	6.5	6.5	6.3	6.7
25	Nitrite as NO_2	mg/l	-	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)
26	Ammoniacal Nitrogen as NH_3-N	mg/l	-	0.68	1.78	0.72	1.85
27	Petroleum Hydrocarbons	mg/l	-	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
28	Floating Matters	mg/l	10 mg/l	BLQ(LOQ:1)	BLQ(LOQ:1)	BLQ(LOQ:1)	BLQ(LOQ:1)
29	Electrical Conductivity	µS/cm	-	10140	10500	7620	7990
30	COD	mg/l	-	44	48	48	60
31	Alkalinity as CaCO3	mg/l	-	264	246	238	264
32	Total Hardness as CaCO3	mg/l	-	636	642	588	680
33	Calcium as Ca	mg/l	-	186	146	162	194
34	Magnesium as Mg	mg/l	-	68	74	64	78
35	Sodium as Na	mg/l	-	1014	964	964	1040
36	Potassium as K	mg/l	-	86	82	68	86
37	Flouride as F	mg/l	-	0.53	0.51	0.68	0.48
38	Phenolic compound as C6H5OH	mg/l	-	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)
39	Cyanide	mg/l	-	Absent	Absent	Absent	Absent
40	Aluminium	mg/l	-	7.86	8.23	6.86	10.24
41	Total coliforms	MPN/100 ml	-	1200	980	960	1200
42	Faecal coliforms	MPN/100 ml		800	700	600	800

Note: BLQ- Below the Limit of Quantification; LOQ- Limit of Quantification.

Analyst

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TEST REPORT-13

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Marine Water Biological Analysis (0.3 meter)**
Sample Mark : **Near HFTPL Jetty**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No.	Parameters	Values	Test Method
1	**Phytoplankton (64µm mesh)**		
	Total Cell Count	7100 cells/L	APHA 24th Edition Part 10200
	Total Genus	08	
	Genus	Ceratiumspp, Peridiniumspp, Chaetocerosspp, Triodesmiumspp, Pyroystisspp, Noctiluaspp, Biddulphiaspp.,Odontellaspp	
2	**Zooplankton (200µm mesh)**		
	Total Cell Count	3300 cells/L	APHA 24th Edition Part 10200
	Total Genus	04	
	Genus	Ceratiumspp,Thalassiosiraspp,Ceratiumspp,Rhizosoleniaspp	

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TEST REPORT-14

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Marine Water Biological Analysis (0.3 meter)**
Sample Mark : **Near Lock Approach**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No.	Parameters	Values	Test Method
1	**Phytoplankton (64µm mesh)**		
	Total Cell Count	7200 cells/L	APHA 24th Edition Part 10200
	Total Genus	04	
	Genus	Chaetocerosspp, Triodesmiumspp, Pyroystisspp, Noctiluaspp, Biddulphiaspp	
2	**Zooplankton (200µm mesh)**		
	Total Cell Count	3800 cells/L	APHA 24th Edition Part 10200
	Total Genus	03	
	Genus	Thalassiosiraspp,Ceratiumspp,Rhizosoleniaspp	

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TEST REPORT-15

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Marine Water Biological Analysis (0.3 meter)**
Sample Mark : **NearOuter Terminal– II**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No.	Parameters	Values	Test Method
1	**Phytoplankton (64µm mesh)**		
	Total Cell Count	6600 cells/L	APHA 24th Edition Part 10200
	Total Genus	05	
	Genus	Noctiluaspp, Thalassiothrixspp, Streptothecaspp, Corethronspp,Melosiraspp	
2	**Zooplankton (200µm mesh)**		
	Total Cell Count	2800 cells/L	APHA 24th Edition Part 10200
	Total Genus	03	
	Genus	Copepod, Favellaspp,Eucalanus spp.	

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TEST REPORT-16

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Marine Water Biological Analysis (0.3 meter)**
Sample Mark : **Near 1st Oil Jetty**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No	Parameters	Values	Test Method
1	**Phytoplankton (64µm mesh)**		
	Total Cell Count	6500 cells/L	APHA 24th Edition Part 10200
	Total Genus	05	
	Genus	Skeletonemaspp, Biddulphiaspp, Bacillaria spp., Chaetocerosspp.Dinoflagellatesspp.	
2	**Zooplankton (200µm mesh)**		
	Total Cell Count	3000 cells/L	APHA 24th Edition Part 10200
	Total Genus	04	
	Genus	Globigerina spp,Eucalanus spp,Copepod,Oithanarigida	

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5.5 Light Penetration

The amount of light that phytoplankton are accumulated to not only affect their growth but also their fluorescence output. Phytoplankton situated at the top of the water column on a bright sunny day can get over-saturated with light energy thereby decreasing the amount of fluorescence that their cells give off. Conversely, phytoplankton deeper in the water column where there is minimal light may adapt their shapes to maximize processing light energy for growth, which in turn increases the amount of fluorescence per cell. The light penetration found near HFTPL Jetty, near 1st oil jetty, near OT-II and near Lock approach location were moderate to low. As high turbidity of water may affect the light penetration into the water body.

5.6 Chlorophyll Content Estimation

Chlorophyll-containing phytoplankton was measured; 25 ml of sample water are concentrated by filtration at low vacuum through a glass fiber filter. The pigments are extracted from the phytoplankton in 90% acetone with the aid of a mechanical tissue grinder and are allowed to steep 2-24 hours. The resulting slurry is centrifuged to clarify the solution, and the absorbance of the supernatant liquid was measured at different wavelengths to determined chlorophylls a, b, and c (630, 647 and 664) respectively. Absorbance values was entered into a set of equations to that utilize the extinction coefficients of the pure pigments in 90% acetone to simultaneously calculate the concentrations of the pigments in a mixed solution.

In the optical methods the pigments such as (Chlorophyll a, b, and c) were identified. The phyto plankotonic community of the Haldia Port reservoir is composed predominantly by Chlorophyceae and Bacillariphyceae. Phytoplanktonic community is dominated by cyanobacteria being the Chlorophyceae is the second most abundant group. Results for the month of Feb2024in the place of near HFTPL Jetty, 1st oil jetty, near OT-II and Lock approach location of Hooghly river.

5.7 Primary Productivity

Productivity refers to the rate of production on a unit area basis. The total amount of solar energy converted to chemical energy by green plant is gross primary production.The estimation of primary productivity is predicted on the relationship between oxygen evolution and carbon fixation. Primary productivity varies from freshwater to estuarine and from

estuarine to marine water body like near HFTPL Jetty, near 1st oil jetty, near OT-II and near Lock approach.

The data was observed for **Feb2024**of gross primary productivity (GPP), net primary productivity (NPP) and community respiration (CR) of**Feb2024.**

Table 5.4. MeanMonthlyVariationsof GPP,NPPandRESValuesing$Cm^{-2}day^{-1}$(Mean± SD)atHaldia Dock Complex duringFeb2024

Months	Temperature of Water in ^0C	GPP $gCm^{-2}day^{-2}$	NPP $gCm^{-2}day^{-1}$	RES(CR) $gCm^{-2}day^{-1}$	IS:10500 - 2012	
					Acceptable Limits	Permissible Limits
Feb	26.4	174.72 ± 2.56	144.9 ± 2.56	41.57 ± 3.24	NA	NA

Note: GPP - Gross Primary Productivity, NPP - Net Primary Productivity, CR - Community Respiration, NA – Not Applicable.

5.8Shell Fish and Fin Fish

During water quality monitoring near HFTPL Jetty, near 1st oil jetty, near Outer Terminal II and near Lock Approach 3 species of shell fishes i.e. Penaeus indicus,Penaeus monodon and Macrobrachium malcolmsonii and 5 species of fin fishes like Labeo bata, Rastrelliger kanagurta,Puntius sophore, Tenualosa toil, Thryssa sp, were found.

6.0 SEDIMENT QUALITY RESULTS

6.1 Monitoring Location Selection Criteria

The sediment sampling locations were selected as per the identified with reference to previous EIA study and discussion to official person of Haldia Dock Complex. The monitoring locations are given in Table 6.1.

Table 6.1: Sediment Quality Monitoring Locations

Sl. No.	Sediment Sampling Location	Sample Code
1	Near HFTPL Jetty	S1
2	Near Lock Approach	S2
3	Near Outer Terminal – II	S3
4	Near 1st Oil Jetty	S4

6.2 Monitoring Methodology

Sediment samples were collected at four locations and analyzed as per the standard existing procedures. Sterilized canisters were used for collection of sediment samples, stored in ice box and transported to laboratory for chemical analysis as per APHA Standard Method and results recorded for chemical parameters like pH, Texture, Sodium, Potassium, Phosphate, Chlorides and Sulphates.

Sediment grab samples were also collected using a Petersen grab, sieved and processed for biological analysis – microbenthic, meiobenthic and macrobenthic community structure analyses in laboratory and results reported in line with the procedures of APHA 22nd Edition 2012 and referring standard species identification references. The benthos samples processing is described below:

The collected wet sediment samples are sieved with varying mesh sizes for segregating the organisms. Macrobenthos are organisms which are retained in the sieve having mesh size between 0.5 and 1 mm. The term meiofauna loosely defines a group of organisms by their size, larger than microfauna but smaller than macrofauna, rather than a taxonomic grouping. In practice, that is organisms that can pass through a 1 mm mesh but will be retained by a 45 µm mesh. Organisms below size of 45 µm are regarded as microbenthos. The sieved organisms are then stained with Rose Bengal and sorted into different groups. The number of organisms in each grab sample is expressed in number per meter square.

6.3 Sampling

The marine sediment sampling in different locations were conducted and chemical analyses for various parameters were completed as per APHA methods and the results are provided in the following report.

Benthos were recorded in marine sediment samples collected from four locations namely near HFTPL Jetty, 1st oil jetty, near OT-II and Lock approach and results are recorded in Annexure.

TEST REPORT-17

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Sediment Analysis**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No.	Parameters	Units	Near HFTPL Jetty	Near Lock Approach	Near Outer Terminal – II	Near 1st oil Jetty
1	pH	-	7.32	6.94	7.20	7.30
2	**Texture**		**Clay Loam**	**Clay Loam**	**Clay Loam**	**ClayLoam**
	Sand	%	33.4	26.4	32.6	28.5
	Silt	%	39.4	43.2	38.5	32.7
	clay	%	27.2	30.4	28.9	38.8
3	Sodium	mg/kg	815.45	818.24	904.52	876.0
4	Potassium	mEq/100g	16.68	16.05	21.86	23.39
5	Phosphate	mg/kg	4.03	10.76	6.36	7.49
6	Chlorides	mEq/100g	44.39	46.56	53.59	53.31
7	Sulphates	mg/100g	168.67	118.31	55.32	53.78
8	Cadmium as Cd	mg/kg	<0.1	<0.1	<0.1	<0.1
9	Copper as Cu	mg/kg	<0.1	<0.1	<0.1	<0.1
10	Lead as Pb	mg/kg	<0.1	<0.1	<0.1	<0.1
11	Zinc as Zn	mg/kg	5.39	5.12	6.24	5.98
12	Magnesium as Mg	mEq/100g	64.48	70.4	74.16	76.66
13	Arsenic as As	mg/kg	<0.1	<0.1	<0.1	<0.1

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TEST REPORT-18

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Sediment Biological Analysis**
Sample Mark : **NearHFTPL Jetty**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No	Parameters	Values	Test Method
1	**Micro Benthos**		
	Total Genus	05	APHA 22nd Edition 2012
	Genus	Dinoflagellates, Odontella Spp, Corethron Spp, Naviculae Spp, Thalassiosira Spp	
2	**MacroBenthos**		
	Total Genus	08	APHA 22nd Edition 2012
	Genus	Rhizosolenia spp,Scrippsiella spp, Thalassiosira Spp,Alexandrium Spp,Phaeocystis Spp, Naviculae spp,Ceratium fuscus,Biddulphia Spp	
3	**Meio Benthos**		
	Total Genus	04	APHA 22nd Edition 2012
	Genus	Obelia Spp, Acartia Spp, Titinopsis Spp, Copepods	

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TEST REPORT-19

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Sediment Biological Analysis**
Sample Mark : **Near Lock Approach**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No	Parameters	Values	Test Method
1	**Micro Benthos**		
	Total Genus	05	APHA 22nd Edition 2012
	Genus	Oithana rigida, Obelia Spp, Copepod nauplii, Acartia Spp, Eucalanus Spp.	
2	**MacroBenthos**		
	Total Genus	07	APHA 22nd Edition 2012
	Genus	Chaetoceros spp, Dinoflagellates spp,Rhizosolenia spp,Scrippsiella spp,Naviculae spp,Dinopysis norvegica, Thalassiothrix spp.	
3	**Meio Benthos**		
	Total Genus	07	APHA 22nd Edition 2012
	Genus	Copepod nauplii,Eucalanus Spp,Obelia Spp,Titinopsis cylindrica,Globigerina Spp, Crab Zoea, Rhincalanus spp.	

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TEST REPORT-20

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Sediment Biological Analysis**
Sample Mark : **Near OT – II**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No	Parameters	Values	Test Method
1	**Micro Benthos**		
	Total Genus	04	APHA 22nd Edition 2012
	Genus	Diatoms,Ciliates,Flagellates,Protozoans	
2	**MacroBenthos**		
	Total Genus	05	APHA 22nd Edition 2012
	Genus	Bivalves,Echinoderms,Sponges,Turbellarians,Crustaceans	
3	**Meio Benthos**		
	Total Genus	04	APHA 22nd Edition 2012
	Genus	Nematodes, Rhincalanus sp, Tintinopsis cylindrica, Acartia sp, Ostracodes	

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TEST REPORT-21

Name of the Client :**Haldia Dock Complex, SMP, Kolkata**
Sample Description : **Sediment Biological Analysis**
Sample Mark : **Near 1st Oil Jetty**
Sample Drawn By : **Hubert Enviro Care Systems Private Limited**
Sampling Date : **29/02/2024**

S.No	Parameters	Values	Test Method
1	**Micro Benthos**		
	Total Genus	04	APHA 22nd Edition 2012
	Genus	Flagellates, Protozoans, Diatoms,Ciliates	
2	**MacroBenthos**		
	Total Genus	05	APHA 22nd Edition 2012
	Genus	Bivalves,Sponges, Polychaeteworms,crustceans, Turbellarians	
3	**Meio Benthos**		APHA 22nd Edition 2012
	Total Genus	04	
	Genus	Copepods, Nematodes, Rhincalanus sp, Acartia sp, Ostracodes	

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7.0 GREEN BELT DEVELOPMENT

7.1 Biodiversity Assessment of Green belt trees

The main objectives of Green Belt development within industrial premises are to absorb the dust and gaseous pollutants, increasing CO_2 absorption and releasing of O_2 for better environment besides providing aesthetic view. It is mandatory that all industrial units have to maintain at least 33 % of Green belt area of the total plot area. Biodiversity encompasses the variety of life at all levels of organization, from genetic diversity within a species to diversity within entire regions or ecosystems. Biodiversity has to be assessed quantitatively with proper scientific, ecological and statistical methods like Quadrat sampling, enumeration of species list, counting and mapping of vegetation. The green belt development has to be maintained regularly within the periphery of the area by the industrial unit as per the statutory requirements of pollution control authorities.

The existing Green Belt area in the industrial premises was physically surveyed in every month during the study period. The Mangroves species were not found in the study location however, terrestrial tree species were found in the study area and the list of available tree species has been enumerated and presented below.

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Table 7.1 Illustrates the list of tree species observed overall. Species counted at specific location (from Sector 8 to Medico IOCL Petrol bunk)around 2.5 Kilometers in the **Haldia Dock Complex, SMP, Kolkata** area during the **Feb 2024** biodiversity survey has been given.

S. No.	Scientific Name	Common/Local Name	Family	Count	pi	lnpi	(-) pi*lnpi
1	*Acacia auriculiformis*	Akasmoni	Mimosaceae	5	0.031646	-3.4531571	0.109277
2	*Acacia nilotica*	Babul	Mimosaceae	3	0.018987	-3.9639827	0.075265
3	*Achras sapota*	Sapeda	Zapotaceae	0	0	0	0
4	*Adina cordifolia*	Haldu	Rubiaceae	0	0	0	0
5	*Aegle marmelos*	Wood Apple	Rutaceae	3	0.018987	-3.9639827	0.075265
6	*Albizzia lebbeck*	Siris	Mimosaceae	12	0.075949	-2.5776884	0.195774
7	*Alstonia scholaris*	Chatim	Apocyanaceae	11	0.06962	-2.6646998	0.185517
8	*Anacardium occidentale*	Cashew Nut	Anacardiaceae	0	0	0	0
9	*Anthocephalus chinensis*	Kadam	Rubiaceae	2	0.012658	-4.3694479	0.055309
10	*Areca catechu*	Betel nut Palm	Palmaceae	0	0	0	0
11	*Artocarpus integrifolia*	Jackfruit	Moraceae	3	0.018987	-3.9639827	0.075265
12	*Azadirachta indica*	Neem	Meliaceae	0	0	0	0
13	*Bauhinia acuminata*	Camel's foot tree	Caesalpiniaceae	2	0.012658	-4.3694479	0.055309
14	*Bombax malabaricum*	Red Silk Cotton tree	Bombacaceae	2	0.012658	-4.3694479	0.055309
15	*Borassus flabellifer*	Palmyra palm	Palmae	5	0.031646	-3.4531571	0.109277
16	*Callistemon speciosus*	Bottle brush tree	Myrtaceae	1	0.006329	-5.062595	0.032042
17	*Calophyllum inophyllum*	Indian doomba oil tree, Indian-laurel	Calophyllaceae	0	0	0	0
18	*Cassia fistula*	Indian Laburnum, Golden shower tree	Caesalpiniaceae	0	0	0	0
19	*Cassia siamea*	Chakunda	Caesalpiniaceae	24	0.151899	-1.8845412	0.286259
20	*Casuarina equisetifolia*	Australian pine tree, Jhau	Casuarinaceae	0	0	0	0
21	*Cocos nucifera*	Coconut palm	Palmae	7	0.044304	-3.1166849	0.138081
22	*Dalbergia sissoo*	Indian Rosewood, Sishu	Fabaceae	0	0	0	0
23	*Delonix regia*	Flame tree, Gulmohar	Caesalpiniaceae	2	0.012658	-4.3694479	0.055309
24	*Dillenia indica*	Elephant Apple, Chalta	Dilleniaceae	0	0	0	0
25	*Eriodendron anfractuosum*	White Silk Cotton tree	Bombacaceae	9	0.056962	-2.8653705	0.163217
26	*Eucalyptus globulus*	Eucalyptus	Myrtaceae	0	0	0	0
27	*Excoecaria agallocha*	Geanoa	Euphorbiaceae	0	0	0	0
28	*Feronia elephantum*	Elephant apple	Rutaceae	0	0	0	0
29	*Ficus benghalensis*	Banyan tree	Moraceae	1	0.006329	-5.062595	0.032042
30	*Ficus cunia*	Fig tree	Moraceae	0	0	0	0
31	*Ficus religiosa*	Peepul tree	Moraceae	0	0	0	0
32	*Gliricidia sepium*	Gliricidia, Quickstick	Fabaceae	0	0	0	0
33	*Gmelina arborea*	Gamhar	Verbanaceae	3	0.018987	-3.9639827	0.075265
34	*Grevillea robusta*	Silver fir, Silky Oak	Proteaceae	0	0	0	0
35	*Grewia asiatica*	Phalsa	Tiliaceae	0	0	0	0
36	*Holarrhenaantidysenterica*	Kurchi	Apocynaceae	1	0.006329	-5.062595	0.032042

37	*Holoptelea integrifolia*	Indian Elm	Ulmaceae	0	0	0	0
38	*Lagerstroemia flosreginae*	Jarul	Lythraceae	0	0	0	0
39	*Leucaena leucocephala*	White Lead tree, Subabul	Mimosaceae	0	0	0	0
40	*Mangifera indica*	Mango tree	Anacardiaceae	3	0.018987	-3.9639827	0.075265
41	*Michella champaca*	Champak	Magnoliaceae	0	0	0	0
42	*Millingtonia hortensis*	Indian Cork tree	Bignoniaceae	0	0	0	0
43	*Mimusops elengi*	Spanish Cherry, Bakul	Zapotaceae	0	0	0	0
44	*Morinda citrifolia*	Mulberry	Moraceae	0	0	0	0
45	*Moringa pterygosperma*	Indian Mulberry	Rubiaceae	16	0.101266	-2.2900063	0.231899
46	*Morus indica*	Drumstick tree, Sajina	Moringaceae	0	0	0	0
47	*Nephelium litchi*	Litchi	Sapindaceae	0	0	0	0
48	*Peltophorum pterocarpum*	Radhachura	Fabaceae	11	0.06962	-2.6646998	0.185517
49	*Phoenix sylvestris*	Date palm	Palmae	5	0.031646	-3.4531571	0.109277
50	*Pithecellobium dulce*	Manila Tamarind	Fabaceae	0	0	0	0
51	*Plumeria acutifolia*	Pagoda tree	Apocynaceae	0	0	0	0
52	*Polyalthia longifolia*	False Ashoka, Debdaru	Annonaceae	16	0.101266	-2.2900063	0.231899
53	*Pongamia pinnata*	Pongam Oil Tree, Karang	Fabaceae	0	0	0	0
54	*Psidium guajava*	Guava	Myrtaceae	1	0.006329	-5.062595	0.032042
55	*Pterospermum acerifolium*	Muchkund	Sterculiaceae	0	0	0	0
56	*Putranjiva roxburghii*	Putranjiva	Euphorbiaceae	0	0	0	0
57	*Samanea saman*	Rain tree	Fabaceae	0	0	0	0
58	*Saraca indica*	Ashok	Fabaceae	0	0	0	0
59	*Sesbania grandiflora*	Hummingbird tree, Bakful	Fabaceae	5	0.031646	-3.4531571	0.109277
60	*Sonneratia apetala*	Rose apple, Jamrul	Myrtaceae	0	0	0	0
61	*Spathodea campanulata*	Keora	Lythraceae	3	0.018987	-3.9639827	0.075265
62	*Swietenia mahagoni*	Fountain tree	Bignoniaceae	0	0	0	0
63	*Syzygium cumini*	Mahogany	Meliaceae	1	0.006329	-5.062595	0.032042
64	*Syzygium samarangense*	Jam, Java plum	Myrtaceae	1	0.006329	-5.062595	0.032042
65	*Tamarindus indica*	Tamarind	Fabaceae	0	0	0	0
66	*Tamarix dioica*	Nona Jhau	Tamaricaceae	0	0	0	0
67	*Tectona grandis*	Teak	Verbenaceae	0	0	0	0
68	*Terminalia arjuna*	Arjun	Combretaceae	0	0	0	0
69	*Terminalia catappa*	Indian Almond	Combretaceae	0	0	0	0
70	*Thespesia populnea*	Tulip tree	Malvaceae	0	0	0	0
71	*Trema orientale*	Charcoal tree	Ulmaceae	0	0	0	0
72	*Trewia nudiflora*	Pituli	Euphorbiaceae	0	0	0	0
			Total	158			2.920

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7.2 Biodiversity Indices

The field survey was completed by HECS team in covered location at Cluster 4 and 5around 6.5 Kilometer at**Haldia Dock Complex, SMP, Kolkata**; a total number of 158 trees (N) have been recorded in the green belt area which comprise 28 numbers of species (S).

Shannon-Wiener Diversity (Biological Diversity)

Shannon-Wiener Index, originally proposed by Claude Shannon, a physicist, is the most commonly used biodiversity indices. It is also called Shannon's diversity index. It is an index that is commonly used to characterize species diversity in a community.

Shannon-Wiener Index is defined by the following function:

$$H = \Sigma[(pi)x\ln(pi)]$$

H = 2.920 (As per the Table Calculation)

Where:

- $p\ i$ = proportion of total sample represented by species i. Divide no. of individuals of species i by total number of samples.

The biological diversity (Shannon-Weiner Index-H') value recorded is 2.920, which represents relatively good diversity among the green belt plant species.

Species Richness (D)

Species richness is the number of different species represented in an ecological community, landscape or region. Species richness is simply a count of species, and it does not take into account the abundances of the species or their relative abundance distributions.

The larger the sample, the more species we would expect to find.Species richness is calculated bydividing the number of species by the square root of the number of individuals

in the sample. This particular measure of species richness is known as D, the Menhinick's index:

$$D = \frac{S}{\sqrt{N}}$$

$D = 28/\sqrt{158} = 2.22$

Where s equals the number of different species represented in your sample, and N equals the total number of individual organisms in the sample.

Species Evenness(J')

Species evenness refers to how close in numbers each species in an environment is. Mathematically it is defined as a diversity index, a measure of biodiversity which quantifies how equal the community is numerically. Species evenness is used to assess how evenly the population is spread across the species in an area.

Species Evenness= H/H_{max}

$H= 2.920$

$H_{max} = Ln(S) = \ln(28) = 3.332$

$= 2.920/3.332 = 0.876$

Significant species evenness (J') of 0.876 has been recorded among all the species surveyed.

Depicts the biodiversity indices plot for the green belt tree species surveyed in and around the **Haldia Dock Complex, SMP, Kolkata**area. Based on the biodiversity, indices calculations was performed using software PRIMER for the trees surveyed at **Haldia Dock Complex, SMP, Kolkata** green belt areas, it is inferred that the areas indicate higher species richness (2.22), diversity (2.920) and significant evenness (0.876) as shown in **Figure 6.**

Girth Size: Girth is a measurement of the distance around the trunk of a tree measured perpendicular to the axis of the trunk. The girth size is measured on an average at the height of 1.5 m above the ground. The girth size varies 32 to 206 cm in the study area during the monitoring period.

Dust Deposition: Average dust deposition found in the area is 0.8 mg/cm^2.

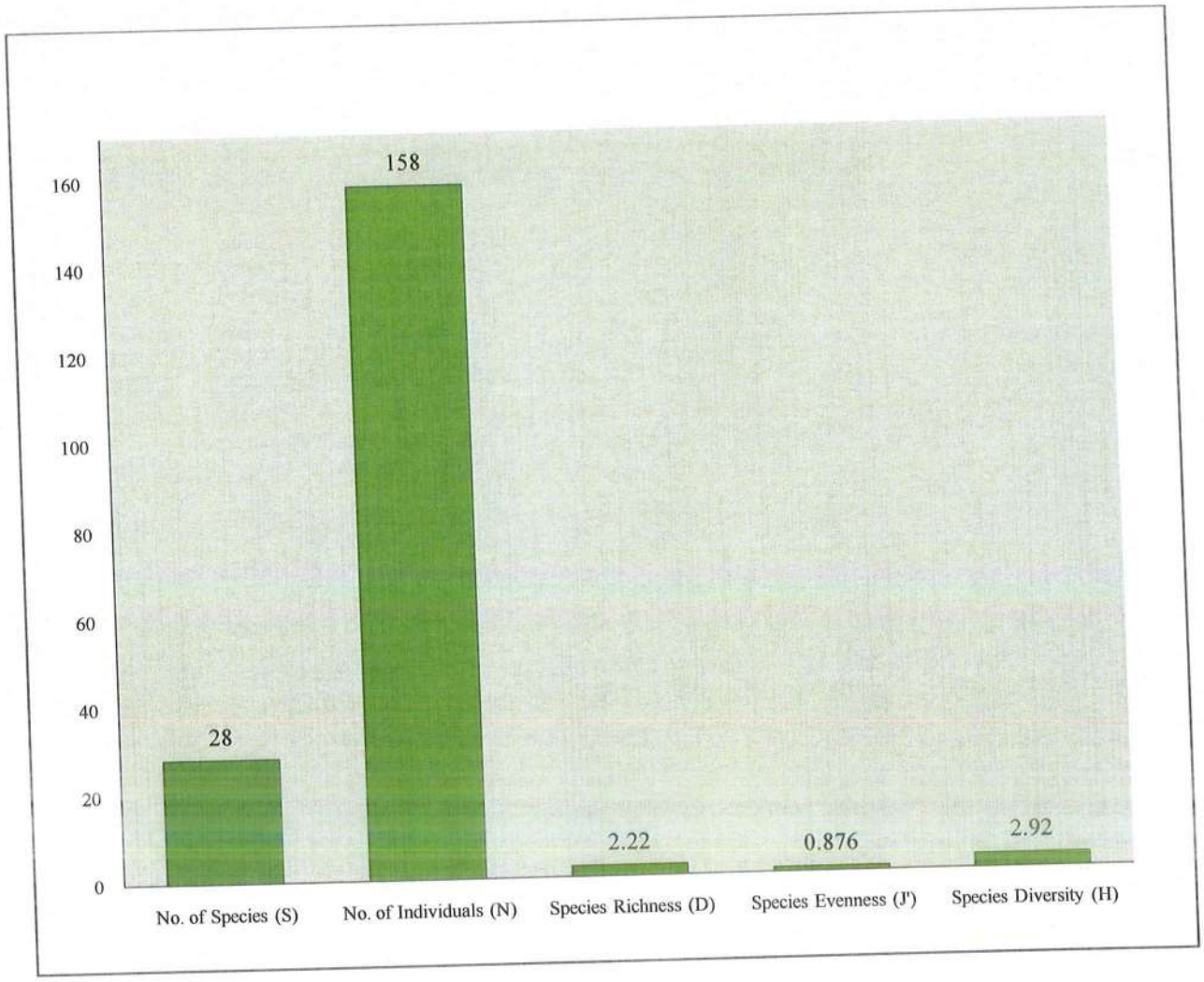
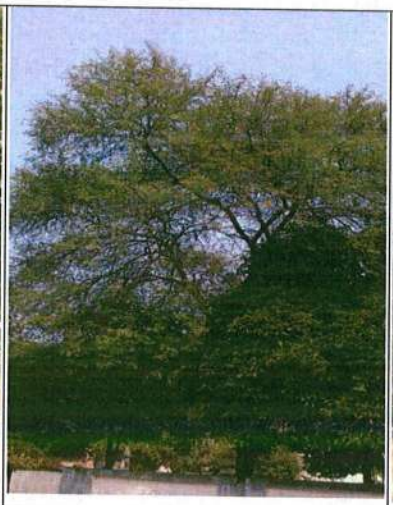


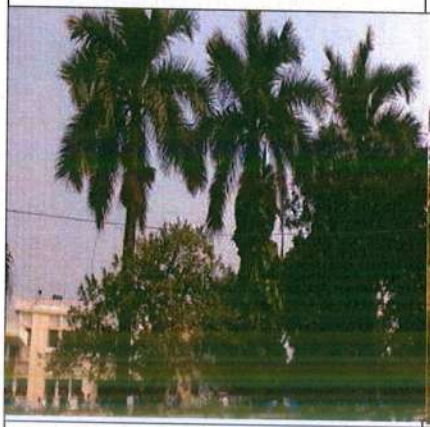
Figure 6. Biodiversity indices plot for the green belt tree species.

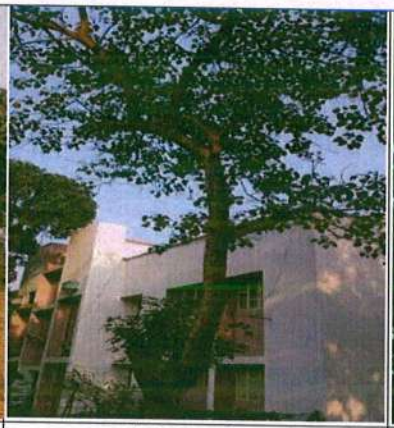
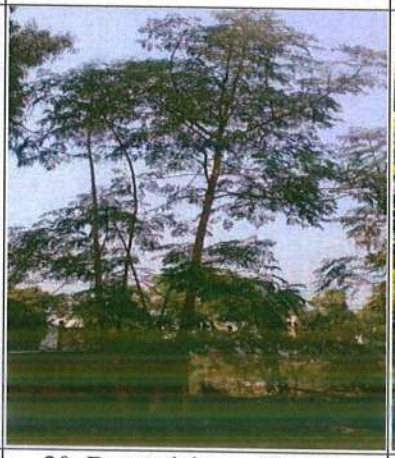
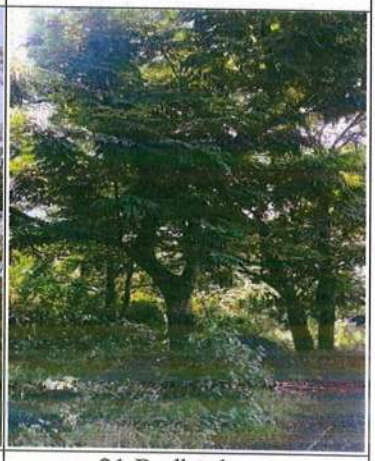
HaldiaDock Complex, SMP, Kolkata

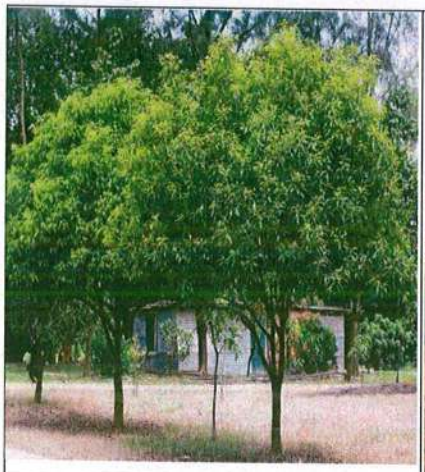
Green Belt Survey

Covered Location at Sector 8 to medico IOCL petrol bunk

		
1. Akasmoni *Acacia auriculiformis*	2. Babul *Acacia nilotica*	3. Wood Apple *Aegle Marmelos*
		
4.Siris *Albizzia lebbeck*	5.Chatim *Alstonia scholaris*	6. Kadam *Anthocephalus chinensis*

		
7. Jack Fruit *Artocarpus Integrifolia*	8. Camels Foot tree *Bauhinia acuminata*	9.Red Silk Cotton Tree *Bombax malabaricum*
		
10. Palmyra palm *Borassus flabellifer*	11.Bottle brush tree *Callistemon speciosus*	12. Chakunda *Cassia siamea*
		
13. Coconut palm *Cocos nucifera*	14. Flame tree/Gulmohar *Delonix regia*	15. White silk cotton tree *Eriodendron anfractuosum*

		
16. Banyan tree *Ficus bengalensis*	17. Gamhar *Gmelina arborea*	18. Kurchi *Holarrhena antidysenterica*
		
19. Mango tree *Mangifera indica*	20. Drumstick tree/ Sajina *Moringa pterygosperma*	21.Radhachura *Peltophorum pterocarpum*
		
22.Date palm *Phoenix sylvestris*	23. False Ashoka, Debdaru *Polyalthia longifolia*	24. Guava *Psidium guajava*



25. Hummingbird tree, Bakful
Sesbania grandiflora

26. Fountain tree
Spathodea campanulata

27. Jam, Java plum
Syzygium cumini

28. Rose apple, Jamrul
Syzygium samarangense

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