Environmental Monitoring Reports For V.O. Chidambaranar Port Trust

Quarterly Report (May'18 - July'18)

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CONTENTS

FOREWORD

V.O.Chidambaranar Port Trust (VOC) has port Operation at Tuticorin area in Tamil Nadu State.

VOC desired to monitor current environmental status at the project site. They entrusted the work of environmental quality monitoring to M/s. Hubert Enviro Care Systems (P) Ltd., Chennai having Environmental Laboratory approved by CPCB/MoEF through their work order **No. CIV-OFCQS-MIS-2018- V1-17/D/847 dated 18.04.18**

A comprehensive environmental monitoring network had been planned to monitor data for Quaterly report for the month of (May'2018 –June'2018). The monitored data on Ambient Air Quality, Water Quality and Noise Levels are collected and presented in this report.

Our sincere thanks are due to **V.O.Chidambaranar Port Trust.**, Tuticorin for awarding this work and Port authorities for their kind co-operation during the study period.

Date:

Place: Chennai - 83. Laboratory Manager.

EXECUTIVE SUMMARY

1.0 **V.O.Chidambaranar Port Trust. (VOC)** has port Operation at Tuticorin area in Tamilnadu State.

2.0 VOC desired to monitor current environmental status of the Project as a part of regular monitoring. Hence, they entrusted the work of environmental quality monitoring to **M/s. Hubert Enviro Care Systems (P) Ltd., Chennai**.

3.0 Study

The data collection Programme is given below;

3.1 Ambient Air Quality Monitoring

Ambient air quality was monitored at locations viz. **TTPS near Coal Dump, Container loading Area, VOC Wharf between berth 3&4, In front of Coal Jetty-1, North Fire station, Administrative Office Building, Port Hospital, Between Berth 5&6, Signal station (VOC Wharf), Port School Building, Railway Quarters.** PM_{10}, $PM_{2.5}$, SO_2, NOx, CO and Pb samples were collected and analyzed during the study period. The air quality status is given in Table and data are given in Annexure. While comparing with CPCB norms for industrial and mixed-use environment, all PM_{10}, $PM_{2.5}$, SO_2, NOx, CO and Pb values were well within the limits.

3.2 Water Quality Monitoring

Ground Water:

Ground water sample from location viz. **Oyster Water Tank, Beach Water Tank**, **Chevalier CIR Machado Plaza (WTA), Residential/Non Residential**, **Gate Inside Green Gate**, **Inside Red Gate (Near Health Centre), Administrative Office**, **Port School** were collected per IS: 3025 and IS: 10500 norms. In general, Water Quality at locations are well within prescribed limits with respect to IS: 10500 norms.

Wastewater:

Wastewater was collected as per IS: 3025. In general, Wastewater Quality at locations were well within prescribed limits with respect to TNPCB norms.

Marine Water:

Marine water sample from location viz. **Approach Channel, Dock Basin Area near Berth 3&4, Dock Basin Area near Berth 5&6, Dock Basin Area near Coal jetty I&II** were collected per IS: 3025. In general, Water Quality at locations are well within prescribed limits with respect to Primary Water Quality Criteria for Class SW- IV (For Harbour Waters).

3.3 Sea Bed Sediment:

Marine water sample from location viz. **Approach Channel, Dock Basin Area near Berth 3&4, Dock Basin Area near Berth 5&6, Dock Basin Area near Coal jetty I&II 3&4,.** were collected per APHA.

3.4 Noise Level Measurement:

Noise levels were recorded using Extech Sound Level Meter at locations **VOC Wharf Pump House, Coal Jetty, Field Workshop, VOC Wharf between Berth 4, Container Loading Area, VOC Shopping Mall, Floating Vessel** during the study period.

3.5 Conclusion

All monitored values were found to be well within the stipulated norms.

1.0 INTRODUCTION

1.1 Background

VOC Port Trust is the 10th Major Port in India. VOC Port Trust policy is to manage the port in a pro-active manner to minimize any impacts an environment from port operations or new developments. VOC Port Trust strives for continual improvement of environment. In order to assess the efficacy of the present environmental management particularly at the coal handling areas and to further improve the air quality, port desired to carry out a detailed study on environmental management at coal handling facilities, Port operational areas etc.

1.2 Environmental Management Plan

Being concerned towards Environmental Protection, VOC Port Trust has prepared an extensive Environmental Management Plan for port operations. The field monitoring studies were carried out for ambient air, water quality and noise levels are presented in this report.

1. Ambient Air Quality
2. Water Quality
3. Sea Bed Sediments
4. Noise Level
5. STP

This report consists of monitoring results and analysis of the above assignment awarded to **Hubert Enviro Care Systems Pvt. Ltd, Chennai**. By VOC vide Work Order No. **CIV-OFCQS-MIS- 2018- V1-17/D/847 dated 18.04.18**

2.0 SCOPE AND METHODOLOGY

2.1 Scope & Methodology

The scope of the study and the present report covers the detailed characterisation of the existing environmental status in the Project area for major environmental components viz. Ambient Air Quality, Water Quality, Sea Bed, and Noise Levels.

2.2 Ambient Air Quality

Meteorology in the upwind and downwind direction as well as to represent the cross sections to assess the ambient air quality monitoring stations were identified on the basis sectional scenario of the project site. Based on the production activities the parameters chosen for assessment of ambient air quality were Particulate matter less than 10 micron (PM_{10}), Particulate matter less than 2.5 micron ($PM_{2.5}$), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), C arbon monoxide (CO), Lead (pb), Ozone (O_3), Ammonia (NH_3), Benzene (C6H6), Benzo (a) Pyrene (BaP) , Arsenic (Ar), Nickel (Ni), Hydrogen sulfide (H_2S) , Carbon dioxide (CO_2), Cadmium (Cd) and Mercury (Hg).

Calibrated respirable dust sampler (with an average flow of 1.2-1.4 m^3/min) were used for monitoring of PM_{10} $PM_{2.5}$ and a tapping provided in the hopper of the same sampler was utilized for sampling of SO_2, NO_2, Ozone (O_3) and Ammonia (NH_3) with proper flow controller (1l/m). Calibrated APM 550 fine particulate sampler was used for monitoring of $PM_{2.5}$. A digital imported CO detector was used for monitoring of CO. PM_{10}, $PM_{2.5}$. and gaseous pollutants were monitored on 24 hourly. The samples were analyzed at our laboratory.

2.3 Water Quality

Water samples were collected and analyzed as per procedures outlined in IS: 3025/

APHA. Sterilized bottles were used for collection of water sample for bacteriological analysis, stored in ice box and transported to the laboratory for the analysis. Parameters like pH, Temperature, Dissolved Oxygen, Residual Chlorine, Conductivity, Free Ammonia, Total Hardness, Calcium Hardness and Magnesium Hardness were measured in the field while collecting the samples.

2.4 Noise Levels

Ambient Noise level measurements in seven locations namely such as **VOC Wharf Pump House, Coal Jetty, Field Workshop, VOC Wharf between Berth 4, Container Loading Area, VOC Shopping Mall, Floating Vessel** were identified at cardinal directions , Which was carried out using a Extech sound level meter, with windscreen during daytime. Noise measurements were made at 1.5 m above ground and about 3m away from walls, buildings or other sound reflecting sources. The measurements were carried out in such a way that 1 m away from the sources and 1 m away from the edge of the roads. In order to reduce the disturbances from standing waves, the noise levels measured were averaged over + 0.5 m each of at least three positions. The mean values were taken for reporting. Ambient noise levels were compared with Air Quality Standards in respect of noise for industrial area.

3.0 Ambient Air Quality Status

3.1 Data Presentation

The objective of the Ambient Air Quality monitoring is to assess the existing levels of air pollutants as well as the regional background concentration in the project area. Air pollution forms an important and critical factor to study the environmental issues in the port areas. Air qualities have to be frequently monitored to know the extent of pollution due to port and allied activities. Thus, ambient air quality monitoring was carried out at 11 locations. The ambient air quality monitoring stations are given table.

Table -3.1 AMBIENT AIR MONITORING STATIONS

SI. No.	Location Code	Location Name
1.	AAQ - 1	TTPS Near Coal Dump
2.	AAQ - 2	Container Loading Area
3.	AAQ - 3	VOC Wharf between Berth 3&4
4.	AAQ - 4	In front of Coal Jetty-1
5.	AAQ - 5	North Fire Station
6.	AAQ - 6	Administrative Office Building
7.	AAQ - 7	Port Hospital
8.	AAQ - 8	Between Berth 5 & 6
9.	AAQ - 9	Signal Station(VOC Wharf)
10.	AAQ - 10	Port School Building
11.	AAQ - 11	Railway Quarters

3.2 Data Analysis

TTPS near Coal Dump (AAQ-1)

In the monitoring location, TTPS Near Coal Dump (AAQ 1), the Sulphur dioxide values were ranging from 19.57 µg/m^3 to 20.83 µg/m3, Nitrogen dioxide values were ranging from 26.32 µg/m^3 to 27.63 µg/m^3, PM_{10} values were ranging from 58.75 to 59.61 µg/ and $PM_{2.5}$ values were ranging from 28.48 to 29.61 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

Container Loading Area (AAQ-2)

In the monitoring location, Container Loading Area (AAQ-2), the Sulphur dioxide values were ranging from 20.3 µg/m^3 to 21.57 µg/m3, Nitrogen dioxide values were ranging from 27.58 µg/m^3 to 28.76 µg/m^3, PM_{10} values were ranging from 55.32 to 56.38 µg/ and $PM_{2.5}$ values were ranging from 27.26 to 28.63 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

VOC Wharf between Berth 3&4 (AAQ-3)

In the monitoring location, VOC Wharf between Berth 3&4 (AAQ-3), the Sulphur dioxide values were ranging from 21.32 µg/m^3 to 22.58 µg/m3, Nitrogen dioxide values were ranging from 33.46 µg/m^3 to 34.63 µg/m^3, PM_{10} values were ranging from 53.61 µg/m^3 to 54.86 µg/m^3 and $PM_{2.5}$ values were ranging from 33.38 µg/m^3 to 34.66 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

In front of Coal Jetty-1 (AAQ-4)

In the monitoring location, In front of Coal Jetty-1 (AAQ-4), the Sulphur dioxide values were ranging from 20.74 µg/m^3 to 21.85 µg/m3, Nitrogen dioxide values were ranging from 29.36 µg/m^3 to 30.59 µg/m^3, PM_{10} values were ranging from 59.68 µg/m^3 to 60.63 µg/m^3 and $PM_{2.5}$ values were ranging from 25.19 µg/m^3 to 26.56 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

North Fire Station (AAQ-5)

In the monitoring location, North Fire Station (AAQ-5), the Sulphur dioxide values were ranging from 18.61 µg/m^3 to 20.48 µg/m3, Nitrogen dioxide values were ranging from 32.58 µg/m^3 to 33.44 µg/m^3, PM_{10} values were ranging from 53.42 µg/m^3 to 54.85 µg/m^3 and $PM_{2.5}$ values were ranging from 29.76 µg/m^3 to 30.70 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

Administrative Office Building (AAQ-6)

In the monitoring location, Administrative Office Building (AAQ-7), the Sulphur dioxide values were ranging from 15.41 µg/m^3 to 16.28 µg/m3, Nitrogen dioxide values were ranging from 29.35 µg/m^3 to 30.43 µg/m^3, PM_{10} values were ranging from 53.44 µg/m^3 to 54.77 µg/m^3 and $PM_{2.5}$ values were ranging from 25.78 µg/m^3 to 26.68 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

Port Hospital (AAQ-7)

In the monitoring location, Port Hospital (AAQ-7), the Sulphur dioxide values were ranging from 13.46 µg/m^3 to 14.69 µg/m3, Nitrogen dioxide values were ranging from 26.58 µg/m^3 to

27.37 µg/m^3, PM_{10} values were ranging from 51.39 µg/m^3 to 52.61 µg/m^3 and $PM_{2.5}$ values were ranging from 23.76 µg/m^3 to 24.99 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

Between Berth 5 & 6 (AAQ-8)

In the monitoring location, Between Berth 5 & 6 (AAQ-8), the Sulphur dioxide values were ranging from 18.49 µg/m^3 to 19.76 µg/m3, Nitrogen dioxide values were ranging from 26.12 µg/m^3 to 27.04 µg/m^3, PM_{10} values were ranging from 67.44 µg/m^3 to 68.53 µg/m^3 and $PM_{2.5}$ values were ranging from 32.55 µg/m^3 to 33.65 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

Signal Station (VOC Wharf) (AAQ-9)

In the monitoring location, Signal Station (VOC Wharf) (AAQ-9), the Sulphur dioxide values were ranging from 22.62 µg/m^3 to 23.74 µg/m3, Nitrogen dioxide values were ranging from 32.57 µg/m^3 to 33.83 µg/m^3, PM_{10} values were ranging from 62.36 µg/m^3 to 63.43 µg/m^3 and $PM_{2.5}$ values were ranging from 24.29 µg/m^3 to 25.78 µg/m^3, respectively. CO and Pb values were found be below detectable limit of < 0.05 µg/m^3.

At this location, all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO and Pb values were found to be within the NAAQ limits.

Port School Building (AAQ-10)

In the monitoring location, Port School Building (AAQ-10), the Sulphur dioxide values were ranging from 17.17 µg/m^3 to 18.62 µg/m3, Nitrogen dioxide values were ranging from 22.59

Table – 3.2 Ambient Air Quality Status

The Ambient air Quality monitoring 11 locations are given in the Table. The air quality data of individual location are presented below for the period May'2018 to July'2018.

S.No	Locations	SO_2 (µg/m^3)		NO_2 (µg/m^3)		PM_{10} (µg/m^3)		$PM_{2.5}$ (µg/m^3)	
		Min	Max	Min	Max	Min	Max	Min	Max
1	TTPS Near Coal Dump (AAQ-1)	19.57	20.83	26.32	27.63	58.75	59.61	28.48	29.67
2	Container Loading Area (AAQ-2)	20.30	21.57	27.58	28.76	55.32	56.38	27.26	28.63
3	VOC Wharf between Berth 3&4 (AAQ-3)	21.32	22.58	33.46	34.63	53.61	54.86	33.38	34.66
4	In front of Coal Jetty-1(AAQ-4)	20.74	21.85	29.36	30.59	59.68	60.63	25.19	26.56
5	North Fire Station (AAQ-5)	18.61	20.48	32.58	33.44	53.42	54.85	29.76	30.70
6	Administrative Office Building (AAQ-6)	15.41	16.28	29.35	30.43	53.44	54.77	25.78	26.68
7	Port Hospital (AAQ-7)	13.46	14.69	26.58	27.37	51.39	52.61	23.76	24.99
8	Between Berth 5 & 6(AAQ-8)	18.49	19.76	26.12	27.04	67.44	68.53	32.55	33.65
9	Signal Station(VOC Wharf) (AAQ-9)	22.62	23.74	32.57	33.83	62.36	63.43	24.29	25.78
10	Port School Building (AAQ-10)	17.17	18.62	22.59	23.86	57.36	58.45	28.46	29.83
11	Railway Quarters (AAQ-11)	22.21	23.59	32.65	33.73	65.15	66.55	24.46	25.76
Average		**19.70**		**29.56**		**58.56**		**28.19**	
NAAQ Standards (2009)		**80**		**80**		**100**		**60**	

Note: SO_2–Sulphur dioxide, NO_2- Nitrogen dioxide, PM_{10} - (Particulate Matter size less than 10 µm), $PM_{2.5}$ - (Particulate Matter size less than 2.5 µm) CO- Carbon monoxide, Pb – Particulate Lead; NAAQ Norms-National Ambient Air Quality Stipulated by CPCB/TNPCB for Industrial Areas 2009. BDL – Below Detectable Limit; D.L- Detectable Limit.

Analyst Signatory **Authorized Signatory**

4.0 WATER QUALITY

4.1 Sampling

Any adverse impact or pollution water will have serious effect on the environment. Hence, it becomes important to monitor the surface water quality periodically in the port project area. The samples were analyzed as per IS: 3025 and compared to the specifications of IS:10500 norms, Primary Water Quality Criteria for Class SW- IV (For Harbour Waters).

Table -4.1 WATER QUALITY SAMPLING LOCATIONS

SI. No.	Location Code	Location Name
1.	WQ - 1	Oyster Water Tank
2.	WQ - 2	Beach Water Tank
3.	WQ - 3	Chevalier CIR Machado Plaza (WTA)
4.	WQ - 4	Residential/ Non residential
5.	WQ - 5	Gate India Green Gate
6.	WQ - 6	Inside Red Gate (Near Health Center)
7.	WQ - 7	Administrative Office
8.	WQ - 8	Port School

4.2 Water - Data Analysis

Oyster Water Tank- (WQ - 1)

At this location, average pH was found to be 7.45.Total Dissolved Solids and Sulphates were found to be 238.33 mg/l and 17.89 mg/l. All heavy metal values are found to be within the permissible limits.

Beach Water Tank (WQ - 2)

At this location, average pH was found to be 7.46.Total Dissolved Solids and Sulphates were found to be 283.33 mg/l and 28.99 mg/l. All heavy metal values are found to be within the permissible limits.

Chevalier CIR Machado Plaza (WTA) (WQ - 3)

At this location, average pH was found to be 7.93.Total Dissolved Solids and Sulphates were found to be 211 mg/l and 19 mg/l. All heavy metal values are found to be within the permissible limits.

Residential/ Non residential (WQ - 4)

At this location, average pH was found to be 7.56.Total Dissolved Solids and Sulphates were found to be 254.66 mg/l and 18.75 mg/l. All heavy metal values are found to be within the permissible limits.

Gate India Green Gate (WQ - 5)

At this location, average pH was found to be 7.65.Total Dissolved Solids and Sulphates were found to be 243 mg/l and 20.47 mg/l. All heavy metal values are found to be within the permissible limits.

Inside Red Gate (Near Health Center) (WQ - 6)

At this location, average pH was found to be 8.34.Total Dissolved Solids and Sulphates were found to be 46 mg/l and 2.68 mg/l. All heavy metal values are found to be within the permissible limits.

Table 4.1: Average Water Quality Parameters											
S. No	**Parameters**	**Units**	**Oyster water Tank**	**Beach Water Tank**	**Chevalier CIR Machado Plaza (WTA)**	**Residential/ Non residential**	**Gate India Green Gate**	**Inside Red Gate (Near Health Center)**	**Administrative Office**	**Port School**	**IS: 10500-2012 Norms**
I	**PHYSICAL & CHEMICAL**										
1	pH (at 25 °C)	-	7.45	7.46	7.93	7.56	7.65	8.34	6.52	7.75	6.5-8.5
2	Appearance	-	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	-
3	Electrical conductivity	µS/cm	385.3	513.3	404.6	418	454	76.6	28.3	474	-
4	Turbidity	NTU	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	2.33	1/5
5	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
6	Total Hardness as CaCO3	mg/l	143.66	184	146.3	145.6	142	24.0	5.33	153.3	200/600
7	Calcium as Ca	mg/l	31.97	37.84	36.07	34.63	28.07	5.84	1.28	34.4	75/200
8	p -Alkalinity (as CaCO3)	mg/l	BDL(DL 1)	BDL(DL 1)	BDL(DL 1)	BDL(DL 1)	BDL(DL 1)	BDL(DL 1)	BDL(DL 1)	BDL(DL 1)	-
9	Total Alkalinity as C_aCO_3	mg/l	134.66	125.33	134.3	141.3	136.6	26.33333	6.66	140.6	200/600
10	Chloride as Cl	mg/l	47.6	59.78	31.96	62.02	47.02	9.906667	5.82	52.03	250/1000
11	Magnesium as Mg	mg/l	16.97	23.1	13.13	15.91	17.07	2.586667	BDL(DL1)	17.54	30/100
12	Total Dissolved Solids	mg/l	238.3	283.3	211	254.6	243.0	46	14.6	255.6	500/2000
13	Sulphate as SO4	mg/l	17.89	28.99	19	18.75	20.4	2.683333	BDL(DL5)	30.62	200/400
14	Fluoride	mg/l	0.306	0.40	0.35	0.353	0.333	BDL(DL0.05)	BDL(DL0.05)	0.37	10/1.5
15	Nitrate as NO3	mg/l	2.56	2.91	2.73	2.64	2.63	1.42	BDL(DL1)	2.93	45
16	Iron as Fe	mg/l	BDL(DL 0.02)	BDL(DL 0.02)	BDL(DL 0.02)	BDL(DL 0.02)	BDL(DL 0.02)	BDL(DL 0.02)	BDL(DL 0.02)	BDL(DL 0.02)	0.3
17	Manganese as Mn	mg/l	BDL(DL 0.05)	BDL(DL 0.05)	BDL(DL 0.05)	BDL(DL 0.05)	BDL(DL 0.05)	BDL(DL 0.05)	BDL(DL 0.05)	BDL(DL 0.05)	0.1/0.3
18	Sodium as Na	mg/l	20.6	28.3	15	28.6	19.6	6.33	2.66	25	-
19	Potassium as K	mg/l	1.66	1.66	1.66	1.66	1.33	BDL(DL1)	BDL(DL1)	1.66	-
20	Phosphate as PO4	mg/l	BDL(DL 0.02)	0.02	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	0.283	-
21	Ammonia as NH3	mg/l	BDL(DL 0.02)	BDL(DL0.02)	BDL(DL 0.02)	BDL(DL 0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	0.5
22	Nitrite as NO2	mg/l	BDL(DL 0.01)	BDL(DL0.02)	BDL(DL 0.01)	BDL(DL 0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
23	Tidy's Test	mg/l	BDL(DL 0.4)	BDL(DL0.4)	BDL(DL 0.4)	BDL(DL 0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	-
24	Fecal Coliform	MPN/100	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	Not detectable

Note: BDL – Below Detection Limit; D.L- Detection Limit.

Analyst Signatory **Authorized Signatory**

5.0 Marine Water Quality Status

Table -5.1 MARINE WATER QUALITY SAMPLING LOCATIONS

SI. No.	Location Code	Location Name
1.	MWQ - 1	Approach Channel-I
2.	MWQ - 2	Dock Basin Area Near Berth 3 & 4
3.	MWQ - 3	Dock Basin Area Near Berth 5 & 6
4.	MWQ - 4	Dock Basin Area Near Coal Jetty I&II
5.	MWQ - 5	Oil Jetty

Approach Channel-I (MWQ - 1)

At this location, average Surface and Depth pH was found to be 8.05 & 8.07. Average Surface and Depth Total Hardness and Salinity were found to be 8666.6 mg/l & 8633.3 mg/l and 31.24 ppt & 30.85 ppt. All heavy metal values are found to be within the permissible limits except hardness. All the values were found to be well within the Primary Water Quality Criteria for Class SW- IV (For Harbour Waters).

Dock Basin Area near Berth 3 & 4(MWQ - 2)

At this location, average surface and Depth pH was found to be 8.05 & 8.10. Average Surface and Depth Total Hardness and Salinity were found to be 8733.3 mg/l & 8666.6 mg/l and 31.59 ppt & 31.72 ppt. All heavy metal values are found to be within the permissible limits except hardness. All the values were found to be well within the Primary Water Quality Criteria for Class SW- IV(For Harbour Waters).

Dock Basin Area near Berth 5 & 6 (MWQ - 3)

At this location, average surface and Depth pH was found to be 8.08 & 8.07. Average Surface and Depth Total Hardness and Salinity were found to be 8766.6 mg/l & 8733.3 mg/l and 34.57 ppt & 34.42 ppt. All heavy metal values are found to be within the permissible limits

Table 5.1(A): Average Marine Surface Water Quality Parameters

S.NO	Parameters	Approach Channel	BERTH 3 & 4	BERTH 5 & 6	COAL JETTY I & II	OIL JETTY	IS: 7967 Norms Harbour
1	Water Level, meter	0.3	0.3	0.3	0.3	0.3	-
2	Atmospheric Temperature, ℃	31.33	31.66	31.33	31.66	31.66	-
3	Water Temperature, ℃	30.66	31.0	32.6	32.3	32.3	-
4	pH @ 25^0C	8.05	8.05	8.08	8.06	8.09	6.5-9.0
5	Turbidity (NTU)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	-
6	Total Suspended Solids, mg/l	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	-
7	Salinity, ppt	31.24	31.59	34.57	34.34	36.21	-
8	Dissolved Oxygen (as O_2), mg/l	5.7	6.1	5.8	6.06	6.2	3.0
9	Total Hardness (as $CaCO_3$), mg/l	8666.6	8733.3	8766.6	8700	8700	-
10	Carbonate Alkalinity, mg/l	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	-
11	Bicarbonate Alkalinity, mg/l	113.3	113.3	113.3	116.6	116.6	-
12	Petroleum Hydrocarbons (PHC), mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
13	Inorganic Phosphate, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
14	Total Phosphorous, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
15	Nitrite as N, mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
16	Nitrate, mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
17	Ammoniacal Nitrogen, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
18	Total Nitrogen , mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
19	Silica, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
20	BOD, 3 days @ 27^0C, mg/l	2.33	2.66	1.66	2.33	2.33	5.0
21	Fecal Coliform (MPN/100ml)	<2	<2	<2	<2	<2	-
22	Cadmium (as Cd), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
23	Chromium (as Cr), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
24	Nickel (as Ni) mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
25	Copper (as Cu), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
26	Mercury (as Hg), mg/l	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	-
27	Arsenic (as As), mg/l	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	-
28	Chromium VI (as Cr VI), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-

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Table 5.1(B): Average Marine Depth Water Quality Parameters

S.NO	Parameters	Approach Channel	BERTH 3 & 4	BERTH 5 & 6	COAL JETTY I & II	OIL JETTY	IS: 7967 Norms Harbour
1	Water Level, meter	12.0	12.0	12.0	12.0	12.0	-
2	Atmospheric Temperature, °C	31.66	31.33	31.66	31.33	31.66	-
3	Water Temperature, °C	30.0	29.6	31.66	31.66	32.0	-
4	pH @ 25^0C	8.07	8.10	8.07	8.08	8.11	6.5-9.0
5	Turbidity (NTU)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	-
6	Total Suspended Solids, mg/l	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	-
7	Salinity, ppt	30.85	31.72	34.42	34.31	35.12	-
8	Dissolved Oxygen (as O_2), mg/l	5.8	6.06	5.96	6.06	6.0	3.0
9	Total Hardness (as $CaCO_3$), mg/l	8633.3	8666.6	8733.3	8700	8666.6	-
10	Carbonate Alkalinity, mg/l	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	-
11	Bicarbonate Alkalinity, mg/l	113.3	116.6	116.6	113.3	113.3	-
12	Petroleum Hydrocarbons (PHC), mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
13	Inorganic Phosphate, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
14	Total Phosphorous, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
15	Nitrite as N, mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
16	Nitrate, mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
17	Ammoniacal Nitrogen, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
18	Total Nitrogen , mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	-
19	Silica, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	-
20	BOD, 3 days @ 27^0C, mg/l	2.33	3.0	1.66	1.66	2.66	5.0
21	Fecal Coliform (MPN/100ml)	<2	<2	<2	<2	<2	-
22	Cadmium (as Cd), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
23	Chromium (as Cr), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
24	Nickel (as Ni) mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
25	Copper (as Cu), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
26	Mercury (as Hg), mg/l	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	-
27	Arsenic (as As), mg/l	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	-
28	Chromium VI (as Cr VI), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-

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6.0 Sediment Quality Status

The sediment quality was analyzed in four locations during May'18 to July'18 and was found to be normal without major toxic heavy metals.

Table -6.1 SOIL QUALITY SAMPLING LOCATIONS

SI. No.	Location Code	Location Name
1.	S - 1	Approach Channel-I
2.	S - 2	Dock Basin Area Near Berth 3 & 4
3.	S - 3	Dock Basin Area Near Berth 5 & 6
4.	S- 4	Dock Basin Area Near Coal Jetty I&II

Table 6.1: Average Sediment Quality Parameters

S.NO	PARAMETERS	UNITS	Approach Channel	Dock Basin Area Near Berth 3 & 4	Dock Basin Area Near Berth 5 & 6	Dock Basin Area Near Coal Jetty I&II
1	Organic Carbon	%	0.29	0.15	0.78	0.84
2	Organic Matter	%	0.45	0.20	1.39	1.48
3	**Sediment Texture**		Fine sand	Fine sand	Fine sand	Fine sand
	a. Sand	%	91.5	94.8	98.0	96.03
	b. Silt	%	2.34	1.33	1.49	1.51
	c. Clay	%	6.16	3.87	0.51	2.46
4	**Heavy Metals in Sediments**					
	a. Cadmium	µg/gm	BDL (DL 0.1)	BDL (DL 0.1)	BDL (DL 0.1)	BDL (DL 0.1)
	b. Copper	µg/gm	11.97	12.59	11.9	10.61
	c. Lead	µg/gm	3.82	4.04	3.48	3.23
	d. Nickel	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
	e. Chromium III	µg/gm	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)
	f. Chromium VI	µg/gm	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)	BDL(DL 0.1)
	g. Mercury	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
5	Arsenic	µg/gm	2.64	2.84	2.47	2.30
6	Total Sulphur	mg/kg	3.23	3.20	4.16	4.76
7	Organic Sulphur Compounds	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
8	Fluorine Compounds	mg/kg	2.32	5.33	1.15	1.77
9	Phosphate compounds	mg/kg	160.6	58.2	160.1	158.3

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7.0 Waste water Quality Status

The Waste water Quality monitoring is given in the Table. The waste water quality data are presented below for the period May‘2018 to July’2018. STP outlet was found to be within CPCB norms.

Table 7.1(A): Average Inlet Waste water Quality Parameters

S.No.	Parameters	Units	Results
1	Total suspended Solids	mg/l	23.0
2	pH	-	7.31
3	Total Dissolved Solids	mg/l	1035.0
4	BOD, 3 days @ 27°C as O_2	mg/l	95.0
5	COD as O_2	mg/l	336.0
6	Chloride as Cl-	mg/l	236.73
7	Sulphate as SO_4	mg/l	42.10
8	Oil and Grease	mg/l	BDL(DL 4)

Table 7.1(B): Average Outlet Waste water Quality Parameters

S.No.	Parameters	Units	Results	Limits
1	Total suspended Solids	mg/l	11.0	30
2	pH	-	7.43	5.5-9.0
3	Total Dissolved Solids	mg/l	895.0	-
4	BOD, 3 days @ 27°C as O_2	mg/l	4.0	20
5	COD as O_2	mg/l	22.0	-
6	Chloride as Cl-	mg/l	246.39	-
7	Sulphate as SO_4	mg/l	42.61	-
8	Oil and Grease	mg/l	BDL(DL 4)	-

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Table 8.1: Average Noise level

S.No	Location	Day Time Noise level in dB (A)	Night Time Noise level in dB (A)
1	VOC Wharf Pump House	62.40	51.83
2	Coal Jetty	68.07	53.97
3	Field Workshop	68.30	52.80
4	VOC Wharf Between Berth 4	66.83	67.20
5	Container Loading Area	57.60	52.07
6	VOC Shopping Mall	54.80	48.80
7	Floating Vessel	64.20	51.97

Limits set by CPCB:

i. Industrial Area : Day Time-75 dB (A); Night Time-70 dB (A).
ii. Commercial Area : Day Time-65 dB (A); Night Time-55 dB (A).
iii. Residential Area : Day Time-55 dB (A); Night Time-45 dB (A).
iv. Silence Zone : Day Time-50 dB (A); Night Time-40 dB (A).
v. Working Area : 90 dB (A).

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9.0 Conclusion:

During the period of May'18 to July'18 Ambient air quality values recorded were within the stipulated NAAQ/CPCB norms for industrial and mixed-use environment. Tested water quality values in all locations partially comply IS: 10500 specifications. Marine water quality was within the prescribed limits as per Primary Water Quality Criteria for Class SW-IV (for Harbour Waters). All tested marine sediments adhered to the marine sediment quality standards.Waste water (STP) outlet was within the CPCB norms. The recorded noise levels complied with the day time and night time noise criteria in all locations.

Environmental Monitoring Reports For V.O.Chidambaranar Port Ltd

Annual Report (2016 - 2017)

Hubert Enviro Care Systems (P) Ltd

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CONTENTS

FOREWORD

M/s. V.O.Chidambaranar Port Trust. (VOC), has port Operation at Tuticorin area in Tamil Nadu State. VOC desired to monitor current environmental status at the project site. They entrusted the work of environmental quality monitoring to M/s. Hubert Enviro Care Systems (P) Ltd., Chennai having Environmental Laboratory approved by CPCB/MoEF through their work order No. CIV-OFCQ3-PRJ-ENVIR-V1-15/D dated 21.04.16

A comprehensive environmental monitoring network had been planned to monitor data for the monitoring period (2016 – 2017). The monitored data on Ambient Air Quality, Water Quality and Noise Levels are collected and presented in this report.

Our sincere thanks are due to **V.O.Chidambaranar Port Trust.**,Tuticorin for awarding this work and Port authorities for their kind co-operation during the study period.

Date :

Place : Chennai - 83. **Laboratory Manager**.

EXECUTIVE SUMMARY

1.0 **M/s. V.O.Chidambaranar Port Trust. (VOC)**, has port Operation at Tuticorin area in Tamilnadu State

2.0 VOC desired to monitor current environmental status of the Project as a part of regular monitoring. Hence, they entrusted the work of environmental quality monitoring to **M/s. Hubert Enviro Care Systems (P) Ltd., Chennai**.

3.0 Study

The data collection Programme is given below;

3.1 Ambient Air Quality Monitoring

Ambient air quality was monitored at locations viz. **TTPS near Coal Dump, Container loading Area, VOC Wharf between berth 3 &4, In front of coal jetty-1, North Fire station, Administrative Office Building, Port Hospital, Between Berth 5 & 6, Signal station(VOC Wharf), Port School Building, Railway Quarters.** PM10, PM 2.5, SO2, NOx ,CO and Pb samples were collected and analysed during the study period. The air quality status is given in Table and data are given in Annexure. While comparing with CPCB norms for industrial and mixed-use environment, all PM10, PM 2.5, SO2, NOx ,CO and Pb values were well within the limits.

3.2 Water Quality Monitoring

Ground Water:

Ground water sample from location viz. **Oyster Water Tank. Beach Water Tank** , **Chevalier CIR Machado Plaza(WTA), Residential/Non Residential**, **Gate Inside Green Gate**, **Inside Red Gate(Near Health Centre), Administrative Office**, **Port School** were collected per IS: 3025 and IS: 10500 norms. In general, Water Quality at locations are well within prescribed limits with respect to IS: 10500 norms.

Marine Water:

Marine water sample from location viz. **Approach Channel, Dock Basin Area near Berth 3&4, Dock Basin Area near Berth 5&6, Dock Basin Area near Coal jetty I&II 3&4,.** were collected per IS: 3025. In general, Water Quality at 8 locations are well within prescribed limits with respect to Primary Water Quality Criteria for Class SW- IV(For Harbour Waters).

Marine Water Biological Quality :

Marine water sample from location viz. **Approach Channel, Dock Basin Area near Berth 3&4, Dock Basin Area near Berth 5&6, Dock Basin Area near Coal jetty I&II 3&4,.** were collected per APHA . In general, Water Quality at locations.

Sea Bed Sediment :

Marine water sample from location viz. **Approach Channel, Dock Basin Area near Berth 3&4, Dock Basin Area near Berth 5&6, Dock Basin Area near Coal jetty I&II 3&4,.** were collected per APHA . In general, Water Quality at locations.

3.4 Noise Level Measurement:

Noise levels were recorded using Extech Sound Level Meter at locations **VOC Wharf Pump House, Coal Jetty, Field Workshop, VOC Wharf Between Barth 4, Container Loading Area, VOC Shopping Mall, Floating Vessel.** during the study period. The abstract of Noise level are given in Table.

3.5 Conclusion

All monitored values were found to be well within the stipulated norms.

1.0 INTRODUCTION

1.1 Background

VOC Port is the first Corporatized Port in India and the 12th Major Ports. It works on the model of 'land Lord" concept. VOC's policy is to manage the port in a pro-active manner to minimize any impact on the environment from port operations or new developments. VOC Port strives for continual improvement of environmental management. In order to assess the efficacy of the present environmental management particularly at the coal handling areas and to further improve the air quality, they desired to carry out a detailed study on environmental quality at coal handling facilities.

1.2 Environmental Management Plan

Being concerned towards Environmental Protection, VOC has prepared an extensive Environmental Management Plan for port operations. The field monitoring studies were carried out for ambient air, water quality and noise levels are presented in this report.

1. Ambient Air Quality
2. Marine water quality and Sea bed sediment
3. Potable Water Quality
4. Noise Pollution
5. Effluent

This report consists of monitoring results and analysis of the above assignment awarded to **Hubert Enviro Care Systems Pvt. Ltd, Chennai**. By VOC vide Work Order No. **CIV-OFCQ3-PRJ-ENVIR-V1-15/D dated 21.04.16.**

2.0 SCOPE AND METHODOLOGY

2.1 Scope & Methodology

The scope of the study and the present report covers the detailed characterisation of the existing environmental status in the Project area for major environmental components viz. Ambient Air Quality, Water Quality, and Noise Levels.

2.2 Ambient Air Quality

Meteorology in the upwind and downwind direction as well as to represent the cross sections to assess the ambient air quality monitoring stations were identified on the basis sectional scenario of the project site. Based on the production activities the parameters chosen for assessment of ambient air quality were Particulate matter less than 10 micron (PM_{10}), Particulate matter less than 2.5 micron ($PM_{2.5}$), Sulphur dioxide(SO_2), Nitrogen dioxide(NO_2), C arbon monoxide (CO), Lead, Ozone, Ammonia, Benzene, Benzo (a) Pyrene , Arsenic, Nickel, Hydrogen sulfide , Carbon dioxide, Cadmium and Mercury.

Calibrated respirable dust sampler (with an average flow of 1.2-1.4 m^3/min)were used for monitoring of PM_{10} $PM_{2.5}$ and a tapping provided in the hopper of the same sampler was utilised for sampling of SO_2,NO_2, Ozone and Ammonia with proper flow controller(1l/m). Calibrated APM 550 fine particulate sampler was used for monitoring of $PM_{2.5}$. A digital imported CO dector was used for monitoring of CO. PM_{10}, $PM_{2.5}$. and gaseous pollutants were monitored on 24 hourly. The samples were analyzed at our laboratory.

2.3 Water Quality

Water samples were collected and analysed as per procedures outlined in IS:3025/ APHA. Sterilised bottles were used for collection of water sample for bacteriological

analysis, stored in ice box and transported to the laboratory for the analysis. Parameters like pH, Temperature, Dissolved Oxygen, Residual Chlorine, Conductivity, Free Ammonia, Total Hardness, Calcium Hardness and Magnesium Hardness were measured in the field while collecting the samples. MPN index of Coliforms were determined in the laboratory as per standard methods.

2.4 Noise Levels

Ambient Noise level measurements in seven identified cardinal directions were carried out using a Extech sound level meter, with windscreen during daytime. Noise measurements were made at 1.5 m above ground and about 3m away from walls, buildings or other sound reflecting sources. The measurements were carried out in such a way that 1 m away from the sources and 1 m away from the edge of the roads. In order to reduce the disturbances from standing waves, the noise levels measured were averaged over + 0.5 m each of at least three positions. The mean values were taken for reporting.

Ambient noise levels were compared with Air Quality Standards in respect of noise for industrial area.

3.0 AMBIENT AIR QUALITY STATUS

3.1 Data Presentation

The objective of the Ambient Air Quality monitoring is to assess the existing levels of air pollutants as well as the regional background concentration in the project area. Air pollution forms an important and critical factor to study the environmental issues in the port areas. Air qualities have to be frequently monitored to know the extent of pollution due to port and allied activities. Thus, ambient air quality monitoring was carried out at locations. The ambient air quality monitoring stations are given table.

Table -3.1 AMBIENT AIR MONITORING STATIONS

SI.No.	Location Name	Location Code
1	TTPS near Coal Dump	AAQ - 1
2	Container loading Area	AAQ - 2
3	VOC Wharf between berth 3 &4	AAQ - 3
4	In front of coal jetty-1	AAQ - 4
5	North Fire station	AAQ - 5
6	Administrative Office Building	AAQ - 6
7	Port Hospital	AAQ - 7
8	Between Berth 5 & 6	AAQ - 8
9	Signal station(VOC Wharf)	AAQ - 9
10	Port School Building	AAQ - 10
11	Railway Quarters	AAQ - 11

Average AAQ monitoring values for the period of 2016 – 2017

Location N ame and Code		PM 10	SO2	NOx	CO	Pb	PM 2.5	O3	NH3	C6H6	BaP	As	Ni	H2S	CO2	Cd	Hg
		µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m3	ng/m3	ng/m3	µg/m3	ppm	ng/m3	ng/m3
TTPS near Coal Dump	Minimum	70.1	21.5	27.5	0.02	BDL (0.05)	47.1	28.3	12.7	0.21	0.18	0.08	0.19	BDL (DL 6)	312	BDL (DL1)	BDL (DL1)
	Maximum	75.2	23.7	31.7	0.03	BDL (0.05)	48.4	32.8	16.9	0.27	0.22	0.17	0.23	BDL (DL 6)	345	BDL (DL1)	BDL (DL1)
Container loading Area	Minimum	62.5	18.3	28.8	0.02	BDL (0.05)	39.7	15.1	16.4	0.06	0.13	0.05	0.12	BDL (DL 6)	318	BDL (DL1)	BDL (DL1)
	Maximum	70.3	21.3	32.4	0.02	BDL (0.05)	42.7	18.8	18.4	0.08	0.15	0.07	0.13	BDL (DL 6)	340	BDL (DL1)	BDL (DL1)
VOC Wharf between berth 3 &4	Minimum	61.4	21.8	33.3	0.03	BDL (0.05)	49.5	25.4	20.4	0.23	0.27	0.12	0.39	BDL (DL 6)	335	BDL (DL1)	BDL (DL1)
	Maximum	65.9	24.6	37.3	0.03	BDL (0.05)	52.9	30.4	22.3	0.26	0.32	0.16	0.45	BDL (DL 6)	348	BDL (DL1)	BDL (DL1)
In front of coal jetty-1	Minimum	75.7	23.2	31.5	0.02	BDL (0.05)	37.2	13.5	14.4	0.29	0.16	0.26	0.24	BDL (DL 6)	329	BDL (DL1)	BDL (DL1)
	Maximum	80.6	26.3	34.1	0.02	BDL (0.05)	40.8	17.1	17.4	0.36	0.18	0.29	0.27	BDL (DL 6)	342	BDL (DL1)	BDL (DL1)
North Fire station	Minimum	43.4	18.7	32	0.03	BDL (0.05)	43.6	18.6	21.2	0.01	0.11	0.12	0.36	BDL (DL 6)	315	BDL (DL1)	BDL (DL1)
	Maximum	47.9	22.6	36.5	0.03	BDL (0.05)	46.3	22.8	24.3	0.15	0.13	0.14	0.38	BDL (DL 6)	325	BDL (DL1)	BDL (DL1)
Administrative Office Building	Minimum	32.4	12.4	25.9	0.02	BDL (0.05)	35.2	21.5	24.1	0.04	0.04	0.11	0.32	BDL (DL 6)	312	BDL (DL1)	BDL (DL1)
	Maximum	35.3	16.7	28.9	0.03	BDL (0.05)	38.3	23.7	25.8	0.08	0.06	0.16	0.41	BDL (DL 6)	324	BDL (DL1)	BDL (DL1)
Port Hospital	Minimum	40.8	14.2	27.6	0.02	BDL (0.05)	31.6	18.8	17.8	0.03	0.01	0.16	0.12	BDL (DL 6)	338	BDL (DL1)	BDL (DL1)
	Maximum	45.2	18.4	29	0.03	BDL (0.05)	34.3	22.5	20.4	0.05	0.03	0.18	0.14	BDL (DL 6)	345	BDL (DL1)	BDL (DL1)

Legend: BDL – Below Detectable Limit., PM_{10} – Particulate Matter; ; SO2- Sulpur dioxide; NOx- Oxides of Nitrogen; CO – Carbon monoxide ;Pb – Particulate Lead (as Pb); $PM_{2.5}$; Ozone (O_3); Ammonia (NH_3); Benzene(C_6H_6); Benzo (a) Pyrene (Bap); Arsenic (A_S); Nickel (Ni); Hydrogen Sulphide(H2S);Carbon Dioxide (CO_2), Cadmium(Cd);Mercury(Hg).

Location N ame and Code		PM 10	SO2	NOx	CO	Pb	PM 2.5	O3	NH3	C6H6	BaP	As	Ni	H2S	CO2	Cd	Hg
		µg/m3	µg/m3	µg/m3	mg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	ng/m3	ng/m3	ng/m3	µg/m3	ppm	ng/m3	ng/m3
Between Berth 5 & 6	Minimum	77.1	17	23.3	0.03	BDL (0.05)	32.6	3.54	23.6	0.12	0.1	0.2	0.24	BDL (DL 6)	316	BDL (DL1)	BDL (DL1)
	Maximum	79.3	20.8	25.4	0.03	BDL (0.05)	35.9	34.4	25.8	0.2	0.14	0.22	0.28	BDL (DL 6)	333	BDL (DL1)	BDL (DL1)
Signal station(VOC Wharf)	Minimum	73.6	22.3	32.4	0.03	BDL (0.05)	34.2	23.2	21.4	0.2	0.11	0.2	0.27	BDL (DL 6)	341	BDL (DL1)	BDL (DL1)
	Maximum	78.9	25.3	35.8	0.03	BDL (0.05)	37.2	25.4	23.4	0.24	0.13	0.22	0.29	BDL (DL 6)	350	BDL (DL1)	BDL (DL1)
Port School Building	Minimum	37.5	15.5	23.6	0.02	BDL (0.05)	37.6	23.5	20.3	0.17	0.25	0.18	0.4	BDL (DL 6)	320	BDL (DL1)	BDL (DL1)
	Maximum	42.6	18.3	25.4	0.02	BDL (0.05)	40.2	27.8	21.9	0.19	0.31	0.21	0.44	BDL (DL 6)	330	BDL (DL1)	BDL (DL1)
Railway Quarters	Minimum	42.6	18.3	25.4	0.02	BDL (0.05)	31.5	19.5	14	0.04	0.02	0.02	0.06	BDL (DL 6)	320	BDL (DL1)	BDL (DL1)
	Maximum	86.3	27.5	35.6	0.02	BDL (0.05)	40.2	27.8	21.8	0.18	0.27	0.21	0.44	BDL (DL 6)	330	BDL (DL1)	BDL (DL1)
Average		**60.2**	**20.4**	**30.1**	**0.02**	**BDL (0.05)**	**39.9**	**22.5**	**20.2**	**0.16**	**0.15**	**0.16**	**0.28**	**BDL (DL 6)**	**330**	**BDL (DL1)**	**BDL (DL1)**

Legend: BDL – Below Detectable Limit., PM10 – Particulate Matter; ; SO2- Sulpur dioxide; NOx- Oxides of Nitrogen; CO – Carbon monoxide ;Pb – Particulate Lead (as Pb); PM2.5; Ozone (O_3); Ammonia (NH_3); Benzene(C_6H_6); Benzo (a) Pyrene (Bap); Arsenic (AS); Nickel (Ni); Hydrogen Sulphide(H2S);Carbon Dioxide (CO_2), Cadmium(Cd);Mercury(Hg).

4.0 WATER QUALITY STATUS

4.1 Sampling

Any adverse impact on water quality will have serious effect on the environment. Hence, it becomes important to monitor the water quality periodically in the port project area. The samples were analysed as per IS 10500/APHA and compared to the specifications of IS:10500 norms, Primary Water Quality Criteria for Class SW- IV(For Harbour Waters).

The Water, marine water, sediment and noise quality data of individual locations are presented below for the period 2016 to 2017.

Average Water Quality Status for the period of 2016 – 2017

S. No	Parameters	Oyster Water Tank		Beach Water Tank		Chevalier CIR Machado Plaza(WTA)		Residential/ Non Residential	
		Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
1	Appearance	Clear	Clear	Clear	Clear & colourless	Clear & colourless	Clear & colourless	Clear & colourless	Clear & colourless
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	pH @ 25^0C	7.54	7.89	7.32	7.92	7.91	8.24	7.64	8.19
4	Turbidity (NTU)	BDL(DL0.1)	BDL(DL1)	BDL(DL0.1)	BDL(DL1)	BDL(DL0.1)	BDL(DL1)	BDL(DL1)	BDL(DL1)
5	Electrical Conductivity ($\mu s\ cm^{-1}$)	458	590	583	626	611	753	562	595
6	Total Dissolved Solids, mg/l	196	281	252	326	291	375	271	294
7	P. Alkalinity (as $CaCO_3$), mg/l	0	0	0	0	0	10	0	0
8	Total Alkalinity (as $CaCO_3$), mg/l	48	138	125	127	150	165	115	160
9	Total Hardness (as $CaCO_3$), mg/l	130	140	135	150	150	160	135	155
10	Calcium (as Ca) mg/l	32	32.21	30.06	33.84	37.2	40.08	28.4	32.06
11	Magnesium (as Mg) mg/l	11.15	17.65	14.58	18.67	12.15	20.05	18.23	18.36
12	Sodium (as Na) mg/l	21	30	29	34	32	43	27	31
13	Potassium (as K) mg/l	1	2	2	2	2	2	2	3
14	Iron (as Fe) mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)
15	Manganese (as Mn), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
16	Chlorides (as Cl^-) mg/l	46.8	63.2	45.32	60.66	67.94	90.64	58.6	65.52
17	Sulphates (as SO_4), mg/l	26.8	29.9	12.32	49.65	29.48	58.4	26.45	30.59
18	Fluoride (as F) mg/l	0.34	0.38	0.37	0.58	0.37	0.67	0.29	0.34
19	Nitrate (as NO_3) mg/l	3.02	3.14	3.26	4.21	3.04	4.32	2.68	3.08
20	Ammonia mg/l	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)
21	Nitrite mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
22	Phosphate mg/l	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)
23	Tidy's Test mg/l	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)
II	**BACTERIOLOGICAL PARAMETERS**								
1	Faecal Coliform per 100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Average Water Quality Status for the period of 2016 – 2017

S. No	Parameters	Gate Inside Green Gate		Inside Red Gate(Near Health Centre)		Administrative Office		Port School	
		Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
1	Appearance	Clear & colourless	Clear	Clear &	Clear & colourless	Clear & colourless	Clear & colourless	Clear	Clear & colourless
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	pH @ 25^0C	7.32	7.78	7.28	7.81	6.96	7.54	7.69	7.8
4	Turbidity (NTU)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL0.1)	BDL(DL1)	BDL(DL0.1)	BDL(DL1)
5	Electrical Conductivity (µs)	157	210	601	695	108	113	606	692
6	Total Dissolved Solids, mg/l	76	126	288	368	65	67	298	329
7	Ph.Alkalinity (as $CaCO_3$), mg/l	0	0	0	0	0	0	0	0
8	Total Alkalinity (as $CaCO_3$), mg/l	22	76	145	168	37	40	138	148
9	Total Hardness (as $CaCO_3$), mg/l	12	80	140	174	7	42	142	150
10	Calcium (as Ca) mg/l	2.57	19.24	32	40.08	9.62	10.2	32.06	33.41
11	Magnesium (as Mg) mg/l	0.84	7.78	14.58	20.47	4.09	4.38	17.01	18.34
12	Sodium (as Na) mg/l	12	32	32	36	5.6	6.3	33	37
13	Potassium (as K) mg/l	0	2	2	2	0	0	2	2
14	Iron (as Fe) mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)
15	Manganese (as Mn), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
16	Chlorides (as Cl^-) mg/l	15.52	25.38	67.94	72.3	8.74	9.1	68.91	83.15
17	Sulphates (as SO_4), mg/l	2.76	6.68	29.48	32.5	3.55	3.83	32.72	58.89
18	Fluoride (as F) mg/l	0	0	0.37	0.4	BDL(DL0.2)	BDL(DL0.2)	0.39	0.5
19	Nitrate (as NO_3) mg/l	1.74	3.28	2.86	3.04	1.4	2.66	3.44	4.65
20	Ammonia mg/l	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)
21	Nitrite mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
22	Phosphate mg/l	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)
23	Tidy's Test mg/l	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)	BDL(DL0.4)
II	**BACTERIOLOGICAL PARAMETERS**								
1	Faecal Coliform per 100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Average Marine Water Quality Status for the period of 2016 – 2017

S. No	Parameters	Approach Channel		Dock Basin Area near Berth 3&4		Dock Basin Area near Berth 5&6		Dock Basin Area near Coal jetty I&II	
		Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
1	Water Level	0.3	13	0.3	13	0.3	13	0.3	13
2	Atmospheric Temperature	32	37	32	37	32	37	32	37
3	Water Temperature	25	30	25	30	25	29	25	29
4	PH @ 25^0C	7.94	8.11	8.01	8.2	7.88	8.48	7.96	8.24
5	Turbidity (NTU)	BDL(DL0.1)	BDL(DL0.1)	BDL(DL0.1)	BDL(DL0.1)	2	2	BDL(DL0.1)	BDL(DL0.1)
6	Total Suspended Solids, mg/l	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)	BDL(DL1)
7	Salinity, ppt	37.08	38.24	35.05	36.81	33.66	35.61	36.45	38.95
8	Dissolved Oxygen (as O_2), mg/l	5.9	6.8	5.8	6.5	5.8	7	5.7	7.3
9	Total Hardness (as $CaCO_3$), mg/l	6000	7700	6400	7600	6800	7200	7000	7790
10	Carbonate Alkalinity mg/l as $CaCO_3$	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)	BDL (DL1)
11	Bicarbonate Alkalinity mg/l as $CaCO_3$	138	142	136	140	138	148	138	143
12	Petroleum Hydrocarbons (PHC) , mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)
13	Inorganic Phosphate, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)
14	Total Phosphorous, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)
15	Nitrite as N, mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)
16	Nitrate, mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)
17	Ammoniacal Nitrogen, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)
18	Total Nitrogen, mg/l	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)	BDL (DL0.01)
19	Silica, mg/l	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)	BDL (DL0.02)
20	BOD, 3 days @ 27^0C, mg/l	2	3	3	7	2	3	2	7
21	Faecal Coliforms (MPN/100ml)	<2	<2	<2	<2	<2	<2	<2	<2
22	Cadmium (as Cd), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
23	Chromium (as Cr), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
24	Nickel (as Ni) mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
25	Copper (as Cu), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)
26	Mercury (as Hg), mg/l	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)	BDL(DL0.001)
27	Arsenic (as As), mg/l	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)	BDL(DL0.005)
28	Chromium VI (as Cr VI), mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)

Average Marine Water Quality Status for the period of 2016 – 2017

S.No	Parameters	Units	Approach Channel		Dock Basin area Nearer to Berth 3 & 4		Dock Basin area Nearer to Berth 5 & 6		Dock Basin area Nearer to Coal Jetty I & II and Oil Jetty	
			Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
1	Organic Carbon	%	0.212	0.23	0.02	0.04	0.776	0.79	0.976	1.12
2	Organic Matter	%	0.365	0.41	0.034	0.06	1.337	1.52	1.682	1.92
3	**Sediment Texture**									
	a. Sand	%	91.6	95.68	95.3	99.47	94.71	99.24	93.71	98.24
	b. Silt	%	0.81	0.91	0.26	0.26	0.98	1.14	0.98	1.07
	c. Clay	%	3.81	7.58	0.48	4.44	0.36	5.31	1.39	5.31
4	**Heavy Metals in Sediments**									
	a. Cadmium	µg/gm	0.54	0.61	1.09	1.24	1.12	1.21	1.18	1.28
	b. Copper	µg/gm	10.58	10.6	4.23	4.63	6.21	6.74	8.1	8.28
	c. Lead	µg/gm	8.17	8.5	13	13.85	19.54	21.04	19.75	21.54
	d. Nickel	µg/gm	0.69	0.77	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
	e. Chromium III	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
	f. Chromium VI	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
	g. Mercury	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
5	Arsenic	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
6	Total Sulphur	µg/gm	2.07	2.95	3.28	3.6	4.2	4.92	6.1	6.19
7	Organic Sulphur Compounds	µg/gm	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)	BDL(<1)
8	Fluorine Compounds	µg/gm	2.08	2.63	1.2	1.39	1.09	1.21	2.14	2.85
9	Phosphate compounds	mg/kg	150.99	162.3	50.04	54.32	151.63	161.2	151.63	160.8

Average Noise Quality Status for the period of 2016 – 2017

S.No	Location	Noise level in dB (A)		
		Minimum	**Maximum**	**Average**
1	VOC Wharf Pump House	62.0	62.6	**62.3**
2	Coal Jetty	63.0	65.3	**64.2**
3	Field Workshop	67.0	70.0	**68.4**
4	VOC Wharf Between Barth 4	65.8	67.4	**66.6**
5	Container Loading Area	53.9	57.6	**55.7**
6	VOC Shopping Mall	52.4	53.0	**52.7**
7	Floating Vessel	62.5	63.1	**62.8**

Average Baseline Oil level in Oil Water Separator for the period of 2016 – 2017

S.No.	Parameters	Units	Results		
			Minimum	**Maximum**	**Average**
1	Oil & Grease	mg/l	276	293	284.5

Average Biological Quality Status for the period of 2016 – 2017

S.No	Parameters	Approach Channel	Dock Basin Area nearer to Berth 3 & 4	Dock Basin Area nearer to Berth 5 & 6	Dock Basin Area nearer to Coal Jetty I&II and Oil Jetty
1	Chlorophyll-a	2.7	2.65	2.6	2.15
2	Pheophytin	1	1.15	1.3	1.15
3	**Phytoplankton (64µm mesh)**				
	Total Cell Count (cells/L)	8396	9750	9255	9435
	Total Genus	11	12	13	13
	Genus identified	Ceratium spp, peridinium spp, Chaetoceros spp, Asterionella spp, Coscinodiscuss spp, Triodesmium spp, Pyroystis spp, Noctilua spp, Biddulphia spp, Bacillaria spp, Thalassiothrix spp.	Coscinodicus spp, Ceratium spp, Peridinium spp, Chaetocerous spp,Asterionella spp,Triodesmium spp,Pyroystis spp,Noctilua spp,Biddulphia spp,Thalassiothrix spp, Streptotheca spp, Skeletonema spp.	Thalassiothrix spp, Streptotheca spp, Skeletonema spp, Cerataulina spp,Ditylium spp,Coscinodicus spp, Ceratium spp, Peridinium spp, Chaetocerous spp,Asterionella spp,Triodesmium spp,Biddulphia spp, Bacillaria spp.	Coscinodicus spp, Thalassiothrix spp, Streptotheca spp, Skeletonema spp, Cerataulina spp , Biddulphia spp, Bacillaria spp, Streptotheca spp, Bacteriastrum spp,Chaetoceros spp,Pyroystis spp,Noctilua spp
4	**Zooplankton (200µm mesh)**				
	Total Cell Count (cells/L)	6348	6802	5920	6205
	Total Genus	6	6	6	5
	Genus	Tintinnida spp, Acartia spp, Copepod, Favella spp, Egg, Larvae-Nauplius	Acartia spp,Copepod,Favella spp,Egg in eye spot stage,egg,Larvae- Nauplius	Tintinnida spp, Acartia spp, Copepod, Favella spp, Egg, Larvae	Acanthometron spp, Acartia spp, Copepod, Favella spp, Egg, Larvae
5	**Macrobenthos**				
	Total Genus	17	18	14	15.5
	Genus	Mussels, Clams, Crustaceans	Mussels, Clams, Crustaceans	Mussels, Clams, Crustaceans	Mussels, Clams, Crustaceans
6	**Microbial Observation**				
	Total Viable Count (CFU/ml)	39	65	45	54
	Total Coliform	< 2 MPN/100ml	< 2 MPN/100ml	< 2 MPN/100ml	< 2 MPN/100ml
	E.coli	Absent/100ml	Absent/100ml	Absent/100ml	Absent/100ml

CONCLUSION

All the ambient air quality, Potable water quality and noise pollution in the V.O.Chidambaranar Port Ltd, Tuticorin, Tamil Nadu vicinity during this monitoring period of 2016 - 2017 were found to be in compliance with the stipulated Statutory Norms NAAQ, 2009, IS 10500 and CPCB.

Standards

National Ambient Air Quality Standards

Sl No	Pollutants	Time Weighted Average	Concentration In Ambient Air	
			Industrial, Residential, Rural & Other Areas	Ecologically sensitive area (notified by central government)
1	Sulphur Dioxide(SO_2)	Annual Average*	50 µg/m^3	20 µg/m^3
		24 hours **	80 µg/m^3	80 µg/m^3
2	Nitrogen Dioxide (as NO_2)	Annual Average*	40 µg/m^3	30 µg/m^3
		24 hours **	80 µg/m^3	80 µg/m^3
3	Particulate Matter (size less than 10µm) (PM_{10})	Annual Average*	60 µg/m^3	60 µg/m^3
		24 hours**	100 µg/m^3	100 µg/m^3
4	Particulate Matter (size less than 2.5µm) ($PM_{2.5}$)	Annual Average*	40 µg/m^3	40 µg/m^3
		24 hours**	60 µg/m^3	60 µg/m^3
5	Ozone (O_3)	8 hours**	100 µg/m^3	100 µg/m^3
		1 hour**	180 µg/m^3	180 µg/m^3
6	Lead (Pb)	Annual Average*	0.5 µg/m^3	0.5 µg/m^3
		24 hours**	1.0 µg/m^3	1.0 µg/m^3
7	Carbon Monoxide (CO)	8 hours**	2 mg/m^3	2 mg/m^3
		1 hour**	4 mg/m^3	4 mg/m^3
8	Ammonia (NH_3)	Annual Average*	100 µg/m^3	100 µg/m^3
		24 hours**	400 µg/m^3	400 µg/m^3
9	Benzene (C_6H_6)	Annual Average*	5 µg/m^3	5 µg/m^3
10	Benzo(a)Pyrene (BaP) Particulate phase only	Annual Average*	1 ng/m^3	1 ng/m^3
11	Arsenic (As)	Annual Average*	6 ng/m^3	6 ng/m^3
12	Nickel (Ni)	Annual Average*	20 ng/m^3	20 ng/m^3

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

**24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they September exceed the limits but not on two consecutive days of monitoring.

IS 10500: 2012c Standards for Drinking water

S.No.	Parameters	Units	IS:10500-2012	
			Desirable limits	Permissible
1	pH (at 25 °C)	-	6.5 - 8.5	-
2	Colour	Hazen Unit	5	15
3	Turbidity	NTU	1	5
4	Odour	-	Agreeable	Agreeable
5	Taste	-	Agreeable	Agreeable
6	Total Hardness as CaCO3	mg/l	200	600
7	Calcium as Ca	mg/l	75	200
8	Silica as SiO2	mg/l	NA	NA
9	Chloride as Cl	mg/l	250	1000
10	Residual free Chlorine	mg/l	0.2	1
11	Cyanide as CN	mg/l	0.05	No Relaxation
12	Total Dissolved Solids	mg/l	500	2000
13	Sulphate as SO4	mg/l	200	400
14	Fluoride	mg/l	1.0	1.5
15	Nitrate as NO3	mg/l	45	No Relaxation
16	Iron as Fe	mg/l	0.3	No Relaxation
17	Phenolic Compounds	mg/l	0.001	0.002
18	Anionic Detergents as MBAS	mg/l	0.2	1.0
19	Zinc as Zn	mg/l	5	NA
20	Chromium as Cr	mg/l	0.05	No Relaxation
21	Copper as Cu	mg/l	0.05	1.5
22	Manganese as Mn	mg/l	0.1	0.3
23	Cadmium as Cd	mg/l	0.003	No Relaxation
24	Lead as Pb	mg/l	0.01	No Relaxation
25	Selenium as Se	mg/l	0.01	No Relaxation
26	Arsenic as As	mg/l	0.01	0.05
27	Mercury as Hg	mg/l	0.001	No Relaxation
28	Mineral Oil	mg/l	0.5	No Relaxation

MoEF Norms for Ambient Noise Levels

Area Code	Category of Area/Zone	Limits in dB (A) Leq	
		Day Time*	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

*: MoEF Norms Ministry of Environment and Forests Norms for Ambient Noise (Leq); Day time is reckoned in between 6 a.m and 10 p.m; Nighttime is reckoned in between 10 p.m and 6 a.m