

COMPLIANCE REPORT TO YOUR ORDER DT. 16TH NOVEMBER 2010

SPECIFIC CONDITIONS:

- i. The total quantity of the dredged material of 35,00,000 cu.m shall be dumped at the specified offshore dumping site of Cochin Port at outer sea, about 15.6 km from the shore.

The dredging work has been completed. Material where dumped as per above direction.

- ii. The approach channel shall be properly demarcated with lighted buoys for safe navigation and adequate traffic control guidelines shall be framed. The fishermen shall be suitably educated and informed about the traffic guidelines.

The approach channel has been properly demarcated with lighted buoys in association with Cochin Port. Even though fishermen are well aware of the traffic guidelines in and around port area they are being educated continuously.

- iii. The material dredged by cutter suction dredger will be used for land development work and for beach nourishment approved by Cochin Port Trust. Dredged material from Trailer Suction Dredger will be dumped at the specified offshore dumping site of Cochin Port at outer sea, about 15.6 km from the shore.

The material dredged from Cutter suction Dredger's were dumped on the western side of the terminal as per the Cochin Port Trust allocated area for dumping. The Trailer Suction Dredger's dredging material was dumped at the designated dumping site of Cochin Port at outer sea, about 15.6 km from the shore.

- iv. The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.

PLL has set up Environment Management Cell under a GM(Technical) and PLL have recruited qualified personnel in HSE department & Laboratory Operation Department for Environment monitoring.

- v. The project proponent shall take up mangrove plantation/green belt in the project area, wherever possible. Adequate budget shall be provided in the Environment Management Plan for such mangrove development.

PLL has approached the Social forestry wing of Kerala State Forest department for this purpose. PLL has decided to associate with Forests department in promoting mangrove cultivation by supplying seedlings and saplings to mangrove owners for enrichment and planting in open areas and farm lands for raising mangroves along with preferred agricultural crops. As suggested by them, Forest department's authorized representative has raised nursery of

20000 seedlings for distribution to public on coastal tracts. Other promotional campaigns and programmes will also be conducted with the help of Forests department towards this objective. 20000 seedlings have already been distributed to Center for water resources development and management (CWRDM), an Institution of The Kerala State Council for Science, Technology and Environment, for planting along the aquaculture ponds, selected in nine coastal district of Kerala, under ongoing project on “Integrated Mangrove Aquaculture for the Environmental Management and Socio-Economic Upliftment of Rural people in Kerala”. A new order will be placed by PLL to the said authorized representative for raising 50000 sapling and will be ready for distribution by Feb-2014 to various parties identified by the forest dept.

- vi. The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purpose.

Budget allocated for environment safeguard will not be diverted for other purposes. PLL has spent a total of about Rs of 109 Crores for expenses towards HSE.

GENERAL CONDITIONS:

- i. Adequate provision for infrastructure facilities including water supply fuel and sanitation must be ensured for construction workers during the construction phase of the project to avoid damage to the environment.

Construction of plant has been completed and commission. Adequate precautions are being taken to prevent any damage to the environment.

- ii. Full support shall be extended to the officers of this Ministry/Regional Office at Bangaluru by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environmental protection activities.

PLL will extend full support to the officers of this ministry’s Regional Office, Bangaluru and the officers of the Central and State Pollution Control Board during the inspection for monitoring purpose. PLL will furnish full details of analysis reports and action plans for environmental protection.

- iii. A Six-Monthly monitoring report shall need to be submitted by the project proponents to the Regional Office of this Ministry at Bangaluru regarding the implementation of the stipulated conditions.

PLL is submitting required six monthly monitoring reports to the Regional Office of MOEF, Bangaluru.

- iv. Ministry of Environment & Forests or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with.

PLL will comply with additional conditions, if any suggested by the ministry or any other competent authority in writing.

- v. The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.

PLL is aware about the right of the ministry and have noted this condition.

- vi. In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment and Forests.

PLL has not carried out any deviation or alteration in the project. PLL will comply with this requirement and will take permit from the Ministry for any modification in the clearance conditions.

- vii. The project proponents shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of start of land development work.

PLL had submitted letter dated 5th Sept-2008, from Director (Technical) addressed to Additional Director, MoEF, Delhi and copy marked to regional officer.

- viii. A copy of the clearance letter shall be marked to concerned Panchayat/Local NGO, if any, from whom any suggestion/representation has been made received while processing the proposal.

No specific suggestion/representation has been made / received from any authority while processing the proposal.

- ix. Kerala Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Centre and Collector's Office/Tehsildar's office for 30 days.

Complied by Kerala State Pollution Control Board.

**Environmental Monitoring of LNG Terminal Kochi - Marine
Dredging work**

31st Report

Submitted to

M/S. AFCONS INFRASTRUCTURE LIMITED

by

Director

Suganthi Devadason Marine Research Institute
44-Beach Road, Tuticorin - 628 001

19 June 2013

For Suganthi Devadason Marine Research Institute


Director

Environmental Monitoring of LNG Terminal Kochi - Marine Dredging work

Sampling on 29.05.2013

Marine Water & Sediment Quality

Physico-chemical parameters

The atmospheric temperature was recorded as 31.4⁰C and water temperature was recorded between 29.0 and 29.3 ⁰C with low in bottom water and high in surface water. The salinity value was observed high in bottom water with 31.0 ppt and low in surface water with 19.0 ppt. The EC value was observed high in bottom water with 29.3 mS/cm and low in surface water sample with 29.1 mS/cm. The pH level was between 7.88 and 7.95 in this station. Turbidity values varied between 6.5 and 8.1 NTU with low in surface water and high in bottom water. The TSS values were observed between 110 and 130 mg/l, with high values in bottom water and low in the surface water sample of this station.

The dissolved oxygen level was recorded as 3.9 and 4.8 mg/l with low values in bottom water and high in surface water. The BOD level was between 1.9 and 2.0 mg/l in this station. The level of calcium was between 380 and 460 mg/l; Magnesium level was high in bottom water with 1254 mg/l and low in surface water sample with 1188 mg/l; Total hardness was high in bottom water sample with 1714 mg/l and low in surface water sample with 1568 mg/l; Carbonate level was between 10 and 20 mg/l and bicarbonate level was between 90 and 100 mg/l; Nitrate level was recorded between 1.11 and 1.36 mg/l, with low value in the surface water and high in bottom water; Nitrite level was between 0.25 and 0.41 mg/l with low level in surface water and high in bottom water; Total Phosphate level was between 0.15 and 0.25 mg/l with high values in bottom water and low in surface water; Inorganic Phosphate level was observed between 0.10 and 0.20 mg/l, with high level in bottom water and low in surface water sample; Silicate level was between 5.0 and 6.9 µg/l with low level in the surface water and high in bottom water; Chloride level was around 17.7 gm/l in all the water samples of this station; and the level

of oil and grease was between 1.15 and 1.25 mg/l with low values in the surface water and high in the bottom water.

The sediment pH level was observed as 7.95. The oil and grease level in the sediment was 1.20 mg/kg. The organic matter in the sediment was 1.806 % while the organic carbon level was observed as 2.255 %. The sediment texture analysis shows that the clay content was high with 37% and sand was low with 30% in this station.

Physico-chemical parameters

Physical parameter	Station (14.5m) Lat 09° 58.355'N Long 076° 13.666'E		
	Surface	Middle	Bottom
Water			
Atmospheric temperature (°C)	31.4		
Water Temperature (°C)	29.3	29.1	29.0
Salinity (ppt)	19.0	25.0	31.0
EC (mS/cm)	29.1	29.3	29.3
Turbidity (NTU)	6.5	7.8	8.1
pH Value	7.88	7.93	7.95
TSS (mg/L)	110	118	130
Chemical parameters			
DO (mg/l)	4.8	4.4	3.9
BOD (mg/l)	2.0	2.0	1.9
Calcium (mg/l)	380	440	460
Magnesium (mg/l)	1188	1221	1254
Total Hardness (mg/l)	1568	1661	1714
Carbonate (mg/l)	20	10	10
Bicarbonate (mg/l)	100	100	90
Nitrates (mg/L)	1.11	1.25	1.36
Nitrites (mg/L)	0.25	0.36	0.41
Total Phosphates (mg/L)	0.15	0.23	0.25
Inorganic phosphate (mg/l)	0.1	0.16	0.20
Silicates (µg/L)	5.0	6.1	6.9
Chloride (gm/l)	17.6	17.6	17.7
Oil & grease (mg/l)	1.15	1.21	1.25

Sediment	
pH Value	7.95
Oil & grease (mg/kg)	1.20
Organic matter (%)	1.806
Organic Carbon (%)	2.255

Sediment texture (%)	Station (14.5m) Lat 09° 58.355'N Long 076° 13.666'E
Sand %	30
Silt %	33
Clay %	37

Biological parameters

Microbiological parameters

The total heterotrophic bacteria in the water were high in bottom water samples with 48×10^4 CFU/ml and low in surface water sample with 31×10^4 CFU/ml. No coli form and *E.coli* were found in the water samples.

Microbiological parameters

Bacteriological analysis	Surface	Middle	Bottom
Water			
THB (CFU/ ml)	31×10^4	40×10^4	48×10^4
<i>E.coli</i> (CFU/ ml)	Nil	Nil	Nil
Coli form count /100ml	Nil	Nil	Nil

Planktons and benthic organisms

The phytoplankton density was 203658 cells/l and zooplankton was 14782 no/m³ in this station. The chlorophyll a was 1.9 mg/l and Pheophytin was 1.8 mg/l in the water sample. The density of macro benthic organisms was low and gastropods were dominant groups followed by bivalves with 23 and 19 no/m² respectively. The density of meiobenthic organisms were 63 no/m² in this station.

Plankton and benthic organisms

Plankton density	Station (14.5m) Lat 09⁰ 58.355'N Long 076⁰ 13.666'E
Phytoplankton (cells/l)	203658
Zooplankton (no/m ³)	14782
Chlorophyll a (mg/l)	1.9
Pheophytin (mg/l)	1.7

Macro benthos (no/m²)	Station (14.5m) Lat 09⁰ 58.355'N Long 076⁰ 13.666'E
Gastropods	23
Bivalves	19
Polychaetes	11
Echinoderms	0
Scaphopods	0
Crustaceans	0
Meiobenthos (no/m²)	63

Heavy metals

The heavy metal analysis in the water showed below detectable level for Arsenic, Chromium, Nickel, Cadmium and Mercury in all the water samples. Lead concentration was found comparatively high in bottom water with 60 ppb and low in surface water with 35 ppb. The copper level was found high in bottom water with 61 ppb and low in surface water with 46 ppb. The heavy metal analysis in the sediment samples showed below detectable level for Chromium and Mercury in this station. The Nickel concentration was 4.16 µg/gm; Lead 4.05 µg/gm; Cadmium 3.13 µg/gm; Iron 498.55 µg/gm; Copper 4.53 µg/gm; Calcium 1.25 mg/gm in the sediment sample of this station.

Heavy metals in water sample

Water sample (ppb) Station (14.5m) Lat 09° 58.355'N Long 076° 13.666'E	Surface	Middle	Bottom
Chromium Cr (ppb)	BDL	BDL	BDL
Lead Pb (ppb)	35	51	60
Nickel Ni (ppb)	BDL	BDL	BDL
Cadmium Cd (ppb)	BDL	BDL	BDL
Mercury Hg (ppb)	BDL	BDL	BDL
Copper Cu (ppb)	46	55	61
Arsenic As (ppb)	BDL	BDL	BDL

BDL - Below Detectable Level

Heavy metals in sediment sample

Sediment sample (Dry weight)	Station (14.5m) Lat 09° 58.355'N Long 076° 13.666'E
Chromium Cr (µg/gm)	BDL
Lead Pb (µg/gm)	4.05
Nickel Ni (µg/gm)	4.16
Cadmium Cd (µg/gm)	3.13
Mercury Hg (µg/gm)	BDL

Iron Fe ($\mu\text{g/gm}$)	498.55
Calcium Ca (mg/gm)	1.25
Copper Cu ($\mu\text{g/gm}$)	4.53

BDL - Below Detectable Level

Summary and Remarks

The environmental monitoring was conducted at LNG Terminal Kochi - Marine Dredging work area on 29.05.2013. The sampling station was fixed by the client. The sediment sample and water samples at 3 levels (surface, middle and bottom) were collected and it was observed that there are no significant changes in the physical, chemical and biological parameters from the baseline data collected on 25.09.2010 and the following months. The salinity values were high in the bottom, while low in middle and surface water samples, which may be due to monsoonal flow and fresh water mix. The results in general indicate that the values are almost similar including TSS values, which are comparatively deviated from the baseline values, however, these changes may not have any significant impact on the prevailing biological resources like plankton density and macro fauna as these variations are temporary. The benthic faunal density is comparatively poor always including baseline data and the following months, but it may be correlated to the prevailing sediment nature. The microbiological parameters like total heterotrophic bacteria are well within the limit and also there was no coliform and *E.coli* found in the water samples. The other physico-chemical parameters, including temperature, dissolved oxygen and heavy metal values are seems to be normal and the changes, if any are seasonal and temporary. In general, the result is an indication that the dredging has no significant impact on the existing biological parameters such as plankton, benthos and biological productivity.

For Suganthi Devadason Marine Research Institute


Director

**Environmental Monitoring of LNG Terminal Kochi - Marine
Dredging work**

30th Report

Submitted to

M/S. AFCONS INFRASTRUCTURE LIMITED

by

Director

**Suganthi Devadason Marine Research Institute
44-Beach Road, Tuticorin - 628 001**

20 May 2013

For Suganthi Devadason Marine Research Institute


Director

Environmental Monitoring of LNG Terminal Kochi - Marine Dredging work

Sampling on 26.04.2013

Marine Water & Sediment Quality

Physico-chemical parameters

The atmospheric temperature was recorded as 31.7°C and the water temperature between 29.6 and 29.8 °C with low in bottom water and high in surface and middle water of this station. The salinity values were between 34 and 35 ppt and EC values were high in middle and bottom water with 29.3 mS/cm and low in surface water sample with 29.1 mS/cm. The pH level was between 7.95 and 7.98. The turbidity values were between 10.5 and 12.3 NTU with high values in bottom water and low in surface water of this station. The Total Suspended Solids (TSS) level was observed between 140 and 170 mg/l, with high values in bottom water and low in the surface water sample.

The dissolved oxygen level varied between 3.5 and 4.4 mg/l with low value in bottom water and high in surface water. The BOD level was around 2.0 mg/l in all the water samples and the level of calcium was around 460 mg/l; Magnesium level was high in bottom water with 1253 mg/l and low in surface water sample with 1218 mg/l; Total hardness was high in bottom water sample with 1713 mg/l and low in surface water sample with 1658 mg/l; Carbonate level was between 10 and 20 mg/l and bicarbonate was between 90 and 100 mg/l; Nitrate level was recorded between 1.41 and 1.72 mg/l, with high values in bottom water and low in the surface water; Nitrite level was between 0.53 and 0.85 mg/l with low level in surface water and high in bottom water sample; Total Phosphate level was between 0.21 and 0.36 mg/l with high in bottom water and low in surface water; Inorganic Phosphate level was observed between 0.15 and 0.28 mg/l in with high values in bottom water and low values in surface water sample; the level of silicate was recorded between 6.9 and 7.9 µg/l with high level in the bottom water and low in surface water; Chloride level was around 17.7 gm/l in all the water samples; and

the level of oil and grease was between 1.19 and 1.30 mg/l with low values in the middle water and high in the bottom water.

The sediment pH level was observed as 7.98. The oil and grease level in the sediment was 1.28 mg/kg. The organic matter in the sediment was 1.856 % while the organic carbon level was observed as 2.361 %. The sediment texture analysis shows that the clay content was high with 37% and sand was low with 28% in this station.

Physico-chemical parameters

Physical parameter	Station (15m) Lat 09° 58.326'N Long 076° 13.607'E		
	Surface	Middle	Bottom
Water			
Atmospheric temperature (°C)	31.7		
Water Temperature (°C)	29.8	29.8	29.6
Salinity (ppt)	35	34	34
EC (mS/cm)	29.1	29.3	29.3
Turbidity (NTU)	10.5	11.6	12.3
pH Value	7.95	7.95	7.98
TSS (mg/L)	140	158	170
Chemical parameters			
DO (mg/l)	4.4	3.8	3.5
BOD (mg/l)	2.0	1.9	1.9
Calcium (mg/l)	440	460	460
Magnesium (mg/l)	1218	1244	1253
Total Hardness (mg/l)	1658	1704	1713
Carbonate (mg/l)	20	20	10
Bicarbonate (mg/l)	100	100	90
Nitrates (mg/L)	1.41	1.56	1.72
Nitrites (mg/L)	0.53	0.71	0.85
Total Phosphates (mg/L)	0.21	0.31	0.36
Inorganic phosphate (mg/l)	0.15	0.23	0.28
Silicates (µg/L)	6.9	7.5	7.9
Chloride (gm/l)	17.7	17.7	17.6

Oil & grease (mg/l)	1.23	1.19	1.30
Sediment			
pH Value	7.98		
Oil & grease (mg/kg)	1.28		
Organic matter (%)	1.856		
Organic Carbon (%)	2.361		

Sediment texture (%)	Station (15m) Lat 09° 58.326'N Long 076° 13.607'E
Sand %	28
Silt %	35
Clay %	37

Biological parameters

Microbiological parameters

The total heterotrophic bacteria in the water were high in bottom water samples with 73×10^4 CFU/ml and low in surface water sample with 48×10^4 CFU/ml. No coli form and *E.coli* were found in the water samples.

Microbiological parameters

Bacteriological analysis	Surface	Middle	Bottom
Water			
THB (CFU/ ml)	48×10^4	59×10^4	73×10^4
<i>E.coli</i> (CFU/ ml)	Nil	Nil	Nil
Coli form count /100ml	Nil	Nil	Nil

Planktons and benthic organisms

The phytoplankton density was 228754 cells/l and zooplankton was 16986 no/m³ in this station. The chlorophyll a was 1.9 mg/l and Pheophytin was 1.8 mg/l in the water sample. The density of macro benthic organisms was low and gastropods were dominant groups followed by bivalves with 21 and 18 no/m² respectively. The density of meiobenthic organisms were 59 no/m² in this station.

Plankton and benthic organisms

Plankton density	Station (15m) Lat 09° 58.326'N Long 076° 13.607'E
Phytoplankton (cells/l)	228754
Zooplankton (no/m ³)	16986
Chlorophyll a (mg/l)	1.9
Pheophytin (mg/l)	1.8

Macro benthos (no/m ²)	Station (15m) Lat 09° 58.326'N Long 076° 13.607'E
Gastropods	21
Bivalves	18
Polychaetes	11
Echinoderms	0
Scaphopods	0
Crustaceans	0
Meiobenthos (no/m ²)	59

Iron Fe ($\mu\text{g/gm}$)	528.96
Calcium Ca (mg/gm)	1.36
Copper Cu ($\mu\text{g/gm}$)	4.71

BDL - Below Detectable Level

Summary and Remarks

The environmental monitoring was conducted at LNG Terminal Kochi - Marine Dredging work area on 26.04.2013. The sampling station was fixed by the client. The sediment sample and water samples at 3 levels (surface, middle and bottom) were collected and it was observed that there are no significant changes in the physical, chemical and biological parameters from the baseline data collected on 25.09.2010 and the following months. The salinity values were almost in same in all levels like surface, middle and bottom water samples. The results in general indicate that the values are almost similar except variation in TSS values in all levels. The TSS values are comparatively deviated from the baseline values, however, these changes may not have any significant impact on the prevailing biological resources like plankton density and macro fauna as these variations are temporary. The benthic faunal density is comparatively poor always including baseline data and the following months, but it may be correlated to the prevailing sediment nature. The microbiological parameters like total heterotrophic bacteria are well within the limit and also there was no coliform and *E.coli* found in the water samples. The other physico-chemical parameters, including temperature, dissolved oxygen and heavy metal values are seems to be normal and the changes, if any are seasonal and temporary. In general, the result is an indication that the dredging has no significant impact on the existing biological parameters such as plankton, benthos and biological productivity.

For Suganthi Devadason Marine Research Institute


Director