ENVIRONMENTALMONITORING REPORT OF SYAMA PRASAD MOOKERJEE PORT

PERIOD: - January' 2023 to December' 2023
(Consolidated Statements)

Directed by:

SYAMA PRASAD MOOKERJEE PORT, Kolkata
(Erstwhile Kolkata Port Trust)

Kolkata Dock System
15, Strand Road, Kolkata - 700001.

SYAMA PRASAD MOOKERJEE PORT, KOLKATA
(Erstwhile Kolkata Port Trust)
Kolkata Dock System
15, Strand Road, Kolkata - 700001

Conducted by:

M/S. R.V. BRIGGS & CO. PRIVATE LIMITED.

8-9, Bentinck Street, Kolkata – 700 001.

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PREFACE

Syama Prasad Mookherjee Port(Kolkata), the renowned Dock of West Bengal, has entrusted us the services for Environmental monitoring work during the period from 01.01.2022 to 02.12.2022, on behalf of the Management of the company. The Present Report has been prepared on the basis of Pollution Monitoring & Analysis Data of M/S. R. V. BRIGGS & CO (P) LTD., Kolkata,a WBPCB approved Laboratory, during the period from January'23 to Decmber'23.

For R. V. Briggs & Co (P) Ltd.

PERIODIC ENVIRONMENTAL MONITORING REPORT

JANUARY' 2023 TO MARCH' 2023

Prepared by R.V.BRIGGS & CO. PRIVATE LIMITED.
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Chapter - 1

1.0 INTRODUCTION:

Pollution is emerging as one of the most significant and challenging environmental problems of our modern Society. The Syama Prasad Mookherjee Port(Kolkata) is situated on the left bank of the Hooghly River at 22°32′53″N 88°18′05″E about 203 km (126 mi) upstream from the sea. The pilotage station is at Gasper/ Saugor roads, 145 Kilometres to the south of the KDS (around 58 km from the sea). The system consists of. Kidderpore Docks (K.P. Docks) : 18 Berths, 6 Buoys / Moorings and 3 Dry Docks. Kolkata Port Trust (officially renamed after the name of BJS founder as Dr. Syama Prasad Mukherjee Port Trust , is the only riverine major port of India located in the city of Kolkata, India, It is the oldest operating port in India, and was constructed by the British East India Company.

Major air pollutants generated by port activities include carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM). Prolonged exposure to these compounds can effect health include respiratory diseases, cardiovascular disease, lung cancer and premature death.

Noise from port areas comes not only from ferries, ships and trade but also from industrial and shipyards activities as well as auxiliary services. In this way, noise pollution can produce negative effects both to the natural eco-system and to the urban population.

Port operations can cause significant damage to water quality and subsequently to marine life and ecosystems, as well as human health. These effects may include bacterial and viral contamination of commercial fish and shellfish, depletion of oxygen in water, and bioaccumulation of certain toxins in fish.8 Major water quality concerns at ports include wastewater and leaking of toxic substances from ships, storm water runoff, and dredging

Waste management is the most important part in the port areas. Waste management relates to all kinds of wastes, both liquid and solid, likely to be disposed of in the port area. These wastes include dredged materials, garbage and oily mixtures discharged from ships, wastes from cargo operations, and all types of discharges from municipal and waterfront industry activities.

1.1.0 Scope of Work: The periodic measurement of Ambient Air quality, Meteorological observation, Ambient Noise quality, Surface water quality, Drinking water quality and also Effluent quality studies were carried out for the session January' 2023 to March' 2023. M/s

R. V. Briggs & Co. Pvt. Limited, 8-9, Bentinck Street, Kolkata – 700001, performed the whole work. Funding and other logistic supports were provided by KPT, Khidderpore. According to the work order, the scopes of work included are as follows:

1.1.1 The whole work was executed for determination of Respirable Particulate matter (PM_{10}), Particulate Matter $PM_{2.5}$, Oxides of Sulfur (SO_2), Oxides of Nitrogen (NO_x), Carbone Monoxide (CO) from each sample. Systematic evaluation of Ambient Air quality took place for 8 hourly for 24 hours for PM_{10}, SO_2, NO_2 & CO and $PM_{2.5}$, one sample for 24 hour basis at four (04) locations.

i) SMP, KPD (Near Dry Dock Area-2)

ii) SMP, KPD-2 (Beside Shed No. 22)

iii) SMP, NSD (Administrative Building)

iv) SMP, NSD (Berth No - 4)

The whole work was executed for determination of Respirable Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Oxides of Sulfur (SO_2), Oxides of Nitrogen (NO_x), Carbone Monoxide (CO) from each sample.

On each day of sampling at each stations samples for all five parameters (PM_{10}, $PM_{2.5}$, SO_2 and NO_2) were collected as follows:

i) PM_{10} 3 (three) shifts of 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

ii) $PM_{2.5}$ 1 (one) shift of 24 (twenty four) hrs. twice in a week for a every 3 months for a period of one year

iii) SO_2 3 (three) shifts of 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

iv) NO_2 3 (three) shifts of 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

v) CO 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

1.1.2 Ambient Noise level monitoring: It was carried out for 24 hourly basis in every month from the following four (04) Locations:

i) KPD, (Near Dry Dock Area - 2)

ii) KPD-2, (Beside Shed No. 22)

iii) NSD, (Near BERTH No. 7)

iv) NSD, (Near BERTH No. 3)

All the study work was carried out for determination of L_{eq}, L_{max}, L_{min}, L_{day}, L_{night}, L_{10}, L_{50} and L_{90}, etc from each locations as per the Principal rules were published in the Gazette of India vide number, S.O 123 (E), dated 14th February, 2000 and subsequently amended vide S.O 1046 (E), dated 22 nd November, 2000, S.O 1088 (E), dated 11 th October, 2002, S.O, 1569 (E), dated the 19 th September, 2006 and S.O 50 (E) dated 11 th January, 2010.).

1.1.3 Water sample collection:

- **Drinking Water** samples collected from
  (i) Head Office Canteen
  (ii) 51 CGR Road, Civil Engg. Dock Office, 2nd Floor Tap.
  (iii) Remount Road Quarter, 9 No. Civil Site Office
  (iv) Port Land Park Quarter, Civil Site Office
  (v) SMP – Kolkata Hospital Canteen # 09
  (vi) Container Terminal Office, (NSD)
  (vii) NS Dock Office ,(WTP)
  (viii) KP Dock Office

Following parameters were determined from the sample: pH, Colour, Turbidity, Chloride, Residual chlorine, Total Dissolved Solid, Coliform Bacteriological count as per stipulated norms for analysis of Drinking Water Quality of Central Pollution Control Board,

The following parameters were taken into consideration for drinking water analysis:

(a) **Microbiological Tests:** (i) Total Coliform Organism / 100 ml. of water, (ii) Faecal coliform Count

- **Dock Basin Water** samples collected from
  (i) 7 – 8 N.S. Dock
  (ii) N.S.D. Lock Entrance
  (iii) KPD 2 (26-28 KPD)
  (iv) KPD 1 (11 KPD)

- **River Water** samples collected from
- (i) Outside NS Dock Basin on River
- (ii) Outside KP Dock Basin on River
- Following parameters were determined from the sample: pH, Colour, Turbidity, Dissolved Oxygen (DO), Bio Chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil & Grease, Sulphate, Ammoniacal Nitrogen (NH_4 – N), Total Dissolved Solid, Total Suspended Solid, Saliniy, Coliform Bacteriological count as per stipulated norms for analysis of Dock Basin & River Water Quality of Central Pollution Control Board,

***1*.2.0 Period of Study:** The entire study period was on selected days between October' 2022 to December' 2022.

1.3.0 Work load Completed: The environmental sampling and related studies that were carried out in the field and at the R. V. Briggs laboratory

Chapter - 2

2.0 AMBIENT AIR QUALITY STUDIES

2.1.0 Objective: The most important objective of the study was to obtain a valid idea about the prevailing ambient air quality over the entire project area, during January' 2023 to March' 2023

2.2.0 Work Elements: The main objectives of the study are:-
As per the work order, the following work elements were evaluated:
(a) Collection of ambient air samples for 24 hourly period from 4 air sampling stations as per para 1.1.1, for determination of the concentration of the following pollutants :
i) Respirable Particulate matter (PM10), (ii) Particulate Matter (PM2.5), (iii) Sulphur Dioxide (SO_2), (iv) Nitrogen Oxide (NOx), (v) Carbone Monoxide (CO) respectively.

2.3.0 Preparation of Sampling Sites: At each of the air sampling stations, the actual site of placement of air sampling equipments were prepared according to the guide lines stipulated in IS: 5182 of Bureau of Indian Standard approved by the Ministry of Environment & Forests (MoEF), Government of India.

2.4.0 Duration of Air Sampling: Air sampling operations were fixed for 24 hours in 3 shifts and were splits into eight hours duration in each shift for 4 stations. So, 12 samples were collected from these stations. Therefore, altogether 12 samples were taken into consideration.

2.5.0 Sampling Equipment & Methodology:

i. Air samples collected by using Respirable dust sampler Machine (Envirotech, APM 460 BL)
ii. $PM_{2.5}$ samples collected by using $PM_{2.5}$ sampler (Instrumex, Model: IPM-FDS/MFC-2500, Polltech, Model: PEM-ADS2.5 & Envirotech Model: APM 550 MFC)

2.6.0 Laboratory Determination:

2.6.1 Respirable Particulate Matter (PM_{10}):- For every station and for every shift, one Glass micro fibre filter paper with a dimension of 203 mm × 254 mm was used to collect air samples. At each station, a total time period of 24 hours duration was taken into consideration for collection of samples. Which was splits into 3 shifts each of 8 hours duration. Thus, for a 24 hours monitoring a

total number of 3 filter papers were used. So, for four (4) stations in total 3 x 4 = 12 samples were collected.

Before sampling, all these filter papers were dried in an air oven followed by drying in desiccators. The dried filter papers were weighed and then fitted in the high volume air sampler. The filter papers were re-weighted at the end of the duration of sampling (8 hours or 6 hours). From the weight indicate the weight of RPM particle collected over a period of 8 hours or 6 hours. From the corresponding data on total volume of air, which passed through the sampling machine over the same duration of time, the concentration of RPM was computed in terms of μg/m^3 of air. The assessments were made according to their respective land use categories.

2.6.2: Particulate Matter ($PM_{2.5}$):

The pre-weighed filter paper, in which $PM_{2.5}$ particles were collected, were weighed both in the pre and post monitoring times. The gain in weight indicated the total weight of $PM_{2.5}$ collected during 24 hour sampling time. From the corresponding data on total volume of air drawn in by the sampling machine, the concentration of PM2.5 was computed in μg/ m^3 of air.

2.6.3: Sulphur Di Oxide (SO_2):

SO_2 in the ambient air was absorbed in 0.05 (M) potassium tetrachloromercurate solution at a flow rate 0.5 litre / minute. It was analysed spectrophotometrically after developing the colour for 30 minutes by adding sulphamic acid, Formaldehyde and P – rosaniline hydrochloride solution as per IS :5182 (Part – II) 2001 (West & Gacke method) and recorded the absorbance at 560 mm. Then the concentration of SO_2 was measured by standard curve and represented the results as μg/m^3 in respect of air volume.

2.6.4: Nitrogen Oxides (NO_x):

NO_x was collected by bubbling air through 0.1 (N) sodium hydroxide and sodium arsenite solution at flow rate 0.4 lit /min. It was analyzed spectrophotometrically after developing the colour for 10 minutes by adding Hydrogen peroxide, sulphanilamide and NEDA solution as per IS : 5182 (Part – VI) 2006 (Jacobs & Hochheiser method) and recorded the absorbance at 540 mm. Then the concentration of NO_x was measured by standard curve and represented the result as μg/m^3 in respect of air volume.

2.6.5: Carbone monoxides (CO):

CO was collected in a bladders and estimated by CO Analyzer and Orsat.

2.7.0 Results of laboratory determinations:

The salient findings of concentrations of PM10, PM2.5, CO, SO_2 and NOx (Table 2.1) of this study are as follows:

2.7.1 Ambient Air Quality:

- ***Near Dry Dock Area-2.:-***

The concentration of PM2.5 ranged from 43.7 µg/m^3 to 60.0 µg/m^3 with a mean value of 48.9 µg/m^3. The concentration of PM10 ranged from 58.3 µg/m^3 to 113.5 µg/m^3 with a mean value of 81.6 µg/m^3 of air. Concentration of SO2 ranged from 3.3 µg/m^3 to 7.10 µg/m^3 of air with a mean value of 5.21 µg/m^3 of air While the concentration of NOx ranged from 23.32 µg/m^3 to 53.72 µg/m^3 of air with a mean value of 31.39 µg/m^3 of air and the concentration of CO ranged from 0.82 mg/m^3 to 1.04 mg/m^3 of air with a mean value of 0.95 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

- ***Beside Shed No:22.:-***

The concentration of PM2.5 ranged from 45.0 µg/m^3 to 54.2 µg/m^3 with a mean value of 51.1 µg/m^3. The concentration of PM10 ranged from 66.4 µg/m^3 to 104.2 µg/m^3 with a mean value of 86.7 µg/m^3 of air. Concentration of SO2 ranged from 1.12 µg/m^3 to 6.47 µg/m^3 of air with a mean value of 5.18 µg/m^3 of air While the concentration of NOx ranged from 24.86 7µg/m^3 to 72.0 µg/m^3 of air with a mean value of 32.38 µg/m^3 of air and the concentration of CO ranged from 0.90 mg/m^3 to 1.08 mg/m^3 of air with a mean value of 0.98 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

- ***Administrative Building.:-***

The concentration of PM2.5 ranged from 45.0 µg/m^3 to 75.4 µg/m^3 with a mean value of 54.2 µg/m^3. The concentration of PM10 ranged from 73.7 µg/m^3 to 159.0 µg/m^3 with a mean value of 93.5 µg/m^3 of air. Concentration of SO2 ranged from 0.69 µg/m^3 to 7.77 µg/m^3 of air with a mean

value of 5.11 µg/m^3 of air While the concentration of NOx ranged from 22.35 7µg/m^3 to 55.21 µg/m^3 of air with a mean value of 30.49 µg/m^3 of air and the concentration of CO ranged from 0.86 mg/m^3 to 1.12 mg/m^3 of air with a mean value of 1.01 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

- ***BERTH No – 4, NS Dock:-***

The concentration of PM2.5 ranged from 47.1 µg/m^3 to 72.1 µg/m^3 with a mean value of 55.7 µg/m^3. The concentration of PM10 ranged from 69.5 µg/m^3 to 159.7 µg/m^3 with a mean value of 94.1 µg/m^3 of air. Concentration of SO2 ranged from 0.42 µg/m^3 to 12.36 µg/m^3 of air with a mean value of 5.54 µg/m^3 of air While the concentration of NOx ranged from 21.85 7µg/m^3 to 43.67 µg/m^3 of air with a mean value of 29.81 µg/m^3 of air and the concentration of CO ranged from 0.69 mg/m^3 to 1.12 mg/m^3 of air with a mean value of 1.00 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

AMBIENT AIR QUALITY STYDY HAD BEEN DEPICTED THROUGH PHOTOGRAPHS

Table - 2.1

LAND USE CATEGORY – WISEDISTRIBUTION OF AIR SAMPLING STATIONS AND ITS ANALYTICAL RESULTS
(JANUARY' 2023 - MARCH' 2023)

Location : SMP, KPD (Near Dry Dock Area-2)
Period : 01.01.2023 to 31.03.2023

Date of Inspection	Unit in µg/m³													Unit in mg/m³			
	PM2.5	PM10				SO2				NO2				CO			
	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.
21.02.2023	**49.2**	86.4	79.5	91.8	**85.9**	5.55	7.10	5.99	**6.21**	28.49	31.14	32.46	**30.70**	1.03	1.02	0.92	**0.990**
24.02.2023	**49.2**	89.5	113.5	71.8	**91.6**	3.33	3.61	3.89	**3.61**	53.72	49.34	41.66	**48.24**	0.99	1.04	0.91	**0.980**
28.02.2023	**45.8**	77.5	83.1	88.5	**83.0**	4.66	5.33	5.55	**5.18**	33.61	37.72	26.06	**32.46**	0.95	0.90	0.86	**0.903**
03.03.2023	**45.0**	65.6	87.1	86.1	**79.6**	5.32	6.17	5.75	**5.75**	31.55	37.72	26.06	**31.78**	0.92	0.99	0.82	**0.910**
06.03.2023	**47.1**	72.7	85.2	60.7	**72.9**	4.68	5.54	4.47	**4.90**	25.38	31.55	27.43	**28.12**	0.99	1.03	0.87	**0.963**
10.03.2023	**51.7**	81.3	95.8	72	**83.0**	4.90	6.60	5.32	**5.61**	26.1	30.9	29.5	**28.80**	0.95	1.03	0.94	**0.973**
14.03.2023	**48.7**	91.4	95	58.3	**81.6**	5.11	5.54	4.68	**5.11**	23.32	26.75	26.75	**25.61**	1.00	0.96	0.92	**0.960**
17.03.2023	**43.7**	62.1	81.9	82.3	**75.4**	5.31	5.96	4.68	**5.32**	24.69	28.12	23.32	**25.38**	0.88	0.91	0.87	**0.887**
Norms NAAQM	**60**				**100**				**60**				**60**				**5.0**

HISTOGRAM OF RESULTS OF AMBIENT AIR QUALITY MONITORING of SMP, KPD (Near Dry Dock Area-2)

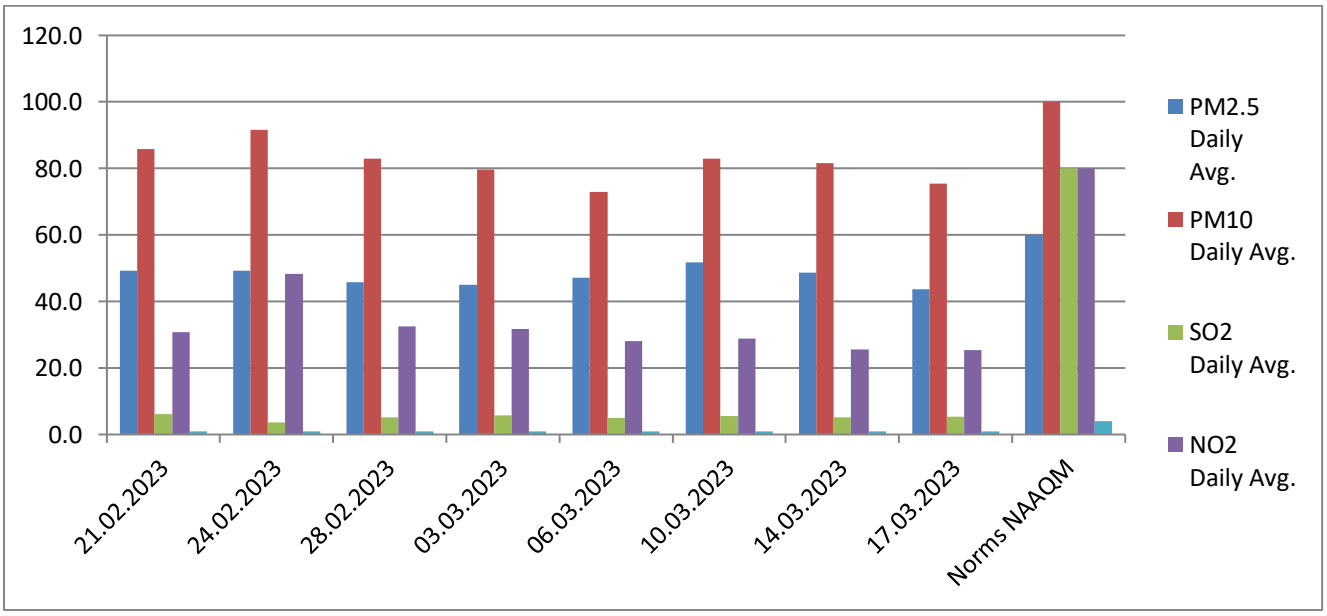

Table - 2.2

Location : SMP, KPD-2 (Beside Shed No. 22)
Period : 01.01.2023 to 31.03.2023

Date of Inspection	Unit in µg/m³													Unit in mg/m³			
	PM2.5	PM10				SO2				NO2				CO			
	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.
21.02.2023	**45.0**	82.2	74.5	82.4	**79.7**	4.88	5.77	5.55	**5.40**	27.47	30.09	24.86	**27.47**	0.97	1.08	1.00	**1.02**

24.02.2023	**54.2**	95.5	93.4	101.2	**96.7**	2.95	1.12	2.39	**2.15**	72.00	51.31	46.94	**56.75**	0.94	0.99	0.91	**0.95**
28.02.2023	**51.3**	75.5	104.2	89.2	**89.6**	5.84	5.17	5.39	**5.47**	29.37	36.19	28.00	**31.19**	0.99	1.02	0.91	**0.97**
03.03.2023	**49.2**	72.1	82.9	97.7	**84.2**	5.18	6.47	6.04	**5.90**	30.73	34.15	25.27	**30.05**	0.97	1.04	0.90	**0.97**
06.03.2023	**52.5**	86.4	95.1	81.8	**87.8**	4.96	5.82	4.96	**5.25**	28.68	32.10	26.63	**29.14**	1.00	1.03	0.96	**1.00**
10.03.2023	**52.9**	83.7	93.7	81.7	**86.4**	5.61	5.82	6.25	**5.89**	27.32	31.41	28.68	**29.14**	0.99	1.08	1.02	**1.03**
14.03.2023	**52.9**	82.5	87.0	90.5	**86.7**	4.96	6.25	5.82	**5.68**	28.00	30.73	25.95	**28.23**	0.91	0.99	0.90	**0.93**
17.03.2023	**50.8**	66.4	83.7	96.4	**82.2**	5.18	6.47	5.38	**5.68**	25.27	28.68	27.32	**27.09**	0.91	0.97	0.92	**0.93**
Norms NAAQM	**60**				**100**				**80**				**80**				**4.0**

HISTOGRAM OF RESULTS OF AMBIENT AIR QUALITY MONITORING of SMP, KPD-2 (Beside Shed No. 22)

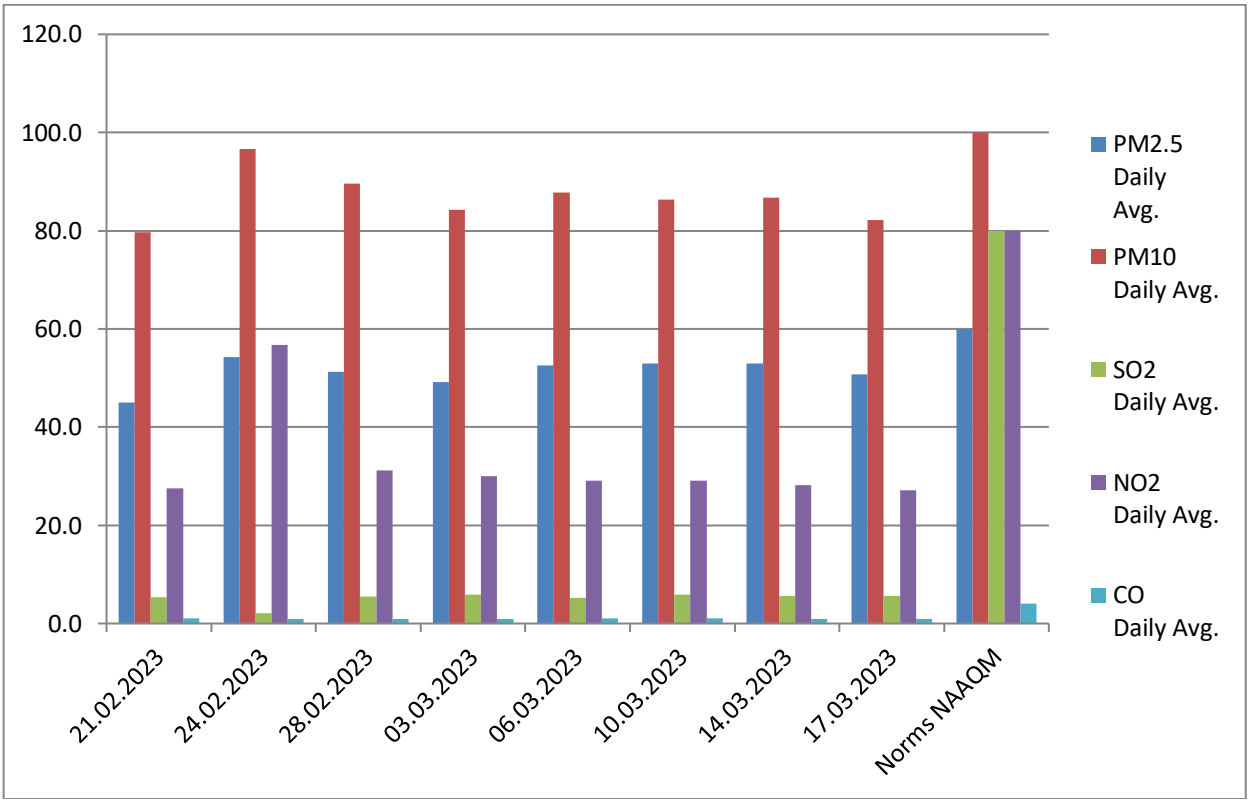

Table - 2.3

Location : SMP, NSD (Administrative Building
Period : 01.01.2023 to 31.03.2023

Date of Inspection	Unit in µg/m³				Unit in mg/m³
	PM2.5	PM10	SO2	NO2	CO

	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.
21.02.2023	**54.6**	86.7	99.3	84.2	**90.1**	5.08	5.52	5.30	**5.30**	24.75	32.57	30.62	**29.31**	0.98	0.99	0.91	**0.96**
24.02.2023	**75.4**	149.1	121.8	159.0	**143.3**	0.69	3.75	4.86	**3.10**	42.22	55.21	51.96	**49.80**	1.12	1.04	0.93	**1.03**
28.02.2023	**57.9**	97.6	73.7	110.5	**93.9**	5.55	5.99	7.77	**6.44**	26.41	34.54	39.28	**33.41**	1.12	1.04	0.93	**1.03**
03.03.2023	**51.7**	94.6	97.0	77.4	**89.7**	4.90	5.75	5.54	**5.40**	24.38	29.80	26.41	**26.86**	1.01	1.10	0.99	**1.03**
06.03.2023	**50.0**	83.3	74.3	85.5	**81.0**	4.47	5.32	4.68	**4.82**	25.73	29.12	24.38	**26.41**	1.04	1.06	0.96	**1.02**
10.03.2023	**45.0**	80.1	83.6	75.4	**79.7**	4.68	5.32	4.90	**4.97**	23.02	28.44	25.06	**25.51**	1.07	0.95	0.86	**0.96**
14.03.2023	**50.0**	78.2	76.2	96.3	**83.6**	5.11	5.54	4.68	**5.11**	24.38	25.73	22.35	**24.15**	1.03	1.08	1.00	**1.04**
17.03.2023	**48.8**	74.3	93.6	91.3	**86.4**	5.32	6.17	5.75	**5.75**	26.41	31.15	27.76	**28.44**	1.00	1.04	0.99	**1.01**
Norms NAAQM	**60**				**100**				**80**				**80**				**4.0**

HISTOGRAM OF RESULTS OF AMBIENT AIR QUALITY MONITORING of SMP, NSD (Administrative Building)

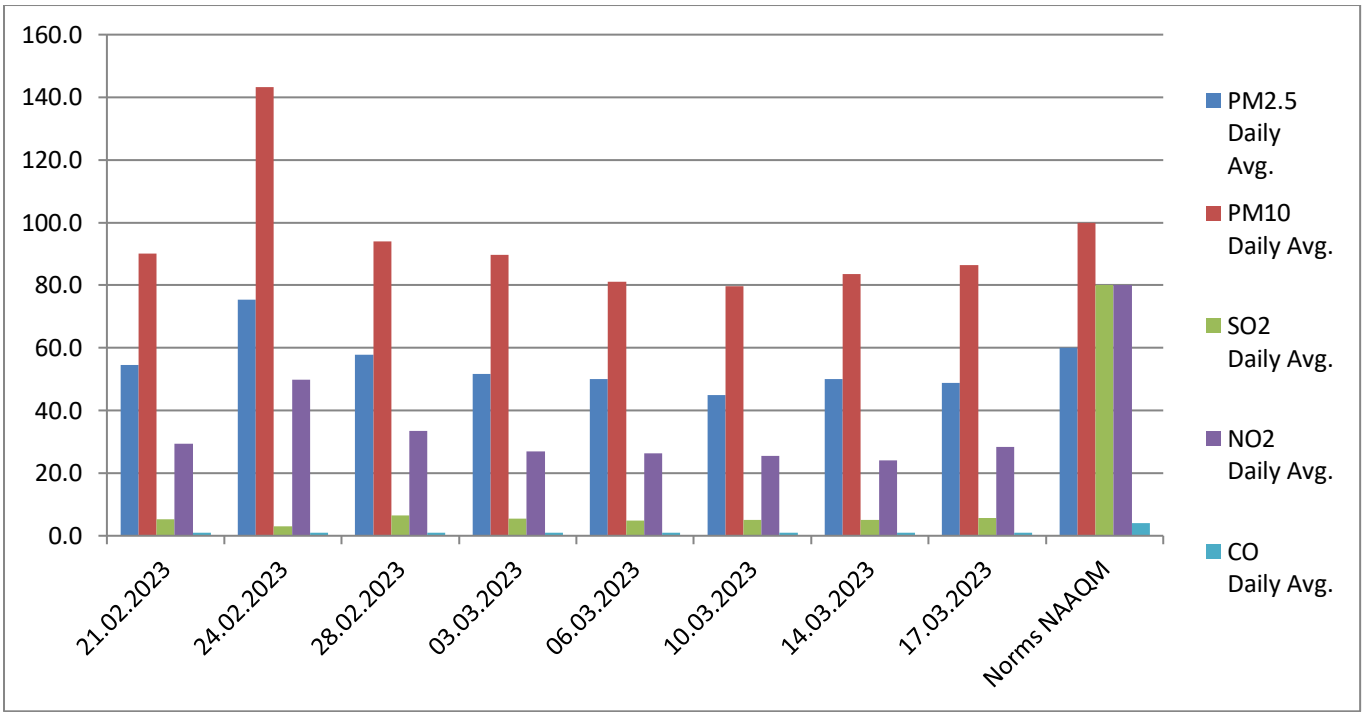

Table - 2.4

Location : SMP, NSD (BERTH NO - 4)

Period : 01.01.2023 to 31.03.2023

Date of	Unit in µg/m³	Unit in mg/m³

Inspection	PM2.5	PM10				SO2				NO2				CO			
	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.	Shift-1	Shift-2	Shift-3	Daily Avg.
21.02.2023	**57.5**	86.1	93.1	96.4	**91.9**	5.33	5.99	5.55	**5.62**	32.32	29.69	32.98	**31.66**	0.94	0.99	0.98	**0.97**
24.02.2023	**72.1**	128.7	102.7	159.7	**130.4**	0.42	5.41	12.36	**6.06**	43.67	42.58	36.03	**40.76**	1.12	1.04	0.96	**1.04**
28.02.2023	**47.1**	81.1	102.4	78.0	**87.2**	5.10	6.44	6.21	**5.92**	27.32	33.46	22.54	**27.77**	1.06	1.02	0.93	**1.00**
03.03.2023	**55.0**	95.8	87.8	92.4	**92.0**	4.68	5.32	5.11	**5.04**	25.27	30.73	23.90	**26.63**	1.02	1.06	0.98	**1.02**
06.03.2023	**55.5**	95.1	97.5	88.1	**93.6**	4.75	5.19	4.32	**4.75**	24.21	31.13	27.67	**27.67**	1.03	1.11	0.90	**1.01**
10.03.2023	**54.2**	86.7	96.7	91.9	**91.8**	5.32	5.96	5.75	**5.68**	28.68	32.10	30.73	**30.50**	1.04	1.11	1.03	**1.06**
14.03.2023	**56.7**	72.9	99.2	93.2	**88.4**	5.54	6.60	6.17	**6.10**	28.00	30.73	29.37	**29.37**	1.01	1.06	1.03	**1.03**
17.03.2023	**47.5**	89.5	74.7	69.5	**77.9**	5.11	5.54	4.90	**5.18**	23.90	26.63	21.85	**24.13**	0.93	0.69	1.03	**0.88**
Norms NAAQM	**60**				**100**				**80**				**80**				**4.0**

HISTOGRAM OF RESULTS OF AMBIENT AIR QUALITY MONITORING of SMP, NSD (BERTH NO - 4)

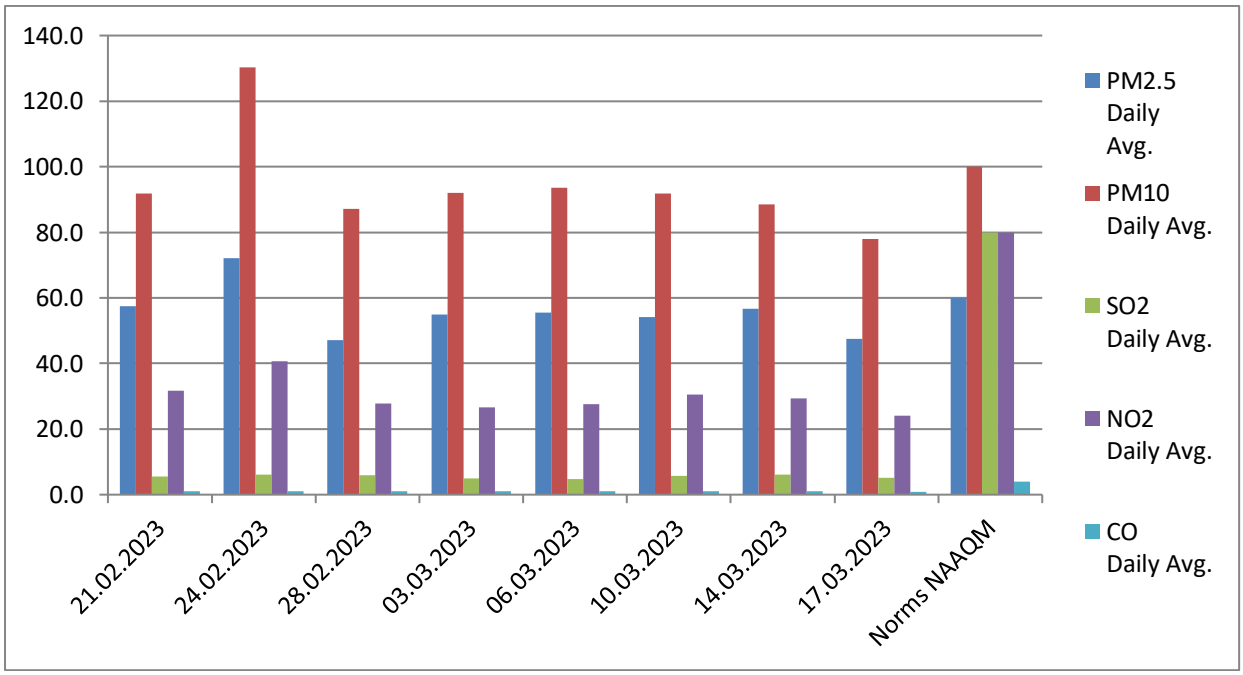

Table – 2.5
[SCHEDULE VII]
[See rule 3 (3B)]
National Ambient Air Quality Standards

Pollutants	Time Weighted	Concentration in Ambient Air (µg / m³ of air)

	Average	Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Areas
Sulphur Dioxide (SO_2)	Annual Average *	50	20
	24 hours**	80	80
Nitrogen Dioxide (NO_2)	Annual Average *	40	30
	24 hours**	80	80
Carbon monoxide (CO)	8 hours**	2	2
	1 hours**	4	4
Particulate Matter (PM10) (size less than 10µm) or PM_{10}	Annual Average *	60	60
	24 hours**	100	100
Particulate Matter (PM2.5) (size less than 2.5µm	Annual Average *	40	40
	24 hours**	60	60

* Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval
** 24 hourly / 8 hourly values should be met 98 % of the time in a year. However, 2 % of the time, it may exceed but not on two consecutive days.

[Norms as per Ministry of Environment and Forests Notification, New Delhi, the 16th November, 2009]
[Environment (Protection) Seventh Amendment Rules, 2009]

Chapter - 3

3.0 AMBIENT NOISE QUALITY STUDY

3.1.0 Objective: An evaluation of ambient noise levels were carried out in and around the working area during January' 2023 to March' 2023, according to the following land use (Table 3.3) categories:

- Ambient Noise level in the Residential areas.
- Ambient Noise levels in the Commercial areas
- Ambient Noise Level in the Industrial areas

3.2.0 Selection of Noise level Monitoring Stations:

The noise level measurement stations selected according to each land use category, the location details of which have been depicted in Table 3.0.

3.3.0 Sampling equipment and methodology:

3.3.1: Equipment:

Noise level measurements were carried out with the help of portable Sound level Meter (SL-4001 and SL 4033SD) respectively. M/s Lutron manufactured both the instruments.

3.3.2: Methodology:

(a) For determination of ambient noise at a particular point, the noise meter probe was pointed to the four cardinal directions of north, south, east and west. Corresponding to each direction a set of reading in "slow" setting was recorded.

(b) During the study time a gap of 30 seconds was allowed between two consecutive data observation. Sound level was collected to monitor the values of L10, L50, L90, Lmax, Lmin& L day and L night during the period of 24 hrs. monitoring period.

(c) The noise levels were recorded continuously at 1 – hourly interval through SL – 4001. Thus in total 1440 readings were recorded after 12 hours study. While through SL 4033 SD, the ambient noise levels were measured for 24 hours continuously. So, here a total number of 2880 readings were recorded after 24 hours study.

The measurements recorded are detailed below:

(c) Equivalent Continuous Sound Pressure Level (Leq):

Equivalent Continuous Sound Pressure Level, or Leq, is the constant noise level that would result in the same total sound energy being produced over a given period. It can be measured in either A, C or Z (Linear) modes. Leq is not an 'average sound level', as it sometimes referred to. The equations used to calculate Leq are not calculating a specific average level.
Leq can be described mathematically by the following equation:

$$Leq = 10\log_{10}\left(\frac{1}{T_M}\int_{Q}^{T_M}\left(\frac{P(t)}{P_O}\right)^2 dt\right)$$

Where:

- Leq is the equivalent continuous linear weighted sound pressure level re 20μPa, determined over a measured time interval Tm (secs)
- P(t) is the instantaneous sound pressure of the sound signal
- Po is the reference sound pressure of 20μPa

When the instantaneous A-weighted sound pressure (PA) of the sound signal is introduced the equivalent continuous A-weighted sound pressure level determined over time interval Tm is as follows:

$$Leq = 10\log_{10}\frac{1}{T_M}\int_{o}^{T_M}\left(\frac{P_A(t)}{P_O}\right)^2 dt$$

In practice when measuring noise it is possible to take Leq readings, with your instrument, of short duration, i.e. <5 minutes, providing all variations of noise emissions are covered. If the measured environment changes greatly then the longer the Leq measurement is taken the more accurate the measurement.

Adding Leq values requires taking an anti-log of each value. The addition can be performed as shown:

A weighting: the A-weighting

$$\text{Total } L_{eq} = 10\log\left(\frac{10^{\frac{L_{eq1}}{10}} + 10^{\frac{L_{eq2}}{10}} + 10^{\frac{L_{eq3}}{10}} + \ldots\ldots + 10^{\frac{L_{eqn}}{10}}}{n}\right)$$

filter covers the full audio range - 20 Hz to 20 kHz and the shape is similar to the response of the human ear at the lower levels.

A-weighted noise measurements are the most widely used and confirm the accuracy of the meter including the filters.
The preferred convention is to write LA = x dB, however dB A and dB (A) are often used, etc.

C-weighting**:** a standard frequency weighting for sound level meters, commonly used for higher level measurements, it also written as dB(C) or dBC.
The A-weighting curve is used extensively for general purpose noise measurements but the C-weighting correlates better with the human response to high noise levels.
L50: If we consider any fluctuating noise levels and store the results once a second, then at the end of an hour we would have 3600 samples. We can then use these samples to determine some helpful statistics. For example if add up all the samples and divide by 3600 then we will get the average or L50% value of the noise over the hour.
L10: By definition the L10 value is the level just exceeded for 10% of the time and takes account of any annoying peaks of noise.
L90: By definition the L90 value is the level just exceeded for 90% of the time and takes account of any annoying peaks of noise.
Lmax is the highest RMS (root mean squared) sound pressure level within the measuring period.
Lmin is the lowest RMS sound pressure level within the measuring period.
Lday is the total results during day time monitoring
Lnight is the total results during night time.

RESULTS OF AMBIENT NOISE LEVEL MONITORING

Table: 3.1

Location : Near Dry Dock Area-2
Period : January' 2023 - March' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)						Night Time (10:00 P.M. to 06:00 A.M.)					
	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
17.01.2023	59.5	64.2	69.4	55.7	74.5	66.3	56.7	61.8	66.6	54.2	71.5	63.7
21.02.2023	57.1	59.4	65.7	55.6	85.6	64.6	57.0	57.8	61.2	55.8	70.5	59.2
14.03.202	52.4	56.2	63.5	46.7	75.2	60.4	48.6	51.7	57.0	41.8	77.8	56.2
Norms	**75**						**70**					

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

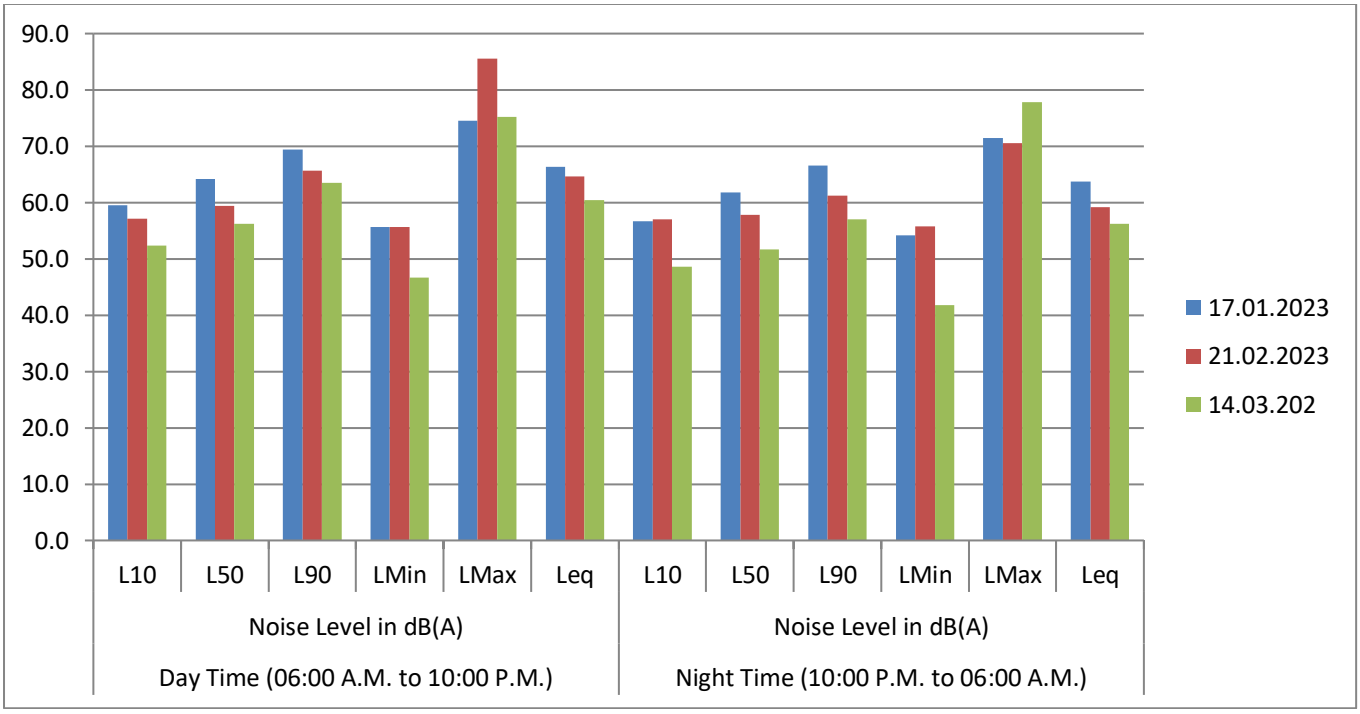

Table: 3.2

Location : Beside Shed No. 22

Period : January' 2023 - March' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)	Night Time (10:00 P.M. to 06:00 A.M.)

	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
17.01.2023	68.4	68.9	70.0	67.6	73.9	69.5	64.8	65.1	65.8	63.3	68.9	65.4
21.02.2023	61.5	66.0	71.1	54.5	81.6	68.0	58.1	64.0	69.4	52.2	79.9	66.3
14.03.202	61.6	66.8	72.2	40.8	82.9	70.0	59.6	62.7	68.1	48.8	85.4	66.0
Norms	**75**						**70**					

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

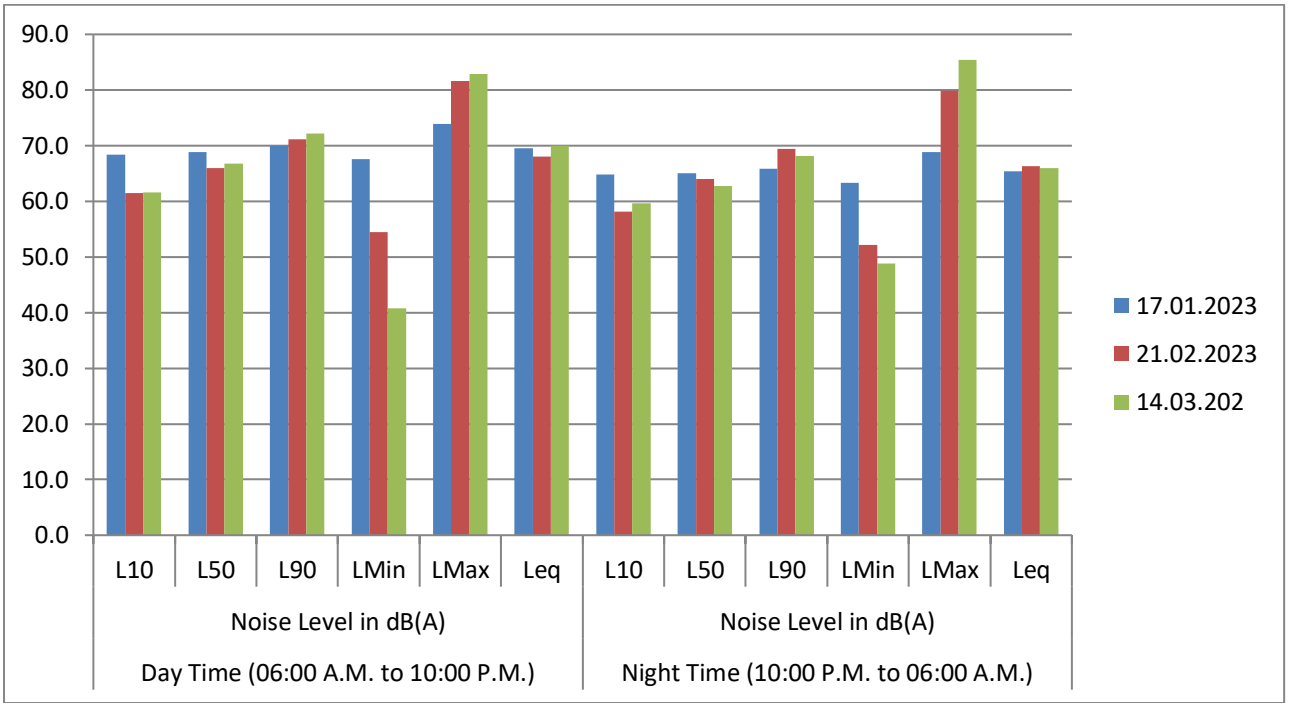

Table: 3.3

Location : Near BERTH No. 7

Period : January' 2023 - March' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)						Night Time (10:00 P.M. to 06:00 A.M.)					
	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
17.01.2023	63.4	66.0	71.8	62.7	80.0	69.6	62.5	62.8	63.5	61.0	66.6	63.1
21.02.2023	45.1	51.4	70.9	42.2	91.1	69.3	50.1	51.0	51.6	42.1	70.1	52.0
14.03.202	50.5	54.0	61.3	45.9	84.3	59.2	48.2	51.8	57.7	45.6	76.3	55.7
Norms	**75**						**70**					

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

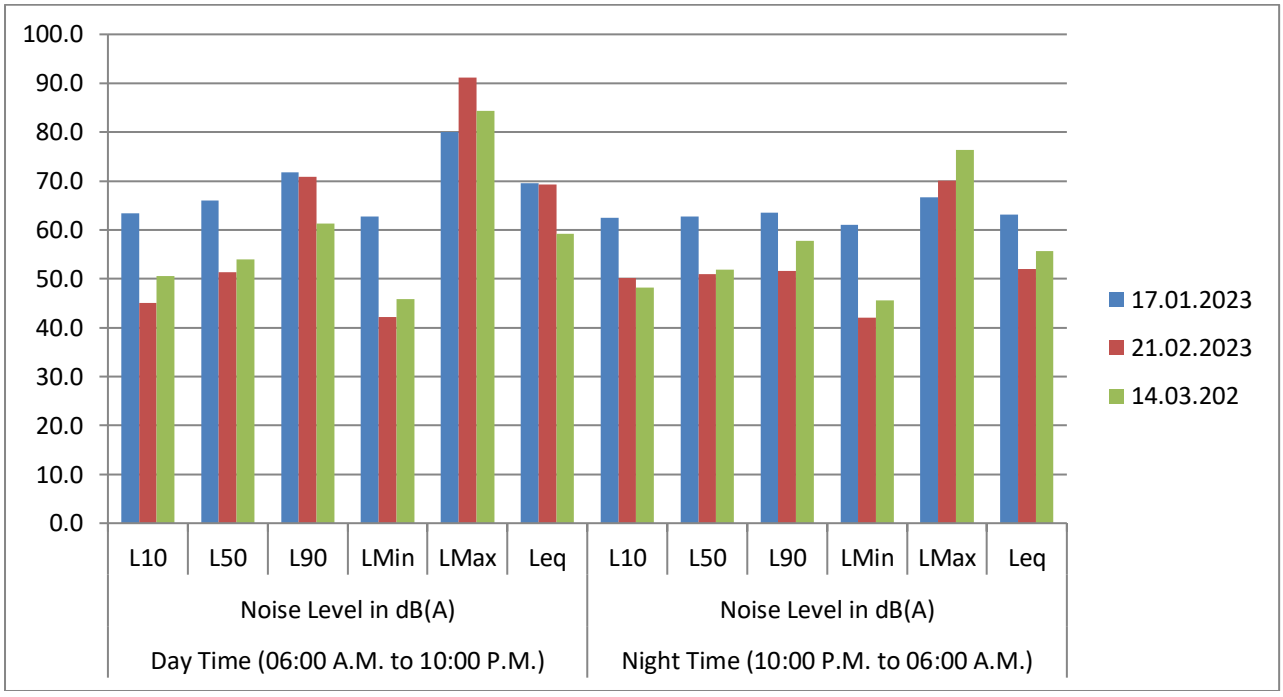

Table: 3.4

Location : Near BERTH No. 3

Period : January' 2023 - March' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)						Night Time (10:00 P.M. to 06:00 A.M.)					
	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
17.01.2023	67.0	67.7	69.6	66.3	74.9	68.8	58.8	59.3	60.0	57.4	62.1	59.5
21.02.2023	61.5	66.0	71.2	54.5	81.6	68.0	58.1	64.0	69.4	52.2	79.9	66.3
14.03.202	57.9	61.8	69.0	48.2	88.5	66.6	48.6	51.7	57.0	41.8	77.8	56.2
Norms	**75**						**70**					

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

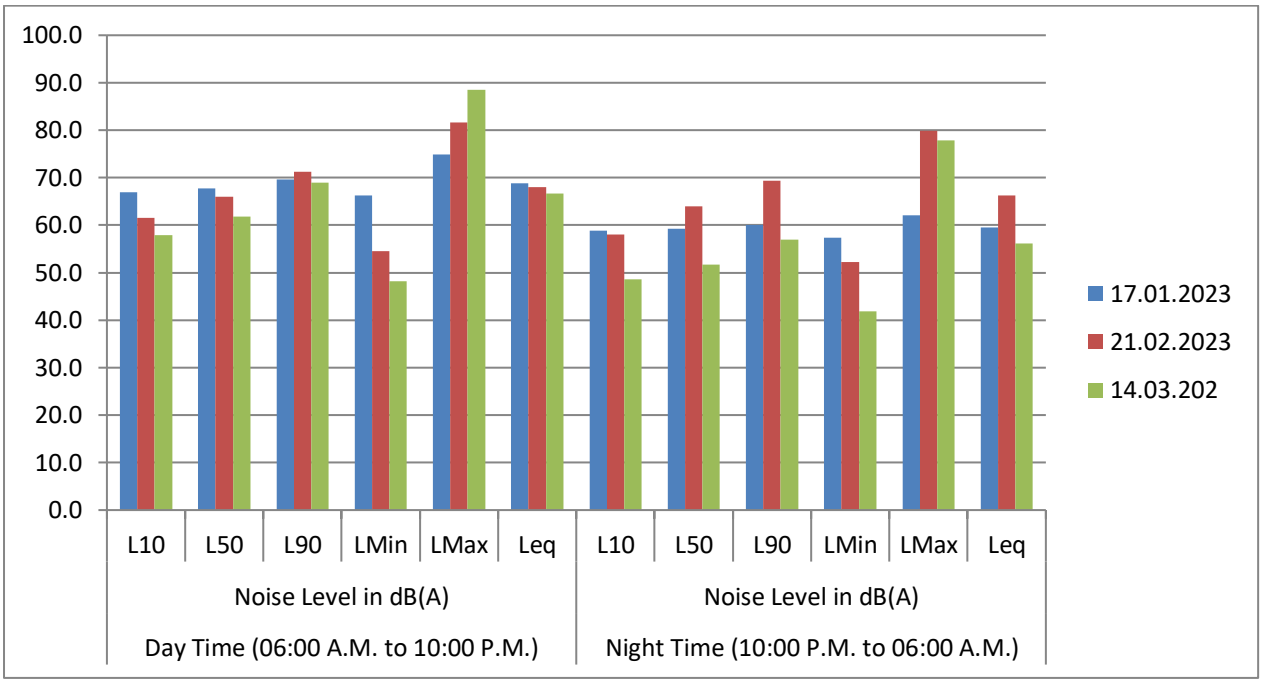

TABLE 3.5
NATIONAL AMBIENT NOISE LEVEL STANDARD

LIMITS IN d(B)A Leq			
AREA CODE	CATEGORY OF AREA	DAY TIME	NIGHT TIME
A	INDUSTRIAL AREA	75	70

B	COMMERCIAL AREA	65	55
C	RESIDENTIAL AREA	55	45
D	SILENCE ZONE	50	40

Note:
1. Day time is reckoned in between 6 a.m and 10 p.m
2. Night time is reckoned in between 10 p.m and 6 a.m
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
4. Mixed categories areas may be declared "as one of the four" above mentioned categories, by the Competent Authority.
5. dB (A) Leq denotes the time weighted average of the level of sound in decibels in scale A, which is relatable to human hearing.

A "decibel" is a unit in which the noise is measured.

"A", in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq : It is energy mean of the noise level over a specified period.

Source:
The Principal Rules were published in the Gazette of India, vide no. S.O 123 (E), dated 14th February 2000 and subsequently amended vise S.O 1046 (E), dated 22nd November, 2000, S.O 1088 (E), dated 11th October, 2002, S.O (1569 (E), dated the 19th September, 2006 and S.O 50 (E) dated 11th January, 2010.

Chapter - 4

4.0 CHARACTERIZATIONS OF DRINKING WATER SAMPLES

4.1.0 Objective:

Most important aim was to get an idea about the quality of the collected water samples, which were mainly used, for drinking purposes**.** The collected samples were analyzed at the laboratory of R. V. Briggs at Kolkata.

4.2.0 Drinking Water Characterization:

Assessment:

The drinking water quality was assessed for the following parameters:

- Total Coliform Organisms
- Faecal Coliform Organism
- pH
- Colour
- Turbidity
- Chloride
- Residual Chlorine
- Total Dissolved Solid

4.3.0 Plan of Sampling:

The details of the water sampling sites are as follows.

(i) NS Dock Office

(ii) 51 CGR Road, Civil Engg. Dock Office, 2nd Floor Tap

(iii) Remount Road Quarter, 9 No. Civil Site Office

(iv) Port Land Park Quarter, Civil Site Office

(v) SMP Hospital,(KOL) Canteen # 09

(vi) Canteen Aquaguard

(vii) NS Dock Office, (Terminal)

(viii) SMP Dock Office

4.4.0 Laboratory Determinations:

Bacteriological Count: The determination of Total coliform & Faecal Coliform count carried out according to the method prescribed by APHA 23rd Edn.9222 B & APHA 23rd Edn. 9222 D respectively.

pH value : The pH value was calculated in the laboratory according to the method *prescribed by the IS 3025 (Part-11) : 1983*

Colour: The colour value was calculated in the laboratory according to the method prescribed IS: 3025-(part-4): 1983.

Turbidity: The turbidity value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-10): 1984.

Chloride: The chloride value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-32): 1988.

Residual Chlorine: The residual chlorine value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-26): 1986.

Total Dissolved Solid: The TDS value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-16): 1984.

REPORT OF DRINKING WATER

Table - 4.1

Date of monitoring: 25.03.2023

Test parameters	Unit	Result							
		51 C G R Road, Civil Engg. Office	N S Dock Office (Terminal)	Remount Road Quarter (9 No. Civil Site Office)	Port Land Park Quarter Civil Site Office	KOPT Hospital Canteen	NS Dock Office (Tap)	KP Dock Office (Tap)	KOPT Head Office Tap (15, Stand Road)
Coliform Organism	CFU/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Faecal Coliform	CFU/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Colour	Hazen	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Turbidity	NTU	< 1	< 1	1.9	< 1	<1.0	<1	< 1	<1
pH value	---	7.5	7.7	7.4	7.4	7.5	7.2	7.3	7.3
Total Dissolved Solids	mg/l	290	558	260	216	268	568	282	574
Chloride as Cl	mg/l	30.9	173	35.0	28.8	32.9	68.0	26.8	68.0
Residual Free Chlorine	mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

4.5.1. Assessment of analytical Results against Standards:

As the above mentioned supply water samples were used mostly for drinking water and also for

cooking purposes, So, the assessment was carried out as per the stipulated Standards of IS: 1622 (1981) for Bacteriological parameters and IS: 10,500 (2012) 2nd revision for other parameters respectively as specified by MoEF, Government of India :

(a) Bacteriological Parameters:

The count of bacteriological parameters in terms of Total coliform count and Faecal Coliform Organisms were absent and are safe to consume in the collected samples.

(b) Organoleptic and Physical Parameters:

pH, Turbidity and Total Dissolved Solids were within their respective acceptable limits.

Table - 4.2

NATIONAL DRINKING WATER STANDARD

Test Parameters	Unit	Norms as per IS: 10500, 2012 (2nd Rev.)	
		Acceptable Limit	Permissible Limit
Coliform Organism	CFU/100ml	Absent	
Faecal Coliform	CFU/100ml	Absent	
Colour	Hazen	5 Max.	15 Max.
Turbidity	NTU	1.0 Max.	5.0 Max.
pH value	---	6.5 - 8.5	No Relaxation
Total Dissolved Solids	mg/l	500 Max.	2000 Max.
Chloride as Cl	mg/l	250 Max.	1000 Max.
Residual Free Chlorine	mg/l	0.2 min	1 Max.

Chapter - 5

5.0 CHARACTERIZATIONS OF SURFACE WATER QUALITY

5.1 Dock Basin & River Water Characterization:

5.1.1 Objective:

The main purpose of the study was to get an idea about the quality of Dock Basin & River water within the area of study. All together 4 Dock Basin warter samples and 2 River water samples were collected and were analyzed within our present area of study.

Four (04) *Dock Basin* samples collected from: (i) 7 - 8 N.S. Dock, (ii) N.S. D. Lock Entrance (iii) KPD 2 (26-28 KPD) and (iv) KPD 1 (11 KPD) respectively.

Two (02) *River water* samples were collected from (i) Outside of NS Dock Basin on RIver, (ii) Outside of KP Dock Basin on River.

5.1.2 Dock Basin & River water character of the present study areas were assessed in terms of the following structure:

(a) Bacteriological Count: (i) Total coliform count (ii) Faecal (E.coli) coliform Count

(b) Organoleptic and Physical Parameters:

i) Colour, (ii) pH value, (iii) Turbidity, (iv) Total Dissolved Solids (iv) Total Suspended Solids

(c) General Parameters Concerning Substances undesirable in Excessive Amounts:

(i) Dissolved Oxyzen, (ii) Salinity, (iii) Ammoniacal Nitrogen, (iv) Sulphate, (v) oil & Grease, (vi) BOD, (vii) COD.

5.1.3: Plan of Sampling:

Altogether Dock Basin warter samples and 2 River water samples were collected from the locations mentioned above (4.8.1). Major groundwater sources, the details of the water sampling sites were given in the Table 4.3 a to 4.3 c.

5.1.4 Sampling Procedure:

For each location three water samples were collected (Plate – 5) for the following analysis: (i) *Bacteriological analysis*: The sample was collected in a pre-sterilised 250 ml. water bottle, wearing throwaway gloves. The sample bottles were previously sterilized by autoclaving. Two layers of papers covered the stopper and the neck of bottle, prior to sterilization. The opening and closing of the bottles in the process of sample collection was carried out with meticulous care to avoid any bacterial contamination from outside source. When water was collected from tube well, the mouth of the tube well was flamed for 10 minutes, and the water was allowed to run for 5 minutes before filling the bottle. The bottle was filled up to neck leaving 3 inches air space vertically below the glass stopper. Immediately after collection, the samples were transported to the R.V.Briggs laboratory in an ice – box, which was kept in temperatures within 4^{o}C. While for determination of other parameters like: *non-metals:* Colour, pH value,Turbidity, Total Dissolved Solids, Total Suspended Solids, Dissolved Oxyzen, Salinity, Ammoniacal Nitrogen, Sulphate, oil & Grease, BOD, COD a total quantity of 2.0 Liters of effluent was collected from the locations in separated bottles. Before collection, the containers were washed with the sample water with vigorous shake. Then the samplings were carried out from 60 cm deep inside .(i) In a dusky glass bottle of 1 litre capacity the sample was collected for determination of Oil & Grease. (ii) Second sample was collected in a plastic container of 1 litre capacity for testing of its pH, Total Suspended Solids, Chemical Oxygen Demand & Bio Chemical Oxygen Demand. The D.O for the sample was measured at the sampling site. After collection, the samples were immediately transported to the R.V.Brigg's laboratory at Kolkata. The whole collection procedure was carried out in presence of KPT official.

5.1.5: Laboratory determination:

The laboratory determination of above mentioned parameters carried out as per following procedure:

- Faecal (E.coli) coliform count : The method was followed as per IS : 1622, 1981
- pH value : The pH value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23^{nd} edition – 4550 H + B)
- Taste : The method was followed according to the procedure of IS : 3025 (Part -8) 1985
- Turbidity : The Turbidity value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23^{nd} edition – 2130 B)

- Total Dissolved Solids (TDS) : The TDS value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 C)
- Total Suspended Solids (TSS): The TSS was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 D).
- Oil & Grease: The Oil &Grease was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5520 B).
- COD: The COD was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5220 B).
- BOD: The BOD was measured in the laboratory according to the method prescribed by the IS 3025 (Part 44) 1966.
- Ammoniacal Nitrogen: The Ammoniacal Nitrogen was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 NH_3F).
- Salinity: The Salinity was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2520 **B**).
- DO: The DO was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 OC).
- Sulphate: The Sulphate was measured in the laboratory according to the method prescribed by I.S. 3025 (Part – 24) – 1986 .

5.1.6 Assessment of Analytical Results against Standards of Dock Basin & River water: (Table 5.1):

The assessment was made against the stipulated standard prescribed by the West Bengal Pollution Control Board:

- ✓ pH value : It was marginally above the stipulated tolerance limit..
- ✓ Colour:
- ✓ Turbidity
- ✓ Total Dissolved Solids
- ✓ Total Suspended Solids: The value was within the specific norms.
- ✓ Oil & Grease: The value was within the fixed norms.
- ✓ BOD: The value was within the given norms.
- ✓ COD: The value was within the set norms.

- ✓ Ammoniacal Nitrogen
- ✓ Sulphate
- ✓ Salinity
- ✓ DO:
- ✓ Total Coliform
- ✓ Faecal Coliform

Table 5.1

Analytical Results of Surface Water Sample collected from the above-mentioned locations

Surface Water (River Water)

Sl. No.	Test Parameters	Unit	Our Ref. No./ Location		Norms as per IS: 2296-1982 (Class C)
			Outside NS Dock Basin on River on 25.03.2023	Outside KP Dock Basin on 25.03.2023	
1	Colour	Hazen	10	10	300 (Max.)
2	pH Value	..	7.79	7.67	6.5 - 8.5
3	Total Dissolved Solids (TDS)	mg/l	392	376	1500 (Max.)
4	Dissolved Oxygen (DO)	mg/l	7.0	6.9	4 (Min.)
5	Oil and Grease (O & G)	mg/l	1.0	1.1	0.1 (Max.)
6	BOD for 3 days at 27°C (BOD)	mg/l	3.5	3.6	3 (Max.)
7	Sulphate as SO_4	mg/l	26	20	400 (Max.)
8	Turbidity	mg/l	9.9	12.1	--
9	Ammoniacal Nitrogen as NH_3-N	mg/l	<0.4	<0.4	--
10	Salinity	PSU	0.5126	0.5031	--
11	Total Suspended Solids (TSS)	mg/l	24	28	--
12	Chemical Oxygen Demand (COD)	mg/l	20	24	--
13	Total Coliform/100 ml.	MPN	33	170	5000 (Max.)
14	Faecal Coliform/100 ml.	MPN	13	79	--

Chapter - 6

6.0 CHARACTERIZATIONS OF WASTE WATER QUALITY

6.1 Waste Water Characterization:

6.1.1 Objective:

The main purpose of the study was to get an idea about the quality of Effluents within the area of study. All together 4 Effluent samples were collected and were analysed within our present area of study.

Four (04) *Effluent* samples collected from: (i) 7 - 8 N.S. Dock, (ii) N.S. D. Lock Entrance (iii) KPD 2 (26-28 KPD) and from (iv) KPD 1 (11 KPD) respectively.

6.1.2 Effluent character of the present study areas were assessed in terms of the following structure:

(a) Bacteriological Count: (i) Total coliform count (ii) Faecal coliform Count

(b) Organoleptic and Physical Parameters:

ii) Colour, (ii) pH value, (iii) Turbidity, (iv) Total Dissolved Solids (iv) Total Suspended Solids

(c) General Parameters Concerning Substances undesirable in Excessive Amounts:

(i) Dissolved Oxyzen, (ii) Salinity, (iii) Ammoniacal Nitrogen, (iv) Sulphate, (v) oil & Grease, (vi) BOD, (vii) COD.

6.1.5: Laboratory determination:

The laboratory determination of above mentioned parameters carried out as per following procedure:

- Faecal (E.coli) coliform count : The method was followed as per IS : 1622, 1981
- pH value : The pH value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4550 H + B)
- Taste : The method was followed according to the procedure of IS : 3025 (Part -8) 1985
- Turbidity : The Turbidity value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2130 B)

- Total Dissolved Solids (TDS) : The TDS value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 C)
- Total Suspended Solids (TSS): The TSS was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 D).
- Oil & Grease: The Oil &Grease was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5520 B).
- COD: The COD was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5220 B).
- BOD: The BOD was measured in the laboratory according to the method prescribed by the IS 3025 (Part 44) 1966.
- Ammoniacal Nitrogen: The Ammoniacal Nitrogen was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 NH_3F).
- Salinity: The Salinity was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2520 **B**).
- DO: The DO was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 OC).
- Sulphate: The Sulphate was measured in the laboratory according to the method prescribed by I.S. 3025 (Part – 24) – 1986 .

6.1.6 Assessment of Analytical Results against Standards of Effluent: (Table 6.1):

The assessment was made against the stipulated standard prescribed by the West Bengal Pollution Control Board:

- ✓ pH value : It was marginally above the stipulated tolerance limit..
- ✓ Colour:
- ✓ Turbidity
- ✓ Total Dissolved Solids
- ✓ Total Suspended Solids: The value was within the specific norms.
- ✓ Oil & Grease: The value was within the fixed norms.
- ✓ BOD: The value was within the given norms.

- ✓ COD: The value was within the set norms.
- ✓ Ammoniacal Nitrogen
- ✓ Sulphate
- ✓ Salinity
- ✓ DO:
- ✓ Total Coliform
- ✓ Faecal Coliform

Table 6.1

ANALYTICAL RESULTS OF THE EFFLUENTSAMPLES COLLECTED
Effluent (Dock Basin Water)

Sl. No.	Test Parameters	Unit	Our Ref. No./ Location				Limit as per Environmental Protection Act, MOE & F for Effluent discharged into Inland surface water
			KPD 2 (26-28 KPD)	NSD Lock Entrance	7-8 N.S. Dick	KPD 1 (11 KPD)	
1	pH Value	..	8.05	7.97	7.85	7.92	5.5 - 9.0
2	Turbidity	NTU	2.2	2.0	7.9	1.8	--
3	Total Suspended Solids (TSS)	mg/l	<10	<10	18	<10	100 (Max.)
4	Ammoniacal Nitrogen as NH_3-N	mg/l	<0.4	<0.4	<0.4	<0.4	50 (Max.)
5	Oil and Grease (O & G)	mg/l	<2	<2	<2	<2	10 (Max.)
6	BOD for 3 days at 27°C	mg/l	3.5	6.2	5.2	4.1	30 (Max.)
7	Chemical Oxygen Demand (COD)	mg/l	18	30	28	21	250 (Max.)
8	Sulphate as SO_4	mg/l	21.8	44	38	24	--
9	Colour	..	10	10	10	10	--
10	Salinity	PSU	0.5523	0.5466	0.5409	0.5466	--
11	Total Dissolved Solids (TDS)	mg/l	472	512	482	464	--
12	Dissolved Oxygen (DO)	mg/l	6.9	6.2	6.5	7.0	--
13	Total Coliform/100 ml. (TC)	MPN	350	110	240	<2	--
14	Faecal Coliform/100 ml. (FC)	MPN	130	49	130	<2	1000 (Max.)

Chapter - 7

7.0 CHARACTERIZATIONS OF SOIL

7.1 Soil Characterization:

7.1.1 Objective:

The main purpose of the study was to get an idea about the quality of Soil within the area of study. All together 2 soil samples were collected and were analysed within our present area of study.

Two (02) *Soil* samples collected from: (i) NSD Area, (ii) KPD Area respectively.

7.1.2 Soil character of the present study areas were assessed in terms of the following structure:

(i) Lead, (ii) Cadmium, (iii) Nickel, (iv) Copper, (v) Mercury, (vi) Hexavalent Chromium, (vii) Iron, (viii) Zinc

7.1.3: Laboratory determination:

The laboratory determination of above mentioned parameters carried out as per following procedure:

- Lead: The method was followed as per our SOP No.: RVB/SOP/05/19, & EPA Method 3050B
- Cadmium : The method was followed as per our SOP No.: RVB/SOP/05/20, EPA Method 3050B
- Nickel : The method was followed as per our SOP No.: RVB/SOP/05/23, EPA Method 3050B
- Copper : The method was followed as per our SOP No.: RVB/SOP/05/24, EPA Method 3050B
- Mercury : The method was followed as per our SOP No.: RVB/SOP/05/17, EPA Method 3050B
- Hexavalent Chromium : The Hexavalent Chromium value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 3500-Cr B)
- Iron : The Iron value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 3500- FeB)
- Zinc : The Zinc value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 3111B)

Table 7.1

ANALYTICAL RESULTS OF THE SOIL SAMPLES COLLECTED

Sl. No.	Test Parameters	Unit	Result	
			NSD Area	KPT Area
1	Lead as Pb	mg/kg	307.2	152.5
2	Cadmium as Cd	mg/kg	<0.5	0.50
3	Nickel as Ni	mg/kg	20.49	22.37
4	Copper as Cu	mg/kg	89.93	44.25
5	Mercury as Hg	mg/kg	<0.01	<0.01
6	Hexavalent Chromium as Cr^{+6}	mg/kg	<0.5	<0.5
7	Iron as Fe	%	2.16	2.19
8	Zinc as Zn	mg/kg	77.70	75.19

PERIODIC ENVIRONMENTAL MONITORING REPORT

APRIL' 2023 TO DECEMBER' 2023

Prepared by R.V.BRIGGS & CO. PRIVATE LIMITED.
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Chapter - 1

1.0 INTRODUCTION:

Pollution is emerging as one of the most significant and challenging environmental problems of our modern Society. The Syama Prasad Mookherjee Port(Kolkata) is situated on the left bank of the Hooghly River at 22°32′53″N 88°18′05″E about 203 km (126 mi) upstream from the sea. The pilotage station is at Gasper/ Saugor roads, 145 Kilometres to the south of the KDS (around 58 km from the sea). The system consists of. Kidderpore Docks (K.P. Docks) : 18 Berths, 6 Buoys / Moorings and 3 Dry Docks. Kolkata Port Trust (officially renamed after the name of BJS founder as Dr. Syama Prasad Mukherjee Port Trust , is the only riverine major port of India located in the city of Kolkata, India, It is the oldest operating port in India, and was constructed by the British East India Company.

Major air pollutants generated by port activities include carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM). Prolonged exposure to these compounds can effect health include respiratory diseases, cardiovascular disease, lung cancer and premature death.

Noise from port areas comes not only from ferries, ships and trade but also from industrial and shipyards activities as well as auxiliary services. In this way, noise pollution can produce negative effects both to the natural eco-system and to the urban population.

Port operations can cause significant damage to water qualityand subsequently to marine life and ecosystems, as well as human health. These effects may include bacterial and viral contamination of commercial fish and shellfish, depletion of oxygen in water, and bioaccumulation of certain toxins in fish.8 Major water quality concerns at ports include wastewater and leaking of toxic substances from ships, stormwater runoff, and dredging

Waste management is the most important part in the port areas. Waste management relates to all kinds of wastes, both liquid and solid, likely to be disposed of in the port area. These wastes include dredged materials, garbage and oily mixtures discharged from ships, wastes from cargo operations, and all types of discharges from municipal and waterfront industry activities.

1.1.0 Scope of Work: The periodic measurement of Ambient Air quality, Meteorological observation, Ambient Noise quality, Surface water quality, Drinking water quality and also Effluent quality studies were carried out for the session January' 2023 to March' 2023. M/s R. V. Briggs & Co. Pvt. Limited, 8-9, Bentinck Street, Kolkata – 700001, performed the whole work. Funding and other logistic supports were provided by KPT, Khidderpore.According to the work order, the scopes of work included are as follows:

1.1.1 The whole work was executed for determination of Respirable Particulate matter (PM_{10}), Particulate Matter $PM_{2.5}$, Oxides of Sulfur (SO_2), Oxides of Nitrogen (NO_x), Carbone Monoxide(CO) from each sample.Systematic evaluation of AmbientAir qualitytook place for 8 hourly for 24 hours for PM_{10}, SO_2, NO_2& CO and $PM_{2.5}$, one sample for 24 hour basis at four (04) locations.

i)SMP, KPD (Near Dry Dock Area-2)

ii) SMP, KPD-2 (Beside Shed No. 22)

iii) SMP, NSD (Administrative Building)

iv) SMP, NSD (Berth No - 4)

The whole work was executed for determination of Respirable Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Oxides of Sulfur (SO_2), Oxides of Nitrogen (NO_x), Carbone Monoxide(CO) from each sample.

On each day of sampling at each stations samples for all five parameters (PM_{10}, $PM_{2.5}$, SO_2 and NO_2) were collected as follows:

i) PM_{10} 3 (three) shifts of 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

ii) $PM_{2.5}$ 1 (one) shift of 24 (twenty four) hrs. twice in a week for a every 3 months for a period of one year

iii) SO_2 3 (three) shifts of 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

iv) NO_2 3 (three) shifts of 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

v) CO 8 (eight) hrs. each twice in a week for every 3 months for a period of one year

1.1.2 Ambient Noise level monitoring: It was carried out for 24 hourly basis in every month from the following four (04) Locations:

i) KPD, (Near Dry Dock Area - 2)

ii) KPD-2, (Beside Shed No. 22)

iii) NSD, (Near BERTH No. 7)

iv) NSD, (Near BERTH No. 3)

All the study work was carried out for determination of L_{eq}, L_{max}, L_{min}, L_{day}, L_{night}, L_{10}, L_{50} and L_{90}, etc from each locations as per the Principal rules were published in the Gazette of India vide number, S.O 123 (E), dated 14th February, 2000 and subsequently amended vide S.O 1046 (E), dated 22 nd November, 2000, S.O 1088 (E), dated 11 th October, 2002, S.O, 1569 (E), dated the 19 th September, 2006 and S.O 50 (E) dated 11 th January, 2010.).

1.1.3Water sample collection:

- **Drinking Water** samples collected from
  (i) Head Office Canteen
  (ii) 51 CGR Road, Civil Engg. Dock Office, 2nd Floor Tap.
  (iii) Remount Road Quarter, 9 No. Civil Site Office
  (iv) Port Land Park Quarter, Civil Site Office
  (v) SMP – Kolkata Hospital Canteen # 09
  (vi) Container Terminal Office, (NSD)
  (vii) NS Dock Office ,(WTP)
  (viii) KP Dock Office

Following parameters were determined from the sample: pH, Colour, Turbidity, Chloride, Residual chlorine, Total Dissolved Solid, Coliform Bacteriological count as per stipulated norms for analysis of Drinking Water Quality of Central Pollution Control Board,

The following parameters were taken into consideration for drinking water analysis:

(a) **Microbiological Tests:** (i) Total Coliform Organism / 100 ml. of water, (ii) Faecal coliform Count

- **Dock Basin Water** samples collected from

(i) 7 – 8 N.S. Dock
(ii) N.S.D. Lock Entrance
(iii) KPD 2 (26-28 KPD)
(iv) KPD 1 (11 KPD)

- **River Water** samples collected from
- (i) Outside NS Dock Basin on River
- (ii) Outside KP Dock Basin on River
- Following parameters were determined from the sample: pH, Colour, Turbidity, Dissolved Oxygen (DO), Bio Chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil & Grease, Sulphate, Ammoniacal Nitrogen (NH_4 – N), Total Dissolved Solid, Total Suspended Solid, Saliniy, Coliform Bacteriological count as per stipulated norms for analysis of Dock Basin&RiverWater Quality of Central Pollution Control Board,

***1*.2.0 Period of Study:** The entire study period was on selected days between October' 2022 to December' 2022.

1.3.0 Work load Completed: The environmental sampling and related studies that were carried out in the field and at the R.V.Briggs laboratory

Chapter - 2

2.0 AMBIENT AIR QUALITY STUDIES

2.1.0 Objective: The most important objective of the study was to obtain a valid idea about the prevailing ambient air quality over the entire project area, during January' 2023 to March' 2023

2.2.0 Work Elements: The main objectives of the study are:-
As per the work order, the following work elements were evaluated:
(a) Collection of ambient air samples for 24 hourly period from 4 air sampling stations as per para 1.1.1, for determination of the concentration of the following pollutants :
i) Respirable Particulate matter (PM10), (ii) Particulate Matter (PM2.5), (iii) Sulphur Dioxide (SO_2), (iv) Nitrogen Oxide (NOx), (v) Carbone Monoxide (CO) respectively.

2.3.0 Preparation of Sampling Sites: At each of the air sampling stations, the actual site of placement of air sampling equipments were prepared according to the guide lines stipulated in IS: 5182 of Bureau of Indian Standard approved by the Ministry of Environment & Forests (MoEF), Government of India.

2.4.0 Duration of Air Sampling: Air sampling operations were fixed for 24 hours in 3 shifts and were splits into eight hours duration in each shift for 4 stations. So, 12 samples were collected from these stations. Therefore, altogether 12 samples were taken into consideration.

2.5.0 Sampling Equipment & Methodology:

i. Air samples collected by using Respirable dust sampler Machine (Envirotech, APM 460 BL)
ii. $PM_{2.5}$ samples collected by using $PM_{2.5}$ sampler (Instrumex, Model: IPM-FDS/MFC-2500, Polltech, Model: PEM-ADS2.5 & Envirotech Model: APM 550 MFC)

2.6.0 Laboratory Determination:

2.6.1 Respirable Particulate Matter (PM_{10}):- For every station and for every shift, one Glass micro fibre filter paper with a dimension of 203 mm × 254 mm was used to collect air samples. At each station, a total time period of 24 hours duration was taken into consideration for collection of

samples. Which was splits into 3 shifts each of 8 hours duration. Thus, for a 24 hours monitoring a total number of 3 filter papers were used. So, for four (4) stations in total 3 x 4 = 12 samples were collected.

Before sampling, all these filter papers were dried in an air oven followed by drying in desiccators. The dried filter papers were weighed and then fitted in the high volume air sampler. The filter papers were re-weighted at the end of the duration of sampling (8 hours or 6 hours). From the weight indicate the weight of RPM particle collected over a period of 8 hours or 6 hours. From the corresponding data on total volume of air, which passed through the sampling machine over the same duration of time, the concentration of RPM was computed in terms of μg/m^3 of air. The assessments were made according to their respective land use categories.

2.6.2: Particulate Matter ($PM_{2.5}$):

The pre-weighed filter paper, in which $PM_{2.5}$particles were collected, were weighed both in the pre and post monitoring times. The gain in weight indicated the total weight of $PM_{2.5}$ collected during 24 hour sampling time. From the corresponding data on total volume of air drawn in by the sampling machine, the concentration of PM2.5 was computed in μg/ m^3 of air.

2.6.3: Sulphur Di Oxide (SO_2):

SO_2 in the ambient air was absorbed in 0.05 (M) potassium tetrachloromercurate solution at a flow rate 0.5 litre / minute. It was analysed spectrophotometrically after developing the colour for 30 minutes by adding sulphamic acid, Formaldehyde and P – rosaniline hydrochloride solution as per IS :5182 (Part – II) 2001 (West & Gacke method) and recorded the absorbance at 560 mm. Then the concentration of SO_2 was measured by standard curve and represented the results as μg/m^3 in respect of air volume.

2.6.4: Nitrogen Oxides (NO_x):

NO_x was collected by bubbling air through 0.1 (N) sodium hydroxide and sodium arsenite solution at flow rate 0.4 lit /min. It was analyzed spectrophotometrically after developing the colour for 10 minutes by adding Hydrogen peroxide, sulphanilamide and NEDA solution as per IS : 5182 (Part – VI) 2006 (Jacobs & Hochheiser method) and recorded the absorbance at 540 mm. Then the concentration of NO_x was measured by standard curve and represented the result as μg/m^3 in respect of air volume.

2.6.5: Carbone monoxides (CO):

CO was collected in a bladders and estimated by CO Analyzer and Orsat.

2.7.0 Results of laboratory determinations:

The salient findings of concentrations of PM10, PM2.5,CO, SO_2 and NOx (Table 2.1) of this study are as follows:

2.7.1 Ambient Air Quality:

- ***Near Dry Dock Area-2.:-***

The concentration of PM2.5 ranged from 30.0 µg/m^3 to 53.8 µg/m^3 with a mean value of 42.3 µg/m^3. The concentration of PM10 ranged from 51.1 µg/m^3 to 89.7 µg/m^3 with a mean value of 71.6 µg/m^3 of air. Concentration of SO2 ranged from 4.5 µg/m^3 to 5.8 µg/m^3 of air with a mean value of 4.9 µg/m^3 of air While the concentration of NOx ranged from 19.9 µg/m^3 to 34.6 µg/m^3 of air with a mean value of 27.1 µg/m^3 of air and the concentration of CO ranged from 0.84 mg/m^3 to 0.90 mg/m^3 of air with a mean value of 0.86 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

- ***Beside Shed No:22.:-***

The concentration of PM2.5 ranged from 33.3 µg/m^3 to 48.3 µg/m^3 with a mean value of 39.1 µg/m^3. The concentration of PM10 ranged from 52.7 µg/m^3 to 80.0 µg/m^3 with a mean value of 63.7 µg/m^3 of air. Concentration of SO2 ranged from 4.1 µg/m^3 to 5.3 µg/m^3 of air with a mean value of 4.9 µg/m^3 of air While the concentration of NOx ranged from 20.3 7µg/m^3 to 20.6µg/m^3 of air with a mean value of 17.9 µg/m^3 of air and the concentration of CO ranged from 0.8 mg/m^3 to 1.0 mg/m^3 of air with a mean value of 0.9 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

- ***Administrative Building.:-***

The concentration of PM2.5 ranged from 38.3 µg/m^3 to 53.7 µg/m^3 with a mean value of 47.8 µg/m^3. The concentration of PM10 ranged from 60.3 µg/m^3 to 90.8 µg/m^3 with a mean value of 79.6 µg/m^3 of air. Concentration of SO2 ranged from 2.2 µg/m^3 to 5.2 µg/m^3 of air with a mean value of 4.3 µg/m^3 of air While the concentration of NOx ranged from 20.6 7µg/m^3 to 29.3 µg/m^3 of air with a mean value of 24.7 µg/m^3 of air and the concentration of CO ranged from 0.9 mg/m^3 to 1.1 mg/m^3 of air with a mean value of 1.0 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

- ***BERTH No – 4, NS Dock:-***

The concentration of PM2.5 ranged from 40.4 µg/m^3 to 51.2 µg/m^3 with a mean value of 45.6 µg/m^3. The concentration of PM10 ranged from 69.8 µg/m^3 to 92.5 µg/m^3 with a mean value of 79.3 µg/m^3 of air. Concentration of SO2 ranged from 4.5 µg/m^3 to 5.5 µg/m^3 of air with a mean value of 4.9 µg/m^3 of air While the concentration of NOx ranged from 22.3 7µg/m^3 to 34.1 µg/m^3 of air with a mean value of 25.6 µg/m^3 of air and the concentration of CO ranged from 0.9 mg/m^3 to 1.2 mg/m^3 of air with a mean value of 1.0 mg/m^3 of air.

Observation: All the parameters are found to be above the norms as per National ambient Air Quality of MINISTRY OF ENVIRONMENT AND FOREST NOTIFICATION New Delhi, on 16th November 2009.

AMBIENT AIR QUALITY STYDY HAD BEEN DEPICTED THROUGH PHOTOGRAPHS

Table - 2.1

LAND USE CATEGORY – WISEDISTRIBUTION OF AIR SAMPLING STATIONS AND ITS ANALYTICAL RESULTS (JANUARY' 2023-MARCH' 2023)

Location : SMP, KPD (Near Dry Dock Area-2)
Period : 01.06.2023 to 30.06.2023

Parameters	Unit	Date of Inspection								Norms as NAAQ,2009
		07.06.2023	10.06.2023	13.06.2023	16.06.2023	19.06.2023	22.06.2023	26.06.2023	29.06.2023	
$PM_{2.5}$ (Size ≤ 2.5µm)	µg/m³	50.8	53.8	42.1	42.1	39.2	42.1	38.3	30.0	60
PM_{10} (Size ≤ 10µm)	µg/m³	89.1	89.7	71.5	79.5	69.0	64.3	58.6	51.1	100
Sulphur Dioxide as SO_2	µg/m³	5.79	4.53	4.54	<4.0	<4.0	4.61	<4.0	<4.0	80
Nitrogen Dioxide as NO_2	µg/m³	27.6	22.3	31.4	34.6	27.2	32.1	21.6	19.9	80
Ozone as O_3	µg/m³	15.8	17.7	16.7	15.7	17.2	19.6	16.8	15.3	180
Ammonia as NH_3	µg/m³	18.0	12.8	9.4	11.8	11.6	14.0	9.6	12.7	400
Carbon Monoxide as CO	mg/m³	0.86	0.86	0.90	0.90	0.90	0.87	0.84	0.84	4
Lead as Pb	µg/m³	0.037	0.033	0.066	0.053	0.053	0.044	0.084	0.045	1
Nickel as Ni	ng/m³	<5.0	<5.0	6.7	<5.0	<5.0	5.2	<5.0	9.5	20
Arsenic as As	ng/m³	0.38	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.37	6.0
Benzene as C_6H_6	µg/m³	<1.0	1.40	<1.0	<1.0	<1.0	<1.0	<1.0	1.62	5.0
Benzo (a) Pyrene	ng/m³	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0

Table - 2.2

Location : SMP, KPD-2 (Beside Shed No. 22)
Period : 01.06.2023 to 30.06.2023

Parameters	Unit	Date of Inspection								Norms as NAAQ,2009
		07.06.2023	10.06.2023	13.06.2023	16.06.2023	19.06.2023	22.06.2023	26.06.2023	29.06.2023	
$PM_{2.5}$ (Size ≤ 2.5µm)	µg/m³	42.1	48.3	35.4	35.4	33.3	44.6	37.5	36.3	60
PM_{10} (Size ≤ 10µm)	µg/m³	69.2	80	62.9	60.2	56	68.7	52.7	59.8	100
Sulphur Dioxide as SO_2	µg/m³	5.34	4.97	4.12	<4.0	<4.0	5.08	<4.0	<4.0	80
Nitrogen Dioxide as NO_2	µg/m³	23.7	22.3	27.9	29.4	27.2	26.7	22.5	20.3	80
Ozone as O_3	µg/m³	18.1	17.6	18.0	17.6	17.1	20.6	16.7	17.5	180
Ammonia as NH_3	µg/m³	26.8	13.1	8.1	8.8	14.4	12.1	10.5	13.0	400
Carbon Monoxide as CO	mg/m³	0.79	0.85	0.85	0.86	0.87	0.97	0.93	0.97	4
Lead as Pb	µg/m³	0.063	0.065	0.046	0.057	0.045	0.062	0.047	0.045	1
Nickel as Ni	ng/m³	<5.0	<5.0	7.6	6.0	<5.0	<5.0	<5.0	8.6	20
Arsenic as As	ng/m³	0.35	<0.25	<0.25	<0.25	<0.25	<0.25	0.69	0.69	6.0
Benzene as C_6H_6	µg/m³	1.28	<1.0	<1.0	1.07	<1.0	<1.0	<1.0	<1.0	5.0
Benzo (a) Pyrene	ng/m³	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0

Table - 2.3

Location : SMP, NSD (Administrative Building)
Period : 01.01.2023 to 31.03.2023

Parameters	Unit	Date of Inspection								Norms as NAAQ,2009
		07.06.2023	10.06.2023	13.06.2023	16.06.2023	19.06.2023	22.06.2023	26.06.2023	29.06.2023	
$PM_{2.5}$ (Size ≤ 2.5µm)	µg/m³	53.7	50.4	45.4	53.7	38.3	48.8	44.2	47.5	60
PM_{10} (Size ≤ 10µm)	µg/m³	90.8	85	89.6	82.7	60.3	81.7	74.5	72.4	100
Sulphur Dioxide as SO_2	µg/m³	5.19	4.31	4.74	4.40	<4.0	4.74	2.17	<4.0	80
Nitrogen Dioxide as NO_2	µg/m³	25.2	20.6	26.8	29.3	22.8	23.3	25.3	23.8	80
Ozone as O_3	µg/m³	17.7	16.8	17.0	16.2	16.2	19.4	19.3	15.8	180
Ammonia as NH_3	µg/m³	22.3	12.0	10.3	12.1	12.1	15.0	12.9	12.3	400
Carbon Monoxide as CO	mg/m³	0.92	1.01	1.01	0.87	0.91	1.03	0.96	1.13	4
Lead as Pb	µg/m³	0.071	0.071	0.027	0.058	0.021	0.052	0.067	0.045	1
Nickel as Ni	ng/m³	<5.0	<5.0	6.4	<5.0	8.1	<5.0	<5.0	8.9	20
Arsenic as As	ng/m³	<0.25	0.49	<0.25	<0.25	0.36	<0.25	0.74	<0.25	6.0
Benzene as C_6H_6	µg/m³	<1.0	<1.0	1.32	<1.0	<1.0	<1.0	<1.0	1.46	5.0
Benzo (a) Pyrene	ng/m³	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0

Table - 2.4

Location : SMP, NSD (BERTH NO - 4)

Period : 01.06.2023 to 31.06.2023

Parameters	Unit	Date of Inspection								Norms as NAAQ,2009
		07.06.2023	10.06.2023	13.06.2023	16.06.2023	19.06.2023	22.06.2023	26.06.2023	29.06.2023	
$PM_{2.5}$ (Size ≤ 2.5µm)	µg/m^3	42.5	46.7	51.2	47.1	42.1	46.3	40.4	48.3	60
PM_{10} (Size ≤ 10µm)	µg/m^3	84.4	77.9	92.5	79.7	78.8	73.8	69.8	77.5	100
Sulphur Dioxide as SO_2	µg/m^3	4.67	4.76	5.15	5.49	<4.0	4.54	<4.0	<4.0	80
Nitrogen Dioxide as NO_2	µg/m^3	26.6	22.5	34.1	26.0	22.3	24.0	23.7	25.7	80
Ozone as O_3	µg/m^3	16.3	18.2	16.2	17.3	18.3	20.4	21.2	18.5	180
Ammonia as NH_3	µg/m^3	22.4	13.4	9.5	11.4	12.1	12.7	17.3	14.8	400
Carbon Monoxide as CO	mg/m^3	0.93	0.87	0.93	0.92	1.04	1.19	1.08	1.06	4
Lead as Pb	µg/m^3	0.068	0.063	0.018	0.050	0.041	0.035	0.058	0.047	1
Nickel as Ni	ng/m^3	<5.0	<5.0	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	20
Arsenic as As	ng/m^3	<0.25	<0.25	<0.25	0.60	<0.25	<0.25	0.60	0.36	6.0
Benzene as C_6H_6	µg/m^3	1.29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0
Benzo (a) Pyrene	ng/m^3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0

Table – 2.5
[SCHEDULE VII]
[See rule 3 (3B)]
National Ambient Air Quality Standards

Pollutants	Time Weighted Average	Concentration in Ambient Air (µg / m³ of air)	
		Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Areas
Sulphur Dioxide (SO_2)	Annual Average *	50	20
	24 hours**	80	80
Nitrogen Dioxide (NO_2)	Annual Average *	40	30
	24 hours**	80	80
Carbon monoxide (CO)	8 hours**	2	2
	1 hours**	4	4
Particulate Matter (PM10) (size less than 10µm) or PM_{10}	Annual Average *	60	60
	24 hours**	100	100
Particulate Matter (PM2.5) (size less than 2.5µm	Annual Average *	40	40
	24 hours**	60	60

* Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval
** 24 hourly / 8 hourly values should be met 98 % of the time in a year. However, 2 % of the time, it may exceed but not on two consecutive days.

[Norms as per Ministry of Environment and Forests Notification, New Delhi, the 16th November, 2009]
[Environment (Protection) Seventh Amendment Rules, 2009]

Chapter - 3

3.0 AMBIENT NOISE QUALITY STUDY

3.1.0Objective: Anevaluation of ambient noise levels were carried out in and around the working area during January' 2023 to March' 2023, according to the following land use (Table 3.3) categories:

- Ambient Noise level in the Residential areas.
- Ambient Noise levels in the Commercial areas
- Ambient Noise Level in the Industrial areas

3.2.0 Selection of Noise level Monitoring Stations:

The noise level measurement stations selected according to each land use category, the locationdetails of which have been depicted in Table 3.0.

3.3.0 Sampling equipment and methodology:

3.3.1:Equipment:

Noise level measurements were carried out with the help of portable Sound level Meter (SL-4001 and SL 4033SD) respectively. M/s Lutron manufactured both the instruments.

3.3.2: Methodology:

(a) For determination of ambient noise at a particular point, the noise meter probe was pointed to the four cardinal directions of north, south, east and west. Corresponding to each direction a set of reading in "slow" setting was recorded.

(b) During the study time a gap of 30 seconds was allowed between two consecutive data observation. Sound level was collected to monitor the values of L10, L50, L90, Lmax, Lmin& L day and L night during the period of 24 hrs.monitoring period.

(c) The noise levels were recorded continuously at 1 – hourly interval through SL – 4001. Thus in total 1440 readings were recorded after 12 hours study. While through SL 4033 SD, the ambient noise levels were measured for 24 hours continuously. So, here a total number of 2880 readings were recorded after 24 hours study.

The measurements recorded are detailed below:

(c) Equivalent Continuous Sound Pressure Level (Leq):

Equivalent Continuous Sound Pressure Level, or Leq, is the constant noise level that would result in the same total sound energy being produced over a given period. It can be measured in either A, C or Z (Linear) modes. Leq is not an 'average sound level', as it sometimes referred to. The equations used to calculate Leq are not calculating a specific average level.
Leq can be described mathematically by the following equation:

$$Leq = 10\log_{10}\left(\frac{1}{T_M}\int_0^{T_M}\left(\frac{P(t)}{P_0}\right)^2 dt\right)$$

Where:

- Leq is the equivalent continuous linear weighted sound pressure level re 20μPa, determined over a measured time interval Tm (secs)
- P(t) is the instantaneous sound pressure of the sound signal
- P0 is the reference sound pressure of 20μPa

When the instantaneous A-weighted sound pressure (PA) of the sound signal is introduced the equivalent continuous A-weighted sound pressure level determined over time interval Tm is as follows:

$$Leq = 10\log_{10}\frac{1}{T_M}\int_0^{T_M}\left(\frac{P_A(t)}{P_0}\right)^2 dt$$

In practice when measuring noise it is possible to take Leq readings, with your instrument, of short duration, i.e.<5 minutes, providing all variations of noise emissions are covered. If the measured environment changes greatly then the longer the Leq measurement is taken the more accurate the measurement.

Adding Leq values requires taking an anti-log of each value. The addition can be performed as shown:

A weighting: the A-weighting

$$\text{Total } L_{eq} = 10\log\left(\frac{10^{\frac{L_{eq}1}{10}} + 10^{\frac{L_{eq}2}{10}} + 10^{\frac{L_{eq}3}{10}} + \ldots\ldots + 10^{\frac{L_{eq}n}{10}}}{n}\right)$$

filter covers the full audio range - 20 Hz to 20 kHz and the shape is similar to the response of the human ear at the lower levels.

A-weighted noise measurements are the most widely used and confirm the accuracy of the meter including the filters.
The preferred convention is to write LA = x dB, however dB A and dB (A) are often used, etc.

C-weighting**:** a standard frequency weighting for sound level meters, commonly used for higher level measurements, it also written as dB(C) or dBC.
The A-weighting curve is used extensively for general purpose noise measurements but the C-weighting correlates better with the human response to high noise levels.
L50: If we consider any fluctuating noise levels and store the results once a second, then at the end of an hour we would have 3600 samples. We can then use these samples to determine some helpful statistics. For example if add up all the samples and divide by 3600 then we will get the average or L50% value of the noise over the hour.
L10: By definition the L10 value is the level just exceeded for 10% of the time and takes account of any annoying peaks of noise.
L90: By definition the L90 value is the level just exceeded for 90% of the time and takes account of any annoying peaks of noise.
Lmax is the highest RMS (root mean squared) sound pressure level within the measuring period.
Lmin is the lowest RMS sound pressure level within the measuring period.
Lday is the total results during day time monitoring
Lnight is the total results during night time.

RESULTS OF AMBIENT NOISE LEVEL MONITORING

Table: 3.1

Location : Near Dry Dock Area-2

Period : April' 2023 to December' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)						Night Time (10:00 P.M. to 06:00 A.M.)					
	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
29.05.2023	57.6	59.6	64.2	54.7	85.6	62.7	57.2	57.9	60.9	55.8	70.5	59.2
22.06.2023	57.1	59.0	63.8	54.3	82.6	63.6	56.9	57.9	61.0	54.8	71.0	60.0
11.07.2023	61.1	65.9	71.0	52.3	82.0	68.0	58.0	63.1	67.9	53.4	76.1	65.1
28.09.2023	64.6	68.2	73.9	57.6	97.0	72.2	63.6	64.5	65.9	62.3	72.9	64.9
28.09.2023	55.5	57.9	64.2	50.2	85.1	62.2	53.8	56.3	58.9	47.0	71.5	57.6
17.10.2023	58.8	63.2	68.6	44.4	84.2	66.2	61.0	61.7	64.4	56.3	70.4	62.8
27.11.2023	61.6	66.8	72.2	40.8	82.9	70.0	59.6	62.7	68.1	48.8	85.4	66.0
21.12.2023	64.6	68.2	73.9	57.6	97.0	72.2	63.6	64.5	65.9	62.3	72.9	64.9

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

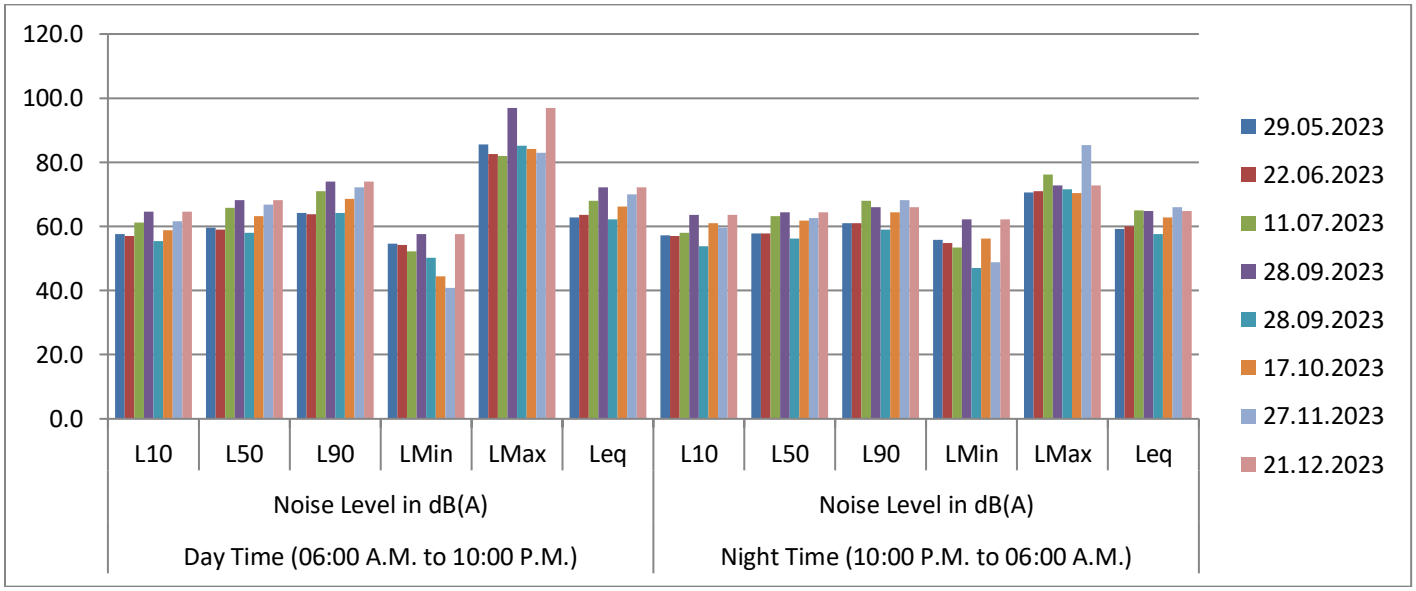

Table: 3.2

Location : Beside Shed No. 22

Period : April' 2023 to December' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)						Night Time (10:00 P.M. to 06:00 A.M.)					
	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
29.05.2023	61.5	65.7	70.5	54.5	81.6	67.8	58.1	63.8	69.3	52.2	79.9	66.3
22.06.2023	61.5	65.7	70.5	54.5	81.6	67.8	58.1	63.8	69.3	52.2	79.9	66.3
11.07.2023	69.0	69.5	70.5	58.9	87.4	70.1	69.2	69.6	70.3	56.7	76.9	69.9
28.09.2023	65.7	69.2	74.8	55.4	95.0	72.9	51.9	57.2	66.4	30.8	87.1	63.9
28.09.2023	63.4	66.9	72.4	53.0	92.6	70.5	54.4	59.6	68.8	33.3	89.6	66.4
17.10.2023	63.9	67.4	72.9	53.5	93.1	71.1	54.7	59.9	69.1	33.6	89.9	66.7
27.11.2023	60.4	63.9	69.6	51.7	92.9	67.9	60.9	62.0	63.4	59.7	70.3	62.3
21.12.2023	63.3	66.8	72.6	55.0	89.2	70.2	63.5	64.6	66.0	62.3	72.9	64.9

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

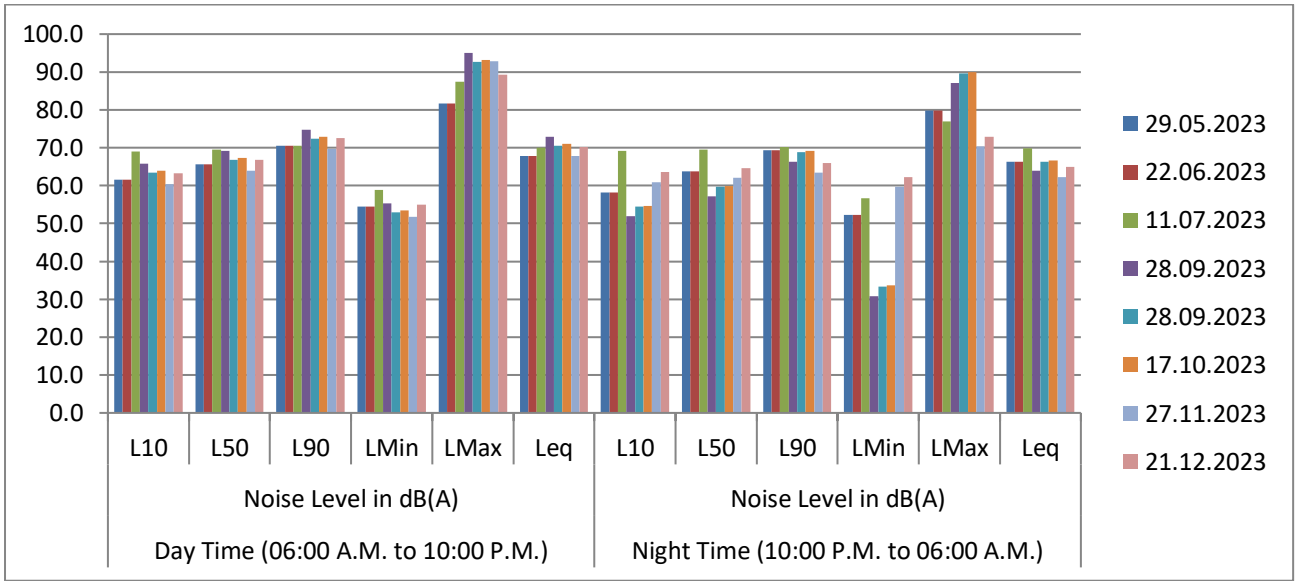

Table: 3.3

Location : Near BERTH No. 7

Period : April' 2023 to December' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)						Night Time (10:00 P.M. to 06:00 A.M.)					
	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
29.05.2023	58.3	59.2	63.2	42.2	91.1	62.0	49.7	50.1	51.9	42.1	70.1	51.5
22.06.2023	58.3	59.2	63.2	42.2	91.1	62.0	49.7	50.1	51.9	42.1	70.1	51.5
11.07.2023	54.7	57.3	63.1	51.3	80.6	61.0	55.7	56.7	61.0	53.5	69.8	58.7
28.09.2023	58.8	63.1	68.5	44.3	84.1	66.1	58.8	59.6	62.2	54.2	68.3	60.6
28.09.2023	71.3	72.2	73.3	62.4	84.8	73.1	66.6	66.2	67.2	65.9	75.8	68.3
17.10.2023	72.1	73.0	74.1	63.2	85.6	73.9	66.0	65.6	66.6	65.3	75.2	67.7
27.11.2023	64.4	69.5	75.7	46.4	87.2	73.4	61.1	66.3	70.4	39.9	75.1	69.1
21.12.2023	67.5	68.2	70.1	61.1	83.7	69.3	67.3	67.8	68.5	58.6	73.2	67.9

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

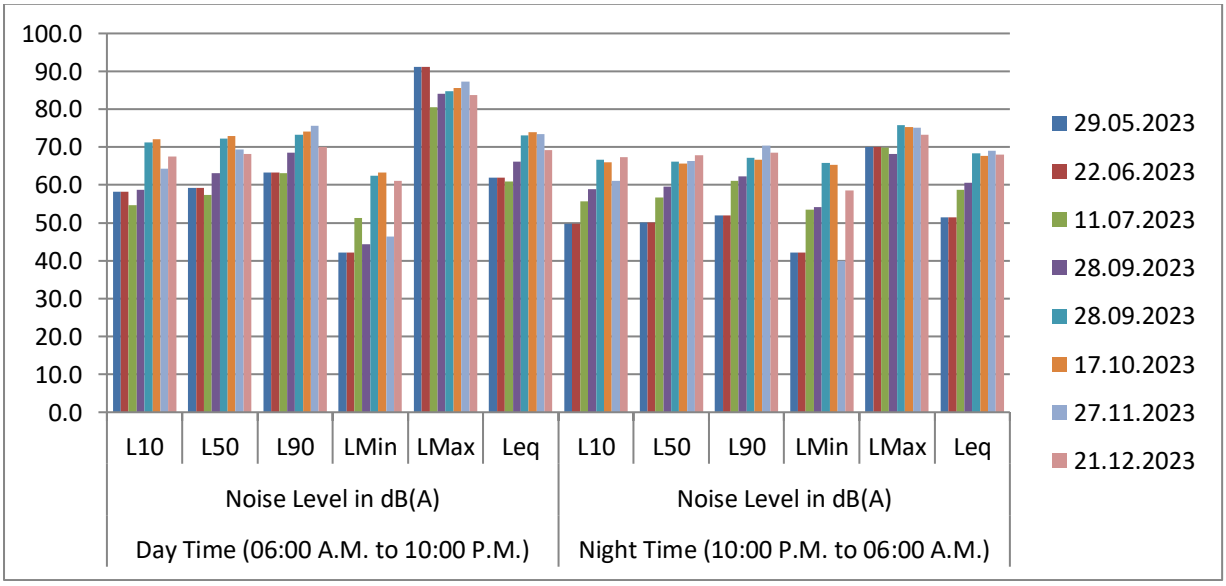

Table: 3.4

Location : Near BERTH No. 3

Period : April' 2023 to December' 2023

Date of Monitoring	Day Time (06:00 A.M. to 10:00 P.M.)						Night Time (10:00 P.M. to 06:00 A.M.)					
	Noise Level in dB(A)						Noise Level in dB(A)					
	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}	L_{10}	L_{50}	L_{90}	L_{Min}	L_{Max}	L_{eq}
29.05.2023	61.6	65.7	70.6	54.5	81.6	67.8	58.1	63.8	69.3	52.2	79.9	66.3
22.06.2023	63.2	67.3	72.2	56.1	83.2	69.4	59.4	65.0	70.5	53.4	81.1	67.5
11.07.2023	65.8	66.5	68.4	59.4	82.0	67.6	65.4	65.9	66.6	56.7	71.3	66.0
28.09.2023	71.5	72.4	73.5	62.7	85.1	73.3	67.0	66.6	67.6	66.3	76.2	68.7
28.09.2023	63.4	66.9	72.4	53.0	92.6	70.5	54.4	59.6	68.8	33.3	89.6	66.4
17.10.2023	54.8	57.2	63.5	49.5	84.4	61.5	53.0	55.5	58.1	46.2	70.7	56.8
27.11.2023	67.5	71.1	74.6	50.1	88.4	72.6	61.8	66.0	68.6	45.0	70.9	67.2
21.12.2023	60.2	65.2	71.5	42.3	83.1	69.2	60.3	65.5	69.6	39.1	74.3	68.3

AMBIENT NOISE LEVEL PRESENTED THROUGH HISTOGRAM

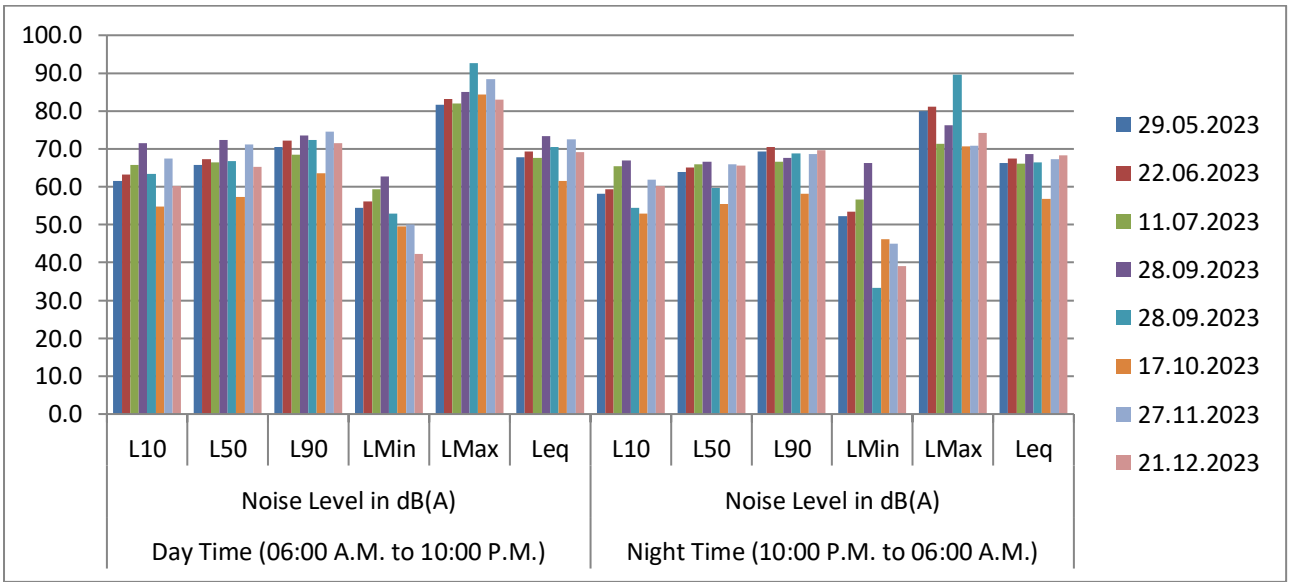

TABLE 3.5

NATIONAL AMBIENT NOISE LEVEL STANDARD

LIMITS IN d(B)A Leq			
AREA CODE	CATEGORY OF AREA	DAY TIME	NIGHT TIME
A	INDUSTRIAL AREA	75	70
B	COMMERCIAL AREA	65	55
C	RESIDENTIAL AREA	55	45
D	SILENCE ZONE	50	40

Note:

1. Day time is reckoned in between 6 a.m and 10 p.m
2. Night time is reckoned in between 10 p.m and 6 a.m
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
4. Mixed categories areas may be declared "as one of the four" above mentioned categories, by the Competent Authority.
5. dB (A) Leq denotes the time weighted average of the level of sound in decibels in scale A, which is relatable to human hearing.

A "decibel" is a unit in which the noise is measured.

"A", in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq : It is energy mean of the noise level over a specified period.

Source:

The Principal Rules were published in the Gazette of India, vide no. S.O 123 (E), dated 14th February 2000 and subsequently amended vise S.O 1046 (E), dated 22nd November, 2000, S.O 1088 (E), dated 11th October, 2002, S.O (1569 (E), dated the 19th September, 2006 and S.O 50 (E) dated 11th January, 2010.

Chapter - 4

4.0 CHARACTERIZATIONS OF DRINKING WATERSAMPLES

4.1.0Objective:

Most important aim was to get an idea about the quality of the collected water samples, which were mainly used, for drinking purposes**.** The collected samples wereanalyzed at the laboratory ofR.V.Briggs at Kolkata.

4.2.0Drinking Water Characterization:

Assessment:
The drinking water quality was assessed for the following parameters:

- Total Coliform Organisms
- Faecal Coliform Organism
- pH
- Colour
- Turbidity
- Chloride
- Residual Chlorine
- Total Dissolved Solid

4.3.0 Plan of Sampling:

The details of the water sampling sites are as follows.

(i) NS Dock Office

(ii) 51 CGR Road, Civil Engg. Dock Office, 2nd Floor Tap

(iii) Remount Road Quarter, 9 No. Civil Site Office

(iv) Port Land Park Quarter, Civil Site Office

(v) SMP Hospital,(KOL) Canteen # 09

(vi) Canteen Aquaguard

(vii) NS Dock Office, (Terminal)

(viii) SMP Dock Office

4.4.0 Laboratory Determinations:

Bacteriological Count:The determination of Total coliform & Faecal Coliform count carried out according to the method prescribed by APHA 23rd Edn.9222 B & APHA 23rd Edn. 9222 D respectively.

pH value : The pH value was calculated in the laboratory according to the method *prescribed by the IS 3025 (Part-11) : 1983*

Colour: The colour value was calculated in the laboratory according to the method prescribed IS: 3025-(part-4): 1983.

Turbidity: The turbidity value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-10): 1984.

Chloride: The chloride value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-32): 1988.

Residual Chlorine: The residual chlorine value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-26): 1986.

Total Dissolved Solid: The TDS value was calculated in the laboratory according to the method prescribed IS: 3025 (Part-16): 1984.

REPORT OF DRINKING WATER

Table - 4.1

Date of monitoring: 28.06.2023

Test parameters	Unit	Result							
		51 C G R Road, Civil Engg. Office	N S Dock Office (Terminal)	Remount Road Quarter (9 No. Civil Site Office)	Port Land Park Quarter Civil Site Office	KOPT Hospital Canteen	NS Dock Office (Tap)	KP Dock Office (Tap)	KOPT Head Office Tap (15, Stand Road)
Coliform Organism	CFU/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Faecal Coliform	CFU/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Colour	Hazen	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Turbidity	NTU	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
pH value	---	7.7	8.2	7.6	7.6	7.7	7.6	7.6	7.8
Total Dissolved Solids	mg/l	278	904	266	258	270	288	638	290
Chloride as Cl	mg/l	27.2	225	25.2	27.2	27.2	33.0	65.9	23.3
Residual Free Chlorine	mg/l	0.20	< 0.1	<0.1	< 0.1	0.20	< 0.1	< 0.1	0.20

Date of monitoring: 29.09.2023

Test parameters	Unit	Result							
		51 C G R Road, Civil Engg. Office	N S Dock Office (Terminal)	Remount Road Quarter (9 No. Civil Site Office)	Port Land Park Quarter Civil Site Office	KOPT Hospital Canteen	NS Dock Office (Tap)	KP Dock Office (Tap)	KOPT Head Office Tap (15, Stand Road)
Coliform Organism	CFU/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Faecal Coliform	CFU/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Colour	Hazen	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Turbidity	NTU	< 1	1.2	<1	< 1	<1.0	<1	< 1	<1
pH value	---	7.5	7.7	7.3	7.4	7.2	7.4	7.4	7.4
Total Dissolved Solids	mg/l	188	538	182	176	160	528	526	156
Chloride as Cl	mg/l	18.7	172.6	20.8	18.7	18.7	168	66.5	17.7
Residual Free Chlorine	mg/l	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

4.5.1. Assessment of analytical Results against Standards:

As the above mentioned supply water samples were used mostly for drinking water and also for cooking purposes, So, the assessment was carried out as per the stipulated Standards of IS: 1622 (1981) for Bacteriological parameters and IS: 10,500 (2012) 2nd revision for other parameters respectively as specified by MoEF, Government of India :

(a) Bacteriological Parameters:

The count of bacteriological parameters in terms of Total coliform count and Faecal Coliform Organisms were absent and are safe to consume in the collected samples.

(b) Organoleptic and Physical Parameters:

pH, Turbidity and Total Dissolved Solids were within their respective acceptable limits.

Table - 4.2

NATIONAL DRINKING WATER STANDARD

Test Parameters	Unit	Norms as per IS: 10500, 2012 (2nd Rev.)	
		Acceptable Limit	Permissible Limit
Coliform Organism	CFU/100ml	Absent	
Faecal Coliform	CFU/100ml	Absent	
Colour	Hazen	5 Max.	15 Max.
Turbidity	NTU	1.0 Max.	5.0 Max.
pH value	---	6.5 - 8.5	No Relaxation
Total Dissolved Solids	mg/l	500 Max.	2000 Max.
Chloride as Cl	mg/l	250 Max.	1000 Max.
Residual Free Chlorine	mg/l	0.2 min	1 Max.

Chapter - 5

5.0 CHARACTERIZATIONS OF SURFACE WATERQUALITY

5.1 Dock Basin & River Water Characterization:

5.1.1 Objective:

The main purpose of the study was to get an idea about the quality of Dock Basin & River water within the area of study. All together 4 Dock Basin warter samples and 2 River water samples were collected and were analyzed within our present area of study.

Four (04) *Dock Basin* samples collected from: (i) 7 - 8 N.S. Dock, (ii) N.S. D. Lock Entrance (iii) KPD 2 (26-28 KPD) and (iv) KPD 1 (11 KPD) respectively.

Two (02) *River water* samples were collected from (i) Outside of NS Dock Basin on RIver, (ii) Outside of KP Dock Basin on River.

5.1.2 Dock Basin & River water character of the present study areas were assessed in terms of the following structure:

(a) Bacteriological Count: (i) Total coliform count (ii) Faecal (E.coli) coliform Count

(b) Organoleptic and Physical Parameters:

i) Colour, (ii) pH value, (iii) Turbidity, (iv) Total Dissolved Solids (iv) Total Suspended Solids

(c) General Parameters Concerning Substances undesirable in Excessive Amounts:

(i) Dissolved Oxyzen, (ii) Salinity, (iii) Ammoniacal Nitrogen, (iv) Sulphate, (v) oil & Grease, (vi) BOD, (vii) COD.

5.1.3: Plan of Sampling:

Altogether Dock Basin warter samples and 2 River water samples were collected from the locations mentioned above (4.8.1). Major groundwater sources, the details of the water sampling sites were given in the Table 4.3 a to 4.3 c.

5.1.4 Sampling Procedure:

For each location three water samples were collected (Plate – 5) for the following analysis: (i) *Bacteriological analysis*: The sample was collected in a pre-sterilised 250 ml. water bottle, wearing throwaway gloves. The sample bottles were previously sterilized by autoclaving. Two layers of papers covered the stopper and the neck of bottle, prior to sterilization. The opening and closing of the bottles in the process of sample collection was carried out with meticulous care to avoid any bacterial contamination from outside source. When water was collected from tube well, the mouth of the tube well was flamed for 10 minutes, and the water was allowed to run for 5 minutes before filling the bottle. The bottle was filled up to neck leaving 3 inches air space vertically below the glass stopper. Immediately after collection, the samples were transported to the R.V.Briggs laboratory in an ice – box, which was kept in temperatures within 4^{o}C. While for determination of other parameters like: *non-metals:*Colour, pH value,Turbidity, Total Dissolved Solids, Total Suspended Solids, Dissolved Oxyzen, Salinity, Ammoniacal Nitrogen, Sulphate, oil & Grease, BOD, COD a total quantity of 2.0 Liters of effluent was collected from the locations in separated bottles. Before collection, the containers were washed with the sample water with vigorous shake. Then the samplings were carried out from 60 cm deep inside .(i) In a dusky glass bottle of 1 litre capacity the sample was collected for determination of Oil & Grease. (ii) Second sample was collected in a plastic container of 1 litre capacity for testing of its pH, Total Suspended Solids, Chemical Oxygen Demand & Bio Chemical Oxygen Demand. The D.O for the sample was measured at the sampling site. After collection, the samples were immediately transported to the R.V.Brigg's laboratory at Kolkata. The whole collection procedure was carried out in presence of KPT official.

5.1.5: Laboratory determination:

The laboratory determination of above mentioned parameters carried out as per following procedure:

- Faecal (E.coli) coliform count : The method was followed as per IS : 1622, 1981
- pH value : The pH value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23^{nd} edition – 4550 H + B)
- Taste : The method was followed according to the procedure of IS : 3025 (Part -8) 1985
- Turbidity : The Turbidity value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23^{nd} edition – 2130 B)

- Total Dissolved Solids (TDS) : The TDS value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 C)
- Total Suspended Solids (TSS): The TSS was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 D).
- Oil & Grease: The Oil &Grease was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5520 B).
- COD: The COD was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5220 B).
- BOD: The BOD was measured in the laboratory according to the method prescribed by the IS 3025 (Part 44) 1966.
- Ammoniacal Nitrogen: The Ammoniacal Nitrogen was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 NH_3F).
- Salinity: The Salinity was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2520 **B**).
- DO: The DO was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 OC).
- Sulphate: The Sulphate was measured in the laboratory according to the method prescribed by I.S. 3025 (Part – 24) – 1986 .

5.1.6 Assessment of Analytical Results against Standards of Dock Basin & River water:(Table 5.1):

The assessment was made against the stipulated standard prescribed by the West Bengal Pollution Control Board:

- ✓ pH value : It was marginally above the stipulated tolerance limit..
- ✓ Colour:
- ✓ Turbidity
- ✓ Total Dissolved Solids
- ✓ Total Suspended Solids: The value was within the specific norms.
- ✓ Oil & Grease: The value was within the fixed norms.
- ✓ BOD: The value was within the given norms.
- ✓ COD: The value was within the set norms.

- ✓ Ammoniacal Nitrogen
- ✓ Sulphate
- ✓ Salinity
- ✓ DO:
- ✓ Total Coliform
- ✓ Faecal Coliform

Table 5.1

Analytical Results of Surface Water Sample collected from the above-mentioned locations

Surface Water (River Water)

Sl. No.	Test Parameters	Unit	Our Ref. No./ Location		Norms as per IS: 2296-1982 (Class C)
			Outside NS Dock Basin on Riveron 29.09.2023	Outside KP Dock Basin on 25.03.2023	
1	Colour	Hazen	10	10	300 (Max.)
2	pH Value	..	7.6	7.6	6.5 - 8.5
3	Total Dissolved Solids (TDS)	mg/l	580	542	1500 (Max.)
4	Dissolved Oxygen (DO)	mg/l	6.2	6.9	4 (Min.)
5	Oil and Grease (O & G)	mg/l	<2	<2	0.1 (Max.)
6	BOD for 3 days at 27°C (BOD)	mg/l	6.4	4.4	3 (Max.)
7	Sulphate as SO_4	mg/l	56	34	400 (Max.)
8	Turbidity	mg/l	4.7	6.6	--
9	Ammoniacal Nitrogen as NH_3-N	mg/l	<0.4	<0.4	--
10	Salinity	PSU	0.5324	0.5250	--
11	Total Suspended Solids (TSS)	mg/l	14	14	--
12	Chemical Oxygen Demand (COD)	mg/l	28	20	--
13	Total Coliform/100 ml.	MPN	460	350	5000 (Max.)
14	Faecal Coliform/100 ml.	MPN	230	240	--

Chapter - 6

6.0 CHARACTERIZATIONS OF WASTE WATER QUALITY

6.1 Waste Water Characterization:

6.1.1 Objective:

The main purpose of the study was to get an idea about the quality of Effluents within the area of study. All together 4 Effluent samples were collected and were analysed within our present area of study.

Four (04) *Effluent* samples collected from: (i) 7 - 8 N.S. Dock, (ii) N.S. D. Lock Entrance (iii) KPD 2 (26-28 KPD) and from (iv) KPD 1 (11 KPD) respectively.

6.1.2 Effluent character of the present study areas were assessed in terms of the following structure:

(a) Bacteriological Count: (i) Total coliform count (ii) Faecal coliform Count

(b) Organoleptic and Physical Parameters:

ii) Colour, (ii) pH value, (iii) Turbidity, (iv) Total Dissolved Solids (iv) Total Suspended Solids

(c) General Parameters Concerning Substances undesirable in Excessive Amounts:

(i) Dissolved Oxyzen, (ii) Salinity, (iii) Ammoniacal Nitrogen, (iv) Sulphate, (v) oil & Grease, (vi) BOD, (vii) COD.

6.1.5: Laboratory determination:

The laboratory determination of above mentioned parameters carried out as per following procedure:

- Faecal (E.coli) coliform count : The method was followed as per IS : 1622, 1981
- pH value : The pH value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4550 H + B)
- Taste : The method was followed according to the procedure of IS : 3025 (Part -8) 1985
- Turbidity : The Turbidity value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2130 B)

- Total Dissolved Solids (TDS) : The TDS value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 C)
- Total Suspended Solids (TSS): The TSS was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2540 D).
- Oil & Grease: The Oil &Grease was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5520 B).
- COD: The COD was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 5220 B).
- BOD: The BOD was measured in the laboratory according to the method prescribed by the IS 3025 (Part 44) 1966.
- Ammoniacal Nitrogen: The Ammoniacal Nitrogen was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 NH_3F).
- Salinity: The Salinity was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 2520 **B**).
- DO: The DO was measured in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 4500 OC).
- Sulphate: The Sulphate was measured in the laboratory according to the method prescribed by I.S. 3025 (Part – 24) – 1986 .

6.1.6 Assessment of Analytical Results against Standards of Effluent:(Table 6.1):

The assessment was made against the stipulated standard prescribed by the West Bengal Pollution Control Board:

- ✓ pH value : It was marginally above the stipulated tolerance limit..
- ✓ Colour:
- ✓ Turbidity
- ✓ Total Dissolved Solids
- ✓ Total Suspended Solids: The value was within the specific norms.
- ✓ Oil & Grease: The value was within the fixed norms.
- ✓ BOD: The value was within the given norms.

- ✓ COD: The value was within the set norms.
- ✓ Ammoniacal Nitrogen
- ✓ Sulphate
- ✓ Salinity
- ✓ DO:
- ✓ Total Coliform
- ✓ Faecal Coliform

Table 6.1

ANALYTICAL RESULTS OF THE EFFLUENTSAMPLES COLLECTED
Effluent (Dock Basin Water)

Date of monitoring: 28.06.2023

Sl. No.	Test Parameters	Unit	Our Ref. No./ Location				Limit as per Environmental Protection Act, MOE & F for Effluent discharged into Inland surface water
			KPD 2 (26-28 KPD)	NSD Lock Entrance	7-8 N.S. Dick	KPD 1 (11 KPD)	
1	pH Value	..	7.9	8.0	7.9	8.0	5.5 - 9.0
2	Turbidity	NTU	3.2	3.0	8.2	2.4	--
3	Total Suspended Solids (TSS)	mg/l	10	14	20	<10	100 (Max.)
4	Ammoniacal Nitrogen as NH_3-N	mg/l	<0.4	<0.4	<0.4	<0.4	50 (Max.)
5	Oil and Grease (O & G)	mg/l	<2	<2	<2	<2	10 (Max.)
6	BOD for 3 days at 27°C	mg/l	4.7	7.0	4.7	3.7	30 (Max.)
7	Chemical Oxygen Demand (COD)	mg/l	28	36	20	16	250 (Max.)
8	Sulphate as SO_4	mg/l	28.5	52	47	28	--
9	Colour	..	10	10	10	10	--
10	Salinity	PSU	0.7184	0.4579	0.7357	0.7357	--
11	Total Dissolved Solids (TDS)	mg/l	626	506	682	612	--
12	Dissolved Oxygen (DO)	mg/l	6.9	6.0	6.7	6.9	--
13	Total Coliform/100 ml. (TC)	MPN	49	130	350	22	--
14	Faecal Coliform/100 ml. (FC)	MPN	14	23	49	4	1000 (Max.)

Date of monitoring: 29.09.2023

Sl. No.	Test Parameters	Unit	Our Ref. No./ Location				Limit as per Environmental Protection Act, MOE & F for Effluent discharged into Inland surface water
			KPD 2 (26-28 KPD)	NSD Lock Entrance	7-8 N.S. Dick	KPD 1 (11 KPD)	
1	pH Value	..	7.7	7.7	7.9	7.6	5.5 - 9.0
2	Turbidity	NTU	2.9	38.5	4.6	3.4	--
3	Total Suspended Solids (TSS)	mg/l	10	38	12	10	100 (Max.)
4	Ammoniacal Nitrogen as NH_3-N	mg/l	<0.4	<0.4	<0.4	<0.4	50 (Max.)
5	Oil and Grease (O & G)	mg/l	<2	<2	<2	<2	10 (Max.)
6	BOD for 3 days at 27ºC	mg/l	4.3	3.9	3.3	3.4	30 (Max.)
7	Chemical Oxygen Demand (COD)	mg/l	24	30	16	18	250 (Max.)
8	Sulphate as SO_4	mg/l	24	35.76	38	36	--
9	Colour	..	10	10	10	10	--
10	Salinity	PSU	0.5585	0.4772	0.5318	0.5608	--
11	Total Dissolved Solids (TDS)	mg/l	608	544	586	962	--
12	Dissolved Oxygen (DO)	mg/l	6.9	6.7	6.4	6.8	--
13	Total Coliform/100 ml. (TC)	MPN	34	94	940	79	--
14	Faecal Coliform/100 ml. (FC)	MPN	13	46	490	49	1000 (Max.)

Chapter - 7

7.0 CHARACTERIZATIONS OF SOIL

7.1 Soil Characterization:

7.1.1 Objective:

The main purpose of the study was to get an idea about the quality of Soil within the area of study. All together 2soil samples were collected and were analysed within our present area of study.

Two (02) *Soil*samples collected from: (i) NSD Area, (ii) KPD Area respectively.

7.1.2 Soil character of the present study areas were assessed in terms of the following structure:

(i) Lead, (ii) Cadmium, (iii) Nickel, (iv) Copper, (v) Mercury, (vi) Hexavalent Chromium, (vii) Iron, (viii) Zinc

7.1.3: Laboratory determination:

The laboratory determination of above mentioned parameters carried out as per following procedure:

- Lead: The method was followed as per our SOP No.: RVB/SOP/05/19, & EPA Method 3050B
- Cadmium : The method was followed as per our SOP No.: RVB/SOP/05/20, EPA Method 3050B
- Nickel : The method was followed as per our SOP No.: RVB/SOP/05/23, EPA Method 3050B
- Copper : The method was followed as per our SOP No.: RVB/SOP/05/24, EPA Method 3050B
- Mercury : The method was followed as per our SOP No.: RVB/SOP/05/17, EPA Method 3050B
- Hexavalent Chromium : The Hexavalent Chromium value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 3500-Cr B)
- Iron : The Iron value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 3500-FeB)
- Zinc : The Zinc value was calculated in the laboratory according to the method prescribed by the American Public Health Association (APHA) in their Publication (23nd edition – 3111B)

Table 7.1

ANALYTICAL RESULTS OF THE SOIL SAMPLES COLLECTED

Date of Monitoring: 29.06.2023

Sl. No.	Test Parameters	Unit	Result	
			NSD Area	KPT Area
1	Lead as Pb	mg/kg	70.8	30.5
2	Cadmium as Cd	mg/kg	<0.5	< 0.5
3	Nickel as Ni	mg/kg	6.34	< 1.0
4	Copper as Cu	mg/kg	27.5	7.98
5	Mercury as Hg	mg/kg	0.61	0.94
6	Hexavalent Chromium as Cr^{+6}	mg/kg	<0.5	< 0.5
7	Iron as Fe	%	1.196	0.561
8	Zinc as Zn	mg/kg	116.7	23.7

Date of Monitoring: 29.06.2023

Sl. No.	Test Parameters	Unit	Result	
			NSD Area	KPT Area
1	Lead as Pb	mg/kg	83.11	96.20
2	Cadmium as Cd	mg/kg	1.09	1.09
3	Nickel as Ni	mg/kg	13.10	12.90
4	Copper as Cu	mg/kg	42.60	55.20
5	Mercury as Hg	mg/kg	3.83	3.04
6	Hexavalent Chromium as Cr^{+6}	mg/kg	< 0.5	< 0.5
7	Iron as Fe	%	300.30	224.40
8	Zinc as Zn	mg/kg	1.94	1.89