

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI

In

APPLICATION NO.14 OF 2017 (SZ)

Meenava Thanthai K.R. Selvaraj Kumar & 1 Ors. .... Applicants

Vs

National Coastal Zone Management Authority & Ors. .... Respondents

APPLICATION NO.16 OF 2017 (SZ)

Saravanan Dakshinamurthy .... Applicant

Vs

Union of India & Ors. .... Respondents

APPLICATION NO.38 OF 2017 (SZ)

Ashwini Kumar .... Applicant

Vs

Union of India & 8 Ors. .... Respondents

APPLICATION NO.40 OF 2017 (SZ)

P.Somasundaram .... Applicant

Vs

Union of India & 3 Ors. .... Respondents

**JOINT COMMITTEE SITE INSPECTION REPORT BY THE OFFICIALS OF REGIONAL OFFICE OF THE MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE (MOEF&CC), CHENNAI, DEPARTMENT OF FISHERIES, TAMIL NADU AND TAMIL NADU POLLUTION CONTROL BOARD (TNPCB) IN COMPLIANCE TO THE ORDER OF THE HON'BLE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE, CHENNAI DATED 08/01/2020 IN APPLICATION NOS 14, 16, 38 & 40 OF 2017.**

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI

Joint Committee Site Inspection Report by the Officials of Regional Office of the Ministry Of Environment, Forest And Climate Change (MoEFCC), Chennai, Department of Fisheries, Tamil Nadu And Tamil Nadu Pollution Control Board (TNPCB) in Compliance to the Order of The Hon'ble National Green Tribunal, Southern Zone, Chennai Dated 08.01.2020 In Application Nos 14, 16, 38 & 40 of 2017.

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JOINT COMMITTEE SITE INSPECTION REPORT BY THE OFFICIALS OF  
REGIONAL OFFICE OF THE MINISTRY OF ENVIRONMENT, FOREST AND  
CLIMATE CHANGE (MOEF&CC), CHENNAI, DEPARTMENT OF FISHERIES,  
TAMIL NADU AND TAMIL NADU POLLUTION CONTROL BOARD (TNPCB)  
IN COMPLIANCE TO THE ORDER OF THE HON'BLE NATIONAL GREEN  
TRIBUNAL, SOUTHERN ZONE, CHENNAI DATED 08/01/2020 IN  
APPLICATION NOS 14, 16, 38 & 40 OF 2017.

**Background**

This refers to the spillage of oil occurred due to the collision of inbound vessel MT Dawn Kancheepuram with outbound vessel BW Maple at Ennore near fairway buoy of Kamarajar port on 28.01.2017 and subsequent damage caused to environment due to oil spillage in sea shore area.

Vide Order dated 8.1.2020 in O.A.Nos. 14, 16, 38 & 40 of 2017 Hon'ble NGT(SZ) has directed to submit status report regarding the amount of compensation disbursed, mode of calculation of compensation, remedial measures that have been taken to remedy the damage caused to environment and restore it to its original position, whether remedial measures that have been taken are sufficient or not and also the present state of affairs prevailing in that area.

In compliance with Hon'ble NGT (SZ) Order dated 8.1.2020 in O.A. Nos. 14, 16, 38 & 40 of 2017, a Joint Committee was constituted comprising of members from the Ministry Of Environment, Forest And Climate Change (MOEF&CC), Chennai, Department of Fisheries, Tamil Nadu and Tamil Nadu Pollution Control Board (TNPCB). Accordingly the Joint Committee visited the site on 06.08.2020

As per the Order dated 8.1.2020 the status report shall be submitted by MoEF & CC, Tamil Nadu Pollution Control Board, Department of Fisheries, Government of Tamil Nadu from the stage of incident till date regarding (i) compensation paid to affected persons (ii) what are the steps taken by the government to remediate the damage caused to environment, especially in that area, from the point of view of fishermen community (iii) how far aquatic life and livelihood of fishermen is affected and (iv) whether remedial measures taken have improved the condition in that area. (Copy of Order dated 8.1.2020 is at Annexure-1)

**i). Compensation Paid To Affected Persons:**

Regarding issuing of compensation to affected peoples (fisherman communities) Department of Fisheries, Government of Tamil Nadu is the nodal department. In this regard the Department of Fisheries have constituted 18 teams, comprising of 65 officials, in order to assess the quantum of livelihood loss suffered by various groups such as fishing labourers, fisherwomen, labourers involved in allied activities, fish vendors, owners of Motorized boats, Non- motorized boats and Mechanized boats. Based on the team report, a proposal was sent to Government for a total amount of Rs.203.225 Crore towards providing compensation to 1,12,051 affected fishermen. Meanwhile an amount of Rs.5000 was also provided to 30000 affected fishermen families as an interim relief by the State Government. (Rs.5000/- each to the 30,000 affected fishermen families)

As directed by Hon'ble NGT, Department of Fisheries extends the time limit for receipt of applications up to 10.8.2018 and additional 2,442 eligible applications were accepted. Accordingly a revised compensation proposal for

an amount of Rs.240.0034 crore to the affected 1,11,448 fishermen families was sent to Government and the compensation against category wise application is as follows:

Affected Category		Total No. of Claims	Amount recommended Rs/Unit	Total Compensation(Rs.in Lakh)
Mechanized Owner	Boat	922	70000	645.4
Motorized Owner	Boat	6916	40000	2766.4
Non-Motorized Boat Owner		2467	30000	740.1
Fishing labourers		40580	15000	6087
Fisherwomen allied activities	in	47145	12000	5657.4
Fish vendors		9090	12000	1090.8
Allied labourers	Activity	1885	12000	226.2
Additional applications as per the NGT Direction		2442	12000	293.04
TNFDC, Marketing		1		40
Total Restoration		111448		17546.34
				6429

measures	
Contingency	25
<b>Grand Total</b>	<b>24000.34</b>

As per the orders of Hon'ble High Court, Madras in W.P. No.2979 of 2018 an amount of Rs.141 Crores (Including Rs.10 Crore for Ecosystem restoration works) was received from insurer of shipping companies on 28.03.2018. Apart from this an amount of Rs.15 Crore was also released by the Insurers of the shipping companies towards the reimbursement of amount released by the Government towards interim relief to 30,000 fishermen families of belonging to the three districts. Also an irrevocable Bank Guarantee worth for the remaining amount of Rs.84 crore was issued by the Shipping companies as per the directions of Honorable High Court without prejudice to the original claim preferred.

To calculate the quantum of compensation to be provided to the fishers of all categories so as to judiciously allocate relief within the released amount Rs.141 crore against the total claim of Rs.240 crores, a Relief Recommendation Committee was constituted.

The committee has recommended the following compensation package to the affected fishermen.

Affected Category	Actual Amount recommended /Unit	Amount recommended by Committee	Total No of claims	Total Amount in Rs
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Mechanized Boat Owner	70000	35000	922	32270000
Motorized Boat Owner	40000	20000	6916	138320000
Non-Motorized Boat Owner	30000	15000	2467	37005000
Fishing labourers	15000	12000	40580	486960000
Fisherwomen in allied activities	12000	10000	47145	471450000
Fish vendors	12000	10000	9090	90900000
Allied Activity labourers	12000	10000	1885	18850000
Additional applications as per the NGT Direction	12000	10000	2442	24420000
TNFDC, Marketing	2000000	2000000	1	2000000
<b>Total</b>			<b>111448</b>	<b>130,2175000</b>
Restoration measures		10,0000000		10,0000000

Contingency	12,00,000	12,00,000
Buffer for Grievance Redressal	66,25,000	66,25,000
<b>Grand Total</b>		<b>141,00,00,000</b>

As on today, the total amount disbursed to the affected categories is as follows

Affected Category	No. of persons received relief	Amount released per head	Total Relief Amount in lakhs
Fishing labourers	43,672	12,000	5240.64
Fisherwomen in allied activities	44760	10,000	4,476.00
Allied Activity labourers	1720	10,000	172.00
Fish vendors	7,331	10,000	733.10
Motorized Boat Owner	5073	20,000	1014.48
Non- Motorized Boat Owner	314	15000	47.10
Mechanized Boat Owner	916	35,000	320.48
Petitioner as Allied	57	10,000	4.20

Petitioner as Vendor	884	10,000	88.40
TNFDC, Marketing Contingency			32.00
<b>Total</b>	<b>104,728</b>		<b>12,128.4</b>
Ecosystem Restoration measures			1000.00
<b>Grand Total</b>			<b>13,128.4</b>

So far an amount of Rs.121.284 Crore has been disbursed to 1,04,728 eligible fishermen after de-duplication process. Rs.09.716 Crore is kept as savings after deletion of duplicate data and ineligible claims. The detailed report submitted by the Fisheries department is at **Annexure-II**

**ii) Steps Taken by the Government to Remediate the Damage Caused to Environment:**

In compliance to the order of the Hon'ble national green tribunal, southern zone, Chennai dated 26/04/2017 in application nos. 14, 16, 38 & 40 of 2017 a report was submitted to the Hon'ble NGT(SZ) based on the site inspection dated 29.6.2017 by a Joint Committee comprising of officials from TNPCB and MoEFCC. During that inspection the then committee visited 25 contaminated sites to verify the status and found that there was no deposit of oil residue. **(Copy of the report based on the site inspection dated 29.6.2017 is at Annexure-III)**

During the earlier inspection on 29.6.2017 following recommendations were given by the committee and the status of implementation was verified by the present Joint Committee during the visit dated 6.8.2020 and are as follows:

Sl.No	Recommendation dated	Status as on 6.8.2020
1	29.6.2017 Authorization under the provisions of Hazardous Wastes (Management, Handling and Transboundary) Rules, 2016 needs to be obtained from TNPCB for the bio-remediating oil contaminated sand.	Tamil Nadu Pollution Control Board (TNPCB) had accorded authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, vide Authorization No.17HFC8126640 dated 15.2.2017 to dispose the oily waste through the process of bio-remediation developed by M/ s. Indian Oil Corporation Limited [IOCL] using Oilivorous Bacteria. Accordingly, about 184.42 MT of material consisting of sludge oil mixed with sea water (159.35 KL) and oil contaminated sand (25.075 MT) was treated using bio-remediation, by M/s. IOCL.  Subsequently, For the second phase treatment, the KPL has obtained authorization under Hazardous and

Other Wastes (Management and Transboundary Movement) Rules 2016, for the disposal by bioremediation of the balance quantity of the oily wastes and oil contaminated sand from TNPCB vide Authorization No. 19HRC27210863 dated 16.09.2019 for treating (i) 55 KL of oily sludge and (ii) 225 T of oil contaminated sand lying in the port by bioremediation using Oilivorous bacteria developed by M/s. Indian Oil Corporation Limited.(iii) 15T of the solid waste mixed with the contaminated sand for disposal through TSDF for incineration.

Now the second phase bioremediation of oily waste of about 55 KL and oil contaminated sand of about 225 MT process is in progress.

2 Damaged poly-ethylene liners at the periphery of the bioremediation site should be replaced at the earliest.

The damaged Poly ethylene liner at periphery of Bioremediation site was replaced immediately and process was completed in September 2017.

Now the second phase bioremediation of oily waste of about

- 55 KL and oil contaminated sand of about 225 MT process is in progress.
- 3 Dedicated closed sheds with impervious concrete lining shall be provided for storage of balance quantity of oily sludge as well as oil contaminated sand. The shed shall be equipped with adequate fire safety arrangements in order to meet any exigency.
- As directed by the Committee, dedicated closed shed with impervious lining was provided for the storage of oil contaminated sand. The oily sludge was stored in leak proof plastic barrels of various sizes and the same were kept covered with plastic sheets and placed on concrete surface. Regular monitoring of the barrels was carried out. The bio-remediation pit and the shed are located adjacent to KPL fire station, where fire tender, fire extinguishers and crew are available round the clock. Personnel are deployed to continuously monitor the bioremediation site on regular basis. The oil contaminated sand stored in the shed and the oily sludge stored in the barrels are put in a pit and is being treated by bioremediation process, and the shed was now dismantled and removed,
- 4 Empty buckets, empty barrels, Authorization under Hazardous and

sintex tanks used for collection of oily sludge, sand contaminated with oil residues, HDPE bags, gunny bags soiled with oily residues, used gum boots & other oil contaminated personnel protective equipment, oil contaminated absorbent booms/ absorbent pads and fishing nets with oily deposits are to be considered as Hazardous Wastes and authorization has to be obtained at the earliest and the waste needs to be disposed immediately. Further, Dedicated closed sheds with impervious concrete lining shall be provided for storage of these materials

Other Wastes (Management and Transboundary Movement) Rules 2016 was obtained from Tamil Nadu Pollution Control Board (TNPCB) vide a authorization No.17HFC8126640 dated 15.2.20 17 . As per Clause 13 under Additional Specific conditions, the waste barrels/ drums were disposed to TSDF, Gummudipoondi. The balance quantity of the solid wastes was stored in a covered shed adjacent to the bioremediation pit. Authorization was obtained from TNPCB under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016 vide Authorization No. 19HRC272 10863 dated 16.09.2019 for the second phase of bioremediation process. Accordingly the oil contaminated barrels, booms, solid wastes were sent to TSDF Gummidipoondi. The oil contaminated sand and oily sludge is being treated by bioremediation process.

- 5 Bio-remediation site required to be fenced and display sign boards needs to be kept for every 30 meters along the periphery of the site. Krib wall around the periphery of the site shall be constructed immediately.
- 6 Total Petroleum Hydrocarbons content in the oily sludge & oil contaminated sand which is being bio-remediated should be continuously monitored.
- 7 Total Petroleum Hydrocarbons content in the ground water samples and soil samples
- During the 1<sup>st</sup> phase of bio-remediation fencing a long with display boards were erected and later removed. Agreed to make fencing for the second phase also.
- The 1st phase bioremediation was initiated on 06.02.2017 by M/s.Indian Oil Corporation Limited. Subsequently at every 15th day, the composite soil samples were taken from the site and analyzed for Total Petroleum Hydrocarbons and Polycyclic aromatic hydrocarbons content. The final report on "Bioremediation of oil sludge and oil contaminated sand from Ennore Port, at Kamarajar Port Limited (KPL), Chennai" submitted by IOCL, Faridabad was forwarded to TNPCB by KPL vide letter dated 08.01.2018.
- During the Phase-I Bio-Remediation process, for monitoring of ground water contamination, 12 peizometric

needs to be analyzed by M/s KPL through a MoEF&CC recognized laboratory.

wells were installed around the pit having a depth of 20 feet. Water samples were analyzed for oil content and heavy metals. The analysis results are given in the report submitted by M/s. IOCL, the final report on "Bioremediation of oil sludge and oil contaminated sand from Ennore Port, at Kamarajar Port Limited (KPL), Chennai.

KPL monitored ground water through M/ s. Richardson & Cruddas (1972) Ltd. [A Govt. of India Undertaking], a recognized laboratory, during the process of bioremediation. The report of analysis revealed that oil and grease and petroleum hydrocarbons in all the wells are Below detection Limit (BDL). The analysis reports along the final report submitted by M/s. IOCL was forwarded to Tamil Nadu Pollution Control Board vide our letter dated 08.01.20 18

During the present visit, the Joint Committee Inspection team noticed that the Authorities (M/s. Kamaraj Prt Ltd and Indian Oil Corporation

Ltd.) has implemented the recommendation of the committee report based on the inspection dated 29.6.2017 in its letter and spirit.

The present committee members carried out the inspection at 1<sup>st</sup> and 2<sup>nd</sup> phase of Bioremedial site in M/s Kamarajar Port Limited and the shoreline stretch of Ennore in Tiruvallur District. It is also observed that the parameters are within the limit and therefore no evidence of seepage of oil from the bioremediation site to the surrounding area. A detailed report submitted by the Kamaraj Port Ltd regarding the progress in bioremediation process is at Annexure-IV

Photo of the 1st phase bioremediation site is as below.(Fig-1)



Figure-I: The site of First phase bioremediation site. Now the soil is stabilized and it is evident that there are growing plants normally

Photo of the 2nd phase bioremediation site is as below (Fig-2 to Fig-4).

Fig-2



Fig-3

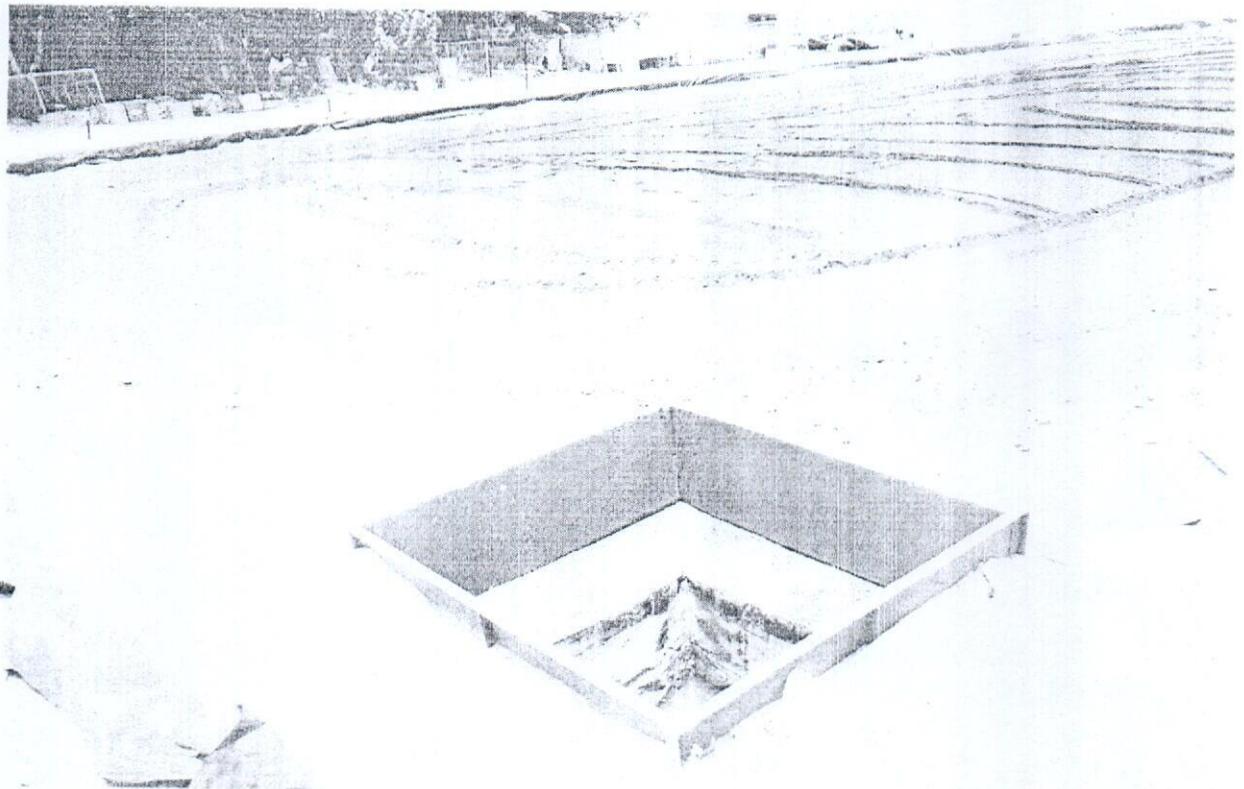
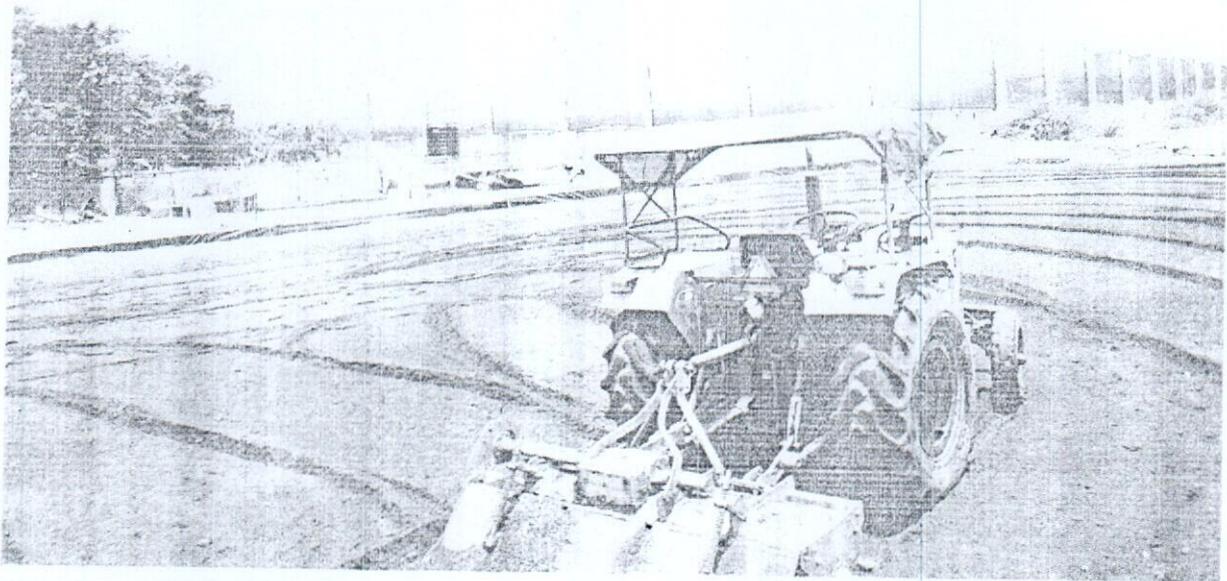


Fig-4



### iii). How Far Aquatic Life and Livelihood of Fishermen is Affected

As per the report of Fisheries Department it is evident that the worst scenario observed due to the Oil spill tragedy was wide spread death of marine aquatic organisms & various fish species. The damages inflicted to the Fishery resources has lead to poor fish production in turn affected the livelihood of the Fishers of the three Districts.

Livelihood of 111448 Fisher folk, under various categories such as Mechanized Boat Owners, Motorized Boat Owners, Non Motorized Boat

Owners, Fish Vendors and Allied activity Labours was affected. The total livelihood loss and ecosystem restoration in Rs. 240 crore.

Though the compensation was not to the full extent of loss suffered by the fisher community, the compensation was paid to the fisher folk in order to help them to revive and restore their livelihood to the possible extent. Due to the resilience nature of the community with the assistance provided to them and with their own resources, the fishermen of the oil spill affected districts have returned their livelihood activities and gradually returned to normalcy.

**iv). Whether remedial measures taken have improved the condition in that area?**

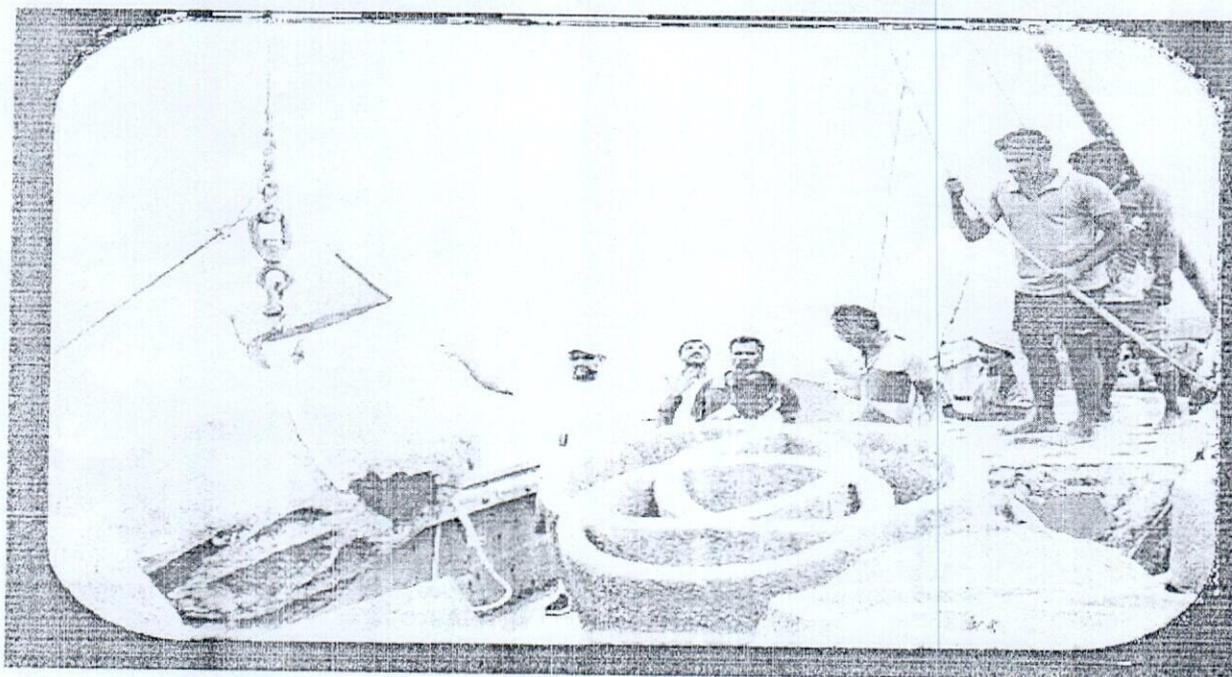
It is observed that the Oil spill incident has led to mortality of aquatic organisms and in certain cases profound impact on the physical status of these organisms. There is a remarkable decline in the quantity of fish catches consequent to the oil spill particularly in near shore areas. Aquatic resources needs to be enhanced in the Oil spill affected districts which would enable enhancement of livelihood of Fishers, As a measure to restore ecosystem, out of the total amount of Rs.141 Crore released by the Insurer of the Shipping companies an amount of Rs.10.00 Crore has been included towards restoration of marine ecosystem in the three districts affected due by oil spill incident. The said amount has been allocated for fabrication and installation of artificial reefs in 30 locations in the oil spill affected districts viz., Chennai, Thiruvallur and Kancheepuram. CMFRI has been entrusted with the Consultancy services and site identification has been completed and deployment is in progress. Now the condition in the affected area is normal.

Photo of installation of artificial reefs is at Fig-6 to Fig-7

Fig-6

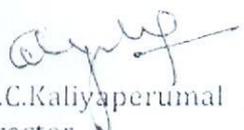


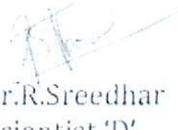
Fig-7

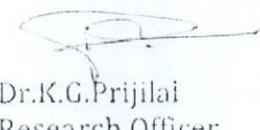


### Conclusion

During the visit no oil residue was noticed at the affected site and also the fishing activity are now in normal condition which was resumed soon after 2 to 3 months after the incident as per the data of Fisheries department. So far an amount of Rs.121.284 Crore has been disbursed to 104728 eligible fishermen. It is also noted that the port authorities and Indian Oil Corporation teams has successfully completed stage I of bioremediation process using IOC, R&D developed bioremediation technology, which was initiated on 6.2.2017 for treating 184 MT of oil sludge and oil contaminated sand. Now all the environmental parameters at the bioremediation site is found to be within the permissible limit and no contamination was observed in the site including ground water and soil quality, which was also evident from the analysis report. It is also noted that vegetation has started growing on the stage-I site, which is an indicator of good soil quality. Now for treating the balance oil sludge/oil contaminated soil, stage II bioremediation process is in progress and will continue till the Total Petroleum Hydrocarbon reaches to the permissible level (TPH less than 1%). The committee observed that condition of the affected areas due to oil spill is now reaches to normal.

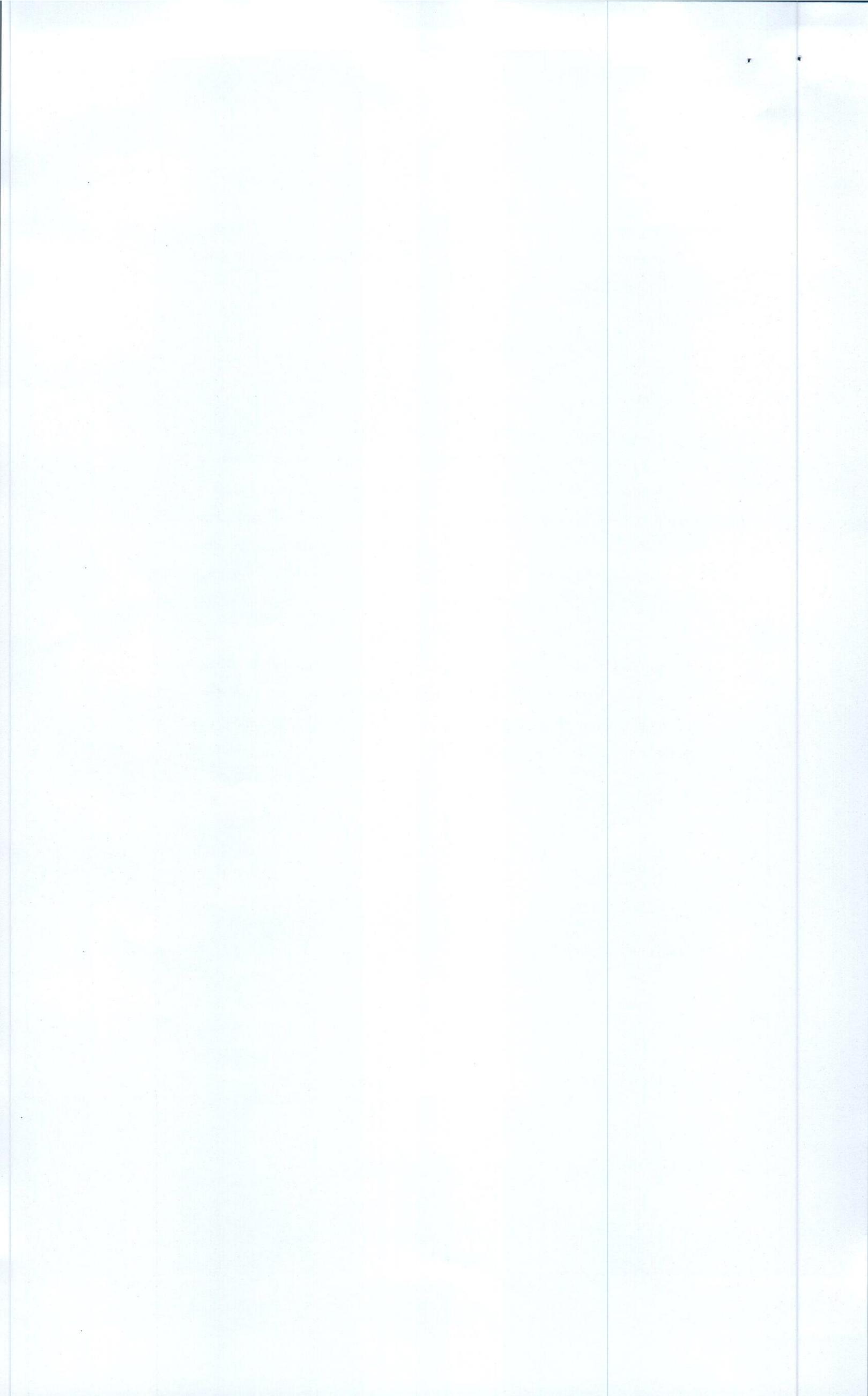
  
Dr.C.Kaliyaperumal  
Director  
MoEFCC

  
Dr.R.Sreedhar  
Scientist 'D'  
MoEFCC

  
Dr.K.G.Prijilai  
Research Officer  
MoEFCC

  
Shri M, Malaiyandi  
Joint Chief Environmental Engineer  
TNPCB

  
Shri A. Elango  
Joint Director of Fishries  
Govt of Tamil Nadu



Item Nos. 11 to 14

BEFORE THE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI

Original Application No. 14 of 2017 (SZ)

IN THE MATTER OF:

Meenava Thanthai K.R. Selvaraj Kumar .. Applicant(s)

WITH

The Chairman,  
National Coastal Zone Management Authority & others .. Respondents

For Applicant(s)  
For Respondent(s):

Mr. Mageshwaran  
M/s. G.M. Syed Nurullah Sheriff  
for R1, R14  
M/s. Kamalesh Kannan. for R2,  
R5, R7 & R8  
M/s. S. Vasudevan for R10  
M/s. S. Raghunathan for R11  
M/s. D.S. Ekambaram for R12  
Mr. Abdul Saleem  
Mr. S. Saravanan for R6

Application No. 16 of 2017 (SZ)

Saravanan Dakshinamurthy .. Applicant(s)

WITH

Union of India and others. .. Respondents

For Applicant(s)  
For Respondent(s):

M/s. Yogeswaran  
Mr. G.M. Syed Nurullah Sheriff for R1  
M/s. Kamalesh Kannan for R4  
M/s. S. Vasudevan for R6  
M/s. S. Raghunathan for R7  
M/s. D.S. Ekambaram for R8  
Mr. Abdul Saleem  
Mr. Saravanan for R9

Original Application No. 38 of 2017 (SZ)

Ashwini Kumar .. Applicant(s)

WITH

Union of India and others .. Respondents

For Applicant(s)

Nil

For Respondent(s):

M/s. Me. Saraswathy for R1  
M/s. Kamalesh Kannan for R3  
Mr. Abdul Saleem  
Mr. S. Saravanan for R4  
Mr. S. Raghunathan

Original Application No. 40 of 2017 (SZ)

P. Soma Sundaram

.. Applicant(s)

WITH

Union of India and others.

.. Respondents

For Applicant(s)

Nil

For Respondent(s):

Mrs. Me. Saraswathy for R1

Mr. S. Raghunathan

M/s. D.S. Ekambaram for R4

Date of hearing: 08.01.2020

**CORAM: HON'BLE MR. JUSTICE K. RAMAKRISHNAN, JUDICIAL MEMBER  
HON'BLE MR. SAIBAL DASGUPTA, EXPERT MEMBER**

### ORDER

The matter relates to damage caused to environment due to oil spillage in sea shore area on account of collision of two ships. It is seen from the earlier order that a committee comprising of MoEF & CC and Tamil Nadu Pollution Control Board has been constituted to go into the question of oil spillage and also remedial measures to be taken to restore the damage caused to environment. Inspection was conducted and report has been filed and thereafter certain directions were issued to consider the question of compensation payable to fishermen community who are affected by oil spillage.

Pursuant to the order dated 14.12.2017 no further status report has been filed. So, the committee as well as respective respondents are directed to submit status report regarding the amount of compensation disbursed, mode of calculation of compensation, remedial measures that have been taken to remedy the damage caused to environment and restore it to its original position, whether remedial measures that have been taken are sufficient or not and also the present state of affairs prevailing in that area. The status report shall be submitted by MoEF & CC,

Tamil Nadu Pollution Control Board, Department of Fisheries, Government of Tamil Nadu from the stage of incident till date regarding compensation paid to affected persons and what are the steps taken by the government to remediate the damage caused to environment, especially in that area, from the point of view of fishermen community. They are also directed to submit the report as to how far aquatic life and livelihood of fishermen is affected, whether remedial measures taken have improved the condition in that area. If they want, all the three agencies viz., MoEF & CC, Tamil Nadu Pollution Control Board and Fisheries Department are at liberty to co-opt any other subject expert for this purpose. The authorities are directed to submit the report within three months to this Tribunal by e-mail @ ngtszfilling@gmail.com. The committee shall give notice to the counsel appearing for the petitioners who alone is permitted to participate in the inspection. Their objection also can be considered by the committee and submit their response regarding the same.

For consideration of report post on 11.5.2020

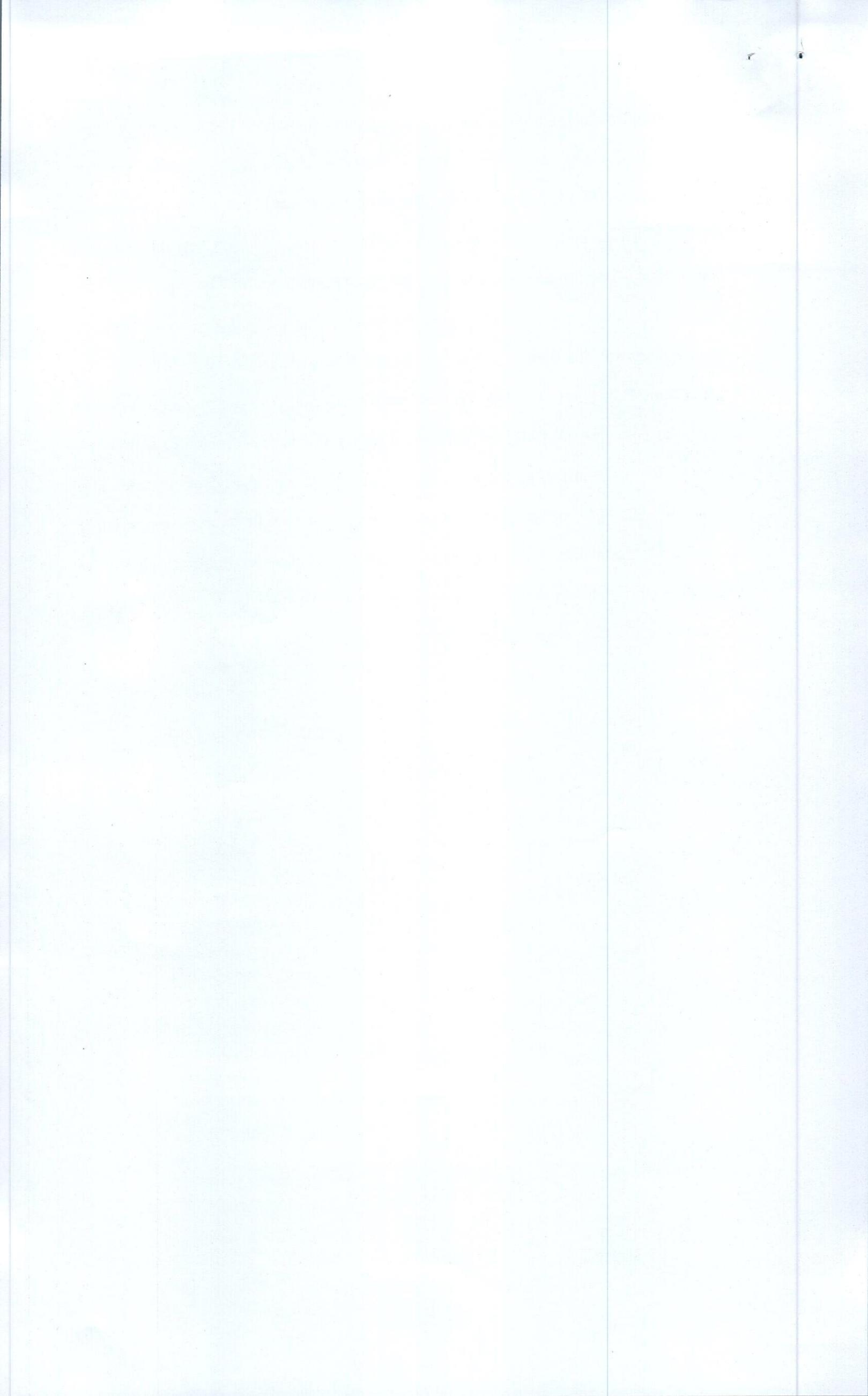
.....J.M.

(Justice K. Ramakrishnan)

.....E.M.

( Saibal Dasgupta )

kk



**Report to be submitted to Oil Spill Committee**

**1. Compensation Paid to Affected Person.**

Two Merchant ships viz. M.T. BW Maple and M.T. Dawn Kancheepuram accidentally collided off the Kamarajar Port, Ennore, Tamil Nadu on 28.1.2017. Due to this accident, there was an oil spill of bunker oil which spread across the sea and the seashores of Thiruvallur, Chennai and Kancheepuram districts of Tamil Nadu.

Due to this oil spill incident, about 104 Kilometer of coastal area was affected envisaging 28 Kilometer of Thiruvallur District, 19 Kilometer of Chennai District and 57 Kilometer of Kanchipuram District.

This Oil spill had adversely affected the livelihoods of fishermen of these three districts and these fishermen did not venture into sea for a period of more than one month.

Department of Fisheries have constituted 18 teams, comprising of 65 officials, in order to assess the quantum of livelihood loss suffered by various groups such as fishing labourers, fisherwomen, labourers involved in allied activities, fish vendors, owners of Motorized boats, Non-motorized boats and Mechanized boats. Based on the team report, a proposal was sent to Government for a total amount of Rs.203.225 Crore towards providing compensation to 1,12,051 affected fishermen. Accordingly, the Government of Tamil Nadu preferred a claim for compensation relief assistance of Rs.203.225 Crore.

Meanwhile, as a measure to provide immediate relief to the affected fishers, the State Government vide Government Order (Ms).No.58,

Animal Husbandry and Fisheries (FS3) Department dated 03.03.2017, sanctioned an amount sum of Rs.15 crore to provide immediate relief at the rate of Rs.5000/- each to the 30,000 affected fishermen families of there three districts.

In pursuance to the application No.14 filed before the Honourable National Green Tribunal to extend time limit for receipt of applications from the affected fishermen who have not filed their claims earlier and to arrive an appropriate quantum of compensation to be recovered from the ship owners, the Honourable National Green Tribunal directed this Department to extend the time limit for receipt of applications up to 10.8.2018. An additional 2,442 eligible applications were accepted and a revised compensation proposal for an amount of Rs.240.0034 crore to the affected 1,11,448 fishermen of Thiruvallur, Chennai and Kanchipuram coastal districts was sent to Government and the Hon'ble National Green Tribunal, Southern Zone was informed about the above.

**2. Category-wise applications received and compensation proposal submitted to Government:**

**Table : I**

<b>Affected Category</b>	<b>Total no of Claims</b>	<b>Amount recommended (in Rs/ Unit)</b>	<b>Total compensation amount (Rs in Lakh)</b>
Mechanized Boat Owner	922	70000	<b>645.4</b>
Motorised Boat Owner	6916	40000	<b>2766.4</b>
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Additional applications as per the NGT Direction	2442	12000	293.04
TNFDC, Marketing	1		40
<b>Total</b>	<b>111448</b>		<b>17546.34</b>
Restoration measures			6429
Contingency			25
<b>Grand Total</b>			<b>24000.34</b>

As per the orders of Hon'ble High Court, Madras in W.P. No.2979 of 2018 an amount of Rs.141 Crores (Including Rs.10 Crore for Ecosystem restoration works) was received from insurer of shipping companies on 28.03.2018. Apart from this an amount of Rs.15 Crore was also released by the Insurers of the shipping companies towards the reimbursement of amount released by the Government towards interim relief to 30,000 fishermen families of belonging to the three districts. Also an irrevocable Bank Guarantee worth for the remaining amount of Rs.84 crore was issued by the Shipping companies as per the directions of Honorable High Court without prejudice to the original claim preferred.

To calculate the quantum of compensation to be provided to the fishers of all categories so as to judiciously allocate relief within the released amount Rs.141 crore against the total claim of Rs.240 crores, a Relief Recommendation Committee was constituted. The committee has recommended the following compensation package to the affected fishermen.

The Relief Recommendation Committee has recommended compensation to the categories of Owners of recommended Mechanized Fishing Boat, Motorized Fishing Crafts and Non motorized Fishing crafts to

the maximum of 50% of the assessed value of loss and for the categories vis., Fishing laborer, Fisherwomen in Fisheries allied activities, Allied activity labourer, Fish vendors, compensation was limited to the maximum of 80% of the assessed value of livelihood loss as proposed in the original compensation proposal, so that 141 crore is appropriated amongst different categories.

Based on the quantum of compensation recommended to each category, the total amount allocated to each category along with numbers of claims are given below:

**3. Amount recommended by the Relief Recommendation Committee for disbursement of Rs.141 Crore**

Table: II

Category	Actual amount recommend ed /unit	Amount recommended by Committee (In Rs)	Total no of Claims	Total amount (In Rs)
Mechanized Boat Owner	70000	35000	922	3,22,70,000
Motorized Boat Owner	40000	20000	6,916	13,83,20,000
Non-Motorized Boat Owner	30000	15000	2,467	3,70,05,000
Fishing Labourers	15000	12000	40,580	48,69,60,000
Fisherwomen in allied activities	12000	10000	47,145	47,14,50,000
Fish vendors	12000	10000	9,090	9,09,00,000
Allied Activity Labourers	12000	10,000	1,885	1,88,50,000
Additional applications as per NGT	12000	10,000	2,442	2,44,20,000

directions.				
TNFDC Marketing	20,00,000	20,00,000	1	20,00,000
<b>Total</b>			<b>1,11,448</b>	<b>130,21,75,000</b>
Eco system Restoration measures		10,00,00,000		10,00,00,000
Contingency		12,00,000		12,00,000
Buffer for Grievance Redressal		66,25,000		66,25,000
<b>Grand Total</b>				<b>141,00,00,000</b>

The Total relief amount disbursed to the beneficiaries as on 30.08.2020 is as detailed below:

**4. Relief amount disbursed to applicants as on 30.08.2020.**

**Table :III**

<b>Name of the Category</b>	<b>No. of persons received relief amount</b>	<b>Amount released per head</b>	<b>Total Relief amount (in lakhs)</b>
Fishing Laborer	43,672	12,000-	5,240.64
Fisherwomen in Fisheries allied activities	44,760	10,000-	4,476.00
Allied activity Labours	1,720	10,000-	172.00
Fish Vendors	7,331	10,000-	733.10
Motorised Boat Owner	5,073	20,000-	1,014.48
Non-Motorised Boat Owner	314	15,000-	47.10
Mechanized Boat Owner	916	35,000-	320.48
Petitioner as Allied	57	10,000	4.20
Petitioner as vendor	884	10,000	88.40
TNFDC and contingencies			32.00

<b>Total</b>	<b>104,728</b>		<b>12,128.4</b>
Ecosystem restoration			1000.00
<b>Total</b>			<b>13,128.4</b>

So far an amount of Rs.121.284 Crore has been disbursed to 1,04,728 eligible fishermen after de-duplication process. Rs.09.716 Crore is kept as savings after deletion of duplicate data and ineligible claims.

**5. STEPS TAKEN BY THE GOVERNMENT TOWARDS REHABILITATION OF ENVIRONMENT FOR SUSTAINABILITY OF FISHERMEN COMMUNITY.**

Fishing sector was the worst affected sector due to the Oil spill incident. Livelihood of the Fishers has been greatly affected as the Fishing implements were damaged being choked with oil and the fishermen did not venture for fishing for more than a month.

As a measure to provide immediate relief to the affected fishers, the State Government vide Government Order (Ms).No.58, Animal Husbandry and Fisheries (FS3) Department dated 03.03.2017, sanctioned an amount sum of Rs.15 crore to provide immediate relief at the rate of Rs.5000/- each to the 30,000 affected fishermen families and the same was disbursed to affected fishermen families.

An amount of Rs. 141 Crore was requested for disbursement of relief to the various categories of Fishers, Mechanized Boat Owners, Motorised Boat Owners, Non Motorised Boat Owners, Fish Vendors and Allied activity Labours compensation of Rs.121.284 Crore has been disbursed to 1,04,728 eligible fishermen after de-duplication process.

Rs.09.716 Crore is kept as savings after deletion of duplicate data and remaining are ineligible claims.

**6. How far Aquatic Life and Livelihood of Fishermen is affected.**

The worst scenario observed due to the Oil spill tragedy was widespread death of marine aquatic organisms & various fish species. The damages inflicted to the Fishery resources has lead to poor fish production inturn affected the livelihood of the Fishers of the three districts.

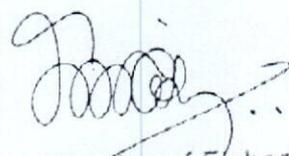
Livelihood of 111448 Fisherfolk, under various categories such as Mechanized Boat Owners, Motorized Boat Owners, Non Motorized Boat Owners, Fish Vendors and Allied activity Labours was affected. The total livelihood loss and ecosystem restoration in Rs. 240 crore.

Though the compensation was not to the full extent of loss suffered by the fisher community, the compensation was paid to the fisher folk in order to help them to revive and restore their livelihood to the possible extent. Due to the resilience nature of the community with the assistance provided to them and with their own resources, the fishermen of the oil spill affected districts have returned them livelihood activities and gradually returned to normalcy.

**7. WHETHER REMEDIAL MEASURES TAKEN TO IMPROVE THE CONDITIONS IN THE AREA.**

It is observed that the Oil spill incident has led to mortality of aquatic organisms and in certain cases profound impact on the physical status of these organisms. There is a remarkable decline in the quantity of fish catches consequent to the oil spill particularly in near shore areas. Aquatic resources needs to be enhanced in the Oil spill affected districts

which would enable enhancement of livelihood of Fishers, As a measure to restore ecosystem, out of the total amount of Rs.141 Crore released by the Insurer of the Shipping companies an amount of Rs.10.00 Crore has been included towards restoration of marine ecosystem in the three districts affected due by oil spill incident. The said amount has been allocated for fabrication and installation of artificial reefs in 30 locations in the oil spill affected districts viz., Chennai, Thiruvallur and Kancheepuram. CMFRI has been entrusted with the consultancy services and site identification has been completed and deployment is in progress.



Joint Director of Fisheries  
(Regional), Chennai-06.

Annexure - III

JOINT SITE INSPECTION REPORT BY THE OFFICIALS OF REGIONAL OFFICE OF THE MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE (MOEF&CC), CHENNAI AND TAMIL NADU POLLUTION CONTROL BOARD (TNPCB) IN COMPLIANCE TO THE ORDER OF THE HON'BLE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE, CHENNAI DATED 26/04/2017 IN APPLICATION NOs. 14, 16, 38 & 40 OF 2017

SUBMITTED TO

THE HON'BLE NATIONAL GREEN TRIBUNAL,  
SOUTHERN ZONE, CHENNAI.

JULY, 2017

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JOINT SITE INSPECTION REPORT BY THE OFFICIALS OF REGIONAL OFFICE OF THE  
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE (MOEF&CC), CHENNAI  
AND TAMIL NADU POLLUTION CONTROL BOARD (TNPCB) IN COMPLIANCE TO THE  
ORDER OF THE HON'BLE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE, CHENNAI  
DATED 26/04/2017 IN APPLICATION NOS 14, 16, 38 & 40 OF 2017

## I Background

This refers to the spillage of oil occurred due to the collision of inbound vessel MT Dawn Kancheepuram with outbound vessel BW Maple at Ennore near fairway buoy of Kamarajar port on 28.01.2017 at 3.45 am. In this regard, the Hon'ble National Green Tribunal (SZ), Chennai vide its order dated 26/04/2017 in Application Nos [14 of 2017 (SZ): Meenava Thanthai K.R. Selvaraj Kumar & 1 Ors Vs The Chairman, National Coastal Zone Management Authority, Gol & 18 Ors; 16 of 2017 (SZ): Saravanan Dakshinamurthy Vs Union of India & 8 Ors; 38 of 2017 (SZ): Ashwini Kumar Vs Union of India & 8 Ors; 40 of 2017 (SZ): P.Somasundaram Vs Union of India & 3 Ors] passed the following directions which is stated below:

*"In so far as it relates to the remediation, it is stated that all the 20 sites which are chosen for remediation and cleaning the process, has been completed. However, this statement is repudiated by some of the parties. In view of the same, we direct the MoEF& CC along with Tamil Nadu State Pollution Control Board to inspect various sites mentioned and file a Report as to whether the remediation and cleaning process has been done in a proper manner and whether any other activity is to be followed.*

*In this connection, certain other relevant points have been raised by Mrs. Vaishnavi Jayakumar, Member of Civil Society which are as follows:*

- 1. Whether the entire 200 to 300 Metric tonnes of sludge which is stated to have been recovered has been disposed in an environmental friendly manner?*
- 2. After the accident took place, what steps have been taken for the purpose of investigation by the Police Department as well as Director General of Shipping?*

*As stated above, we have already directed the MoEF& CC along with the Board to inspect and find out the 20 sites which are stated to have been cleaned up.*

We direct the MoEF& CC and the Board to ascertain about the deposit of 200 to 300 Mts. of sludge recovered and find out whether all the required environmental safeguards are taken and inform the same in the Report on the next date of hearing”.

In pursuance to the aforesaid order of the Hon'ble Tribunal, the following officials carried out the inspection of the M/s Kamarajar Port Limited and the shoreline stretch from Ennore in Tiruvallur District to Kanathur in Kancheepuram District on 29/06/2017:

- i. Shri Sundar Ramanathan, Scientist 'D', Regional Office, MoEF&CC, Chennai-34.
- ii. Shri D.Vasudevan, District Environmental Engineer, TNPCB, Ambattur, Tiruvallur District, Chennai – 58.
- iii. Shri V.Rohit Kumar, Assistant Environmental Engineer, TNPCB, Board Office, Guindy, Chennai -32.
- iv. Shri R.Jayamurugan, Assistant Environmental Engineer, O/o District Environmental Engineer, Chennai District, TNPCB, Chennai – 106 (Accompanied only for shore line inspection in Chennai District).

**II. Description about the field visit and inspection of the M/s Kamarajar Port Limited (KPL):**

**Bio-remediation site:**

The team visited the M/s KPL in order to ascertain about the deposit of 200 to 300 Mts. of sludge recovered and find out as to whether the required environmental safeguards are taken during the storage, handling and bio-remediation of the oil sludge as per the order of the Hon'ble Tribunal.

During inspection, it is observed that M/s KPL has provided a bio-remediation pit of dimension 172 meters x 16.5 meters for remediation of oil sludge and oil contaminated sand. It is noted that the bio-remediation site is provided with poly-ethylene liners. Lay out map of the bio-remediation site indicating its dimension and locations of 16 piezometric wells is enclosed as **Annexure -I**. The details regarding receipt and treatment of oily sludge and oil contaminated sand as per the records produced by the representatives of M/s KPL is as follows:

**Table 1: Details regarding receipt and treatment of oily sludge and oil contaminated sand by M/s KPL**

S.No.	Details	Received as on 5/04/2017	Disposed for bio-remediation	Balance to be treated
1.	Quantity of oily sludge (KL)	213.95	159.35	54.60
2.	Quantity of oil contaminated sand (MT)	250.655	25.075	225.58

TNPCB has issued authorization to M/s KPL vide Proc. No T5/TNPCB/F.0044/AMB/HWA///RL/AMB/2017 dated 15.2.2017 for handling only oily sludge hazardous waste as follows:-

Sl. No.	Schedule / Name of the Processes	Name of Hazardous Waste (with category No)	Quantity	Activities for which Authorization is issued
1	Schedule 1/3 Cleaning Emptying and maintenance of petroleum oil storage tanks including ships	3.1 Cargo residue, washing water and sludge containing oil	184 T/Annum	Collection, Storage, Transportation, Treatment, Disposal (on site Bio remediation using an Olivorous bacteria by M/s. IOCL at Kamarajar Port Ltd.
2.	Schedule 1/3, Cleaning emptying and maintenance of petroleum oil storage tanks including ships	3.1-Cargo residue, washing water and sludge containing oil	64 T/Annum	Collection, Transportation and Storage within the Port in a safe and secured place.

M/s KPL informed that the gradient of ground water flow at the bio-remediation site is from West to East. It is observed during the visit that for monitoring ground water quality, 4 nos. of piezometric wells were installed on the western side (upstream), 10 nos. of piezometric wells were installed on the eastern side (Downstream) and one no. of piezometric well each in the northern and southern sides of the bio-remediation site were installed. Further, the ground water quality is being monitored by M/s KPL through M/s Richardson Cruddas (1972) Limited [A Govt. of India undertaking] from 23.3.2017 onwards on fortnightly basis. Copies of the ground water analytical reports collected during the months of April and May 2017 were made available during the visit are enclosed as **Annexure -II**. The analytical reports states that the levels of Petroleum Hydro Carbons and Oil & Grease are found to be Below Detectable Limits (BDL).

Subsequent to the inspection, the team collected 5 piezometric well samples and one composite soil sample on 04/07/2017 from bio remediation site through M/s SMS Labs Services Private

Limited, Chennai and the analysis results are depicted below. Report of analysis is enclosed as **Annexure –III**.

**Table 2: Analysis results of piezometric well samples at the bio-remediation site**

Parameters	Location & identification of Piezometric wells around the bioremediation site				
	North side PW (KPL N1)	South side PW (KPL S 1)	West side PW (KPL W 3)	East side PW (KPL E3)	East side PW (KPL E 6)
Oil & Grease, mg/l	BDL	BDL	BDL	BDL	BDL
GRO, µg/l	BDL	BDL	BDL	BDL	BDL
DRO, µg/l	0.0299	0.0368	0.0251	0.0182	0.0354
TPH, mg/l	0.0372	0.0633	0.0356	0.0289	0.0472
VOC, µg/l	BDL	BDL	BDL	BDL	BDL

**Note: Prescribed limit – Oil & Grease – 10 mg/L (Source: MoEF Notification, dated 22.12.1998)**

From the ROA of the bore well samples collected, it is inferred that oil and grease level is found to be below detectable limit in the monitoring piezometric well samples. The traces of Diesel Range Organics (DRO) and Total Petroleum Hydrocarbons (TPH) are found in the samples, but the levels are below 0.1 mg/l. The VOC levels in the samples were below detectable limits.

**Table 3: Analysis results of composite soil sample at the bio-remediation site**

Parameters	Composite Soil sample collected at the bio remediation site
Total Petroleum Hydrocarbon (TPH) mg/l	194.91
GRO, µg/l	BDL
DRO, µg/l	135.46
VOC, µg/l	BDL

**Note: Prescribed limit – TPH (C5 - C36) – 5000 mg/kg [Source: Schedule II of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016]**

It is inferred from above table that the sludge and sand mixture disposed in the bioremediation pit has degraded due to microbial action. Initially the ROA of the sludge sample collected on 28.03.2017 indicated the DRO level of are 2,84,604 mg/kg and it has presently reduced to 135 mg/kg. Total Petroleum Hydrocarbon (TPH) initially of 3,68,963 mg/kg has now reduced to **195 mg/kg**.

It was also observed during the visit that the kreb wall around the periphery of the bio-remediation site is yet to be provided and there was no fencing and only one display board has been erected at site. In this context, M/s KPL informed that they have executed work order with M/s Ramky Electrical Works for construction of kreb wall and is expected to be completed by end of July, 2017. A copy of the work order executed is enclosed as **Annexure –IV**. It is also observed that a road is being laid in the western side of the bio-remediation site. The top

portions of the piezometric wells are likely to be damaged due to the road construction activity and its needs to be adequately protected. Further, the balance quantity of oily sludge as well as oil contaminated sand which are to be treated is kept in an open storage yard. Besides, empty buckets, empty barrels, sintex tanks used for collection of oily sludge, sand contaminated with residues, HDPE bags, gunny bags soiled with oily residues, used gum boots & other oil contaminated personnel protective equipment, oil contaminated absorbent booms/ absorbent pads and fishing nets with oily deposits are found stored in open. Photographs taken during the visit are given as below:

Figure 1: Bio-remediation site of M/s KPL

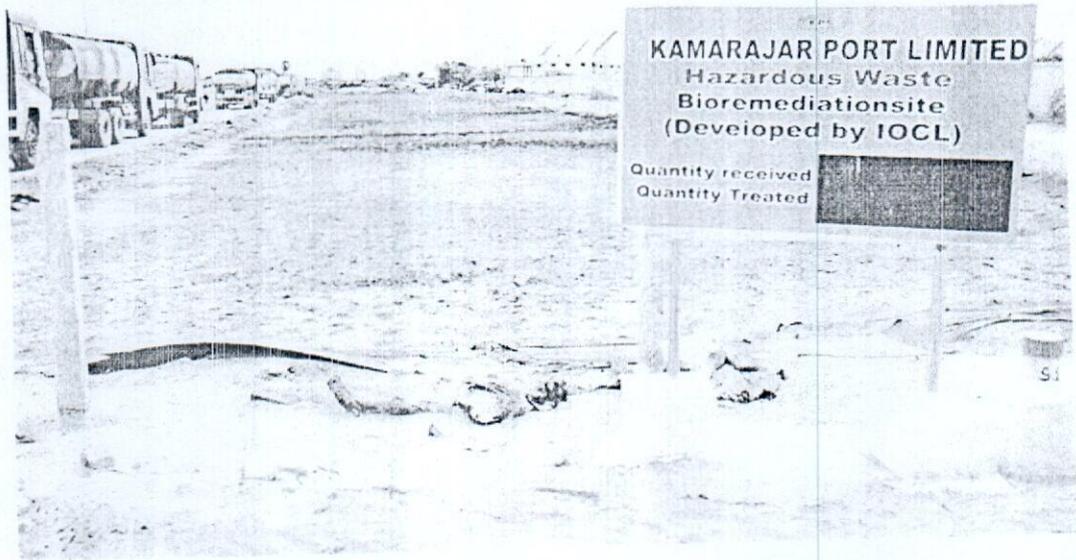


Figure 2: Kreb wall construction around the bio-remediation site

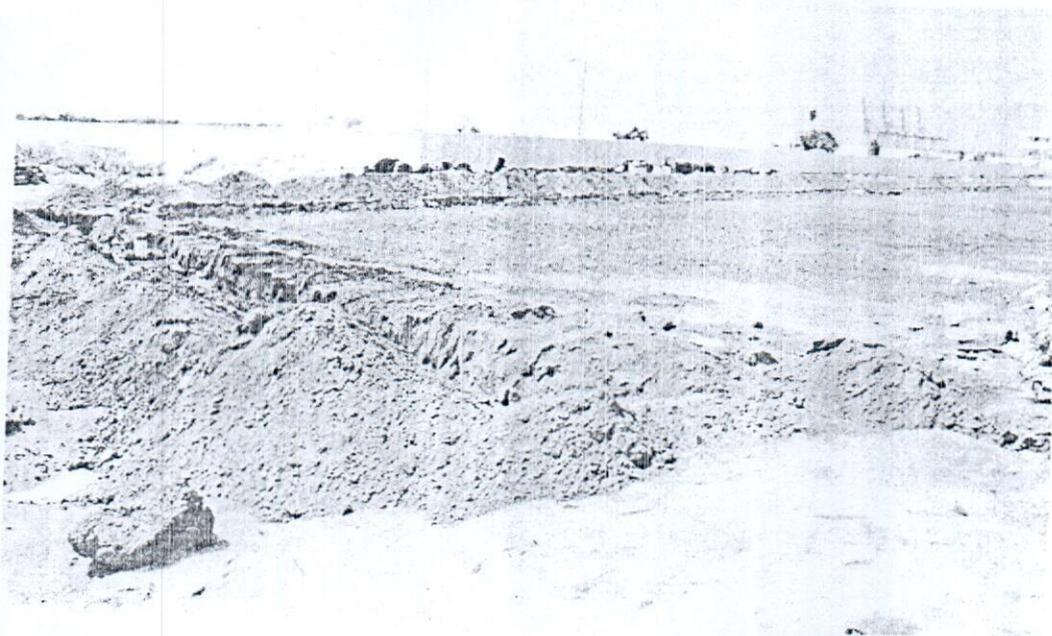


Figure 3: Piezometric well established around the bio-remediation site



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Figure 4: Open storage of empty sintex tanks at the bio-remediation site



Figure 5: Open storage of oil contaminated materials at the site



Figure 6: Joint inspection by the team at the bio-remediation site



After detailed deliberations, the team noted that following environmental safeguards shall be adopted for the bio-remediation site.

- i. Authorization under the provisions of Hazardous Wastes (Management, Handling and Transboundary) Rules, 2016 needs to be obtained from TNPCB for the bio-remediating oil contaminated sand.
- ii. Damaged poly-ethylene liners at the periphery of the bio-remediation site should be replaced at the earliest.
- iii. Dedicated closed sheds with impervious concrete lining shall be provided for storage of balance quantity of oily sludge as well as oil contaminated sand. The shed shall be equipped with adequate fire safety arrangements in order to meet any exigency.
- iv. Empty buckets, empty barrels, sintex tanks used for collection of oily sludge, sand contaminated with oil residues, HDPE bags, gunny bags soiled with oily residues, used gum boots & other oil contaminated personnel protective equipment, oil contaminated absorbent booms/ absorbent pads and fishing nets with oily deposits are to be considered as Hazardous Wastes and authorization has to be obtained at the earliest and the waste needs to be disposed immediately. Further, Dedicated closed sheds with impervious concrete lining shall be provided for storage of these materials.

- v. Bio-remediation site required to be fenced and display sign boards needs to be kept for every 30 meters along the periphery of the site. Krieb wall around the periphery of the site shall be constructed immediately.
- vi. Total Petroleum Hydrocarbons content in the oily sludge & oil contaminated sand which is being bio-remediated should be continuously monitored.
- vii. Total Petroleum Hydrocarbons content in the ground water samples and soil samples needs to be analyzed by M/s KPL through a MoEF&CC recognized laboratory.

### III. Description about the field visit and inspection of the contaminated sites:

The team inspected the following locations on 29/06/2017 to assess the post clean up situation after removal of oil sludge which was washed ashore after the collision incident which occurred on 28/01/2017.

**Table 4: List of contaminated sites inspected by the team on 29/06/2017**

Site No.	Site Name	District
1.	ETPS (old bay)	Tiruvallur
2.	Ernavur Kuppam	Tiruvallur
3.	Kasi Kovil Kuppam	Tiruvallur
4.	Bharathi Nagar	Tiruvallur
5.	Ernavur	Tiruvallur
6.	Ramkrishna Nagar Part II	Tiruvallur
7.	KVK Kuppam	Tiruvallur
8.	Palagai Thotti Kuppam	Tiruvallur
9.	Masthankoil I	Tiruvallur
10.	Masthankoil II	Tiruvallur
11.	Thiruvottiyur Kuppam	Tiruvallur
12.	Kanni Kovil Kuppam	Tiruvallur
13.	Thiruchinar Kuppam	Tiruvallur
14.	Tollgate – New Washermenpet	Chennai
15.	Anna Nagar Beach	Chennai
16.	Northern Breakwater of Kasimedu Harbor	Chennai
17.	Marina Beach -I (Behind swimming pool)	Chennai
18.	Marina Beach -II (Behind light house)	Chennai
19.	Srinivasapuram Beach	Chennai
20.	Elliot's Beach	Chennai
21.	Thiruvanmiyur Beach	Chennai
22.	Kottivakam Beach	Kancheepuram
23.	Palavakkam Beach	Kancheepuram
24.	Neelankarai Beach	Kancheepuram
25.	Kanathur Beach	Kancheepuram

Site No:1 – Ennore Thermal Power Station:-

Ennore Thermal Power Station's old bay was inspected on 29.6.2017. No deposits of Tar Balls or Oil-sediments were found on the structures as well as on the rocks which were reported to be cleaned by M/s International Tankers Owners Pollution Federation Limited (ITOPF).

Figure 7: Photograph of M/s Ennore Thermal Power Station old bay

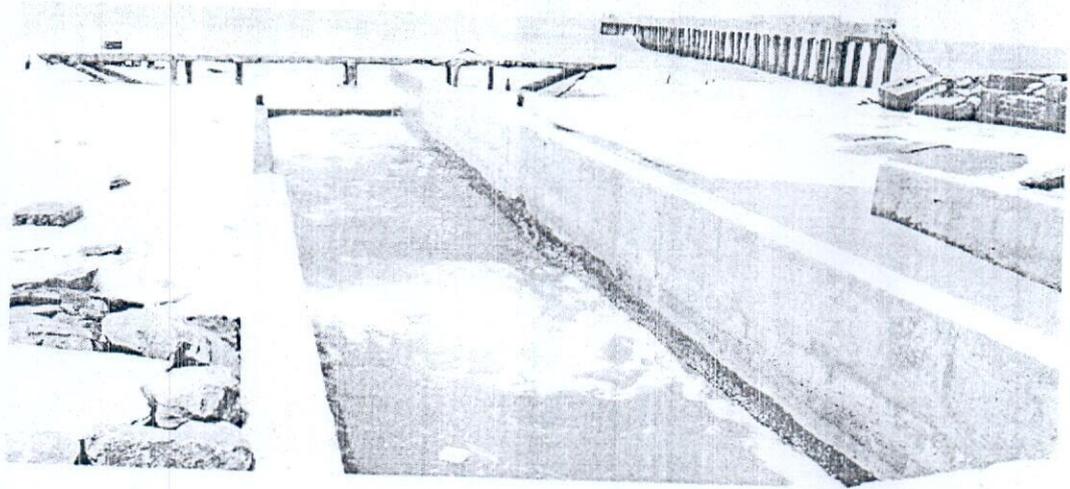


Figure 8: Photograph depicting rocks at ETPS old bay



Site No:2 – Ernavur Kuppam:-

Ernavur Kuppam was inspected on 29.6.2017. The shore line was found to be clean and no fresh deposits of oil residues or Tar balls were noticed on the beaches as well as on the rocks laid for shore protection. The surface of the rocks which were taken up for clean-up is found to be free of oil deposit.

Figure 9: Photograph depicting Ernavur Kuppam

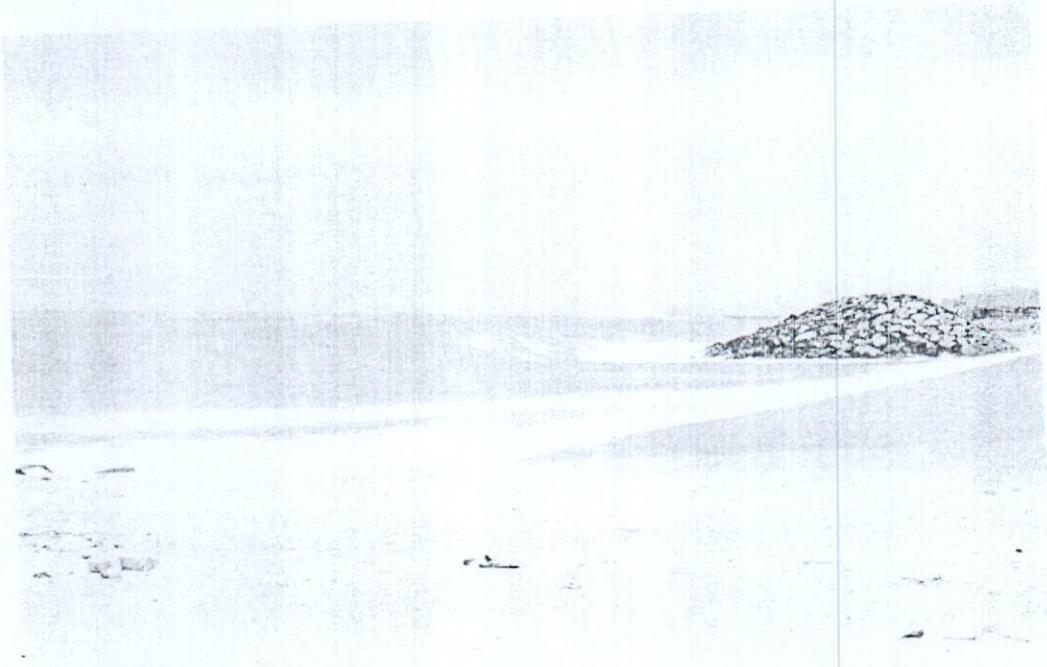


Figure 10: Photograph depicting rocks at Ernavur Kuppam



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Site No:3 – Kasi Kovil Kuppam:-

After post clean-up operations, the shoreline near Kasi Kovil Kuppam was found to be clean and no oil sediments or tar balls were found on the beach as well as on the rock surface.

Figure 11: Photograph depicting Kasi Kovil Kuppam

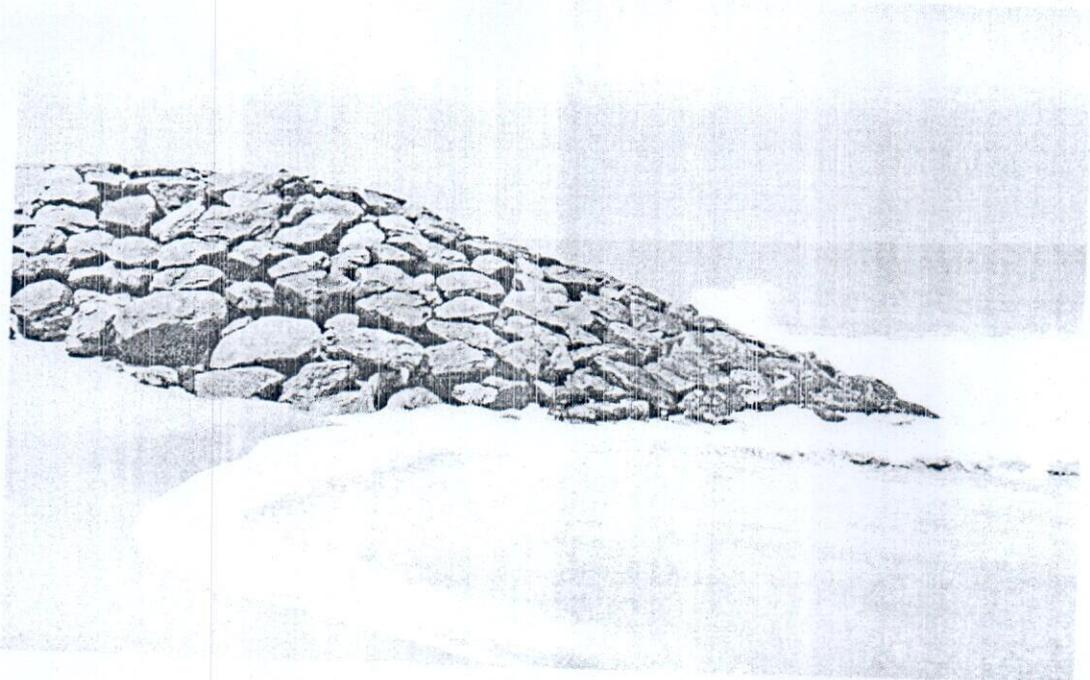


Figure 12: Photograph depicting rocks at Kasi Kovil Kuppam



Site No:4 – Bharathi Nagar:-

Bharathi Nagar was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed on the rock surface.

Figure 13: Photograph depicting Bharathi Nagar

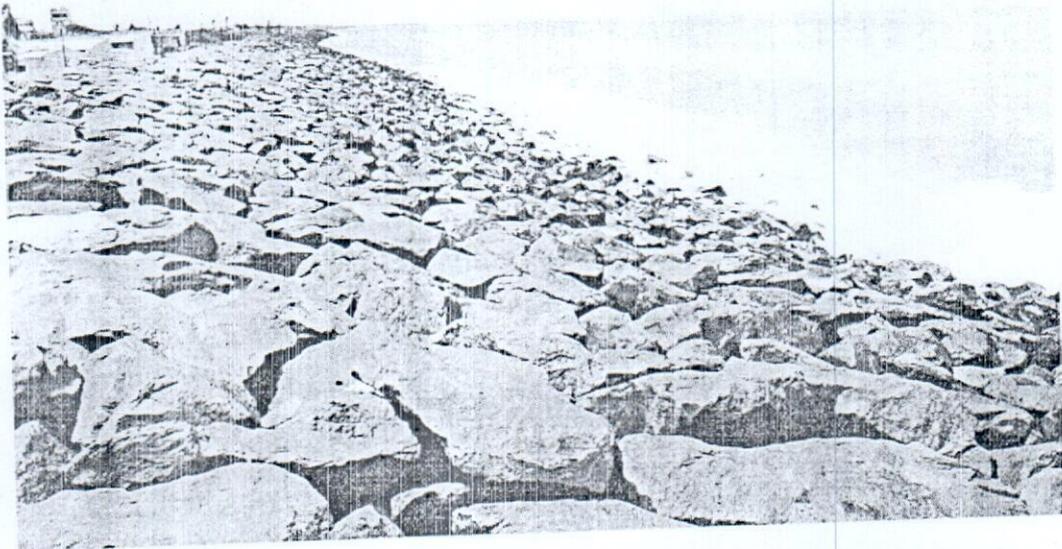
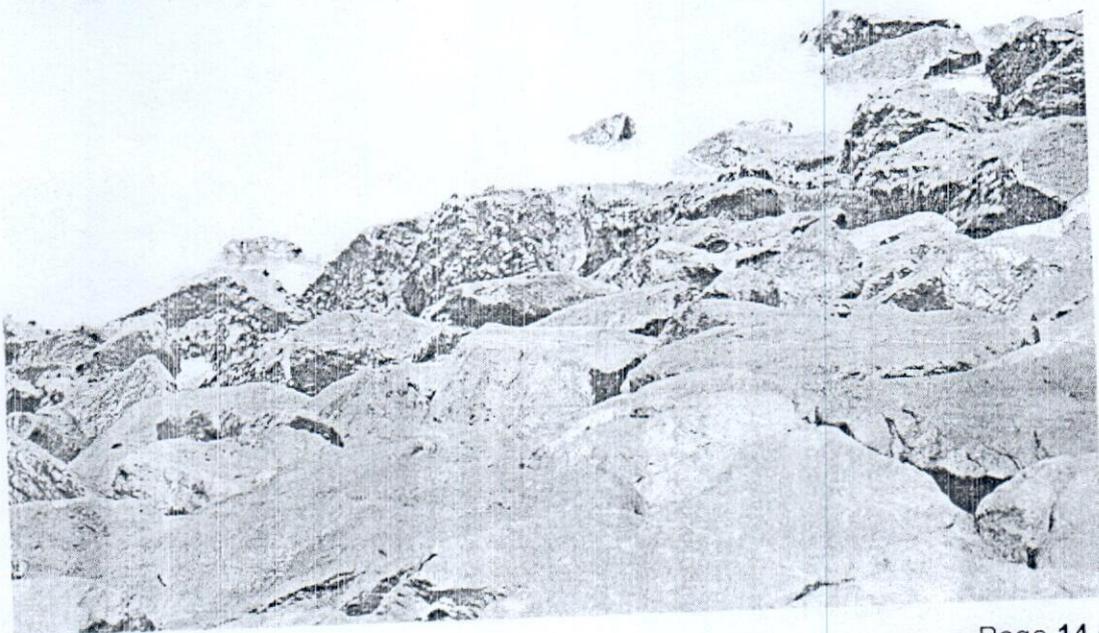


Figure14: Photograph depicting rocks at Bharathi Nagar



Site No:5 – Ernavur:-

This site was most affected during the oil slick. At present, no oil deposits were found on the surface of the rocks and it's appears to be clean. Fresh sand was found to be deposited on the crevices between the rocks. Few catamarans were found to be parked on the boulders. In the adjacent beach, few mechanized boats were berthed on shore and no oil sediments (or) tar balls were found to be deposited.

Figure 15: Photograph depicting Ernavur



Figure 16: Photograph depicting rocks at Ernavur



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Figure 17: Photograph depicting boats and fishing nets at Ernavur



Site No:6 – Ramakrishna Nagar Part II:-

Ramakrishna Nagar Part II was inspected on 29.6.2017. No deposits of oil residues or Tar balls were noticed on the surface of the rocks.

Figure 18: Photograph depicting Ramakrishna Nagar Part II



Figure 19: Photograph depicting boulders at Ramakrishna Nagar Part II



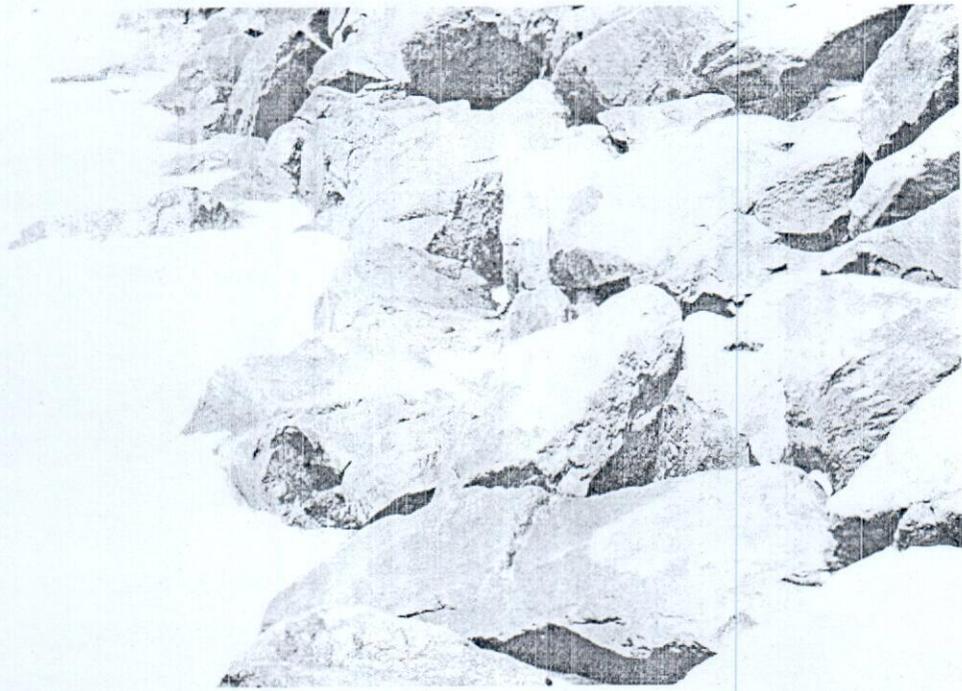
Site No:7 – KVK Kuppam:-

After post clean-up operations, the shoreline near KVK Kuppam was found to be clean and no oil sediments or tar balls were found on the surface of the rocks.

Figure 20: Photograph depicting KVK Kuppam



Figure 21: Photograph depicting rocks at KVK Kuppam



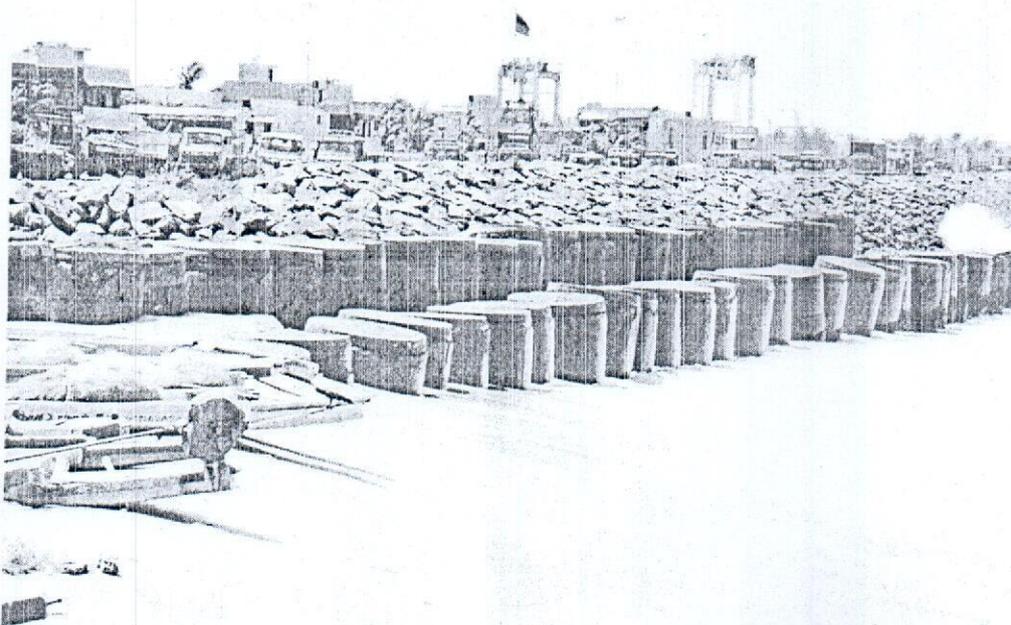
Site No:8 – Palagai Thotti Kuppam:-

After post clean-up operations, the shoreline near Palagai Thotti Kuppam was found to be clean and no oil sediments or tar balls were found.

Figure 22: Photograph depicting Palagai Thotti Kuppam



Figure 23: Photograph depicting boulders at Palagai Thotti Kuppam



Site No:9 – Masthankoil I:-

Masthankoil I was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

Figure 24: Photograph depicting Masthankoil I



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Figure 25: Photograph depicting rocks at Masthankoil I



Site No:10 – Masthankoil II:-

Masthankoil II was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

Figure 26: Photograph depicting Masthankoil II



Figure 27: Photograph depicting Masthankoil II



Site No: 11 – Thiruvottriyur Kuppam:-

After post clean-up operations, the shoreline near Thiruvottriyur Kuppam was found to be clean and no oil sediments or tar balls were found.

Figure 28: Photograph depicting Thiruvottriyur Kuppam

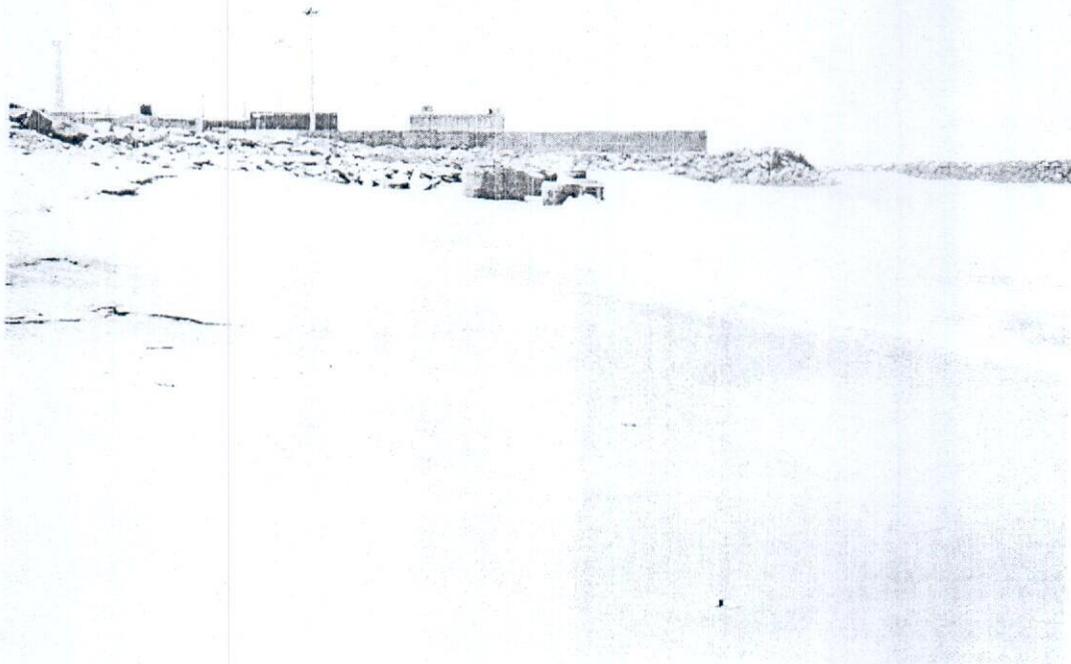
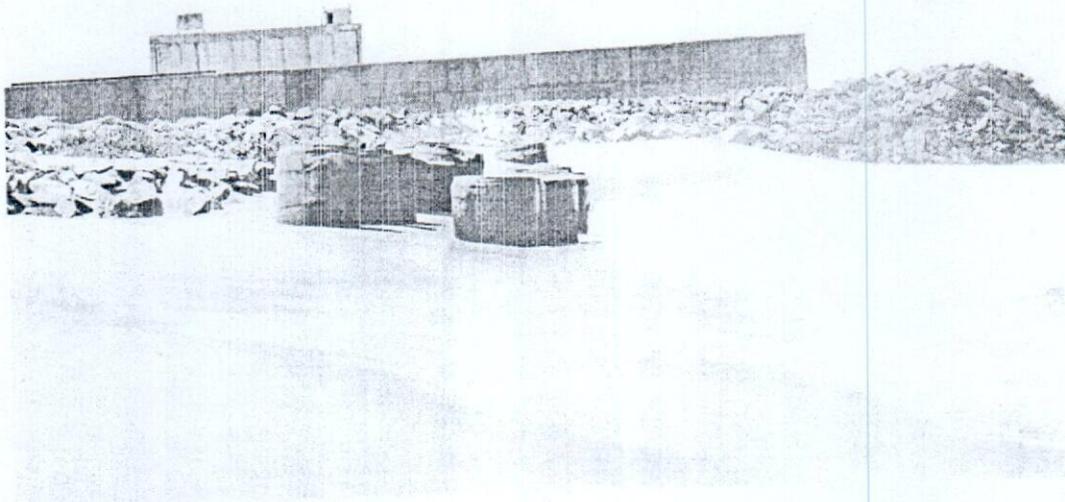


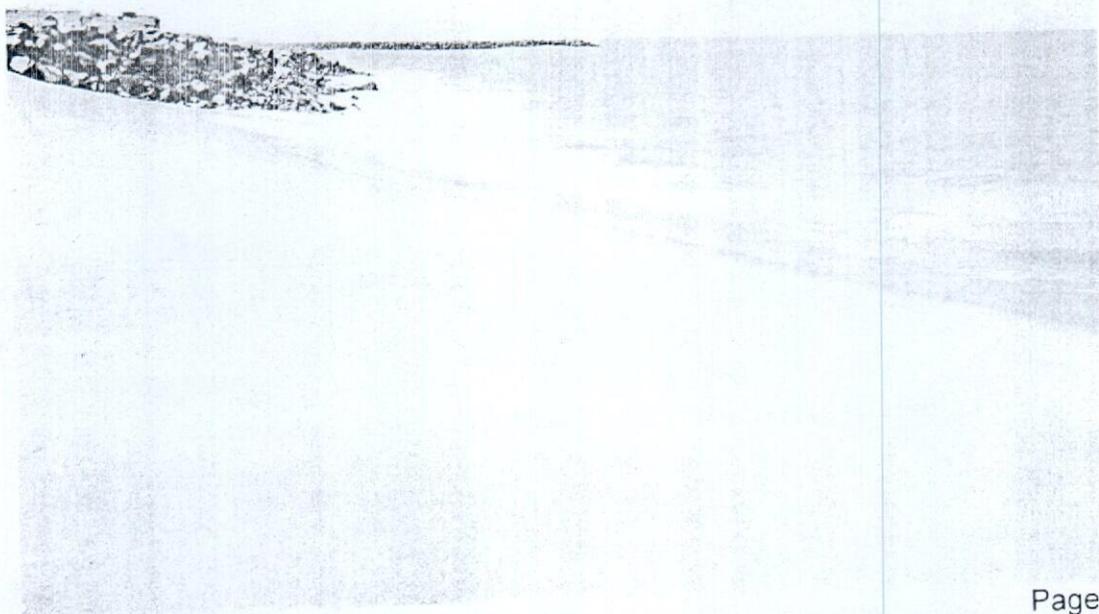
Figure 29: Photograph depicting boulders at Thiruvottriyur Kuppam



Site No:12 – Kanni Kovil Kuppam:-

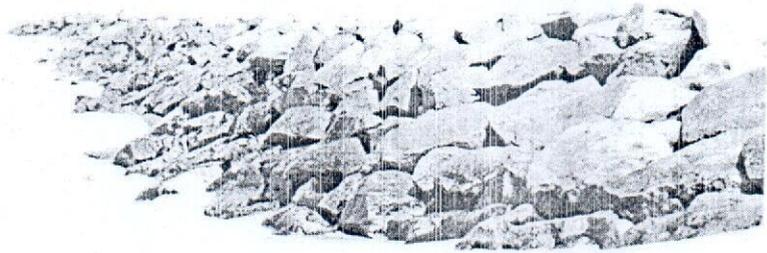
After post clean-up operations, the shoreline near Kanni Kovil Kuppam was found to be clean and no oil sediments or tar balls were found.

Figure 30: Photograph depicting Kanni Kovil Kuppam



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Figure 31: Photograph depicting rocks at Kanni Kovil Kuppam



Site No:13 – Thiruchinar Kuppam:-

After post clean-up operations, the shoreline near Thiruchinar Kuppam was found to be clean and no oil sediments or tar balls were found.

Figure 32: Photograph depicting Thiruchinar Kuppam



Figure 33: Photograph depicting rocks at Thiruchinar Kuppam



Site No:14 – Tollgate – New Washermenpet:-

Tollgate – New Washermenpet was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

Figure 34: Photograph depicting Tollgate -New Washermenpet



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**Site No:15 – Anna Nagar Beach:-**

After post clean-up operations, the shoreline near Anna Nagar Beach was found to be clean and no oil sediments or tar balls were found.

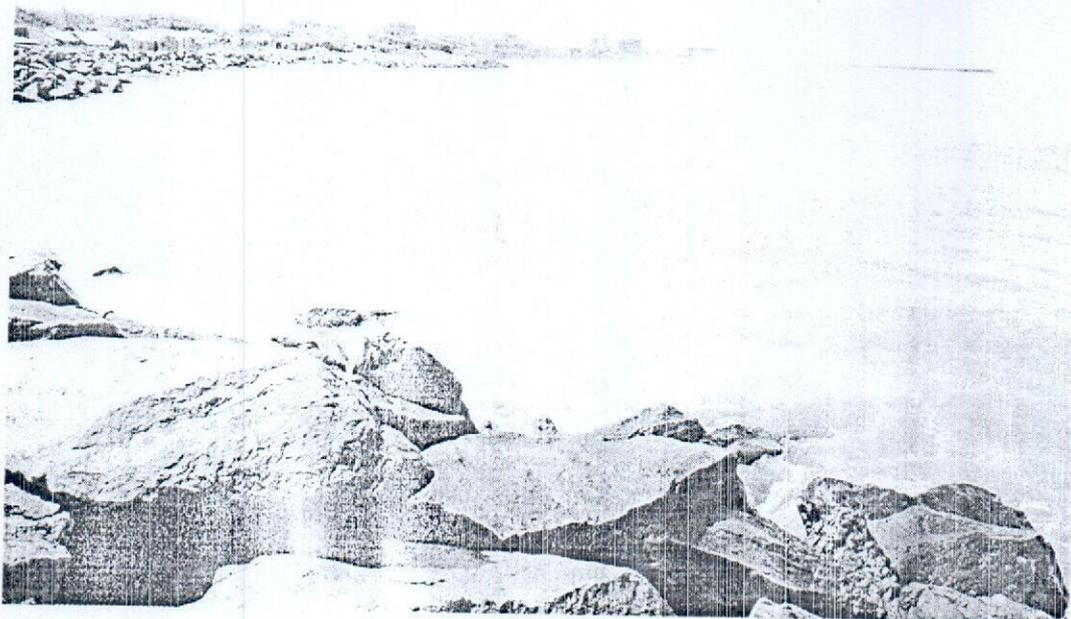
**Figure 35: Photograph depicting Anna Nagar Beach**



**Site No:16 – Northern Breakwater of Kasimedu Harbour:-**

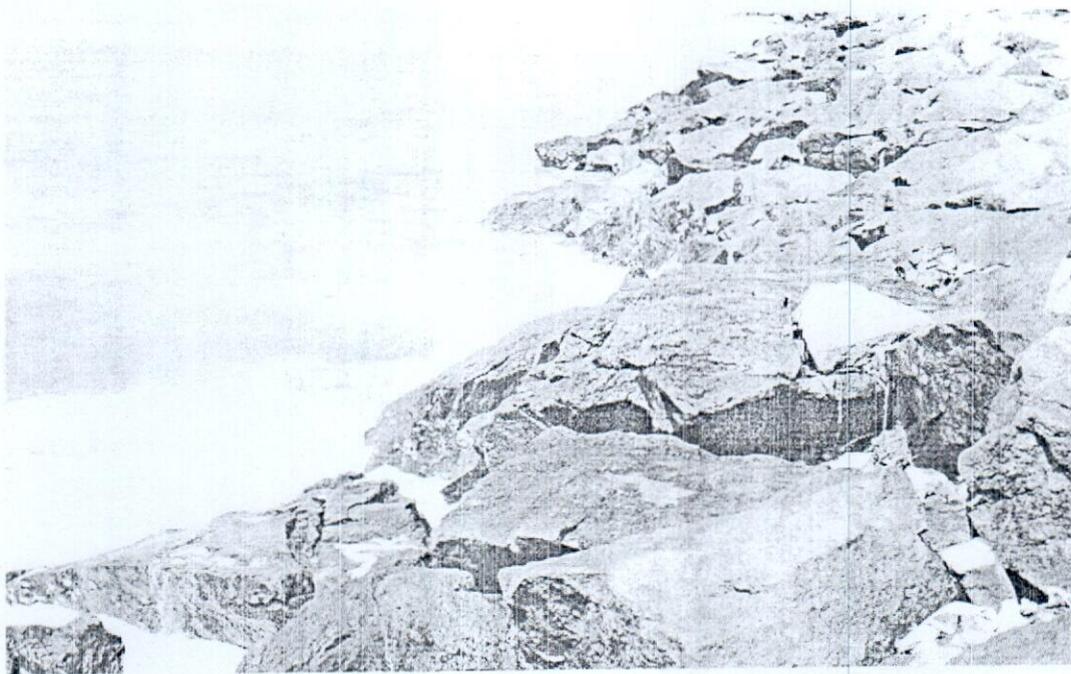
Northern Breakwater of Kasimedu Harbour was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

**Figure 36: Photograph depicting Northern Breakwater of Kasimedu Harbour**



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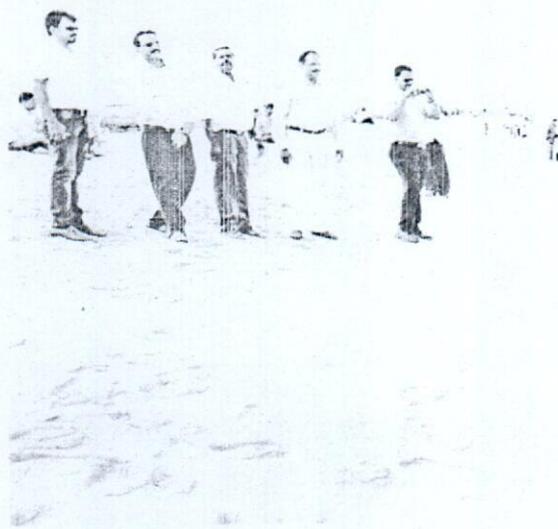
Figure 37: Photograph depicting Northern Breakwater of Kasimedu Harbour



Site No:17 – Marina Beach I (Behind swimming pool):-

Marina Beach I was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

Figure 38: Photograph depicting Marina Beach I (Behind swimming pool)



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**Site No:18 – Marina Beach II (Behind light house):-**

Marina Beach II (Behind light house) was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

**Figure 39: Photograph depicting Marina BeachII (Behind light house)**

**Site No:19 – Srinivasapuram Beach:-**

Srinivasapuram Beach was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

**Figure 40: Photograph depicting Srinivasapuram Beach**



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Figure 41: Photograph depicting Srinivasapuram Beach

Site No:20 – Elliot's Beach:-

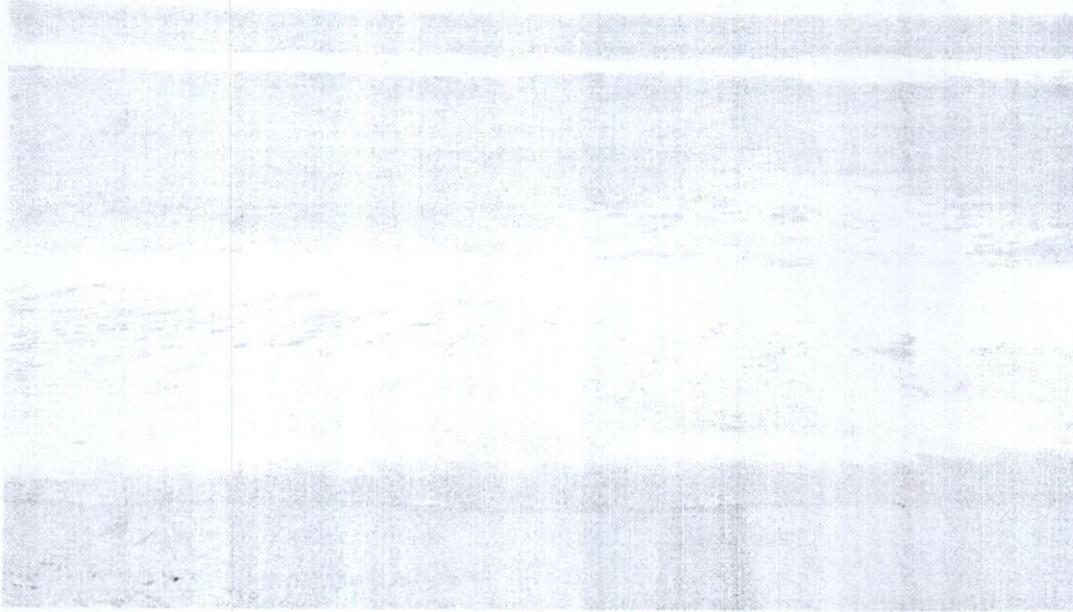
Elliot's Beach was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

Figure 42: Photograph depicting Elliot's Beach



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Figure 43: Photograph depicting Elliot's Beach



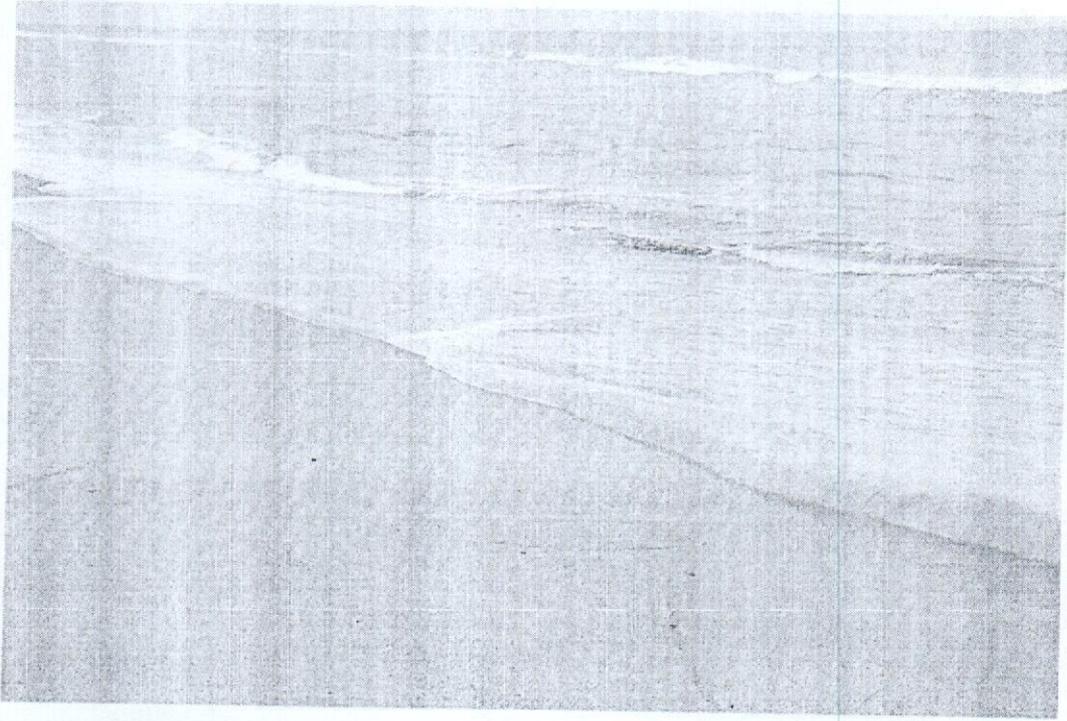
Site No:21 – Thiruvanmiyur Beach:-

Thiruvanmiyur Beach was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

Figure 44: Photograph depicting Thiruvanmiyur Beach



Figure 45: Photograph depicting Thiruvanmiyur Beach



Site No:22 – Kottivakam Beach:-

Kottivakam Beach was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

Figure 46: Photograph depicting Kottivakam Beach



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**Site No:23 – Palavakkam Beach:-**

Palavakkam Beach was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

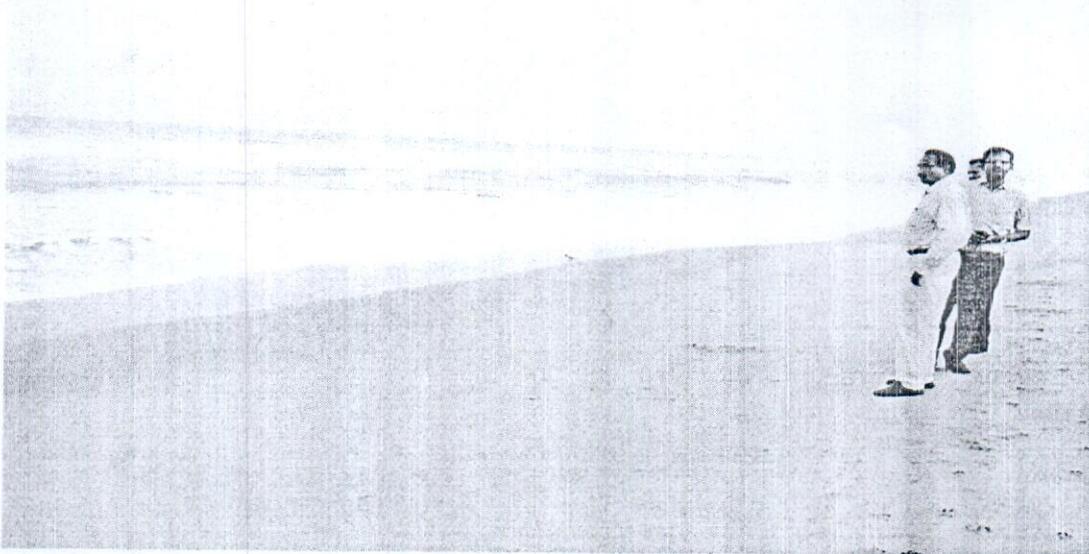
**Figure 47: Photograph depicting Palavakkam Beach**



**Site No:24 – Neelankarai Beach:-**

Neelankarai Beach was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

**Figure 48: Photograph depicting Neelankarai Beach**



**Site No:25 – Kanathur Beach:-**

Kanathur Beach was inspected on 29.6.2017. The shore line was found to be clean and no deposits of oil residues or Tar balls were noticed.

**Figure 49: Photograph depicting Kanathur Beach**



The clean-up status of the contaminated sites as ascertained by the team is given as below:

**Table 5: Clean-up status of the contaminated sites as on 29/06/2017**

Site No.	Site Name	Clean up status
1.	ETPS (old bay)	The beach and surroundings of the sea are found to be cleaned up.
2.	Ernavur Kuppam	
3.	Kasi Kovil Kuppam	
4.	Bharithir Nagar	
5.	Ernavur	
6.	Ramkrishna Nagar Part II	
7.	KVK Kuppam	
8.	Palagai Thotti Kuppam	
9.	Masthankoil I	
10.	Masthankoil II	
11.	Thiruvottiyur Kuppam	
12.	Kanni Kovil Kuppam	
13.	Thiruchinar Kuppam	
14.	Tollgate – New Washermenpet	
15.	Anna Nagar Beach	
16.	Northern Breakwater of Kasimedu Harbor	
17.	Marina Beach -I (Behind swimming pool)	

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Site No.	Site Name	Clean up status
18.	Marina Beach -II (Behind light house)	The beach and surroundings of the sea are found to be cleaned up.
19.	Srinivasapuram Beach	
20.	Elliot's Beach	
21.	Thiruvanmiyur Beach	
22.	Kottivakam Beach	
23.	Palavakkam Beach	
24.	Neelankarai Beach	
25.	Kanathur Beach	

NA – Not Applicable

#### **IV. Summary:**

1. It is inferred from Table 2 that the oil and grease level is found to be below detectable limit in the monitored piezometric well samples. The traces of Diesel Range Organics (DRO) and Total Petroleum Hydrocarbons (TPH) are found in the samples, but the levels are below 0.1 mg/l. The VOC levels in the samples were below detectable limits.
2. It is inferred from Table 3 that the sludge and sand mixture disposed in the bioremediation pit has degraded due to microbial action. Initially the ROA of the sludge sample collected on 28.03.2017 indicated the DRO level of are 2,84,604 mg/kg and it has presently reduced to 135 mg/kg. Total Petroleum Hydrocarbon (TPH) initially of 3,68,963 mg/kg has now reduced to 195 mg/kg.
3. It is inferred from Table 5 that the aforesaid sites have been cleaned up and no further follow-up action is required in this regard.

#### **V. Recommendations:-**

With respect to the waste disposal and remediation, following environmental safeguards shall be adopted at the bio-remediation site:

#### **Bio-remediation site:**

- i. Authorization under the provisions of Hazardous Wastes (Management, Handling and Transboundary) Rules, 2016 needs to be obtained from TNPCB for the bio-remediating oil contaminated sand (225.58 Tons).
- ii. Dedicated closed sheds with impervious concrete lining shall be provided for storage of balance quantity of oily sludge as well as oil contaminated sand. The shed shall be equipped with adequate fire safety arrangements in order to meet any exigency.
- iii. Empty buckets, empty barrels, sintex tanks used for collection of oily sludge, sand contaminated with oil residues, HDPE bags, gunny bags soiled with oily residues, used

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gum boots & other oil contaminated personnel protective equipment, oil contaminated absorbent booms/ absorbent pads and fishing nets with oily deposits are to be considered as Hazardous Wastes and authorization has to be obtained at the earliest and the waste needs to be disposed immediately. Further, Dedicated closed sheds with impervious concrete lining shall be provided for storage of these materials.

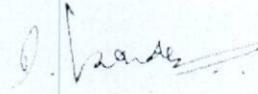
- iv. Bio-remediation site required to be fenced and display sign boards needs to be kept for every 30 meters along the periphery of the site. Krib wall around the periphery of the site shall be constructed immediately
- v. Total Petroleum Hydrocarbons content in the oily sludge & oil contaminated sand which is being bio-remediated should be continuously monitored
- vi. Total Petroleum Hydrocarbons content in the soil samples needs to be analyzed by M/s KPL through a MoEF&CC recognized laboratory.

Status of clean-up process:

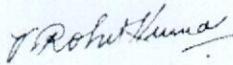
With respect to the status of clean-up process, the beach and surroundings of the sea in all 25 sites are found to be cleaned up and no further follow-up action is required in this regard.



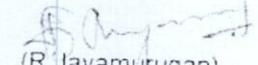
(Sundar Ramanathan)  
Scientist 'D'  
Regional Office of MoEF&CC  
Chennai.



(D Vasudevan)  
District Env. Engineer  
TNPCCB  
Ambattur - Tiruvallur  
District



(V. Rohit Kumar)  
Asst. Env. Engineer  
TNPCCB Board Office,  
Guindy, Chennai.



(R. Jayamurugan)  
Asst. Env. Engineer  
TNPCCB  
Chennai.

6/

Annexure - IV

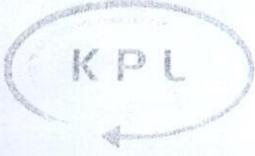
காமராஜர் துறைமுக நிறுவனம்

कामराजर पोर्ट लिमिटेड

Kamarajar Port Limited

(erstwhile Ennore Port Limited)

(A Mini Ratna Government of India Undertaking)



KPL/MS/Oil-spill/ 2020

Date: 03.09.2020

To,  
Dr. K G Prijilal, RO  
Ministry of Environment Forest & Climate Change,  
No 34, HEPS Campus,  
Cathedral Garden Road,  
Nungambakkam, Chennai-34

Subject: Visit of the Joint Committee constituted by Hon'ble NGT(SZ) in  
O.A.Nos.14,16,38 &40 of 2017 to Port on 6.8.2020-Regarding.

Ref: Your email dated 04/08/2020

Sir,

With reference to the above visit of the Joint Committee constituted by Hon'ble NGT(SZ) to Kamarajar Port on 06/08/2020, the request documents and the status report on the recommendations of the Joint site inspection by the officials of MoEF and TNPCB on 29.06.2017 are as follows:

**A brief on the oil spill incident**

Collision of the two vessels M.T. Dawn Kanchipuram and B. W. Maple occurred at the approach waters of Kamarajar Port on 28.01.2017 around 0345 hrs. The collision resulted in oil spill. The spilled oil reached the beaches with waves contaminating the soil. The oily wastes and the oil contaminated sand collected from various coastlines was brought to KPL for disposal.

**1st phase bio-remediation**

Tamil Nadu Pollution Control Board (TNPCB) had accorded authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016 vide Authorization No.17HFC8126640 dated 15.2.2017 to dispose the oily waste through the process of bio-remediation developed by M/s. IOCL using Oilivorous Bacteria [**Annexure-I**].

Accordingly, about 184.42 MT of material consisting of oily sludge mixed with sea water (159.35 Kl) and oil contaminated sand (25.075 MT) was treated using bio-remediation, by M/s. Indian Oil Corporation Limited (IOCL). The final report on the bioremediation issued by IOCL was submitted to TNPCB vide KPL letter No. KPL/MS/Env/HW/2017 dated 08.01.2018 and TNPCB has taken note of it.

Registered Office & Trade Facilitation Centre :  
4<sup>th</sup> Floor, Super Speciality Diabetic Centre  
(erstwhile DLB Building)  
Rajaji Salai, Chennai - 600 001.  
Ph : 044-25251666-70 Fax : 044-25251665  
CIN : U45203TN1999GOI043322

பதிவுகரி காரியாலய & வர்த்தமய சுவியக கரி :  
சுயீய சிபீகரி, சூப்பர் சபீசலிடி டயபீடரி கரி சேரி,  
(டீ புல சிபீ கரி கரி)  
ராஜாசி சலாி, சேரி-600 001  
புரி : 044-25251666-70 ஫ேகரி : 044-25251665

Port Office : Vallur Post, Chennai - 600 120  
Ph : 044-27950030-40 Fax : 044-27950002

புர்டு காரியாலய : வல்லூர் புர்டு, சேரி - 600 120  
புரி : 044-27950030-40 ஫ேகரி : 044-27950002

website : www.ennoreport.gov.in e-mail : info@epl.gov.in  
Kamarajar Port - India's Port of the Millennium

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## **2<sup>nd</sup> phase bio-remediation**

Subsequently KPL has obtained authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016 for the disposal of the balance quantity of the oily wastes and oil contaminated sand from TNPCB vide Authorization No. 19HRC27210863 dated 16.09.2019 for the following quantity of the oily wastes (i) 55 KL of oily sludge and (ii) 225 T of oil contaminated sand for disposal by bio-remediation using Oilivorous bacteria developed by M/s. Indian Oil Corporation Limited and (iii) 15T of the solid waste mixed with the contaminated sand for disposal through TSDF for incineration. The copy of the authorization is enclosed as **Annexure-II**. Accordingly 2<sup>nd</sup> phase bioremediation of oily sludge and oil contaminated sand is being carried out by M/s. IOCL.

The oil contaminated hazardous wastes were sent to common Treatment Storage & Disposal facility (TSDF) operated by Tamilnadu Waste Management Limited.

### **Formation of Committee to assess environmental impact and suggest remedial measures by Department of Environment & Forests Department, Government of Tamil Nadu.**

Soon after the oil spill incident, Kamarajar Port Limited [KPL] has engaged National Centre for Sustainable Coastal Management, [A unit of Ministry of Environment, Forests & Climate Change [MoEF&CC], Govt. of India] to carry out a study "Assessment of Environmental and ecological impact of oil spill along the coast of Chennai. Accordingly NCSCM has prepared a "Report On Spill Chennai Coast: Environment & Ecological impacts". The report was forwarded to MoEF&CC vide KPL letter No. KPL/MS/MoEF&CC/2017 dated 12.06.2017.

After the incident of collision of the ships and the subsequent oil spill, Environment & Forest Department, Govt. of Tamil Nadu had constituted a Committee under the Chairmanship of Dr.B.R.Subramanian, Project Director (Retd.), ICMAM PD, Chennai to assess the environmental impact and to suggest remedial measures in the G.O.(D) No.65, Environment & Forests (EC.3) Department, dated 14.03.2017. The copy of the letter enclosed as **Annexure-A**.

Department of Environment vide letter R.C. No.P1/154/2017-1 dated 31.08.2017 [**Annexure-B**] has informed about the constitution of a committee to assess the Environmental Impact and to suggest the remedial measures, by carrying out various studies through various departments/institutions and also requested for funding of Rs.5.68 crores to

carryout the various studies by various organizations. KPL had paid an amount of Rs.5.68 crores to Department of Environment on 26.12.2017.

**Point wise action taken to the recommendations of the inspection during the site visit on 29.06.2017.**

**1. Authorization under the provisions of Hazardous Wastes (Management, Handling and Transboundary) Rules 2016 needs to be obtained from TNPCB for the bio-remediating oil contaminated sand.**

Tamil Nadu Pollution Control Board (TNPCB) had accorded authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, vide Authorization No.17HFC8126640 dated 15.2.2017 to dispose the oily waste through the process of bio-remediation developed by M/s. Indian Oil Corporation Limited [IOCL] using Oilivorous Bacteria. The copy of the authorization is enclosed as **Annexure-I**. Accordingly, about 184.42 MT of material consisting of sludge oil mixed with sea water (159.35 KL) and oil contaminated sand (25.075 MT) was treated using bio-remediation, by M/s. IOCL.

Subsequently, KPL has obtained authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, for the disposal by bioremediation of the balance quantity of the oily wastes and oil contaminated sand from TNPCB vide Authorization No. 19HRC27210863 dated 16.09.2019 for the following quantity of the oily wastes (i) 55 KL of oily sludge and (ii) 225 T of oil contaminated sand lying in the port for disposal by bio-remediation using Oilivorous bacteria developed by M/s. Indian Oil Corporation Limited.(iii)15T of the solid waste mixed with the contaminated sand for disposal through TSDF for incineration. The copy of the authorization is enclosed as **Annexure-II**.

The treatment of the oily waste of about 55 KL and oil contaminated sand of about 225 MT by the process of bio-remediation has been started.

**2. Damaged poly-ethylene liners at the periphery of the bio-remediation site should be replaced at the earliest**

The damaged Poly ethylene liner at periphery of Bio remediation site was replaced immediately and process was completed in September 2017.

**3. Dedicated closed shed with impervious concrete lining shall be provided for storage of balance quantity of oily sludge as well as oil contaminated sand. The shed shall be equipped with adequate fire safety arrangements in order to meet any exigency.**

As directed by the Committee, dedicated closed shed with impervious lining was provided for the storage of oil contaminated sand. The oily sludge was stored in leak proof plastic barrels of various sizes and the same were kept covered with plastic sheets and placed on concrete surface. Regular monitoring of the barrels was carried out. The bio-remediation pit and the

shed are located adjacent to KPL fire station, where fire tender, fire extinguishers and crew are available round the clock. Personnel are deployed to continuously monitor the bioremediation site on regular basis.

The oil contaminated sand stored in the shed and the oily sludge stored in the barrels are put in a pit and is being treated by bioremediation process, and the shed was dismantled and removed.

**4. Empty buckets, empty barrels, sintex tanks used for collection of oily sludge sand contaminated with residues, HDPE bags, gunny bags, soiled with oily residues used gum boots & other oil contaminated personnel protective equipment, oil contaminated absorbent booms/absorbent pads and fishing nets with oily deposits are to be considered as Hazardous wastes and authorization has to be obtained at the earliest and the wastes needs to be disposed immediately. Further dedicated closed sheds with impervious concrete lining shall be provided for storage of those materials.**

As directed, authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016 was obtained from Tamil Nadu Pollution Control Board (TNPCB) vide authorization No.17HFC8126640 dated 15.2.2017. As per Clause 13 under Additional Specific conditions, the waste barrels / drums were disposed to TSDF, Gummudipoondi.

The balance quantity of the solid wastes was stored in a covered shed adjacent to the bioremediation pit. Authorization was obtained from TNPCB under Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016 vide Authorization No. 19HRC27210863 dated 16.09.2019 for the second phase of bioremediation process. Accordingly the oil contaminated barrels, booms, solid wastes were sent to TSDF Gummudipoondi. The oil contaminated sand and oily sludge is being treated by bioremediation process.

**5. Bio-remediation site required to be fenced and display boards needs to be kept for every 30 meters along the periphery of the site shall be constructed immediately.**

During the 1<sup>st</sup> phase of bio-remediation fencing along with display boards were erected and later removed.

**6. Total Petroleum Hydrocarbons content in the oily sludge & oil contaminated sand which is being bio-remediated should be continuously monitored.**

The 1<sup>st</sup> phase bioremediation was initiated on 06.02.2017 by M/s. Indian Oil Corporation Limited. Subsequently at every 15<sup>th</sup> day, the composite soil samples were taken from the site and analysed for Total Petroleum Hydrocarbons and Polycyclic aromatic hydrocarbons content. The final report on "Bioremediation of oil sludge and oil contaminated sand from Ennore Port, at Kamarajar Port Limited (KPL), Chennai" submitted by IOCL, Faridabad was forwarded to TNPCB by KPL vide letter dated 08.01.2018. The copy of the report is enclosed as **Annexure- III**.

**7.Total Petroleum Hydrocarbons content in the ground water samples and soil samples needs to be analysed by M/s. KPL through a MoEF&CC recognized laboratory.**

During the Phase-I Bio-Remediation process, for monitoring of ground water contamination, 12 piezometric wells were installed around the pit having a depth of 20 feet. Water samples were analysed for oil content and heavy metals. The analysis results are given in the report submitted by M/s. IOCL, the final report on "Bioremediation of oil sludge and oil contaminated sand from Ennore Port, at Kamarajar Port Limited (KPL), Chennai" [**Annexure-III**].

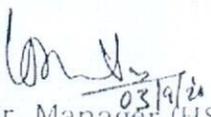
KPL monitored ground water through M/s. Richardson & Cruddas (1972) Ltd. [A Govt. of India Undertaking], a recognized laboratory, during the process of bioremediation. The report of analysis revealed that oil and grease and petroleum hydrocarbons in all the wells are Below detection Limit (BDL). The analysis reports along the final report submitted by M/s. IOCL was forwarded to Tamil Nadu Pollution Control Board vide our letter dated 08.01.2018 [**Annexure- III**].

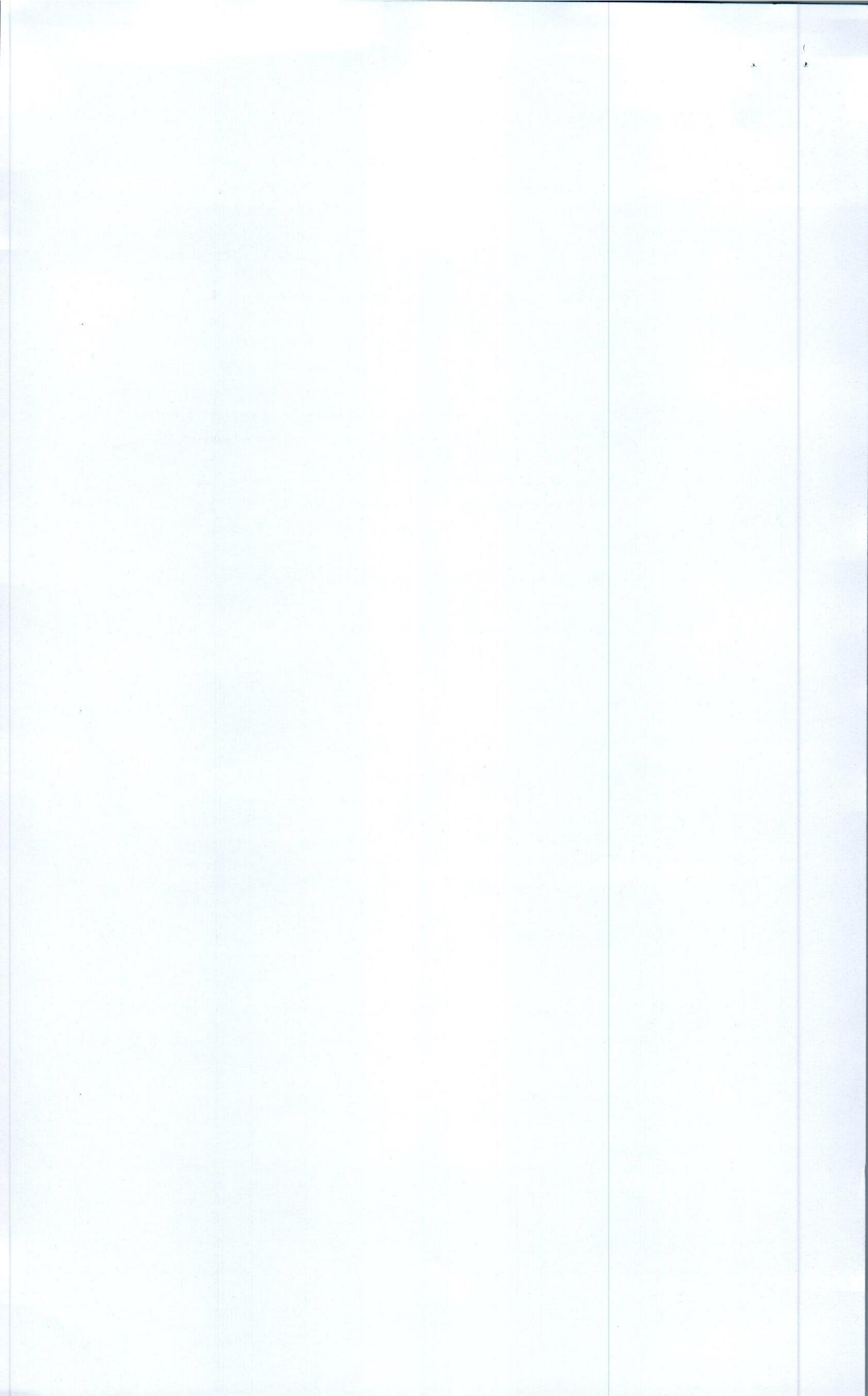
**Analysis results of piezometric well samples at the bio-remediation site.**

The 1<sup>st</sup> phase bioremediation was initiated on 06.02.2017 by M/s. Indian Oil Corporation Limited. For monitoring of ground water contamination, 12 piezometric wells were installed having a depth of 20 feet. Water samples were analysed for oil content and heavy metals. The analysis results are given in the report submitted by M/s. IOCL, the final report on "Bioremediation of oil sludge and oil contaminated sand from Ennore Port, at Kamarajar Port Limited (KPL), Chennai" is enclosed as **Annexure- III**.

KPL monitored ground water through M/s. Richardson & Cruddas (1972) Ltd. [A Govt. of India Undertaking], a recognized laboratory, during the process of bioremediation. The report of analysis revealed that oil and grease and petroleum hydrocarbons in all the wells are below detection Limit (BDL). The analysis reports along the final report submitted by IOCL was forwarded to Tamil Nadu Pollution Control Board vide our letter dated 08.01.2018 [**Annexure III**].

Yours sincerely,

  
03/1/20  
Sr. Manager (HSE)



Annexure - I



**TAMILNADU POLLUTION CONTROL BOARD**

**AUTHORISATION No. 17HFC8126640 dated 15/02/2017**

**Proceeding No. T5/TNPCB/F.0044AMB/HWA/RL/AMB/2017 dated 15/02/2017**

Sub: Tamil Nadu Pollution Control Board - Hazardous Waste Authorization-Fresh- M/s: KAMARAJAR PORT LIMITED, S.F.No. 1/2A2, 2B, 3A2 Puzuthivakkam Village, 1/3A2,7/3B2,1/3C2 etc in Ennore Village, PUZHUTHIVAKKAM Village, PONNERI Taluk, Tiruvallur District - Authorization under Rule 6 (2) of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 enacted under Environment (Protection) Act, 1986 - Issued- Reg.

Ref: 1. Units application for Authorization dated 05.02.2017  
2. HWA-IR.No.0044AMB/HWA/RL/DEE/AMB/2017 dated 11/02/2017

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**FORM 2**

[See rule:6 (2)]

**FORM FOR GRANT OR RENEWAL OF AUTHORISATION TO THE OCCUPIERS, RECYCLERS, REPROCESSORS, REUSERS, USER AND OPERATORS OF DISPOSAL FACILITIES**

- Number of authorization: 17HFC8126640 and dated: 15/02/2017.
- Chairman cum Managing Director of M/s. KAMARAJAR PORT LIMITED is hereby granted an Authorisation based on the enclosed signed Inspection report for Collection, Storage, Transportation, Treatment, Disposal of hazardous or other wastes or both on the premises situated at S.F.No. 1/2A2, 2B, 3A2 Puzuthivakkam Village, 1/3A2,7/3B2,1/3C2 etc. in Ennore Village, PUZHUTHIVAKKAM Village, PONNERI Taluk, Tiruvallur District.

Sl. No	Schedule./ Name of the Processes	Name of Hazardous Waste (with category No)	Quantity	Activities for which Authorization is issued
1	Schedule I/3. Cleaning, emptying and maintenance of petroleum oil storage tanks including ships.	3.1-Cargo residue, washing water and sludge containing oil	184 T/Annum	Collection, Storage, Transportation, Treatment, Disposal (On-site Bio remediation using an Oilivorous bacteria by M/s. IOCL at Kamarajar Port Ltd)
2	Schedule I/3. Cleaning, emptying and maintenance of petroleum oil storage tanks including ships.	3.1-Cargo residue, washing water and sludge containing oil	64 T/Annum	Collection, Transportation and Storage within the Port in a safe and secured place.

- This authorization shall be valid for a period upto 14/02/2018.  
The Authorization is issued subject to the following general and special conditions annexed.

**POLLUTION PREVENTION PAYS**

அகம் தூய்மை வாய்மைக்கு ! புறம் தூய்மை வாழ்வுக்கு !

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## TAMILNADU POLLUTION CONTROL BOARD

Member Secretary  
Tamil Nadu Pollution Control Board  
Chennai

### A. GENERAL CONDITIONS OF AUTHORIZATION

1. The authorised person shall comply with the provisions of the Environment (Protection) Act, 1986 and the rules made there under.
2. The authorization or its renewal shall be produced for inspection at the request of an officer authorized by Tamil Nadu Pollution Control Board.
3. The person authorized shall not rent, lend, sell, transfer or otherwise transport the hazardous and other wastes except what is permitted through this Authorisation.
4. Any unauthorized change in personnel, equipment or working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorization.
5. The person authorised shall implement Emergency Response procedure (ERP) for which this authorisation is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc and their possible impacts and also carry out mock drill in this regard at regular interval of time.
6. The person authorised shall comply with the provisions outlined in the CPCB guidelines on "Implementing Liabilities for Environmental damages due to Handling and Disposal of Hazardous Wastes and Penalty".
7. It is the duty of the authorized person to take prior permission of Tamil Nadu Pollution Control Board to close down the facility.
8. The imported Hazardous and other wastes shall be fully insured for transit as well as the accidental occurrences and its clean-up operation.
9. The record of consumption and fate of the imported hazardous and other wastes shall be maintained.
10. The Hazardous and other wastes which gets generated during recycling or reuse or recovery or pre-processing or utilisation of imported hazardous or other wastes shall be treated and disposed of as per specific conditions of Authorisation.
11. The importer or Exporter shall bear the cost of import or export or mitigation of damages if any.
12. An application for the renewal of an authorization shall be made as laid down under these Rules.
13. Any other conditions for compliance as per the Guidelines issued by the MoEF and CC or CPCB from time to time.
14. Annual returns shall be filed by June 30th for the period ending 31st March of the previous financial year.

### B. SPECIFIC CONDITIONS - HW Generator

1. The occupier/generator shall be responsible for safe and environmentally sound management of hazardous and other wastes.

POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு ! புறம் தூய்மை வாழ்வுக்கு !



## TAMILNADU POLLUTION CONTROL BOARD

2. The occupier shall follow the following steps for the management of hazardous and other wastes. (a) prevention (b) minimization (c) reuse (d) recycling (e) recovery, utilisation including co-processing and (f) safe disposal
3. The occupier shall take all the steps while managing hazardous and other wastes - (a) To contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and (b) To provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety.
4. The occupier shall store the hazardous and other wastes for a period not exceeding ninety days and shall maintain a record of sale, transfer, storage, recycling, recovery, pre-processing, co-processing and utilisation of such wastes and make these records available for inspection.
5. The hazardous and other wastes shall be stored temporally in an isolated area earmarked for the purpose within the occupier's premises (it shall not be accessible to rain water) till scientific disposal. The storage area shall be fenced properly and a sign of danger shall be placed at the storage site.
6. The containers holding the hazardous and other wastes shall be kept in good condition and made of materials which can withstand the physical and environmental conditions during storage and transportation. Only properly cleaned containers shall be used for storage of hazardous and other wastes.
7. The occupier handling hazardous or other wastes shall maintain records of such operations of generation, handling, storage and disposal as per Form 3.
8. The hazardous and other wastes generated in the establishment of the occupier shall be sent or sold to an authorised actual user or shall be disposed of in an authorised disposal facility.
9. The occupier handling hazardous or other wastes shall ensure that the hazardous and other wastes are packaged in a manner suitable for safe handling, storage and transport as per the guidelines issued by the Central Pollution Control Board from time to time.
10. The labelling of package of hazardous or other wastes shall be done as per Form 8. The label shall be of non-washable material, weather proof and easily visible.
11. The hazardous and other wastes shall be transported from the occupier's establishment to an authorised actual user or to an authorised disposal facility in accordance with the provisions of these rules.
12. The transport of the hazardous and other wastes shall be in accordance with the provisions of these rules and the rules made by the Central Government under the Motor Vehicles Act, 1988 and the guidelines issued by the Central Pollution Control Board from time to time in this regard.
13. The occupier shall provide the transporter with the relevant information in Form 9, regarding the hazardous nature of the wastes and measures to be taken in case of an emergency and shall label the hazardous and other wastes containers as per Form 8.
14. The authorisation for transport shall be obtained either by the sender or the receiver on whose behalf the transport is being arranged.
15. The transporter/sender of the hazardous and other wastes shall prepare and maintain manifest in Form 10.
16. The occupier or the operator or the transporter shall immediately intimate TNPCB through telephone, e-mail about the accident and subsequently send a report in Form 11, where an accident occurs at the facility of the occupier handling hazardous or other wastes and operator of the disposal facility or during transportation.

### POLLUTION PREVENTION PAYS

அகம் தூய்மை வாய்மைக்கு ! புறம் தூய்மை வாழ்வுக்கு !

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17. The occupier who intends to get its hazardous and other wastes treated and disposed of by the operator of a treatment, storage and disposal facility shall provide the operator of that facility, such specific information as may be needed for safe storage and disposal.
18. The occupier shall be liable for all damages caused to the environment due to improper handling and management of the hazardous and other wastes.
19. The occupier handling hazardous and other wastes shall submit annual returns containing the details specified in Form 4 to TNPCB on or before the 30th day of June of every year for the preceding period April to March.
20. Any increase in quantity of handling of hazardous and other wastes, any change in category of hazardous and other wastes and any change in method of handling operations shall be brought to the notice of the TNPCB and fresh authorization shall be obtained.

#### ADDITIONAL SPECIFIC CONDITIONS

1. The unit shall store the Hazardous materials within a in an earmarked storage area.
2. The unit shall provide a display board for specifying the quantity of hazardous waste received and being bio-remedied at Kamarajar Port Limited.
3. The unit shall maintain FORM III of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 in the premises.
4. The unit shall furnish the FORM IV of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 to the TNPCB, on or before thirtieth June of every year.
5. The unit shall furnish an undertaking or declaration to comply with all provisions including the scope of submitting bank guarantee in the event of spillage, leakage or fire while handling the hazardous and other waste before 31.03.2017.
6. The unit shall provide copy of the Emergency Response Plan (ERP) which should address procedures for dealing with emergency situations (viz. Spillage or release or fire) as specified in the guidelines of Central Pollution Control Board.
7. Proper design and operational aspect of the system shall be provided to ensure that soil and ground water are not contaminated during the process. In this regard the unit shall analyse the soil and ground water samples for parameters such as TPH (Total Petroleum Hydro Carbons) & PAH (Poly Aromatic Hydrocarbons).
8. The oily sludge and residues being bio-remedied shall be analysed for parameters such as , TPH & PAH once in 15 days.
9. Monitoring of ground water shall be carried out through peizometric wells and soil samples shall be collected at appropriate places at regular intervals and it shall be analysed to ascertain that there is no contamination of ground water and soil due to the ongoing bio-remediation process.
10. The bio-remedied sludge shall be scientifically disposed after conducting tests for residual hydrocarbons and heavy metals. The unit shall furnish the characteristics of bio-remedied sludge prior to disposal.
11. If the bio-remediation process is not successfully carried out, the unit shall send the waste to common treatment facility (TSDF) for suitable treatment.
12. Regular sample reports/progress report shall be submitted to the O/o District Environmental Engineer, Ambattur, TNPCB, Chennai.

#### POLLUTION PREVENTION PAYS

அகம் தூய்மை வாழ்வுக்கு ! புறம் தூய்மை வாழ்வுக்கு !



## TAMILNADU POLLUTION CONTROL BOARD

13. The waste barrels / drums shall be disposed to authorised recyclers of TNPCB / TSDF.  
14. For any additional quantity of handling hazardous wastes under the waste category no. 3.1, a separate application shall be made to TNPCB for authorisation.

Member Secretary  
Tamil Nadu Pollution Control Board  
Chennai

To  
Chairman cum Managing Director  
KAMARAJAR PORT LIMITED  
Vallur Post, Chennai.  
Pin:600120

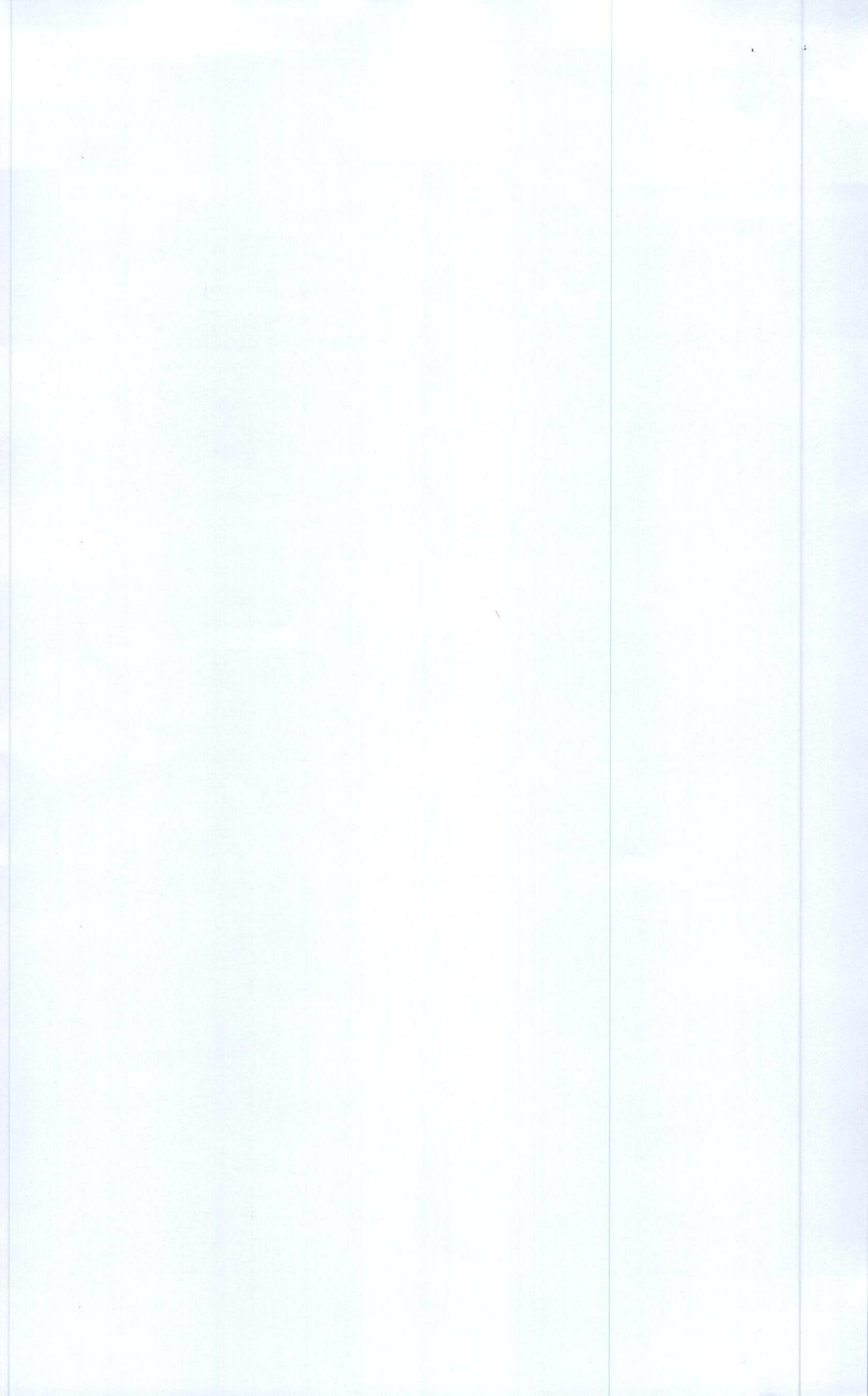
**Copy to:**

1. The JCEE-Monitoring, Tamil Nadu Pollution Control Board, Chennai.
2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, AMBATTUR.

**POLLUTION PREVENTION PAYS**

அகம் தூய்மை வாய்மைக்கு ! புறம் தூய்மை வாழ்வுக்கு !

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ABSTRACT

Environment – Two Cargo ships collided at Ennore Kamarajar Port area – Environment impact due to oil spillage – Formation of Committee to assess environmental impact and suggest remedial measure – Orders – Issued.

ENVIRONMENT AND FORESTS (EC.3) DEPARTMENT

G.O.(D.)No.65

Dated: 14.03.2017

தூன்முுகி பங்குனி, - 1

திருவள்ளூர் ஆண்டு - 2048

Read:

From the Director of Environment Letter RC.No.P1/154/2017, dated 3.2.2017.

ORDER:-

In the letter read above, the Director of Environment has stated that two ships viz., M.T.BW Maple, which is returning from the Ennore Kamarajar Port after unloading LPG and MD Dawn, Kancheepuram, which is carrying Diesel collided at Ennore Kamarajar Port Area on 28.01.2017 about 4.00 a.m. and about 1.5 kms from the coast. He has further reported that there is spillage of oil due to the collision of ships and it is ascertained from the Coast Guard Officials and media reports that the oil slick is spread along the rock beaches of Thiruvallur district besides Marina beach of Chennai and upto Thiruvanniyur of Kancheepuram district. It is also noticed that some Turtles and hatchlings were washed ashore along the Ennore Coast. The fishermen complained that they could not venture into the sea for fishing during the past few days and their livelihood is affected badly. In this connection the Chief Secretary to Government has convened meetings with concerned officials of Central and State Governments on 31.01.2017 and 01.02.2017. After detailed deliberation, among other things, it was suggested to form a committee consisting of experts from various fields to assess the Environmental impact due to the spillage of oil in the sea. The above incident necessitated to assess the following factors:-

(i)	Quantity of leaked oil and its composition, properties etc.
(ii)	The extent of damage caused to the Marine and coastal environment including flora and fauna, at present, in short term and long run.

(iii)	The adverse impact on air, water and sand at present and likely impact in future.
(iv)	The extent of health hazards to the public at present and likely affect in future.

2. The Director of Environment has further stated that the above assessment is essentially required to decide on the following matters:-

(i)	To assess the possibility of recovery of marine eco-system to the original status.
(ii)	To formulate programmes to mitigate and adapt due to adverse impact of the oil spillage and to restore the marine eco system.
(iii)	To carryout health welfare programmes to the affected people.
(iv)	To formulate framework to prevent such incidents in future
(v)	To fix sector wise agencies, institutions, departments and their responsibilities to implement the plans, guidelines including financial implications.

Hence, the Director of Environment has suggested to formulate a Committee to carryout the above task comprising of the experts, environmentalists, institutions, agencies, Departments of concerned sectors.

3. The Government after careful examination of the proposal of the Director of Environment and to approve for formation of a Committee to carryout the above task comprising of the following experts, environmentalists, institutions, agencies, Departments of concerned sectors as detailed below:-

Sl. No.	Composition of the Committee	Designation
1.	Dr.B.R. Subramanian, Member, Tamil Nadu State Coastal Zone Management Authority and Project Director and Scientist "G" (Retired), ICMAM Project Directorate, Ministry of Earth Sciences, Chennai.	Chairman

2.	Dr. Indumathi Nambi, Associate Professor, Division of Water Resources and Environmental Engineering, IIT Madras.	Member
3.	Dr. T.Balasubramanian, Former Member, Tamil Nadu State Coastal Zone Management Authority and Director (Retired), CAS in Marine Biology, Annamalai University.	Member
4.	Dr.S. Srinivasalu, Director, Institute of Ocean Management, Anna University, Chennai.	Member
5.	Dr. Jayashree Vencatesan, Member, Tamil Nadu State Coastal Zone Management Authority.	Member
6.	A Senior Expert nominated from the Central Pollution Control Board.	Member
7.	A Senior Expert nominated from the Tamil Nadu Pollution Control Board.	Member
8.	A Senior Expert / Scientist from the Tamil Nadu Maritime Board, Chennai.	Member
9.	A Senior Expert / Scientist from the Central Marine Fisheries Research Institute, Chennai.	Member
10.	A Senior Expert / Joint Director, nominated from the Fisheries Department, Government of Tamil Nadu.	Member
11.	The Wild Life Warden, Guindy Children's Park, Chennai.	Member
12.	The Additional Director of Department of Environment, Chennai.	Member and Convenor

4. The Committee shall assess the following factors:-

(i)	Quantity of leaked oil and its composition, properties etc.
(ii)	The extent of damage caused to the Marine and coastal environment including flora and fauna, at present, in short term and long run.

(iii)	The adverse impact on air, water and sand at present and likely impact in future.
(iv)	The extent of health hazards to the public at present and likely affect in future.

The committee shall decide on the following matter:-

(i)	To assess the possibility of recovery of marine eco-system to the original status.
(ii)	To formulate programmes to mitigate and adapt due to adverse impact of the oil spillage and to restore the marine eco system.
(iii)	To carryout health welfare programmes to the affected people.
(iv)	To formulate framework to prevent such incidents in future.
(v)	To fix sector wise agencies, institutions, departments and their responsibilities to implement the plans, guidelines including financial implications.

5. The Committee will submit a detailed reports with facts and figures with reference to the items mentioned in para-4 above.

6. The Committee is permitted to conduct meetings, consultations with various agencies, institutions, organizations, fishermen group, NGOs etc., as it deemed necessary, for the purpose of carrying out the task.

7. The Committee may have the site visits/field inspections, in the affected areas.

8. The tenure of the Committee is three months from the date of issue of orders.

9. The Traveling allowance and Dearness Allowance to the expert members shall be permitted as equivalent to the members of the 1<sup>st</sup> class committee of the State Government.

10. A sum of Rs 2000/- (Rupees Two Thousand only) per day may be allowed as sitting fees to the Chairman and Members (Non-officials) of the above Committee, for the days of inspections, meetings and sittings.

11. All the expenditures in respect of above Committee towards performing its duties and responsibilities, administrative expenses, stationery and miscellaneous charges, Travel Allowance, Dearness Allowance, contingencies, sitting fees etc., will be met from and out of the funds available from the relevant head under Coastal Zone Development Fund.

12. The orders issued with the concurrence of Finance Department vide its U.O.10372/Fin(AHD&F)/2017, dated 10.03.2017.

(BY ORDER OF THE GOVERNOR)

Md. NASIMUDDIN  
PRINCIPAL SECRETARY TO GOVERNMENT

To  
The Director of Environment, Chennai - 15.  
The Chairman, Tamil Nadu Pollution Control Board, Chennai - 32.  
All the members Through the Director of Environment, Chennai - 15.

Copy to:-

The Chief Minister's office, Secretariat, Chennai - 9.  
The Special Personal Assistant to Hon'ble Minister (Environment), Chennai - 9.  
The Senior Private Secretary to Government, Environment and Forests Department, Chennai - 9.  
SF/SC.

//Forwarded By Order//

  
Section Officer





DEPARTMENT OF ENVIRONMENT

From  
Dr. H.Mallesappa, I.F.S.,  
Director of Environment,  
Ground Floor, Panagal Building,  
Saidapet, Chennai 600 015

To  
The Chairman,  
Kamarajar Port Limited,  
Rajaji Salai,  
Chennai-01

Annexure - B

Copy: GM(MS)



R.C. No.P1/154/2017-1 dated 31.08.2017

Sir,

Sub: Environment - Two Cargo Ships collided off Ennore Kamarajar Port area on 28.01.2017 - Environment Impact due to oil spillage - Formation of Committee to assess environmental impact and suggest remedial measure - Orders issued - Request to arrange a sum of Rs. 5.68 crores-Regarding

- Ref: 1. G.O. (D) No.65, Environment & Forests (EC.3) Department, dated 14.03.2017  
2. This office letter no. P1/154/2017, dated 19.06.2017  
3. G.O. (3D) No.39, Environment & Forests (EC.3) Department, dated 09.08.2017

\*\*\*\*\*

I wish to inform that the consequence on the collision of two ships off Ennore Kamarajar Port area on 28.01.2017 and the resultant of oil spill, Environment & Forest Department, Govt. of Tamil Nadu have constituted a Committee under the chairmanship of Dr. B.R. Subramanian, Member of Tamil Nadu State Coastal Management Authority (TNSCZMA) and Project Director (Retd.), ICMAM PD, MoES, Chennai to assess the environmental impact and to suggest remedial measures in the G.O. reference 1<sup>st</sup> cited. The committee was entrusted to assess the environmental impact and decide on the following matters

- To assess the possibility of recovery of marine eco-system to the original status
- To formulate programmes to mitigate and adapt due to adverse impact of the oil spillage and to restore the marine eco system.
- To carryout health welfare programmes to the affected people.
- To formulate framework to prevent such incidents in future.
- To fix sector wise agencies, institutions, departments and their responsibilities to implement the plans, guidelines including financial implications.

2) In this regard, the Committee meetings were held on 04.04.2017, 21.04.2017 and 06.06.2017 at Chennai with various stakeholders and discussed the following

Original letter &w  
clones and a CD  
training Report given to  
Council

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factors. The Committee has obtained the following details from various Departments/ Institutions.

- i. Quantity of leaked oil and its composition, properties etc.
- ii. The extent of damage caused to the marine and coastal environment including flora and fauna, at present, in short term and long run.
- iii. The adverse impact on air, water and sand at present and likely impact in future.
- iv. The extent of health hazards to the public at present and likely affect in future

3) The Chairman and Members of the Committee have visited the Kamarajar port Limited on 27.04.2017 to inspect the damaged ship MT DAWN Kanchipuram which caused oil spill on 28th January, 2017 at the sea off Ennore coast, the site at Port where bioremediation of oil sludge collected from the sea & coast in and around Ernavoor coast, is carried out.

4) Accordingly, the committee Members have studied & discussed the above factors and prepared the report on assessment of environmental impact based on the details obtained from the various agencies/ institutions like National Centre for Sustainable Coastal Management(NCSCM), Integrated Coastal and Marine Area Management (ICMAM) Project Directorate, IIT Madras, Tamil Nadu Maritime Board, Institute of Ocean Management, Central Marine Fisheries Research Institute(CMFRI), Kamarajar Port Limited, Chennai Port Trust, Indian Coast Guard , Mercantile Marine Department, Indian Oil Corporation Limited etc. and departments like Forests, Fisheries, Environment, Central Pollution Control Board, Tamil Nadu Pollution Control Board, Public Health and preventive Medicine etc.

5) After the detailed deliberations, the committee has furnished the report on assessment of impact of Oil spill occurred due to collision of two ships in the sea off Ennore, Chennai and the said report has been forwarded to the Government for approval in this office letter dated 19.06.2017. A soft copy of the Expert committee report is enclosed herewith in this regard.

6) In continuation, in the G.O. reference 3<sup>rd</sup> cited (copy enclosed), the Government has accepted the Expert Committee report and requested the Director of Environment to take appropriate action on the consolidated recommendation for prevention, mitigation and assessment of impact of oil spills as suggested by the Expert Committee.

7) In this regard, it is informed that the following items of works are to be taken up through various Department/institution for a sum of Rs. 5.68 crore based on the report of the Expert Committee on assessment of Oil Spill at Ennore , Chennai.

i.	Monitoring of Water quality, sediment and biological parameters for 3 years
ii.	Monitoring of Soil and bore well water quality in the Bio remediation site at KPL for 3 years
iii.	Development of database on Ennore Oil Spill
iv.	Monitoring of marine turtles from Pulicat to Kovalam for 3 years
v.	Long term Monitoring of Coastal birds for 5 Years
vi.	Determination of safe limits of TPH and PAH in marine organisms for 5 years
vii.	Studies on Foraminifera for 3 years
viii.	Monitoring of Epiflora and fauna, Interstitial fauna and benthic faunal population for 5 years after short term monitoring
ix.	Cytogenic effects of oil spill on marine organisms using biomarkers

8) Also, it is informed that the Government has directed the Department of Environment to approach the port Authorities for funding of Rs.5.68 crores to carryout the above activities as indicated in the Expert Committee Report, under Phase -I initially.

9) Hence, it is requested to arrange for the funding of Rs.5.68 crores and disburse to the Department of Environment by means of Demand Draft in favour of " Director of Environment, Chennai-15" at the earliest, as suggested by the Government, so as to carry out the Phase I activities recommended by the Expert Committee , through Various Department/Institutions effectively.

10) I request to arrange for early funding and intimate the fact at the earliest.

Encl: As above

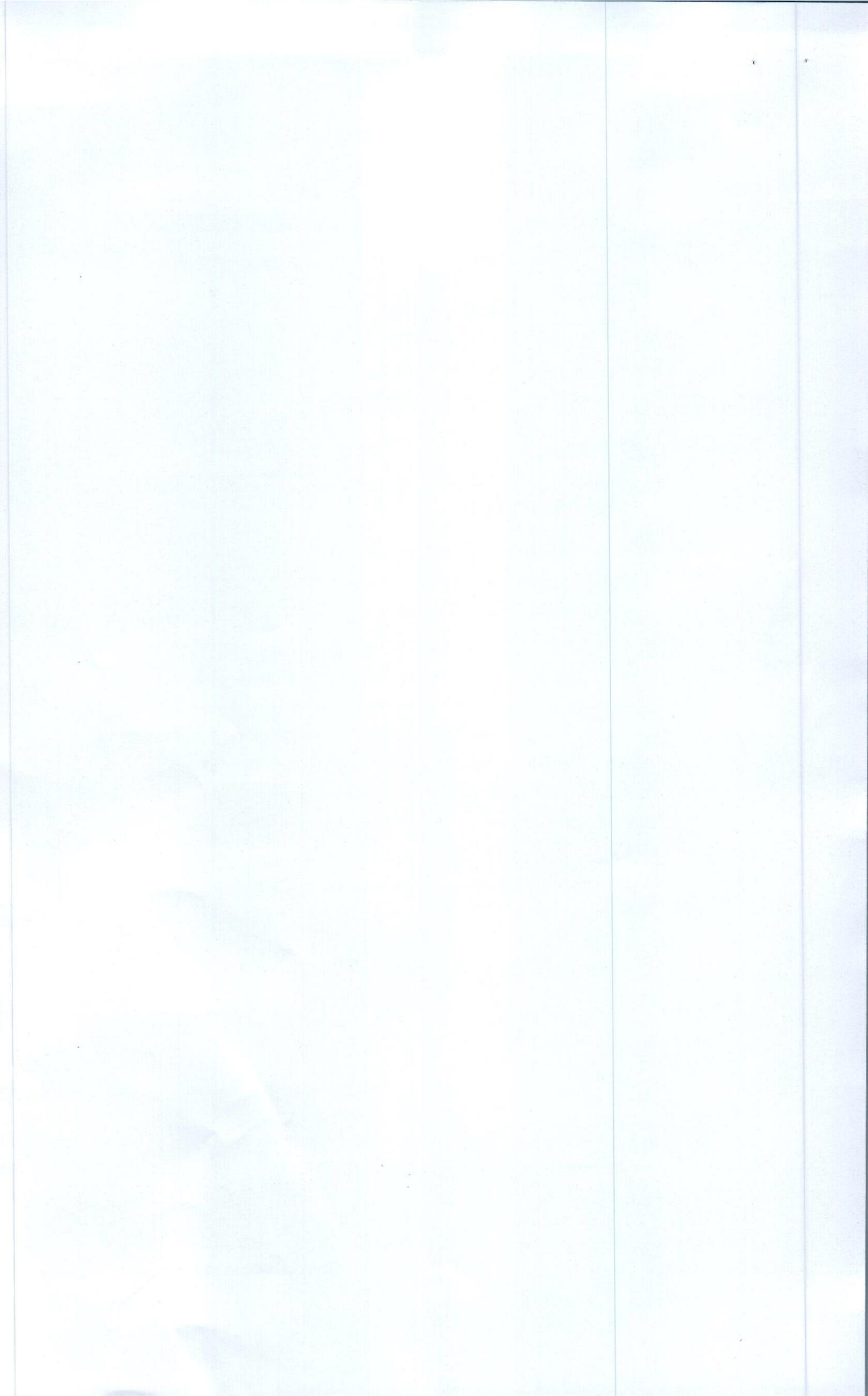
Yours faithfully,  
Sd./-H.Malleshappa,  
Director of Environment

//Forwarded by Order//

*S. Pandian*  
31/08/2017  
For Director of Environment

*A*  
31/8/17

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TAMILNADU POLLUTION CONTROL BOARD



Handwritten notes and stamps: 05/10/19, 1194, 30/11/19, and other illegible markings.

AUTHORISATION No. 19HRC27210863 dated 16/09/2019

Proceeding No. TI/TNPCB/F.0304GMP/HWA/RL/GMP/2019 dated 16/09/2019

Sub: Tamil Nadu Pollution Control Board – Hazardous Waste Authorization-Renewal- M/s. KAMARAJAR PORT LIMITED. S.F.No. 1/2A2, 2B, 3A2 Puzuthivakkam Village. 1/3A2,7/3B2,1/3C2 etc. in Ennore Village, PUZHUTHIVAKKAM Village, PONNERI Taluk, Tiruvallur District - Authorization under Rule 6 (2) of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 enacted under Environment (Protection) Act, 1986 – Issued- Reg.

Ref: 1. Bd. proc No. TI/TNPCB/F.0304GMP/HWA/RL/ GMP/2018 dated 07.08.2018  
2. Unit's Application No. 27210863 Dated: 16.07.2019  
3. HWA-IR.No.0304GMP/HWA/RL/DEE/GMP/2019 dated 13.08.2019

FORM 2

[See rule 6 (2)]

FORM FOR GRANT OR RENEWAL OF AUTHORISATION TO THE OCCUPIERS RECYCLERS, REPROCESSORS, REUSERS, USER AND OPERATORS OF DISPOSAL FACILITIES

- 1. Number of authorization: 19HRC27210863 and dated : 16/09/2019
- 2. Chairman cum Managing Director of M/s. KAMARAJAR PORT LIMITED is hereby granted an Authorisation based on the enclosed signed Inspection report for Collection, Storage, Transportation and disposal of hazardous or other wastes or both on the premises situated at S.F.No. 1/2A2, 2B, 3A2 Puzuthivakkam Village. 1/3A2,7/3B2,1/3C2 etc. in Ennore Village, PUZHUTHIVAKKAM Village PONNERI Taluk, Tiruvallur District.

Table with 5 columns: Sl No, Schedule / Name of the Processes, Name of Hazardous Waste (with category No), Quantity, and Activities for which Authorization is issued. It contains 3 rows of data regarding hazardous waste disposal.

3. This authorization shall be valid for a period upto 15/09/2020.

The Authorization is issued subject to the following general and special conditions annexed

Handwritten signature

R. Kannan

Digitally signed by R. Kannan Date: 2019.09.23 12:31:55



## TAMILNADU POLLUTION CONTROL BOARD

2. The authorization or its renewal shall be produced for inspection at the request of an officer authorized by Tamil Nadu Pollution Control Board.
3. The person authorized shall not rent, lend, sell, transfer or otherwise transport the hazardous and other wastes except what is permitted through this Authorisation.
4. Any unauthorized change in personnel, equipment or working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorization.
5. The person authorised shall implement Emergency Response procedure (ERP) for which this authorisation is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc and their possible impacts and also carry out mock drill in this regard at regular interval of time.
6. The person authorised shall comply with the provisions outlined in the CPCB guidelines on "Implementing Liabilities for Environmental damages due to Handling and Disposal of Hazardous Wastes and Penalty".
7. It is the duty of the authorized person to take prior permission of Tamil Nadu Pollution Control Board to close down the facility.
8. The imported Hazardous and other wastes shall be fully insured for transit as well as the accidental occurrences and its clean-up operation.
9. The record of consumption and fate of the imported hazardous and other wastes shall be maintained.
10. The Hazardous and other wastes which gets generated during recycling or reuse or recovery or pre-processing or utilisation of imported hazardous or other wastes shall be treated and disposed of as per specific conditions of Authorisation.
11. The importer or Exporter shall bear the cost of import or export or mitigation of damages if any.
12. An application for the renewal of an authorization shall be made as laid down under these Rules.
13. Any other conditions for compliance as per the Guidelines issued by the MoEF and CC or CPCB from time to time.
14. Annual returns shall be filed by June 30th for the period ending 31st March of the previous financial year.

### B. SPECIFIC CONDITIONS - HW Generator

1. The occupier/generator shall be responsible for safe and environmentally sound management of hazardous and other wastes.
2. The occupier shall follow the following steps for the management of hazardous and other wastes. (a) prevention (b) minimization (c) reuse (d) recycling (e) recovery, utilisation including co-processing and (f) safe disposal
3. The occupier shall take all the steps while managing hazardous and other wastes - (a) To contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and (b) To provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety.
4. The occupier shall store the hazardous and other wastes for a period not exceeding ninety days and shall maintain a record of sale, transfer, storage, recycling, recovery, pre-processing, co-processing and utilisation of such wastes and make these records available for inspection:
5. The hazardous and other wastes shall be stored temporally in an isolated area earmarked for the purpose within the occupier's premises (it shall not be accessible to rain water) till scientific disposal. The storage area shall be fenced properly and a sign of danger shall be placed at the storage site.
6. The containers holding the hazardous and other wastes shall be kept in good condition and made of materials which can withstand the physical and environmental conditions during storage and transportation. Only properly cleaned containers shall be used for storage of hazardous and other wastes.
7. The occupier handling hazardous or other wastes shall maintain records of such operations of generation, handling, storage and disposal as per Form 3.



## TAMILNADU POLLUTION CONTROL BOARD

10. The labelling of package of hazardous or other wastes shall be done as per Form 8. The label shall be of non-washable material, weather proof and easily visible.
11. The hazardous and other wastes shall be transported from the occupier's establishment to an authorised actual user or to an authorised disposal facility in accordance with the provisions of these rules.
12. The transport of the hazardous and other wastes shall be in accordance with the provisions of these rules and the rules made by the Central Government under the Motor Vehicles Act, 1988 and the guidelines issued by the Central Pollution Control Board from time to time in this regard.
13. The occupier shall provide the transporter with the relevant information in Form 9, regarding the hazardous nature of the wastes and measures to be taken in case of an emergency and shall label the hazardous and other wastes containers as per Form 8
14. The authorisation for transport shall be obtained either by the sender or the receiver on whose behalf the transport is being arranged.
15. The transporter/sender of the hazardous and other wastes shall prepare and maintain manifest in Form 10.
16. The occupier or the operator or the transporter shall immediately intimate TNPCB through telephone, e-mail about the accident and subsequently send a report in Form 11, where an accident occurs at the facility of the occupier handling hazardous or other wastes and operator of the disposal facility or during transportation
17. The occupier who intends to get its hazardous and other wastes treated and disposed of by the operator of a treatment, storage and disposal facility shall give to the operator of that facility, such specific information as may be needed for safe storage and disposal.
18. The occupier shall be liable for all damages caused to the environment due to improper handling and management of the hazardous and other wastes.
19. The occupier handling hazardous and other wastes shall submit annual returns containing the details specified in Form 4 to TNPCB on or before the 30th day of June of every year for the preceding period April to March.
20. Any increase in quantity of handling of hazardous and other wastes, any change in category of hazardous and other wastes and any change in method of handling operations shall be brought to the notice of the TNPCB and fresh authorization shall be obtained.

### ADDITIONAL SPECIFIC CONDITIONS

#### a. Waste Streams 3.3 - Sludge and filters contaminated with oil

1. Waste Streams 3.3 - Sludge and filters contaminated with oil – 15 T comprising of oil contaminated waste like booms, gumboots, shoes, cloths etc received from various locations from the coast cleaning operations after the oil spill incident shall be disposed to the Common Treatment Storage & Disposal facility operated by Tamilnadu Waste Management Limited.

2. The unit shall provide copy of the Emergency Response Plan (ERP) which should address procedures for dealing with emergency situations (viz. Spillage or release or fire) to the transporter of the wastes as specified in the guidelines of Central Pollution Control Board.

3. The waste shall be disposed to the Common Treatment Storage & Disposal facility within 60 days.

#### b. Waste Stream 3.1-Cargo residue, washing water and sludge containing oil :

Waste Stream 3.1-Cargo residue, washing water and sludge containing oil 55KL mainly comprising of the slimy sludge collected from various locations from the coast cleaning operations after the oil spill incident shall be disposed by bio remediation along with waste stream 3.3 - Sludge and filters contaminated with oil 225 T comprising of oil contaminated sand received from the coast cleaning operations shall be disposed and treated by bio remediation at the designated area using Oilivorous bacterial Culture by involving M/s. India Oil Corporation Limited which had assisted the Port in bio remediation earlier. Subject to the following



## TAMILNADU POLLUTION CONTROL BOARD

4. Proper disposal of treated sludge shall be decided by conducting tests for residual hydrocarbons and metals and the unit shall furnish the characteristics of remedied sludge and scientific proposal for disposal. Of the same
  5. ROA of the sludge remedied, Monitoring Bore Well Samples and reports pertaining to progress in the bio remediation process shall be submitted to the O/o District Environmental Engineer, Gummidipoondi, TNPCB, Chennai.
  6. The unit shall furnish a certificate/report endorsing the completion of the bio-remediation operation once the bio remediation process is completed.
- c. Other Conditions to be complied with
1. The Port shall ensure that all relevant provisions of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 are complied with.
  2. The Port shall maintain the records of generation of hazardous waste in Form 3 and shall furnish the copy of the manifest in Form 10 endorsed by the dispatcher, transporter and receiver of Hazardous wastes.
  3. The Port shall furnish the Annual returns in Form 4 of the Rules to the Board on or before 30th June for the previous year from April to March.
  4. The authorization is subject to such conditions as may be specified in the Rules for the time being in force under the Environment (Protection) Act, 1986 and the conditions mentioned in the Schedule A& B.
- d. The unit shall furnish the quarterly progress report of Bio remediation along with the compliance status of the conditions stipulated in the Authorisation to the Board with a copy marked to DEE/Gummidipoondi.

R. Kannan

Digitally signed by R. Kannan  
Date: 2019.09.23 17:31:55  
+05'30'

For Member Secretary  
Tamil Nadu Pollution Control Board  
Chennai

To  
Chairman cum Managing Director  
KAMARAJAR PORT LIMITED  
Vallur Post, Chennai.  
Pin:600120

**Copy to:**

1. The JCEE-Monitoring, Tamil Nadu Pollution Control Board, Chennai.
  2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, GUMMIDIPOONDI.
-



காமராஜர் துறைமுக நிறுவனம்

कामराजर पोर्ट लिमिटेड

Kamarajar Port Limited

(A Mini Ratna Government of India Undertaking)

KPL/MS/Env/HW/2017

Date: 08.01.2018

To

The Member secretary,  
Tamil Nadu pollution Control Board,  
76, Mount Salai, Guindy,  
Chennai- 600 032.

Kind Attention: Thiru.N.Sundara Gopal, M.E

**Sub:** M/s. Kamarajar Port Limited-Hazardous Waste Management- Status report on compliance of conditions imposed in the Authorization-Forwarded-Reg.

**Ref:** Lr.No:TS1/TNPCB/F.044/AMB/HWA/RL/AMB/2017 dated: 13.12.2017.

Sir,

Please find enclosed compliance report on the conditions imposed in the Authorization.

About 159.35 KL of sludge oil and oil mixed seawater and 25.075 MT of oil contaminated sand totaling to 184.425 MT was treated with bio-remediation.

About 54.60 KL of sludge oil and oil mixed with sea water and about 225.58 MT Oil contaminated sand is still left for disposal at Kamarajar port. About 11.70 KL of skimmed oil is stored in barrels inside port.

However, Kamarajar Port requests TNPCB to accord permission for the disposal of the balance quantity of oily sludge, oil contaminated sand and skimmed oil through TSDF facility, M/s. Tamil Nadu Waste Management Limited at Gumudipoondi.

Thanking you.

Yours sincerely,

*(Signature)*

General Manager (Marine Services)

Registered Office & Trade Facilitation Centre :  
2<sup>nd</sup> Floor, (North Wing) & 3<sup>rd</sup> Floor,  
Jawahar Building,  
17, Rajaji Salai, Chennai - 600 001.  
Ph : 044-25251666-70 Fax : 044-25251665  
CIN: U45203TN1999GOI043322

पंजीकृत कार्यालय & व्यवसाय सुविधा केन्द्र :  
दूसरी मंजिल, (उत्तर विंग) & तीसरी मंजिल,  
जवाहर बिल्डिंग,  
17, राजाजी सलाई, चेन्नई-600 001.  
फोन : 044-25251666-70 फैक्स : 044-25251665

Port Office : Vallur Post, Chennai - 600 120  
Ph : 044-27950030-40 Fax : 044-27950002

पोर्ट कार्यालय : वल्लूर पोस्ट, चेन्नई - 600 120  
फोन : 044-27950030-40 फैक्स : 044-27950002

website : www.kamarajarport.in e-mail : info@kplmail.in  
Kamarajar Port - India's Port of the Millennium

Sub: Kamarajar Port Limited- Compliance report to the conditions mentioned in the authorization given for Hazardous wastes. AUTHORISATION NO. 17HFC8126640 dated 15/02/2017. Proceeding No. T5/TNPCB/F.004AMB/HWA/RL/AMB/2017 dated 15/02/2017

**GENERAL CONDITIONS**

S. No	General Conditions of Authorization	Compliance status
1	The authorised person shall comply with the provisions of the Environment (Protection) Act, 1986 and the rules made there under.	Noted.
2	The authorization or its renewal shall be produced for inspection at the request of an officer authorized by Tamil Nadu Pollution Control Board.	Noted.
3	The person authorized shall not rent, lend, sell, transfer or otherwise transport the hazardous and other wastes except what is permitted through this Authorisation.	Noted.
4	Any unauthorized change in personnel, equipment or working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorization.	Noted. No change in personnel, equipment or working condition.
5	The person authorised shall implement Emergency Response procedure (ERP) for which this authorisation is being granted considering all site specific possible scenarios such as spillages, leakages, fire ,etc and their possible impacts and also carry out mock drill in this regard at regular interval of time.	Complied. Port is regularly carrying out mock fire drills at various locations inside the port. The present bio-remediation pit/storage of waste is near the port fire station and it is monitored continuously.
6	The person authorised shall comply with the provisions outlined in the CPCB guidelines on "Implementing Liabilities for Environmental damages due to Handling and Disposal of Hazardous Wastes and Penalty".	Noted.

7	It is the duty of the authorized person to take prior permission of Tamil Nadu Pollution Control Board to close down the facility.	Noted.
8	The imported Hazardous and other wastes shall be fully insured for transit as well as the accidental occurrences and its clean-up operation.	No hazardous waste is imported. The oily sludge and contaminated sand collected from various coasts was brought to port for treatment using bio-remediation
9	The record of consumption and fate of the imported hazardous and other wastes shall be maintained.	No hazardous waste is imported. The oily sludge and contaminated sand collected from various coasts was brought to port for treatment/disposal. Records of quantity of oily sludge and contaminated sand brought to port are maintained.
10	The Hazardous and other wastes which gets generated during recycling or reuse or recovery or preprocessing or utilisation of imported hazardous or other wastes shall be treated and disposed of as per specific conditions of Authorisation.	No hazardous waste is imported. The oily sludge and contaminated sand collected from various coasts are treated by bio-remediation method.
11	The importer or Exporter shall bear the cost of import or export or mitigation of damages if any.	Not applicable. No import/export of hazardous material.
12	An application for the renewal of an authorization shall be made as laid down under these Rules.	Noted.
13	Any other conditions for compliance as per the Guidelines issued by the MoEF and CC or CPCB from time to time.	Noted.
14	Annual returns shall be filed by June 30th for the period ending 31st March of the previous financial year.	Noted.

**SPECIFIC CONDITIONS**

S.No	Specific Conditions- Generator	HW	Compliance status
1	The occupier/generator shall be responsible for safe and environmentally sound management of hazardous and other wastes.		Noted.
2	The occupier shall follow the following steps for the management of hazardous and other wastes. (a) prevention (b) minimization (c) reuse (d) recycling (e) recovery, utilisation including co-processing and (f) safe disposal.		Noted. The oily sludge and contaminated sand collected from various coasts was brought to port for treatment using bio-remediation.  The empty barrels are disposed to TSDF facility at Gummudipoondi.
3	The occupier shall take all the steps while managing hazardous and other wastes - (a) To contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and (b) To provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety.		Complied. Provided necessary safety measures.
4	The occupier shall store the hazardous and other wastes for a period not exceeding ninety days and shall maintain a record of sale, transfer, storage, recycling, recovery, pre-processing, co-processing and utilisation of such wastes and make these records available for inspection.		Records of quantity of oily sludge and contaminated sand collected from various coasts and brought to port are maintained.
5	The hazardous and other wastes shall be stored temporally in an isolated area earmarked for the purpose within the occupier's		Complied. Hazardous and other wastes were isolated and fenced. Sign board is installed.

	premises (it shall not be accessible to rain water) till scientific disposal. The storage area shall be fenced properly and a sign of danger shall be placed at the storage site.	
6	The containers holding the hazardous and other wastes shall be kept in good condition and made of materials which can withstand the physical and environmental conditions during storage and transportation. Only properly cleaned containers shall be used for storage of hazardous and other wastes.	The oily sludge is kept in closed container (barrel) in good condition.
7	The occupier handling hazardous or other wastes shall maintain records of such operations of generation, handling, storage and disposal as per Form 3.	Records of quantity of oily sludge and contaminated sand collected from various coasts and brought to port are maintained. Similarly the quantity of oily waste and contaminated sand treated using bio-remediation, balance quantity left for treatment are maintained.
8	The hazardous and other wastes generated in the establishment of the occupier shall be sent or sold to an authorised actual user or shall be disposed of in an authorised disposal facility.	The collected oily sludge and contaminated sand is treated using bio-remediation by M/s. IOCL.  The empty barrels with traces of hazardous waste were sent to M/s. TNWML at Gummudipoondi.
9	The occupier handling hazardous or other wastes shall ensure that the hazardous and other wastes are packaged in a manner suitable for safe handling, storage and transport as per the guidelines issued by the Central Pollution Control Board from time to time.	The oily sludge is stored in closed containers. Other waste are properly covered and stored.

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10	The labelling of package of hazardous or other wastes shall be done as per Form 8. The label shall be of non-washable material, weather proof and easily visible.	Complied. The empty barrels with traces of hazardous waste were sent to M/s. TNWML at Gummudipoondi. The manifest Form 8 is maintained.
11	The hazardous and other wastes shall be transported from the occupier's establishment to an authorised actual user or to an authorised disposal facility in accordance with the provisions of these rules.	Complied. The empty barrels with traces of hazardous waste were sent to M/s. TNWML at Gummudipoondi, an authorized agency.
12	The transport of the hazardous and other wastes shall be in accordance with the provisions of these rules and the rules made by the Central Government under the Motor Vehicles Act, 1988 and the guidelines issued by the Central Pollution Control Board from time to time in this regard.	Complied. The empty barrels with traces of hazardous waste were sent to M/s. TNWML at Gummudipoondi, an authorized agency.
13	The occupier shall provide the transporter with the relevant information in Form 9, regarding the hazardous nature of the wastes and measures to be taken in case of an emergency and shall label the hazardous and other wastes containers as per Form 8.	Complied. The empty barrels with traces of hazardous waste were sent to M/S. TNWML at Gummudipoondi. The manifest Form 8 and 9 is maintained.
14	The authorisation for transport shall be obtained either by the sender or the receiver on whose behalf the transport is being arranged.	Noted. KPL has obtained authorization from TNPCB for the Hazardous waste.
15	The transporter/sender of the hazardous and other wastes shall prepare and maintain manifest in Form 10.	Complied. The empty barrels with traces of hazardous waste were sent to M/S. TNWML at Gummudipoondi. The manifest Form 10 is maintained.
16	The occupier or the operator or the transporter shall immediately intimate TNPCB through telephone, e-mail about the accident and subsequently send a report in Form	Noted.

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	11, where an accident occurs at the facility of the occupier handling hazardous or other wastes and operator of the disposal facility or during transportation.	
17	The occupier who intends to get its hazardous and other wastes treated and disposed of by the operator of a treatment, storage and disposal facility shall give to the operator of that facility, such specific information as may be needed for safe storage and disposal.	Noted. The oily waste was stored in closed containers.
18	The occupier shall be liable for all damages caused to the environment due to improper handling and management of the hazardous and other wastes.	Noted.
19	The occupier handling hazardous and other wastes shall submit annual returns containing the details specified in Form 4 to TNPCB on or before the 30th day of June of every year for the preceding period April to March.	Noted.
20	Any increase in quantity of handling of hazardous and other wastes, any change in category of hazardous and other wastes and any change in method of handling operations shall be brought to the notice of the TNPCB and fresh authorization shall be obtained.	Noted. Any increasing quantity of handling or change in methodology will be carried out after getting authorization from TNPCB.

**ADDITIONAL SPECIFIC CONDITIONS**

S. No	Additional Specific Conditions	Compliance status
1	The unit shall store the Hazardous materials within a in an earmarked storage area.	Complied. Hazardous materials stored in earmarked area.
2	The unit shall provide a display board for specifying the quantity of hazardous waste received and being bio-remedied at Kamarajar Port Limited.	Complied. The display board mentioning the quantity of hazardous waste received and being bio-remedied at Kamarajar Port Limited is placed.
3	The unit shall maintain FORM III of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 in the premises.	Noted. Records of quantity of oily sludge and contaminated sand collected from various coasts and brought to port are maintained. Similarly the quantity of oily waste and contaminated sand treated using bio-remediation, balance quantity left for treatment are maintained. The ground Water quality is monitored surrounding the bio-remediation pit.
4	The unit shall furnish the FORM IV of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 to the TNPCB, on or before thirtieth June of every year.	Noted. However this is a one time authorization accorded by TNPCB for the treatment of oily sludge and oil contaminated sand using bio-remediation.
5	The unit shall furnish an undertaking or declaration to comply with all provisions including the scope of submitting bank guarantee in the event of spillage, leakage or fire while handling the hazardous and other waste before 31.03.2017.	Noted.
6	The unit shall provide copy of the Emergency Response Plan (ERP) which should address procedures for dealing with emergency situations	Noted. Port is having a Disaster Management Plan with addressed aspects of fire, spillage, Tsunami,

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	(viz. Spillage or release or fire) as specified in the guidelines of Central Pollution Control Board.	earth quake, etc.
7	Proper design and operational aspect of the system shall be provided to ensure that soil and ground water are not contaminated during the process. In this regard the unit shall analyse the soil and ground water samples for parameters such as TPH (Total Petroleum Hydro Carbons) & PAH (Poly Aromatic Hydrocarbons).	<p>Complied.</p> <p>The bio-remediation is being carried out by M/s. IOCL.</p> <p>The design of the pit and treatment of waste was done by M/s. IOCL. The bio-remediation is monitored by M/s. IOCL.</p> <p>The results of analysis of TPH and PAH content of the soil at different intervals during the period 21.02.2017 to 25.09.2017 is given in the final report - Bioremediation of oil sludge and oil contaminated sand at KPL, submitted by M/s. IOCL, R&amp;D centre. The said report is enclosed as <b>Annexure-I</b>.</p>
8	The oily sludge and residues being bio-remedied shall be analysed for parameters such as TPH & PAH once in 15 days.	<p>The results of analysis of TPH and PAH content of the soil at different intervals during the period 21.02.2017 to 25.09.2017 is given in the final report - Bioremediation of oil sludge and oil contaminated sand at KPL, submitted by M/s. IOCL, R&amp;D centre. The said report is enclosed as <b>Annexure-I</b>.</p>
9	Monitoring of ground water shall be carried out through peizometric wells and soil samples shall be collected at appropriate places at regular intervals and it shall be analysed to ascertain that there is no contamination of ground water and soil due to the ongoing bio-remediation process.	<p>The results of the ground water monitoring carried out during the period 23.3.2017 to 29.4.2017 by M/s. Richardson &amp; Cruddass are enclosed as <b>Annexure -II</b>.</p> <p>The results of the ground water monitoring for oil content carried</p>

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		<p>out during the period 08.3.2017 to 25.9.2017 is given in the final report - Bioremediation of oil sludge and oil contaminated sand at KPL, submitted by M/s. IOCL, R&amp;D centre. The said report is enclosed as <b>Annexure-I</b>.</p> <p>The results of the ground-water monitoring for heavy metals carried out during the period of March to July 2017 (bi-monthly monitoring) by M/s. IOCL is enclosed as <b>Annexure-I</b>.</p>
10	The bio-remedied sludge shall be scientifically disposed after conducting tests for residual hydrocarbons and heavy metals. The unit shall furnish the characteristics of bio-remedied sludge prior to disposal.	Noted.
11	If the bio-remediation process is not successfully carried out, the unit shall send the waste to common treatment facility (TSDF) for suitable treatment.	Noted.
12	Regular sample reports/progress report shall be submitted to the O/o District Environmental Engineer, Ambattur, TNPCB, Chennai.	Noted.
13	The waste barrels / drums shall be disposed to authorised recyclers of TNPCB /TSDF.	Complied. Port has disposed empty barrels to M/s. TNWML at Gummudipoondi.
14	For any additional quantity of handling hazardous wastes under the waste category no. 3.1, a separate application shall be made to TNPCB for authorisation.	Noted.

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**Bioremediation of Oil Sludge and Oil  
Contaminated Sand from Ennore Port,  
at Kamarajar Port Limited (KPL),  
Chennai**

**Final Report**



**Indian Oil Corporation Ltd.  
R & D Centre, Sector -13,  
Faridabad - 121 007 Haryana**

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## EXECUTIVE SUMMARY

On January 28, 2017, two cargo ships, the Maple and the Dawn Kanchipuram, with heavy furnace or bunker oil collided at Ennore port in Chennai causing bunker oil to spill into the sea. The spilled oil reached to the beaches with waves contaminating the soil. The spilled oil sludge was collected along with contaminated soil and its suitable disposal in environmental friendly manner was urgently required. On advice of MoP&NG, IOC R&D undertook the disposal of oil sludge and oil contaminated sand generated from the cleaning operation of oil spill at Ennore port, Chennai using well established **indigenous environment friendly bioremediation technology (IOC, R&D Bio-remediation Technology)**. The bioremediation of around 184 MT of oil sludge and oil contaminated sand was initiated on 06.02.2017 at Kamarajar Port Limited (KPL), Chennai premises in consultation with Tamilnadu State Pollution Control Board (TNSPCB) as per mutually agreed methodology. Subsequently, to monitor the performance of process, composite samples from bioremediation site were collected at every 15<sup>th</sup> day and analyzed for solvent extractable total petroleum hydrocarbon (TPH) i.e., oil content and Polycyclic aromatic hydrocarbon (PAH) content. The TPH was analyzed by our in-house developed stringent method as well as using EPA method. It was found that after 121 days, the TPH content in the bioremediation site was much less than 1%, which is suitable for disposal from environmental pollution point of view (Ref: US EPA report **DE-FG22-95MT95018-01**). The TPH after 230 days of bio-remediation further got reduced to 0.4%, as per the indigenous developed method. However, the TPH after 230 days found to be 0.039% as per standard method 9071B of EPA SW-846. Vegetation has started growing fully on the site similar to vegetation growing in adjacent soil. The heavy metal in the bio-remediation soil at the site and the leachate of the residual oily sludge collected from the bioremediation site was analyzed and found that the heavy metal concentration are within the permissible limits of Health & Safety at Work (HSW) Management Act 2016. The soil characteristics of the bioremediation site were also analyzed and no

deterioration has been observed. Further, the quality of groundwater was also monitored and analyzed at the bioremediation site. It was found that there is no contamination of the underground water quality at the bioremediation site and water quality is as per the BIS/WHO as well as EPA (LIE) limits. The soil & water sample were also got analyzed by the third party M/s Shree Ram Research Institute, New Delhi and found to be within the permissible limits. Based upon the detailed analysis results of soil & water, it can be concluded that the bioremediation of the 184 MT of oil sludge /oil contaminated sand has been completed successfully and the site can be used for suitable vegetation.

# INTRODUCTION

## 1.0 THE ISSUE

On January 28, 2017, two cargo ships, the Maple, having offloaded LPG, and on its way out, and the Dawn Kanchipuram, with heavy furnace or bunker oil, and coming in, collided at Ennore port in Chennai causing bunker oil to spill into the sea (**Figure-1**). The spilled oil reached to the beaches with waves contaminating the soil. The spilled oil sludge was collected along with contaminated soil and its disposal in environment friendly manner was an issue.



**Figure 1: Oil spill at Ennore beach**

IOC R&D has a bioremediation technology which is a well established and in the last ten years more than 90000 metric ton of oily sludge at various oil installations including marketing and refinery locations have been successfully treated using this technology. In view of this, MoP&NG advised IOC R&D to take up the bioremediation of oily sludge getting generated from the cleaning operation of oil spill at Chennai Ennore port using IOC's indigenous bioremediation technology.

## 1.1 Bioremediation Process

Bioremediation consists of using naturally occurring living organisms (usually bacteria, fungi, actinomycetes, cyanobacteria and to a lesser extent, plants) to reduce or eliminate toxic pollutants. These organisms may be naturally occurring or laboratory cultivated. The microorganisms break down, or degrade, hazardous substances into less toxic or nontoxic substances. Microorganisms, just like humans, eat and digest organic substances for nutrients and energy. The microorganisms break down the organic contaminants into harmless products—mainly carbon dioxide and water (Figure-2).

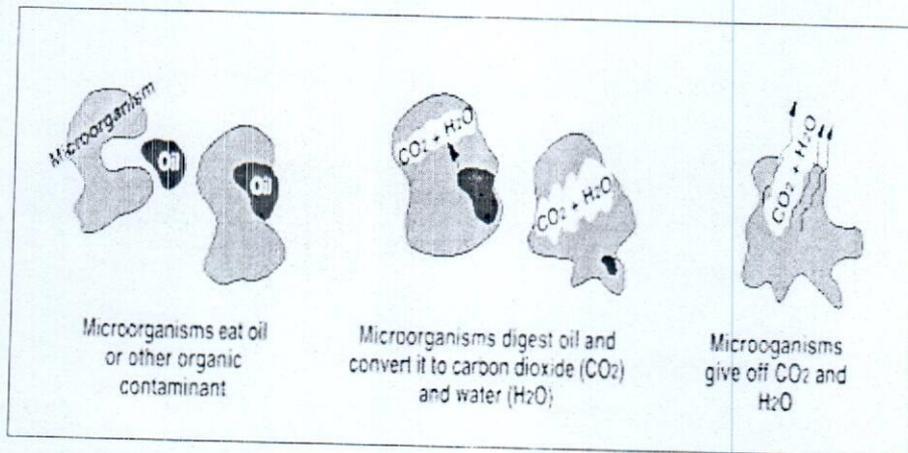


Figure 2: Schematic Diagram of Aerobic Biodegradation in Soil

## 1.2 The Technology

IOC, R&D has indigenously developed bioremediation technology called Oilivorous Technology based on combination of bio-augmentation and bio-stimulation for environment friendly and cost effective disposal of various types of oily sludges. The technology involves the use of microbial blend of natural isolates that are specifically adapted to degrade various types of hydrocarbons in soil and water. This technology has widely been used for the bioremediation of oily sludges generated in refineries and drill cutting industry. The technology has further been suitably optimized for the bioremediation of sludge generated from oil spills. Depending upon the type and location of contaminants, various variants

of this process developed and duly protected by several patents filed by IndianOil are put in practice. This technology has also been recommended by Central Pollution Control Board and is under IPR protection. It has been widely recognized and accredited with several technology awards like:

- NPMP (National Petroleum Management Programme) for Creativity and Innovation, 2003
- IP (Institute of Petroleum, UK) Technology Award, 2003
- Greentech award for Environmental Excellence, 2003
- ADNOC HSE, 2006
- Golden Peacock Innovation Award, 2010

It has also been successfully used at Paradip port in India when oil spill occurred due to sinking of Blackrose, an oil vessel in September 2009. This was perhaps the first time that the bioremediation technology was used on marine soils in India. Further, during the oil spill at Mumbai in 2010 when MSC Chitra, carrying 1200 cargo containers, 2600 tonnes of fuel and 88 tonnes of lubricants, collided with bulk carrier Khalija off the Mumbai coast and oil spilled in Mumbai coast, this technology was successfully employed using specially prepared microbial blend to sustain high salinity. Proprietary nutrient recipe was also used to hasten the break-down of hydrocarbon contaminants.

The technology has got approval from various state pollution control boards like Rajasthan, Maharashtra, Punjab, Haryana and Tamilnadu for disposal of oily sludge in past. Moreover about 50000 Tons of oily sludge has been successfully treated using this R&D Bio-remediation technology in India.

# METHODOLOGY

## 2.0 Authorization:

Subsequent to submitting required documents, authorization for conducting bioremediation through IOC developed technology was obtained from TNSPCB (Annexure-1).

## 2.1 Selection of sites and initiation of bioremediation

IOC R&D scientists visited the site on Feb 1, 2017 to explore the possibility of use of bioremediation technology for the disposal of oil sludge/sand generated during oil spill. Meanwhile, a 500 kg of Bio-inoculum and 100 kg of optimized nutrient was air lifted to Chennai (Figure-3). Subsequently, IOC R&D scientists in consultation with TN state pollution control Board (TNSPCB) and Kamarajar Port Ltd (KPL) representatives finalized the location for the bioremediation at KPL. The site preparation, sampling and monitoring details are given in Annexure-2.

Accordingly, bioremediation site was prepared by removing the grass and stones and adding soils in the form of a single block. A pit of 200x15 meter size and one foot deep was prepared (Figure-4) and HDPE sheets were laid down in the pit to avoid any percolation of oil in the ground below the pit (Figure-5). Layer of normal soil was spread on the HDPE sheet and 184 MT of oil sludge and oil-contaminated soil was mixed with normal soil in the pit (Figure-6). Soil and oil were mixed properly with around 400 Kg of R&D developed bio-inoculum/nutrient (Figure-7). The site was barricaded and identified properly. Tiling and watering of bioremediation site is being done once in a week by IOC (M).

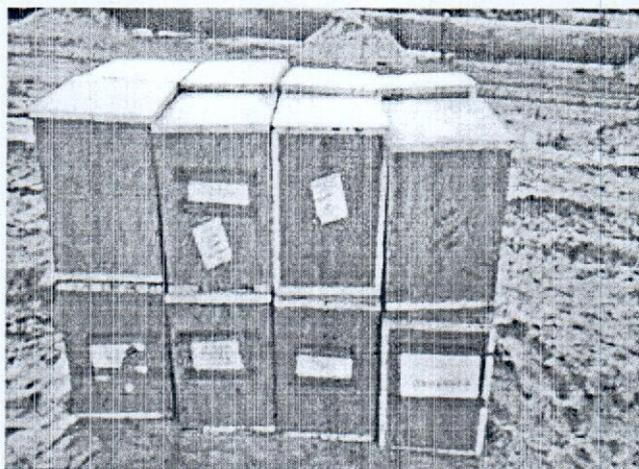


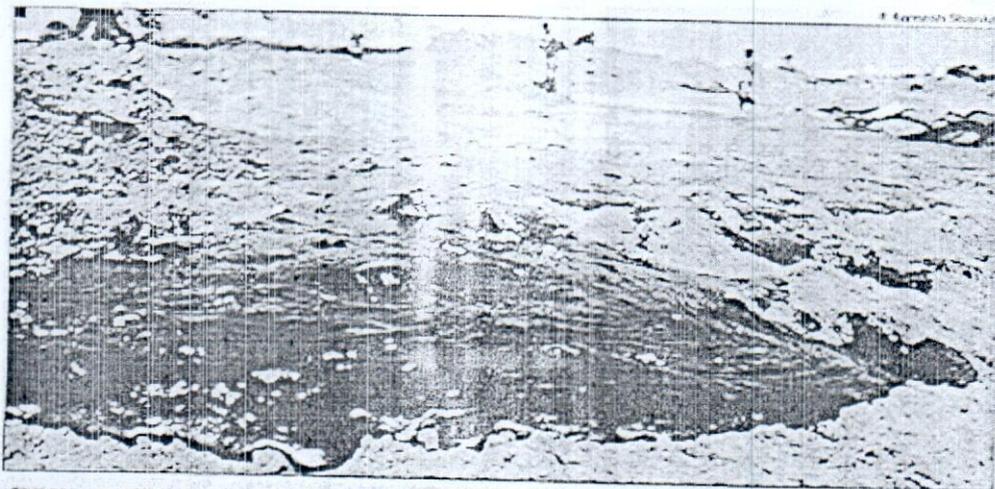
Figure 3: Bio-inoculum and Nutrient – Airlifted to Chennai



Figure 4: Pit prepared for Bioremediation Process



Figure 5: Safeguarding from percolation of sludge to soil using HDPE sheets



**CLEAN-UP:** Oil slick removed from the sea off Chennai was discharged into a pit at Kamarajar Port for remediation on Saturday. The process could take three months

**Figure 6: Mixing of Sludge from the Oil Spill and Normal Soil**



**Figure 7: Mixing of Bio-inoculum and Nutrients with the Sludge substrate**

Efforts were made to uniformly spread the oil sludge/oil contaminated sand on the bio-remediation site at zero day before initiation of bioremediation. The soil samples were periodically collected from the bioremediation site in the polythene bags and were analyzed at IOCL R&D Centre Faridabad for monitoring the bioremediation process performance. For practical purpose the site was divided in equal four blocks and statistically representative samples were taken from the site (from all blocks A, B, C & D) and final composite samples was made by

mixing 500 g composite samples from each blocks. The soil and water samples are being collected at every 15 days intervals and samples were analyzed for various parameters like TPH content, PAH content, microbial population, heavy metals in ground water etc. The sampling details are given in **Annexure-2**.

## **2.2 Analysis of TPH and PAH**

First, water content in oily sludge was estimated by heating of oily sludge up to 80 °C. Total 100g oily sludge from each samples were taken in 1000ml measuring cylinder. Measuring cylinders containing oily sludge (each measuring cylinder contains 100g oily sludge) were kept in water bath and heated up to 80°C. Due to heating water drops will settle in the bottom of measuring cylinder and thus water quantity in the oily sludge was measured.

Thus water present in the oily sludge was measured. After removal of water from oil sludge total petroleum hydrocarbon (TPH) was extracted from oily sludge samples by using hexane and toluene mix in 1:1 by refluxing for 1hr. Solvents were evaporated in a fume hood by gentle nitrogen steam. The SARA analysis was carried out by TLC-FID. After TPH extraction the soil residue was further analyzed. The residue was taken in crucibles and heated at 650°C in the Muffle furnace for 6 hours. After cooling, the amount of ash was quantified. TPH extraction and estimation was also done as per the standard method No. 9071B of EPA SW-846. This method is based on TPH extraction using n-Hexane only.

For PAHs estimation the TPH was dissolved in n-hexane and the soluble part after filtration has been analyzed as per ASTM 6591 using reverse phase HPLC.

## **2.3 Analysis of selected heavy metals in soil of bioremediation site**

The heavy metals were analyzed for the soil samples collected from bioremediation site and mixed uniformly to get one single composite sample. This composite sample was used for necessary analysis of heavy metals. The metal content was measured by ICP OES 8300 (Dual View) (PerkinElmer)

subsequent to calibrating the instrument with 0ppm (blank) and 10ppm multi-element standard.

#### **2.4 Ground water monitoring at bioremediation site**

For monitoring the ground water contamination, 12 piezometric wells were installed having depth of 20 feet. Water from bore wells was flushed out before sampling. After flushing of water from bore wells, water samples were collected in duplicate in polythene bottles. One sample was kept separately for analysis of pH, oil/grease, and conductivity test while another sample was fixed by concentrated HNO<sub>3</sub>. The ground water quality was monitored during and after the completion of the bioremediation process.

#### **2.5 Carbon number distribution (CND) of TPH**

The TPH extracted from soil samples during bioremediation were also analysed for CND using Perkin Elmer Clarus 500 GC with flame ionization detector (FID). A non-polar capillary metal column 100 % dimethyl polysiloxane (60 m x 0.32 mm id x 0.25 µm film thickness) was used for the desired separation. The temperature programme was 35°C (0.5min)-10°C- 450°C (20min) to achieve separation using injector temperature 350°C and detector temperature 350°C with 2.0 ml/min column flow (He).

#### **2.6. Analysis of leachable heavy metals in oily sludge**

Leachable heavy metals were analyzed in oil sludge samples collected at zero day i.e. before initiation of the bioremediation and after the completion of the bioremediation process. In the bottom of the plastic container a slope of 30° angle was prepared by impermeable material. The container containing oily sludge and acidified water was kept for 60 days to generate leachate. Selected heavy metals were analyzed in leachate by as per ICAP-MS method.

## 2.7 Monitoring of soil contamination at different depth

Soil samples were collected from different depth at the bioremediation during bioremediation. Soil samples were collected from the depth of 25cm horizon (0-25cm depth), 50cm horizon (26-50cm depth), 75cm horizon (51-75cm depth), and 100cm horizon (76-100cm depth). The soil samples were analyzed for the oil contamination by monitoring the TPH at different depth. The TPH was determined as per the standard method.

### 3.0 Results

The bioremediation was initiated on 06.02.2017. Subsequently, at every 15<sup>th</sup> day, the composite soil samples were taken from the site and analyzed for solvent extractable Total petroleum hydrocarbon (TPH) and Polycyclic aromatic hydrocarbon (PAH) content.

The TPH and PAH of the site at different time period is as given in the **Table 1 & 1a** and graphically represented as **Figure 8 & 8a**.

Table 1: TPH and PAH content at different intervals in the soil collected from the site (As per in-house developed method)

Date of sampling	Days*	TPH (ppm)	TPH (g/kg)	% Biodegradation of TPH	PAH (w/w in TPH)	% Biodegradation of PAH
21.02.2017	15	83400	83.4	-	16800	-
08.03.2017	30	44500	44.5	46.64	8700	48.21
24.03.2017	45	38200	38.2	54.20	7500	55.36
08.04.2017	60	20600	20.6	75.30	3800	77.38
22.04.2017	75	14200	14.2	82.97	3000	82.14
06.05.2017	90	12500	12.5	85.01	2712	83.86
30.05.2017	115	10900	10.9	86.93	2659	84.17
06.06.2017	121	9360	9.36	88.78	1952	88.38
28.06.2017	143	8000	8.0	90.41	1221	92.73
12.07.2017	158	6140	6.14	92.64	1137	93.23
12.08.2017	188	5120	5.12	93.86	1075	93.60
25.09.2017	230	4216	4.22	94.94	876	94.79

\*Time interval after start of bioremediation (approx. Days)

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Table 1a: TPH and PAH content of the soil at different intervals from the site (As per Method No. 9071B of EPA SW-846)

Date of sampling	Days*	TPH (ppm )	TPH (g/Kg)	% Biodegradation of TPH	PAH (w/w in TPH)	% Biodegradation of PAH
21.02.2017	15	22330	22.33	-	4498	-
08.03.2017	30	11910	11.91	46.66	2324	48.33
24.03.2017	45	10230	10.23	54.19	2012	55.27
08.04.2107	60	5512	5.51	75.32	1016	77.41
22.04.2017	75	3800	3.82	82.98	738	83.59
06.05.2017	90	3348	3.35	85.01	647	85.62
30.05.2017	115	2920	2.92	86.92	588	86.93
06.06.2017	121	2519	2.52	88.72	446	90.08
28.06.2017	143	1866	1.87	91.64	230	94.89
12.07.2017	158	1347	1.35	93.97	204	95.46
12.08.2017	188	858	0.86	96.16	108	97.60
25.09.2017	230	392	0.39	98.24	41	99.09

\*Time interval after start of bioremediation (approx. Days)

Time (Days)

Figure 8: Biodegradation at different time intervals (As per in-house developed method)

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Time (Day)

Figure 8a: Biodegradation at different time intervals (As per Method No. 9071B of EPA SW-846)

The photographs of site taken at different time intervals from site are depicted as Figure-09, 10, 11, 12, 13, 14, 15, 16 and 17 respectively.



Figure 9: Photograph of the bioremediation site at Zero day. (Dark site colour)

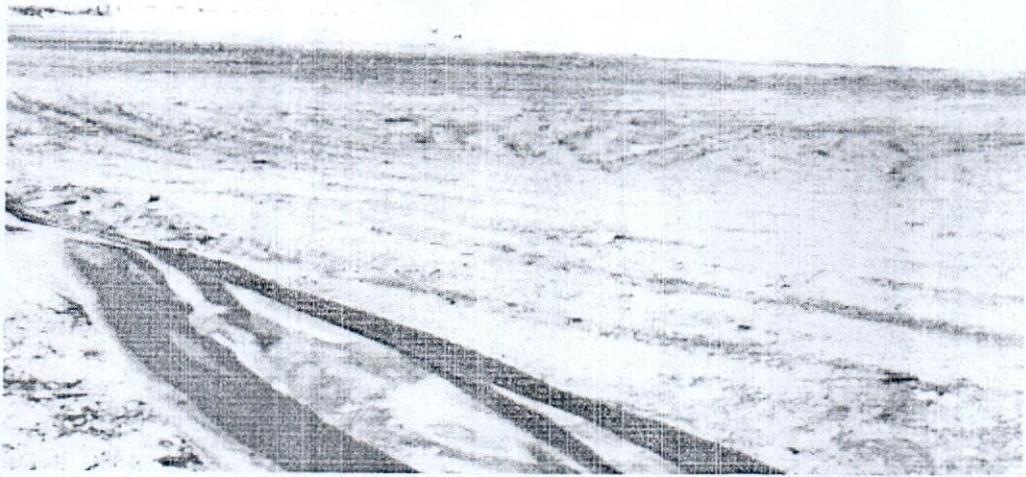


Figure 10: Photograph of the bioremediation site on 15<sup>th</sup> day



Figure 11: Photograph of the bioremediation site on 45<sup>th</sup> day



Figure 12: Photograph of the bioremediation site on 75<sup>th</sup> day



Figure 13: Photograph of the bioremediation site on 105<sup>th</sup> day. The site colour became brown with some vegetation.

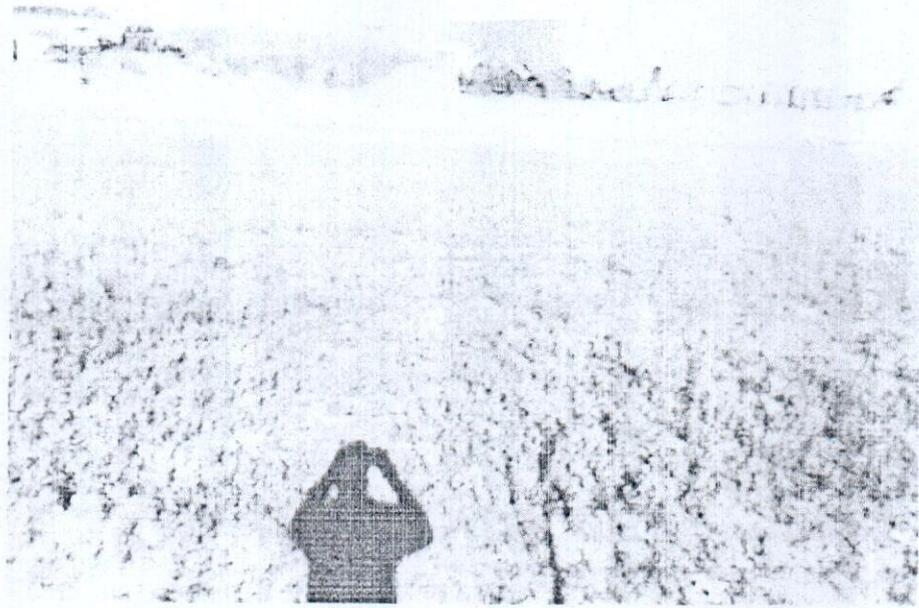


Figure 14: Photograph of the bioremediation site on 121<sup>th</sup> day

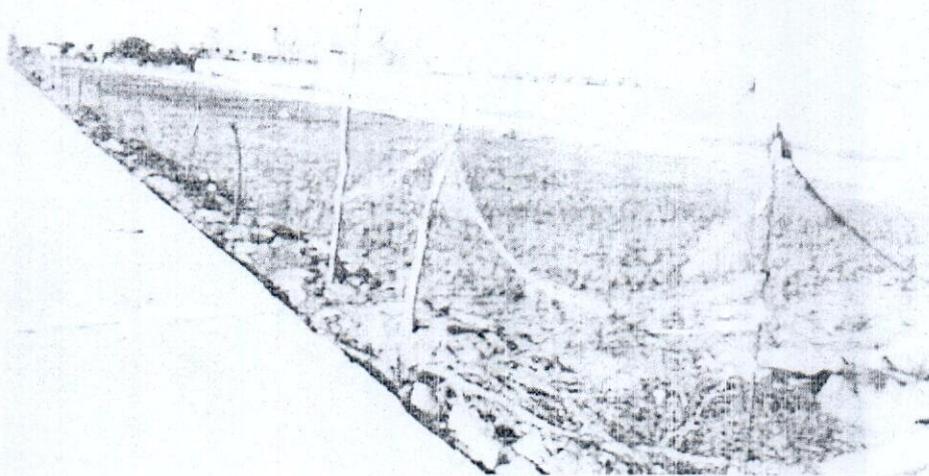


Figure 15: Photograph of the bioremediation site on 150<sup>th</sup> day

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Figure 16: Photograph of the bioremediation site on 200<sup>th</sup> day



Figure 17: Photograph of the bioremediation site on 230<sup>th</sup> day (Green land with full grown vegetation)

### 3.1 Microbial count

The growth of the microbes in the soil of bioremediation site was monitored using specific growth media and results obtained are given in **Table-2**. The results depicted the excellent growth of various groups of hydrocarbon degrading microbes in the site

resulting in commitment decrease of hydrocarbons. In the later days, the degradation of hydrocarbons was slow in comparison to degradation during initial 60 days. Based on prior experience, it is obvious because when the hydrocarbons are in low concentration their bio-availability become a constraint for bacterial degradation.

**Table 2: Microbial count in the soil of the bioremediation site**

Date of Sampling	Microbial count (CFU/g soil)					
	NA	CD	PHD	HD	PD	DB
Neat soil	$4.0 \times 10^5$	Nil	Nil	Nil	Nil	Nil
21.02.2017	$6.8 \times 10^{12}$	$3.2 \times 10^3$	$4.9 \times 10^4$	$8.2 \times 10^5$	$7.2 \times 10^7$	$1.7 \times 10^5$
08.03.2017	$2.9 \times 10^{12}$	$7.2 \times 10^9$	$5.1 \times 10^8$	$8.0 \times 10^9$	$5.8 \times 10^7$	$3.2 \times 10^7$
24.03.2017	$2.1 \times 10^{13}$	$5.8 \times 10^9$	$2.8 \times 10^9$	$7.3 \times 10^9$	$5.2 \times 10^8$	$8.4 \times 10^7$
08.04.2017	$5.4 \times 10^{12}$	$6.2 \times 10^9$	$6.1 \times 10^9$	$7.5 \times 10^9$	$5.4 \times 10^8$	$9.0 \times 10^7$
22.04.2017	$6.7 \times 10^{12}$	$5.8 \times 10^9$	$5.9 \times 10^9$	$8.8 \times 10^9$	$9.2 \times 10^8$	$8.8 \times 10^7$
06.05.2017	$7.9 \times 10^{12}$	$6.2 \times 10^9$	$7.4 \times 10^9$	$9.2 \times 10^9$	$8.9 \times 10^7$	$3.5 \times 10^7$
30.05.2017	$5.2 \times 10^{12}$	$7.5 \times 10^9$	$2.6 \times 10^9$	$7.0 \times 10^9$	$3.2 \times 10^8$	$5.6 \times 10^7$
06.06.2017	$2.8 \times 10^{12}$	$5.6 \times 10^8$	$9.5 \times 10^9$	$3.2 \times 10^9$	$4.8 \times 10^8$	$8.2 \times 10^7$
28.06.2017	$7.2 \times 10^{11}$	$1.8 \times 10^8$	$4.3 \times 10^8$	$5.2 \times 10^7$	$3.6 \times 10^6$	$5.9 \times 10^6$
12.07.2017	$9.8 \times 10^{12}$	$3.2 \times 10^8$	$7.1 \times 10^7$	$8.0 \times 10^8$	$9.8 \times 10^7$	$3.1 \times 10^7$
12.08.2017	$7.4 \times 10^{11}$	$4.5 \times 10^9$	$3.2 \times 10^8$	$7.8 \times 10^6$	$6.3 \times 10^8$	$6.3 \times 10^6$
25.09.2017	$9.3 \times 10^{12}$	$8.2 \times 10^8$	$9.1 \times 10^7$	$4.7 \times 10^8$	$2.2 \times 10^7$	$7.1 \times 10^7$

NA: Nutrient agar plate (heretrophic bacteria); CD: Crude oil degrader; PHD: Phenanthrene degraders; HD: Hexadecane degraders; PD: Phenol degraders; DB: Dibenzothiophene degraders

### 3.2 Carbon number distribution pattern

The carbon number distribution pattern of extracted TPH was analyzed by gas chromatograph (GC-FID). The results are given in **Figure-18 (a, b & c)**. It was observed

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that sample after 15 days contains hydrocarbon in the range of C6 to C34, while the sample after 60 days contains the hydrocarbon in the range of C6 to C30. The reduction of hydrocarbons concentration after 121 days was observed about 79%. The hydrocarbon carbon type present in the TPH samples after 230 days was having distribution in the range of C6 to C20 with the hydrocarbon reduction of more than 96% as compare to the TPH sample after 15 days. However, when the analysis was repeated as per the method No. 9071B of EPA SW-846, the reduction of hydrocarbons concentration after 121 days was observed about 88 % and further reduced to more than 98% having distribution in the range of C6 to C20. The change in carbon number distribution further corroborates time dependent decrease in hydrocarbons content in bioremediation site.

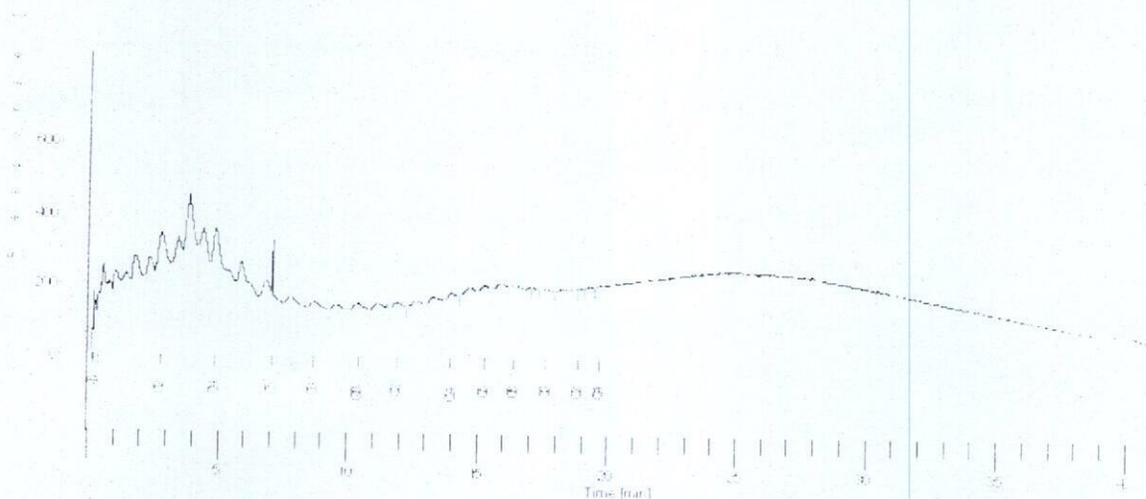


Figure-18a: Gas chromatograph of TPH extracted after 15 days from the bioremediation site

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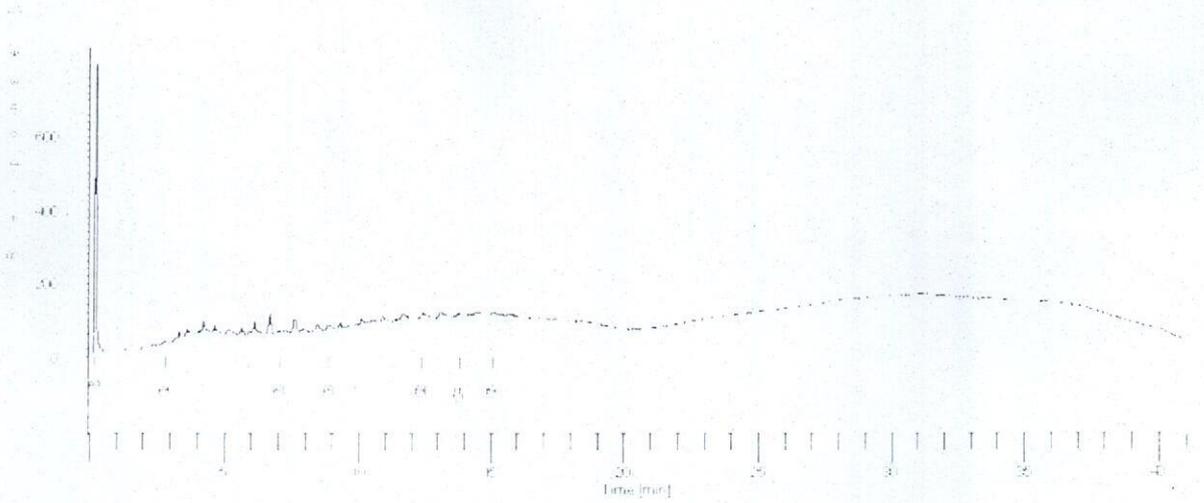


Figure-18 b: Gas chromatograph of TPH extracted after 121 days from the bioremediation site

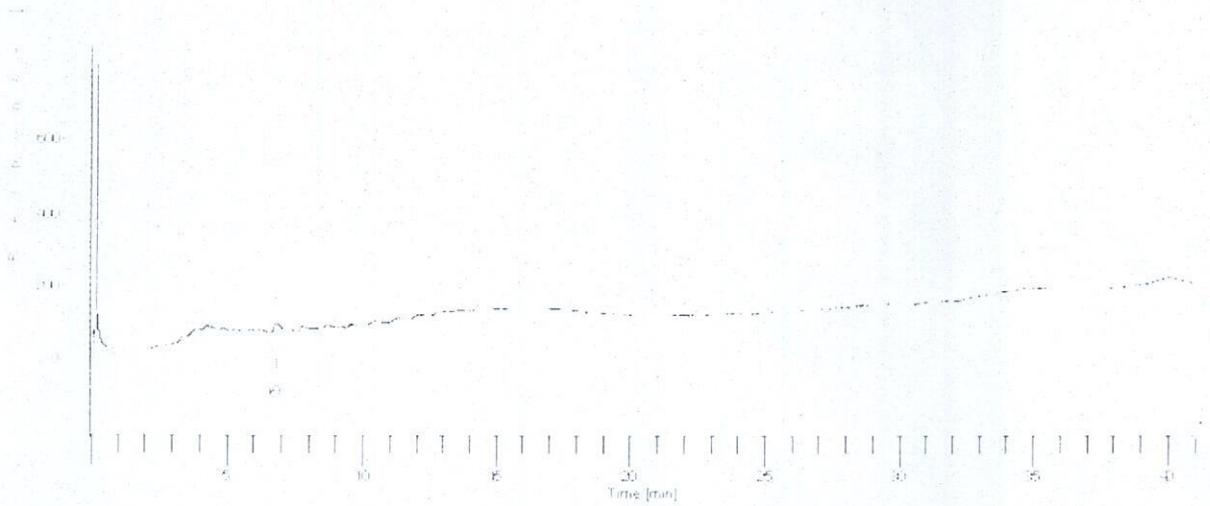


Figure 18c: Gas chromatograph of TPH extracted after 230 days from the bioremediation site

### 3.3 Ground water contamination analysis

For monitoring the ground water contamination, 12 peizometric wells were installed having depth of 20 feet. The water samples are being taken at 15 days intervals and

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analyzed for oil content and heavy metals. The analysis results given in **Table-3** showed no ground water contamination due to the on-going bioremediation process with respect hydrocarbons. Heavy metal analysis of ground water is given in **Table-4 to 8** and result indicated bioremediation process has not caused any ground water/soil contamination with respect to heavy metal/oil content.

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Table 3: Oil content in ground water samples

Well	Oil content ( ppm)								
	Date of sampling								
	08.03.17	24.03.17	08.04.17	22.4.17	06.05.17	30.05.17	06.06.17	28.06.17	12.07.17
S1	ND	ND	ND	ND	ND	ND	ND	ND	ND
N1	ND	ND	ND	ND	ND	ND	ND	ND	ND
W1	ND	ND	ND	ND	ND	ND	ND	ND	ND
W2	ND	ND	ND	ND	ND	ND	ND	ND	ND
W3	ND	ND	ND	ND	ND	ND	ND	ND	ND
W4	ND	ND	ND	ND	ND	ND	ND	ND	ND
E1	ND	ND	ND	ND	ND	ND	ND	ND	ND
E2	ND	ND	ND	ND	ND	ND	ND	ND	ND
E3	ND	ND	ND	ND	ND	ND	ND	ND	ND
E4	ND	ND	ND	ND	ND	ND	ND	ND	ND
E5	ND	ND	ND	ND	ND	ND	ND	ND	ND
E6	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND. Not Detectable

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Table 4: Heavy metal analysis of ground water

Element	8 March 2017													24 March 2017							
	S1	N1	W1	W2	W3	W4	E1	E2	E3	E4	E5	E6	E7	S1	N1	W1	W2	W3	W4	E1	E2
Conc. [ppb]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cr. Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fe	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mn	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	BDL	BDL	BDL	BDL	BDL	BDL	1.2 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL						
Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zn	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cu	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Hg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mo	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Se	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bi	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL < 1ppb

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Table 5: Heavy metal analysis of ground water

Element	8 April 2017													22 April 2017								
Conc. ppb	S1	N1	W1	W2	W3	W4	F1	F2	F3	F4	F5	F6	F7	S1	N1	W1	W2	W3	W4	F1	F2	
As	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cr. Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Hg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	2.4 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.7 ppb	BDL	BDL						
Cu	2.1 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.9 ppb	BDL	BDL						
Mn	BDL	2.6 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	6.7 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5.0 ppb	BDL						
Fe	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zn	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mo	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Se	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
V	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
U	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Al	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cl	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Br	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
I	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
B	23.3 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	26.9 ppb	BDL	BDL						

BDL < 1ppb

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Table 6: Heavy metal analysis of ground water

Element	6 May 2017													22 May 2017								
Conc. (ppb)	S1	N1	W1	W2	W3	W4	E1	E2	E3	E4	E5	E6	E7	S1	N1	W1	W2	W3	W4	E1	E2	
As	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.7 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cr, Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mn	1.4 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.6 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cu	BDL	2.8 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fe	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.7 ppb	BDL	BDL	BDL	BDL	BDL	3.0 ppb	BDL
Zn	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mo	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ag	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Se	2.2 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.8 ppb	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL < 1ppb

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Table 7: Heavy metal analysis of ground water

Element Conc. [ppb]	8 June 2017												24 June 2017									
	S1	N1	W1	W2	W3	W4	F1	F2	F3	F4	F5	F6	F7	S1	N1	W1	W2	W3	W4	F1	F2	
Al	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ar. Total	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ba	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bi	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Br	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cr	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cu	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fe	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Mn	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Se	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Sr	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
V	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zn	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL < 1ppb

*125*



### 3.4 TPH Fractions analysis

Out of the total degradation of the TPH, the degradation of various fractions of the TPH is described in the **Table 9 & 9A** as below.

**Table 9. Degradation of various fractions of the TPH (As per in-house developed method)**

Particulars of samples	Biodegradation of TPH (%) and its fraction in 5 months				
	TPH	Saturate	Aromatics	Resins	Asphaltene
Block A	94.8	99.7	98.4	93.9	92.4
Block B	95.9	98.7	98.4	93.9	92.6
Block C	96.1	95.7	98.4	90.9	95.6
Block D	94.4	98.7	98.4	93.9	92.7

**Table 9 A. Degradation of various fractions of the TPH (As per Method No. 9071B of EPA SW-846)**

Particulars of samples	Biodegradation of TPH (%) and its fraction in 5 months				
	TPH	Saturate	Aromatics	Resins	Asphaltene
Block A	99.1	99.1	98.7	93.4	93.8
Block B	98.9	98.4	97.9	94.1	93.6
Block C	98.5	97.6	97.5	91.9	96.7
Block D	98.8	98.7	98.6	93.8	94.7

### 3.5 Analysis of selected heavy metal in soil

The soil samples were collected before and after completion of the bioremediation. The composite sample was analyzed for the selected heavy metals as shown in the **Table 10**. From the **Table 10 data**, it is clear that the concentrations of the heavy metals in soil of bioremediation site after the bioremediation were within the permissible limits.

Table 10: Heavy metal content in soil from bioremediation site

Elements	Neat Soil/Sand	From bioremediation site								
		08.03.2017	24.03.2017	08.04.2017	22.4.2017	06.05.2017	30.05.2017	06.06.2017	28.06.2017	12.07.2017
Ca (%)	0.53	0.34	0.72	0.67	1.18	0.73	0.6	0.68	0.82	0.74
Cd (ppm)	<10	<10	<10	<10	<10	<20	<10	<10	<10	<10
Co (ppm)	11	<10	34	22	14	<20	17	16	18	14
Cr (ppm)	24	16	42	34	28	45	45	32	41	34
Cu (ppm)	28	<10	<10	<10	<10	<20	11	<10	<10	<10
As (ppm)	30	43	44	47	46	<20	10	<10	<10	<10
Fe (%)	0.93	0.58	2.00	1.40	1.16	2.10	2.10	1.85	1.67	2.08
Ni (ppm)	37	<10	10	<10	<10	<20	12	<10	<10	<10
Pb (ppm)	23	11	21	16	11	<20	13	17	14	16
V (ppm)	27	18	64	44	38	68	63	57	62	54
Zn (ppm)	114	12	30	84	16	23	23	26	23	28

Note: BD: Below detection; Detection limit: 1 ppb

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### 3.6 Analysis of heavy metals in leachates of residual oily sludge

Leachates were collected from the composite sample of the soil collected from the bioremediation site before and after the bioremediation. A 30° angle slope in the bottom of the plastic bucket was maintained to collect leachate. The plastic bucket was filled (with slope angle) with oily sludge and leachate was collected. In this leachate sample heavy metals were analyzed and the data were given in the **Table 11**. Heavy metals in the leachate samples were permissible limits after bioremediation.

**Table 11. Selected heavy metals concentration in leachate before and after bioremediation**

Heavy Metals	Concentration (mg/kg only sludge)		EPA-TCLP regulatory levels
	Before Bioremediation	After Bioremediation	
Mn	BD	BD	-
Zn	BD	BD	-
Cu	BD	BD	-
Ni	0.002	0.002	5 ppm
Pb	BD	BD	-
As	0.002	0.002	5 ppm
Cr (III)	0.05	0.05	5 ppm
Cd	BD	BD	1 ppm
Co	BD	BD	-
Cr (VI)	0.05	0.03	5 ppm
Se	0.001	BD	1 ppm

Note: BD= below Detection; Detection limit 1 PPb

### 3.7 Analysis of soil characteristics at the bioremediation site

At zero day (before initiation of bioremediation) and after completion of the bioremediation soil samples (up to 25cm horizon) were collected in polythene bags. The samples were mixed uniformly to get a homogenized mixed composite mixture. The soil characteristics were found similar to the agricultural soil quality. The results are shown in Table 12.

Table 12: Third party\* characterization of soil at bioremediation site after bioremediation

S. No.	Test Parameters	Unit	After bioremediation	Protocol
1	pH (30gm/75 ml)	pH unit	7.2	IS: 2720, Pt 26
2	E. Conductivity. (1:5 soil water ratio)	µmhos/cm	42	Conductivity meter, APHA 22 <sup>nd</sup> Ed. 2012
3	Moisture	%by mass	1.0	IS:2720 Pt-2-1973
4	Chloride (as Cl)	%by mass	0.2	Method No. 9253-9077 of EPA SW 846
5	Water holding capacity	%by mass	35.2	As per lab manual DIRD, PUNE (Document No. SSD/GL.01)
6	Organic carbon	%by mass	0.34	IS:2720, Pt-22-2010
7	Phosphorus as P	%by mass	0.01	Method No 9253-9077 of EPA SW-846
8	Nitrogen as N	%by mass	0.02	ASTM D 5373 guidelines
9	Arsenic as As	mg/Kg	0.12	APHA 22 <sup>nd</sup> Ed. 3111
10	Mercury as Hg	mg/Kg	0.01	APHA 22 <sup>nd</sup> Ed. 3111
11	Selenium as Se	mg/Kg	N.D	APHA 22 <sup>nd</sup> Ed. 3111
12	Lead as Pb	mg/Kg	10	Method No 9253-9077 of EPA SW-846
13	Cadmium as Cd	mg/Kg	N.D	Method No. 9253-9077 of EPA SW-846
14	Chromium as Cr	mg/Kg	40	Method No. 9253-9077 of EPA SW-846
15	Vanadium as V	mg/Kg	N.D	Method No. 9253-9077 of EPA SW-846
16	Nickel as Ni	mg/Kg	BD	Method No. 9253-9077 of EPA SW-846

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17	Zinc as Zn	mg/Kg	40	of EPA SW-846 Method No. 9253-9077
18	Manganese as MnO	mg/Kg	0.04	of EPA SW-846 Method No. 9253-9077
19	Copper as Cu	mg/Kg	N.D	of EPA SW-846 Method No. 9253-9077
20	Cobalt as Co	mg/Kg	N.D	of EPA SW-846 Method No. 9253-9077
21	Total petroleum hydrocarbons as Oil & Grease	mg/Kg	391	of EPA SW-846 Method No. 9017B of EPA SW-846
22	Polychlorinated Biphenyls (PCBs)	mg/Kg	N.D	SRI/RES SOIL & SOLID WASTE using GC-MS MS & GC-HS
23	Polyaromatic Hydrocarbons (PAHs)	mg/Kg	BDL	
24	<b>Volatile organic compounds</b>			
A	1,2-Dichloroethane	mg/Kg	N.D	
B	Benzene	mg/Kg	N.D	
C	Bromodichloromethane	mg/Kg	N.D	
D	Bromoform	mg/Kg	N.D	
E	Carbon Tetrachloride	mg/Kg	N.D	
F	Chlorobenzene	mg/Kg	N.D	
G	Chloroform	mg/Kg	N.D	
H	Dibromochloromethane	mg/Kg	N.D	
I	Hexachlorobutadiene	mg/Kg	N.D	
J	1,1,1-Trichloroethane	mg/Kg	N.D	
K	Methylene Chloride	mg/Kg	N.D	
L	1,1,2,2-Tetrachloroethane	mg/Kg	N.D	
M	Toluene	mg/Kg	N.D	
N	Ethyl Benzene	mg/Kg	N.D	
O	m-Xylene	mg/Kg	N.D	
P	p-Xylene	mg/Kg	N.D	
Q	o-Xylene	mg/Kg	N.D	

Detection limit for Cd, V, Ni, Cu, Co=10 mg/Kg, Se=0.005 mg/Kg, PCBs=0.001 mg/Kg, PAHs=0.005 mg/Kg and VOCs=0.25-2.5 mg/Kg (\*Third party analysis done by M/s Shriram Institute for Industrial Research)

### 3.8 Oil contamination at different depth in the bioremediation site

Soil samples were collected from different depth at the bioremediation site after completion of the bioremediation. Soil samples were collected from the depth of 25cm horizon (0-25cm depth), 50cm horizon (26-50cm depth), 75cm horizon (51-75cm depth), and 100cm horizon (76-100cm depth). The composite sample was analyzed for TPH for monitoring the oil contamination at different depth of the site. At 15<sup>th</sup> day and at 25 cm horizon, the TPH contamination of the soil was 8.34% as per in-house method, which was reduced to 0.42% after completion of the bioremediation due to degradation of oily sludge by microbes (Table 13). However, TPH values using standard method i.e 9071B of EPA SW-846 got reduced from 2.23% to 0.039% after completion of the bioremediation (Table 13a). Oily sludge contamination was restricted to surface soil of the bioremediation site, which was biodegraded by Oilivorous.

Table 13. TPH contamination (%) in soil at different depth at the bioremediation site (As per in-house developed method)

Depth of Sampling	TPH(%) of the soil samples at	
	*Before bioremediation	After completion of bioremediation
25cm horizon (0-25cm depth)	8.34	0.42
50cm horizon (26-50cm depth)	0.21	0.02
75cm horizon (51-75cm depth)	BD**	BD*
100cm horizon (76-100cm depth)	BD*	BD*

\*after 15 day of start of bioremediation

\*\*below extraction of TPH from soil and analysis of GC. Extraction limit of TPH from soil by Sox let Extractor 1ppm

Table 13a. TPH contamination (%) in soil at different depth at the bioremediation site (As per Method No. 9017B of EPA SW-846)

Depth of Sampling	TPH(%) of the soil samples at	
	Before bioremediation	After completion of bioremediation

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25cm horizon (0-25cm depth)	2.23	0.039
50cm horizon (26-50cm depth)	0.024	BD*
75cm horizon (51-75cm depth)	BD*	BD*
100cm horizon (76-100cm depth)	BD*	BD*

\*after 15 day of start of bioremediation

\*\*below extraction of TPH from soil and analysis of GC. Extraction limit of TPH from soil by Soxhlet Extractor 1ppm

### 3.9 Ground water monitoring at bioremediation site (Third party analysis)

Bore wells at upstream and downstream of the bioremediation site was selected to monitor the ground water quality at the bioremediation site. During bioremediation, the water samples were collected after flushing out of water samples from bore wells at regular intervals. After completion of the bioremediation, the necessary parameters including heavy metals in upstream and downstream ground water were within the permissible limit (Table 14). Third party analysis results further validated no contamination of water samples in line with our laboratory results.

**Table 14. Characteristics of ground water at bioremediation site**

S. No.	Test Parameters	Unit	Upstream	Downstream	Protocol
1	pH@25 C	pH unit	7.48	7.58	
2	Oil & Grease	mg/L	N.D.	N.D.	APHA 22 <sup>nd</sup> Ed. 5520
3	Sulphide	mg/L	N.D.	1.0	
4	Cadmium	mg/L	N.D.	N.D.	IS:3025 Pt-2-2004, RA 2009
5	Chromium	mg/L	N.D.	N.D.	IS:3025 Pt-2-

6	Lead	mg/L	N.D.	N.D.	2004,RA 2009 IS:3025 Pt-2-
7	Arsenic	mg/L	0.001	N.D.	2004,RA 2009 IS:3025 Pt-65-
8	Mercury	mg/L	N.D.	N.D.	2014 IS:3025 Pt-65-
9	Vanadium	mg/L	N.D.	N.D.	2014 IS:3025 Pt-2-
10	Nickel	mg/L	N.D.	N.D.	2004,RA 2009 IS:3025 Pt-2-
11	Zinc	mg/L	0.1	0.1	2004,RA 2009 IS:3025 Pt-2-
12	Manganese	mg/L	0.14	0.16	2004,RA 2009 IS:3025 Pt-2-
13	Copper	mg/L	N.D.	N.D.	2004,RA 2009 IS:3025 Pt 2-
14	Cobalt	mg/L	N.D.	N.D.	2004,RA 2009 IS:3025 Pt 2-
15	Selenium	mg/L	0.003	N.D.	2004,RA 2009 IS:3025 Pt 65-
16	Volatile Organic Compounds	mg/L	Absent	Absent	2014 SOP/Instrument room- I/13

\*N.D. – Not Detected

## SUMMARY

- The bioremediation of around 184 MT of oil sludge and oil contaminated sand was initiated on 06.02.2017 at Kamarajar Port Limited (KPL), Chennai premises in consultation with Tamilnadu State Pollution Control Board (TNSPCB) using IOC,R&D developed bioremediation technology.
- The progress of the bioremediation was extensively monitored for reduction in TPH of the soil at the bioremediation site and the ground water quality.
- Less than 1% TPH criteria for the complete bioremediation was observed after 121 days which was further reduced to 0.4% in 230 days.
- Heavy metal in the soil at the bioremediation site found to be within the permissible limits.
- No deterioration of soil characteristics at the bioremediation was observed.
- Vegetation has started growing fully on the site indicating restoration of good soil quality.
- The groundwater quality at the bioremediation site was also meeting the BIS/WHO as well as EPA (LIE) criteria and no contamination was observed.
- The bioremediation of 184 MT of oily sludge/contaminated sands has been completed successfully based upon detailed analysis of soil & ground water.

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## Annexure

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TAMILNADU POLLUTION CONTROL BOARD



VI. PROVISIONS No. 47(B) S.I. 2006 of G.O. dt. 02.02.2017  
G.O. dt. 02.02.2017 No. 18-1 S.I. 2017 of G.O. dt. 02.02.2017

FORM 2

STATE OF TAMILNADU  
TAMILNADU POLLUTION CONTROL BOARD  
Pollution Control Officer  
Pollution Control Officer  
Pollution Control Officer

S. No. / Date / Name of the Polluter / Name of the Polluting Industry / Name of the Polluting Activity / Name of the Polluting Process / Name of the Polluting Material / Name of the Polluting Substance / Name of the Polluting Gas / Name of the Polluting Solid / Name of the Polluting Liquid / Name of the Polluting Noise / Name of the Polluting Vibration / Name of the Polluting Heat / Name of the Polluting Radiation / Name of the Polluting Other

STATE OF TAMILNADU

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NATIONAL POLLUTION CONTROL BOARD

Member Secretary

Central Board of Secondary Education, New Delhi

Delhi

TERMS AND CONDITIONS OF AUTHORIZATION

1. This authorization is granted to the Member Secretary, Central Board of Secondary Education, New Delhi, for the purpose of carrying out the following work: (a) to collect, collate and disseminate information regarding the pollution control measures adopted by the various industries, municipalities and other public bodies; (b) to conduct research and studies on the pollution control measures; (c) to advise the Government on the pollution control measures; (d) to coordinate the pollution control measures; (e) to monitor the progress of the pollution control measures; (f) to disseminate the information regarding the pollution control measures to the public; (g) to conduct public relations; (h) to conduct training courses; (i) to conduct seminars and conferences; (j) to conduct other activities as may be required for the purpose of the pollution control measures.

TERMS AND CONDITIONS - HW. Conditions

2. The Member Secretary shall be responsible for the proper management and control of the work authorized to him under these terms and conditions. He shall be responsible for the proper utilization of the funds allocated to him for the purpose of the work. He shall be responsible for the proper maintenance and control of the records of the work. He shall be responsible for the proper dissemination of the information regarding the work. He shall be responsible for the proper coordination of the work. He shall be responsible for the proper monitoring of the progress of the work. He shall be responsible for the proper dissemination of the information regarding the work to the public. He shall be responsible for the proper conduct of training courses, seminars and conferences. He shall be responsible for the proper conduct of other activities as may be required for the purpose of the work.

PREVENTION OF POLLUTION ACT

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STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC SAFETY

NOTICE TO THE PUBLIC  
REGARDING THE  
ISSUANCE OF  
DRIVER LICENSES  
AND  
OPERATOR LICENSES  
FOR  
MOTOR VEHICLES  
AND  
MOTORCYCLES

THE DEPARTMENT OF PUBLIC SAFETY  
IS CURRENTLY  
REVIEWING  
THE  
ISSUANCE OF  
DRIVER LICENSES  
AND  
OPERATOR LICENSES  
FOR  
MOTOR VEHICLES  
AND  
MOTORCYCLES

REGISTRATION AND LICENSES

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NEVADA POLLUTION CONTROL BOARD

IV. SPECIAL CONDITIONS

POLLUTION PREVENTION FAYS

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MEMORANDUM FOR THE RECORD

Subject: [Faint text]

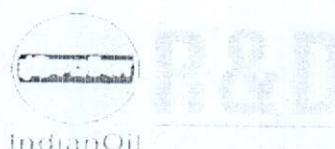
Member Name: [Faint text]

Date: [Faint text]

By: [Faint text]

MEMORANDUM FOR THE RECORD

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### Bioremediation of oily sludge and oil contaminated soil

#### Background:

IOC R&D has indigenously developed a bioremediation technology called **OiliVorous Technology**. This Technology is based on biodegradative tendency of microscopic organisms that live in soil and "eat" chemicals, such as petroleum hydrocarbons. **OiliVorous-S** is a blend of specific microbes selected to biodegrade a wide range of hydrocarbon contaminants of oily sludge.

The appropriate microbes were separated using modern techniques of Microbiology/Molecular biology and tested for effectiveness to biodegrade oily sludge. Finally, a consortium of microbes was formulated that could efficiently biodegrade various constituent hydrocarbons of crude oil like paraffins, aromatics etc. The OiliVorous product mix is selected after determination of compositional characteristics of the hydrocarbons present in the sludge to be bioremediated. The large-scale production of these microbes is done under stringent conditions of quality check and final blend of microbes is adsorbed on a naturally occurring biodegradable carrier matrix to facilitate its dispersion during use and ease in transportation. Depending upon the type and location of contaminants, there are several variants of this technology which is protected by several patents filed by Indian Oil.

The major attributes of the **OiliVorous** product are

- The Microbes in the consortia are Natural isolates and are not Genetically modified
- The OiliVorous product is safer to handle
- It is manufactured from indigenously/locally available raw materials

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- Manufacturing technology has been optimised, improved and has been perfected to commercial scale

### Procedure of conducting bioremediation using Oilivorous Technology

#### A. Site preparation:

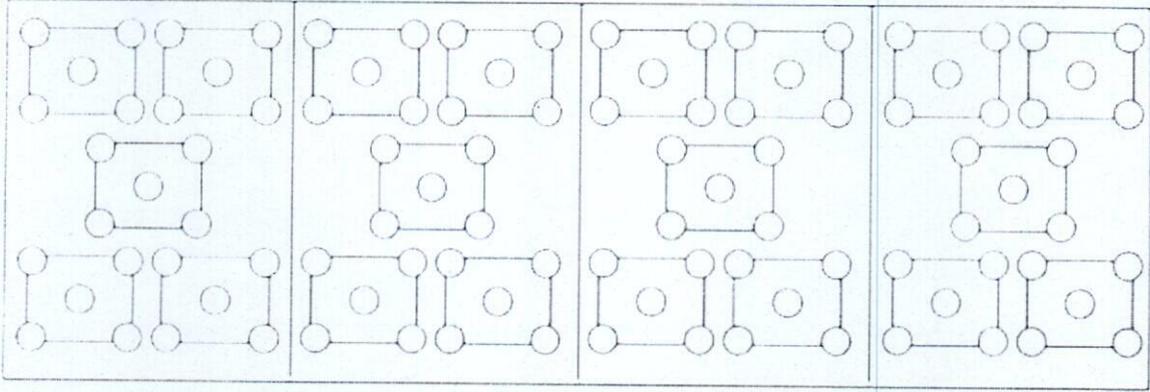
- Identify an area of around 5 sq mt per KL of oil sludge/oil contaminated soil
- Make the area free from debris, grass etc
- Remove the soil from the area up to the depth of around 30-45 cm to make a shallow pit
- Put a robust polythene sheet over the bottom of the above pit. This is to avoid percolation of oil to the ground level.
- The soil removed during the preparation of pit should be brought back over the polythene layer to fill up the pit and it should be leveled.
- Demarcate the oil contaminated site by proper barricade / fencing and identify the sites as "Oil contaminated site".
- Put necessary instruction on a signboard like "**Bioremediation site, please do not enter in contaminated area**".

#### B. Treatment:

- After site preparation, the sludge should be spread over the soil/pit in a uniform manner
- Spread the 'Oilivorous' over the area, (it is advised that person who is spreading it should wear hand gloves and clean his hands with soap after spreading)
- Carry out through mixing of 'Oilivorous' -sludge and soil by tilling/making the soil upside down (care should be taken to avoid the rupture of polythene sheet)
- Dissolve 'nutrient' powder supplied by us in tap water in a bucket (around 1 kg/20 litre) and spray it over the treatment area.
- Spray water over the treatment site to make it slightly wet
- The tilling and watering should be carried out at a interval of 7 days regularly.

### C. Sampling:

- The plot to be divided into four equal blocks.
- From each block five samples to be collected (as shown in below figure).
- To take sample from each point, select at least five equidistant points from center of the (01 at center + 04) and collect around 500gms of a homogenous/uniform sample from each point.



- The soil sample from all depth (30-45 cm) should be collected.
- Mix the samples to make a composite sample and dispatch around 1kg of this sample for analysis.
- The sample should be collected at the time of the start of the bioremediation and at every month interval.

### D. Analysis:

Following samples to be analyzed:

- Virgin soil used from site for bioremediation
- Oil sludge/oil contaminated soil to be bioremediated
- Soil samples collected from bioremediation site at beginning of the bioremediation and during bioremediation

The above samples shall be analyzed for:

- Solvent extractable hydrocarbon ( total petroleum hydrocarbons, TPH)
- Gas Chromatography (GC) of TPH profiling in respect of carbon number distribution before and during bioremediation

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- Heavy metals
- Soil characteristics ( for soil samples) like water holding capacity, soil bulk density, soil organic carbon, soil total nitrogen and phosphorus content, soil pH and conductivity, Microbial population

#### E. Ground water monitoring:

- Install test bore well (Piezometric, 2 inch dia and 20 feet depth) at the upstream ( 2 Nos) and downstream (4 Nos) of the bioremediation site.
- Water from bore well should be flushed out before sampling. After flushing of water from borewell should be collected in polythene bottles (2L).
- Take zero day water samples from the bore wells installed and samples shall be analyzed for oil & grease, pH, conductivity and heavy metal concentration.
- Water samples should be collected in duplicate, one for oil, grease, pH and conductivity test and another for metal ( like As, Cd, Co, Cr3, Cr6, Hg, Cu, Mn, Mo, Ni, V, , Pb, Se, Zn) testing after fixing with concentrated HNO<sub>3</sub> (1N).
- Collect the ground water sample from the test bore well at monthly intervals and analyze the samples for oil & grease, pH, conductivity and heavy metal concentration

#### F. Assessment of Bioremediation process

- Bioremediation shall continue till TPH in oily sludge shall be within the permissible level (TPH less than 1%).
- Grass and flower plants shall be grown on the bioremediation site after successful completion of the bioremediation treatment.
- Keep the logbook of treatment and submit a detail report to SPCB.

# रिचर्डसन एण्ड क्रुडस (1972) लिमिटेड

(भारत सरकार का उपक्रम)

## इंजिनियर्स

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स्थापना

ESTD.1858

ISO 9001 CO.,



An ISO 9001:2008 Certified Company  
Certification No. BE-15 QMS 5246

Annexure-II

# Richardson & Cruddas (1972) Ltd.

(A Government of India Undertaking)

## ENGINEERS

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Website : www.richardsoncruddas.com

CIN : U26320MH1973GO1016389

## ENVIRONMENTAL ENGINEERING LABORATORY

### Analysis Results of Ground Water (Piezo Wells)

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 15.04.2017  
Source : Bore Well  
Sample Collection on: 23.03.2017 Report No : 5673  
Location Name : S1: South Bore Well, E1-E2-E3: East Bore Wells

Sl. No	Parameters	Unit	S1	E1	E2	E3
1	pH	-	6.72	7.30	7.42	7.56
2	COD	mg/l	<4.0	<4.0	<4.0	<4.0
3	Salinity	ppt	1.23	8.10	0.82	0.72
4	Oil & Grease	mg/l	Nil	Nil	Nil	Nil
5	Iron (as Fe)	mg/l	0.36	0.09	0.08	0.04
6	Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
7	Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
10	Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
11	Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
12	Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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# रिचर्डसन एण्ड क्रुडडस (1972) लिमिटेड

(भारत सरकार का उपक्रम)

## इंजिनियर्स

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Website : www.richardsoncruddas.com

CIN : U28920MH1973GO1016369

### ENVIRONMENTAL ENGINEERING LABORATORY

#### Analysis Results of Ground Water (Piezo Wells)

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 15.04.2017  
Source : Bore Well  
Sample Collection on: 23.03.2017 Report No : 5674  
Location Name : E4-E5-E6-E7- East Bore Wells

Sl. No	Parameters	Unit	E4	E5	E6	E7
1	pH	-	6.57	7.44	7.52	7.76
2	COD	mg/l	<4.0	<4.0	<4.0	<4.0
3	Salinity	ppt	1.02	1.36	0.42	0.46
4	Oil & Grease	mg/l	Nil	Nil	Nil	Nil
5	Iron (as Fe)	mg/l	0.12	0.14	0.11	0.16
6	Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
7	Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
10	Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
11	Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
12	Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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एल.पी. शास्त्री मार्ग	L.B. Shastri Marg.	भावरकुला आईरन वर्क्स	Byculla Iron Works	सिडको इन्डस्ट्रियल एस्टेट	F3, MIDC Industrial Estate
मुंबई पश्चिम	Mulund West	सर. जे.जे. रोड	Slr. J.J. Road,	हिंगना रोड,	Hingna Road,
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फोन : 022-25611973	Phone: 022-25611973	फोन : 022-32283301/2/3	Phone: 022-32283301/2/3	फोन : 07104-237061	Phone: 07104-237061

रिचर्डसन एण्ड  
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(भारत सरकार का उपक्रम)

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CIN : U28920MH1973GO1016389

ENVIRONMENTAL ENGINEERING LABORATORY

Analysis Results of Ground Water (Piezo Wells)

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 15.04.2017  
Source : Bore Well  
Sample Collection on: 23.03.2017 Report No : 5675  
Location Name : N1: North Bore Well, W1-W2-W3-W4: West Bore Wells

Sl. No	Parameters	Unit	N1	W1	W2	W3	W4
1	pH	-	7.53	6.68	6.54	6.59	6.59
2	COD	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0
3	Salinity	ppt	0.52	0.27	0.30	0.34	0.18
4	Oil & Grease	mg/l	Nil	Nil	Nil	Nil	Nil
5	Iron (as Fe)	mg/l	0.24	0.21	0.08	0.22	0.22
6	Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
7	Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
10	Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
11	Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
12	Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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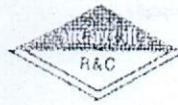
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# रिचर्डसन एण्ड क्रुड्डस (1972) लिमिटेड

(भारत सरकार का उपक्रम)

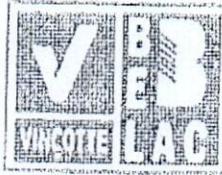
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CIN : U29920MH1973GO1016389

## ENVIRONMENTAL ENGINEERING LABORATORY Analysis Results of Ground Water (Piezo Wells)

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 27.04.2017  
Source : Bore Well  
Sample Collection on: 11.04.2017 Report No : 6428  
Location Name : S1: South Bore Well, E1-E2-E3: East Bore Wells

Sl. No	Parameters	Unit	S1	E1	E2	E3
1	pH	-	6.83	7.25	7.39	7.62
2	COD	mg/l	<4.0	<4.0	<4.0	<4.0
3	Salinity	ppt	1.27	8.34	0.86	0.79
4	Oil & Grease	mg/l	Nil	Nil	Nil	Nil
5	Iron (as Fe)	mg/l	0.43	0.12	0.07	0.08
6	Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
7	Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
10	Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
11	Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
12	Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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180

# रिचर्डसन एण्ड क्रुड्डास (1972) लिमिटेड

(भारत सरकार का उपक्रम)

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Website : www.richardsoncruddas.com  
CIN : U26920MH1973GO1016389

### ENVIRONMENTAL ENGINEERING LABORATORY

#### Analysis Results of Ground Water (Piezo Wells)

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 27.04.2017  
Source : Bore Well  
Sample Collection on: 11.04.2017 Report No : 6429  
Location Name : E4-E5-E6-E7- East Bore Wells

Sl. No	Parameters	Unit	E4	E5	E6	E7
1	pH	-	6.79	7.54	7.59	7.80
2	COD	mg/l	<4.0	<4.0	<4.0	<4.0
3	Salinity	ppt	1.09	1.40	0.48	0.52
4	Oil & Grease	mg/l	Nil	Nil	Nil	Nil
5	Iron (as Fe)	mg/l	0.17	0.12	0.10	0.14
6	Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
7	Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
10	Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
11	Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
12	Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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रिचर्डसन एण्ड  
क्रुड्डस (1972) लिमिटेड

(भारत सरकार का उपक्रम)

इंजिनियर्स

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Website : www.richardsoncruddas.com

CIN : U28920MH1973GO1016389

**ENVIRONMENTAL ENGINEERING LABORATORY**

**Analysis Results of Ground Water (Piezo Wells)**

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 07.04.2017  
Source : Bore Well  
Sample Collection on: 23.03.2017 Report No : 6430  
Location Name : N1: North Bore Well, W1-W2-W3-W4: West Bore Wells

Sl. No	Parameters	Unit	N1	W1	W2	W3	W4
1	pH	-	7.67	6.89	6.75	6.63	6.72
2	COD	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0
3	Salinity	ppt	0.63	0.32	0.36	0.34	0.23
4	Oil & Grease	mg/l	Nil	Nil	Nil	Nil	Nil
5	Iron (as Fe)	mg/l	0.27	0.25	0.12	0.20	0.18
6	Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
7	Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
10	Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
11	Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
12	Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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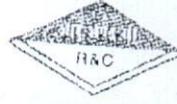
मुलुण्ड	Mulund	पंजीकृत एवं मुख्यालय	Regd. & Head Office :	नागपुर
एल.बी. शास्त्री मार्ग	L.B. Shastri Marg.	भायरकुला आईरन वर्क्स	Byculla Iron Works	F3, एम.आई.डी.सी इंडस्ट्रियल एस्टेट,
मुलुण्ड पश्चिम	Mulund West	सर. जे.जे. रोड	Sir. J.J. Road,	हिमांता रोड,
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फैक्स : 022-25680988	Fax: 022-25680988	फैक्स : 022-23794003	Fax: 022-23794003	फैक्स : 07104-237693
फोन : 022-25611973	Phone: 022-25611973	फोन : 022-32283301/2/3	Phone: 022-32283301/2/3	फोन : 07104-237061

# रिचर्डसन एण्ड क्रुडस (1972) लिमिटेड

(भारत सरकार का उपक्रम)

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ESTD.1858

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# Richardson & Cruddas (1972) Ltd

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### ENVIRONMENTAL ENGINEERING LABORATORY

Analysis Results of Ground Water (Piezo Wells)

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 15.05.2017  
Source : Bore Well  
Sample Collection on: 29.04.2017 Report No : 6843  
Location Name : S1: South Bore Well, E1-E2-E3: East Bore Wells

Sl. No	Parameters	Unit	S1	E1	E2	E3
1	pH					
2	COD		6.78	7.09		
3	Salinity	mg/l	<4.0	<4.0	7.63	7.85
4	Oil & Grease	ppt	1.35	8.41	<4.0	<4.0
5	Iron (as Fe)	mg/l	Nil	Nil	0.89	0.65
6	Petroleum Hydro Carbons	mg/l	0.39	0.14	Nil	Nil
7	Zinc (as Zn)	µg/l	BDL(<0.01)	BDL(<0.01)	0.06	0.06
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
10	Copper (as Cu)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
11	Mercury (as Hg)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
12	Cadmium (as Cd)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
			BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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फोन : 022-32283301/2/3

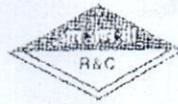
Regd. & Head Office :  
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रिचर्डसन एण्ड  
क्रुडदास (1972) लिमिटेड  
(भारत सरकार का उपक्रम)



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CIN : U28920MH1973GO1015389

**ENVIRONMENTAL ENGINEERING LABORATORY**

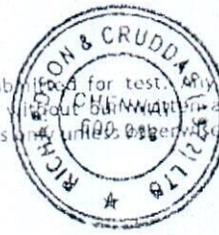
**Analysis Results of Ground Water (Piezo Wells)**

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120  
Place of Collection : Ground Water (Piezo Wells) Report Date : 15.05.2017  
Source : Bore Well  
Sample Collection on: 29.04.2017 Report No : 6844  
Location Name : E4-E5-E6-E7- East Bore Wells

Sl. No	Parameters	Unit	E4	E5	E6	E7
1	pH	-	6.98	7.64	7.86	7.79
2	COD	mg/l	<4.0	<4.0	<4.0	<4.0
3	Salinity	ppt	1.12	1.53	0.63	0.49
4	Oil & Grease	mg/l	Nil	Nil	Nil	Nil
5	Iron (as Fe)	mg/l	0.18	0.14	0.12	0.18
6	Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
7	Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
8	Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
9	Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
10	Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
11	Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
12	Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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एल.पी. शास्त्री मार्ग	L.B. Shastri Marg.	भायरकुला आइरन वर्क्स	Byculla Iron Works	F3, एम.आई.डी.सी इंडस्ट्रियल एस्टेट	F3, MIDC Industrial Estate
मुलुण्ड पश्चिम	Mulund West	सर, जं.रांड	Sr. J.J. Road,	मिंगना रोड,	Mingna Road,
मुम्बई - 400 080.	Mumbai-400 080.	मुम्बई - 400 008.	Mumbai - 400 008.	मुम्बई - 440 016.	Nagpur - 440 016.
फैक्स : 022-25690988	Fax: 022-25690988	फैक्स : 022-23794003	Fax: 022-23794003	फैक्स : 07104-237693	Fax: 07104-237693
फोन : 022-25611973	Phone: 022-25611973	फोन : 022-22283301/2/3	Phone: 022-22283301/2/3	फोन : 07104-237051	Phone: 07104-237051

# रिचर्डसन एण्ड क्रुडस (1972) लिमिटेड

(भारत सरकार का उपक्रम)

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अम्बटूर, चेन्नै - 600 098.

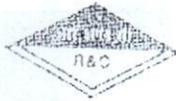
फोन : 044-26254111, 26255856

टेलिग्राम : आईरनवर्क्स

ई-मेल : r\_cruddas@hotmail.com

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वेबसाइट : www.richardsoncruddas.com



स्थापना

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CIN : U28920MH1973GO1016380

### ENVIRONMENTAL ENGINEERING LABORATORY

#### Analysis Results of Ground Water (Piezo Wells)

Issued to : M/s. KAMARAJAR PORT LIMITED,  
Vallur Post, CHENNAI-600 120

Place of Collection : Ground Water (Piezo Wells) Report Date : 15.05.2017

Source : Bore Well

Sample Collection on: 29.04.2017 Report No : 6845

Location Name : N1: North Bore Well, W1-W2-W3-W4: West Bore Wells

Parameters	Unit	N1	W1	W2	W3	W4
pH	-	7.29	7.20	7.62	7.78	7.56
COD	mg/l	<4.0	<4.0	<4.0	<4.0	<4.0
Salinity	ppt	0.57	0.38	0.30	0.35	0.24
Oil & Grease	mg/l	Nil	Nil	Nil	Nil	Nil
Iron (as Fe)	mg/l	0.32	0.27	0.16	0.22	0.21
Petroleum Hydro Carbons	µg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
Zinc (as Zn)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
Nickel (as Ni)	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
Cobalt (as Co)	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
Copper (as Cu)	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
Mercury (as Hg)	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
Cadmium (as Cd)	mg/l	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)	BDL(<0.002)

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			नागपुर F3, एम.आई.डी.सी. इन्डस्ट्रियल एस्टेट हिंजा रोड, मुम्बई - 440 016 फोन : 07104-237693 फोन : 07104-237061
			Nagpur F3, MIDCO Industrial Estate, Hingna Road, Nagpur - 440 016. Fax: 07104-237693 Phone: 07104-237061

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