BEFORE THE NATIONAL GREEN TRIBUNAL,
SOUTHERN ZONAL BENCH, CHENNAI
ORIGINAL APPLICATION NO. 176 OF 2013 (SZ)
(EARLIER OA NO. 562 of 2018 (PB))

IN THE MATTER OF

V.P Krishnamoorthy **.....Applicant**

Versus

Union of India & Ors **.....Respondents**

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S. Suresh 19/6/2020

S. Suresh
Regional Director
Central Pollution Control Board
Regional Directorate (South)
Bengaluru - 560079

Place: Bengaluru

Dated: 19.06.2020

Before The Hon'ble National Green Tribunal,
Southern Zonal Bench, Chennai
Original Application No. 176 of 2103 (SZ)
Earlier OA No. 562 of 2018 (PB)

In the Matter of

V. P. Krishnamoorthy **.....Applicant**

Versus

Union of India **.....Respondents**

REPLY AFFIDAVIT

Reply affidavit on behalf of Central Pollution Control Board (Respondent No. 12) with regard to Objection filed by Bharat Petroleum Corporation ltd., w.r.t Status report dated 16.03.2020 of the Central Pollution Control Board.

1. I, S. Suresh, Son of S.R. Sathyanarayana, Hindu, aged about 57 years, having office at the Regional Directorate (South), Central Pollution Control Board, 1st& 2nd Floors, Nisarga Bhavan, A- Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Bengaluru – 560 079 do hereby solemnly affirm and sincerely state as follows:-

2. That I am presently working as Scientist 'E' & Regional Director, Regional Directorate (South), Central Pollution Control Board (hereafter called as CPCB), Bengaluru and have been authorized to file the present compliance affidavit. I am fully conversant with the facts of the case and hence, competent and authorized to depose and swear the present compliance affidavit as under:

3. That in compliance of Hon'ble NGT order dated 18.09.2019, CPCB coordinated with Indian Council for Medical Research (ICMR) and Tamil Nadu Pollution Control Board (TNPCB) and convened meeting on 19.11.2019 at TNPCB, H.O., Chennai to discuss the scope and modalities of health impact study. The meeting was attended by the officials of CPCB, TNPCB, ICMR, BPCL and representative of M/s Environment Stratus (Consultant for remediation of oil contaminated site). IN the said meeting, representatives of ICMR and BPCL were apprised about the requirement of conducting health studies in time bound manner.

S. Suresh 19/6/2020
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REGIONAL DIRECTORATE (SOUTH)
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU - 560 079. MOB : 9480672128

4. Subsequently, ICMR prepared a detailed proposal comprising scope of work, methodology, procedure for quantification of health impacts including project cost and timelines to complete the study. ICMR submitted the proposal to TNPCB and CPCB on 28.02.2020. Thereafter, CPCB, forwarded the ICMR proposal to BPCL and TNPCB vide letter dated 28.02.2020 with request to expedite award of project to ICMR.

5. Further, as per the directions of Hon'ble NGT, CPCB and TNPCB have carried out groundwater monitoring as well as performance of Soil Vapour Extraction System installed by BPCL for remediation of oil contaminated site at Tondiarpet. The report was submitted before Hon'ble NGT on 16.03.2020.

6. That Hon'ble Tribunal heard the matter on March 18, 2020, and on the request of Respondent No. 6 (M/s BPCL), adjourned the matter for allowing filing the objections by them. M/s BPCL has filed the objections on June 09, 2020 the same was received through CPCB counsel.

That para wise reply from CPCB on the said objections are as below:

Para 1 to 14:

7. It is submitted that with respect to averments made is para 1 to 14 are about General information, on-going remediation work and its status, hence no comments to offer from this Respondent No. 12.

8. **Para 15:** *"With regard to Point No. 1 of the Status Report dt. 16.03.2020 (i.e.) BPCL awarding the work of conducting the Health study to ICMR, it is submitted that BPCL had obtained approval from its management to float the tender. Further, by email dt. 24.04.2020 and 06.05.2020, BPCL has requested for detailed specifications, scope of work, job description, estimate cost item wise, timelines, vendor registration by ICMR and other details from CPCB in order to float the tender. The details are awaited from CPCB. BPCL is awaiting for the reply from CPCB on the details sought for floating the tender."*

S. Suresh 19/6/2020

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REGIONAL DIRECTORATE (SOUTH)
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CPCB Reply:

That as per the direction of Hon'ble NGT, as a committee member CPCB taken lead role to convene the meeting with ICMR and follow-up with ICMR to obtain the detailed proposal comprising scope of work, methodology, procedure for quantification of health impacts including project cost and timeline to complete the study and the same was sent to BPCL vide letter dated February 28, 2020 **(Annexure -1,2,3)** with request to expedite award of project to ICMR. However, no official communication has been received from BPCL, after lapse of fifty-six days CPCB received mail from BPCL, the matter of mail is as below:

"Please help us with following details to float the single tender to ICMR.

1. Detailed specifications of tender
2. Scope of work, job description and estimate cost item wise, time lines for the job, LD clause etc.
3. Vendor registration template in the format (enclosed) duly filled and submit by vendor (ICMR) to register them. (ICMR need to provide their registration / incorporation certificate, GSTN copy and other details as per the format enclosed)"

That it is the responsibility of BPCL to justify placing single tender on ICMR. Since ICMR has submitted the detailed technical and financial proposal, BPCL might have sought required clarifications from ICMR and request CPCB/TNPCB to convene a meeting with ICMR. Further, it is humbly submitted that CPCB may not justify or recommend tendering terms, which may be finalised between ICMR and BPCL following the established procedures of respective agencies.

9. **Para 16:** *"With regard to Pont no 2 of Status Report dated 16.03.2020 (i.e.) the findings of the ground water quality study conducted by CPCB and TNPCB, it is submitted the remedial activity at the site has resulted in reduction of ground water concentrations. The concentration of chemicals of concern although above laboratory detection limits, are reducing in the wells sampled. Chemicals of concern at this site are DRO, GRO and BTEX. It is important to note that CPCB has not established permissible limits for the chemicals of concern at this site."*

CPCB Reply:

That in reply to points raised by M/s BPCL at para 16, CPCB submit the following facts before Hon'ble NGT:

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On receipt of complaints dated July 14, 2013 regarding Petroleum impact in bore wells located in the public domain on TH road and VP Koil Street at Tondiarpet, Chennai; CPCB/TNPCB inspected and directed BPCL to discontinue the damaged pipelines carrying petroleum products and also directed to take up detailed study to assess the extent of contamination and its remediation. As per the direction of Hon'ble NGT, BPCL engaged the experts from IIT Madras in November, 2013 and conducted initial evaluation and prepared tender documents, scope of work for the remediation work. Accordingly, BPCL engaged the consultant M/s Stratus Environment in December, 2014 to carryout remediation of oil contaminated site under the supervision of IIT Madras. In the remedial works initiated under guidance from IIT, Madras, risk assessment studies were not carried out to derive site specific target levels.

While hearing the matter on March 17, 2016, the Hon'ble NGT implead the CPCB and passed an order that *" till date no remediation measures worthy of speaking has been taken in the interest of the residents in the area, we discharge the experts from IIT-M from any further supervision over the remediation efforts and directed the CPCB to take up the supervision of remediation work of erasing oil contamination in the water aquifer in Tondiarpet taking into consideration all the reports of experts of IIT-M as well as the Board and file its report by next date of hearing. In this exercise the CPCB is permitted to avail the service and /or expertise from any recognised Organisation/Institute located in the Country. The cost involved for the said purpose shall be fully borne by the BPCL* ***(Annexure-4)*** *".*

That in compliance to the aforesaid order, CPCB has inspected the oil contaminated site at Tondiarpet along with the officials of TNPCB on April 05, 2016 and reviewed the status of remediation works. The salient observations vis-à-vis recommendations communicated to BPCL vide CPCB letter dated April 27, 2016 **(Annexure -5)**. The major salient observations are as below:

> "(4) The remedial measures initiated are not based on any quantifiable risk reduction. There is need to set standards for remediation based on reduction in risk at the receptor rather than just operating a soil vapour extraction system. It is therefore suggested that the scope of work to the consultant should include a quantitative risk assessment. Tier-1 screening of the soil and groundwater may be carried out using Canadian screening standards and Dutch intervention values.

S. Suresh 19/6/2020

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(8) Based on site specific target levels derived from risk assessment, the consultant shall evaluate multiple remedial options that may be required beyond soil vapour extraction system including proposal for long term plan for assessment and monitoring may be submitted to TNPCB and CPCB within a period of 4 months. Short term findings on performance of SVE system may be included in this report.

(10) Target level for remediation shall be set based on quantitative risk assessment and such target level shall be authorised by TNPCB to monitor the remediation works."

CPCB reviewed implementation of above recommendations and the project status including reasons given by BPCL for not implementation of aforesaid suggestions were submitted to Hon'ble NGT vide status report dated November 16, 2016 **(Annexure -6)**. The extracted paragraph of status report of CPCB dated November 16, 2016 is as below;

"(iii) As per the CPCB recommendations, it is required to set Site Specific Target levels (SSTL) to be derived from quantitative risk assessment using any suitable model based on the human health risk associated with both inhalation and incidental ingestion of specific contaminants at the exposure concentration and SPR (Source-Pathway-Receptor) linkage. M/s BPCL has not made any progress in developing SSTL, however, excavation of contaminated soil for the proposed Metro construction may alter the source pathway receptor considerations for developing the SSTL, therefore it may be appropriate to develop SSTL at later stage. "

It is submitted that as per directions of Hon'ble NGT, CPCB has been monitoring ground water quality and performance of soil vapour extraction system and effectiveness of remediation is reported in comparison to previously observed values. Since excavation works of CMRL are nearing completion in impacted area, M/s BPCL may carry out risk assessment studies by engaging a reputed remediation consultant and proposed Site Specific Target levels (SSTL) may be submitted to TNPCB for acceptance or authorization of remediation standards.

S. Suresh 19/12/2020

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10. **Para 17:** *"With regard to the statement that there is presence of TOC, TPH and DRO in the 4 deep bore wells, it is stated that these wells historically have detectable concentrations of petroleum hydrocarbons. Similar to the shallow wells, the concentration of chemicals of concern are declining. For example concentration of DRO in well MW-5B was initially reported to be 19.81 mg/L in December 2015, but the current concentration as reported by CPCB is 0.193 mg/L. Further, with regard to the statement that the concentration of mineral oil was found within permissible limit in all monitored wells except in one location (MW-5B), it is stated that the initial concentration of mineral oil in MW-5B was reported to be 9.44 mg/L in December 2016 and current concentration reported by CPCB is 0.82, indicating a significant reduction in concentration.*

CPCB Reply:

That as per the directions of Hon'ble NGT, CPCB initiated monitoring of groundwater since June, 2016 by selecting 9 monitoring wells installed in core area as well as in boundary of contaminated site and the status report showing fluctuation of concentrations of chemicals of concern in groundwater was submitted to Hon'ble NGT vide CPCB status report dated January 05, 2018 **(Annexure-7)**. The report revealed that "concentration of Mineral Oil and Gasoline Range of Organics (GRO) found less than 0.01 mg/L and 20 µg/L, respectively in most of monitoring well locations. However, concentration of Diesel Range of Organics (DRO), Total Petroleum Hydrocarbon (TPH) and Total Hydrocarbon (THC) in groundwater indicates that the present system of operation of SVE could not establish the satisfactory reduction".

Due to ongoing Metro excavation and seasonal variation of groundwater, monitoring wells identified by CPCB (except MW-5B) were either closed or dried-up. In contrary to claims of M/s BPCL, comparison of TOC, DRO and THC levels in monitoring well MW-5B, in samples collected on 22 November, 2017 and 14 February, 2020 indicates clear increment in concentrations values from 14 mg/L, 0.089 mg/L & 0.272 mg/L to as high as 64 mg/L, 0.193 mg/L & 1.01 mg/L respectively, however such increment may be attributed to movement of groundwater and change in hydro-geological conditions due to CMRL works. CPCB monitoring has also indicates that low concentrations in other wells, however over-all remediation efficiency cannot be decided based on monitoring of few wells. Therefore, based on observed groundwater quality CPCB concluded that the present system of operation of SVE could not establish the satisfactory reduction in groundwater contamination. It is therefore necessary to augment SVE system by connecting as many wells as possible and by operating both the SVE systems simultaneously to optimal extraction rate. The observations of BPCL claiming significant reduction in concentration is not acceptable.

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PRAYER

That it is humbly submitted payed that Hon'ble NGT may issue suitable direction to BPCL to;

1. Issue suitable direction to M/s BPCL to carry out detailed site investigation and risk assessment study to evolve Site Specific Target Levels (SSTLs) for remediation of oil contaminated site at Tondiarpet, Chennai;
2. Direct M/s BPCL to augment SVE system by connecting as many wells as possible and by operating both the SVE systems simultaneously to optimal extraction rate;

This answering Respondent No. 12 shall abide to any direction passed by the Hon'ble Tribunal.

S. Suresh 19/6/2020

DEPONENT

S. SURESH
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE (SOUTH)
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU - 560 079. MOB : 9480672128

VERIFICATION

It is verified that the content of this reply affidavit is based on office records. Nothing has been concealed therein.

Signed and verified on this 19th day of June 2020 at Bengaluru

S. Suresh 19/6/2020

DEPONENT

S. SURESH
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE (SOUTH)
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
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COUNSEL FOR
12th RESPONDENT

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

NGT Matter- (Time Bound)

F.No.Tech-/39/legal (NGT)/TN/RDS/2019-20/

February 28, 2020

To

The Member Secretary
Tamil Nadu Pollution Control Board
No. 76, Mount Salai, Guindy
Chennai - 600032

Sub: Hon'ble National Green Tribunal, (Principal Bench), New Delhi orders dated September 18, 2019 in the matter of OA No. 562/2019 (SZ) (Earlier O. A. No. 176 of 2013) V.P. Krishnamoorthy Vs The Union of India & Ors. In the matter of remediation of oil contaminated site at Tondiarpet, Chennai

Sir,

This has reference to meeting convened on 19.11.2020 at TNPCB, HO, Chennai in compliance to above order, wherein it was concluded **(copy of the minutes at Annexure I)** that Indian Counsel of Medical Research (ICMR) may undertake field visit to understand the ground reality of Oil contaminated site at Tondairpet and to submit detailed proposal including scope of study, methodology, procedure for quantification including cost and time frame to complete the study on health hazards in the oil contaminated site at Tondairpet. As agreed in the meeting, ICMR submitted the detailed proposal including cost estimates to carry out the study. Copy of mail dated 28.02.2020 received from ICMR is enclosed for ready reference **(Annexure 2& 3)**.

In view of the above and in order to comply with NGT directions, it is requested that TNPCB may quickly coordinate with BPCL to award the project to ICMR and to complete the study at the earliest possible. It is also requested to kindly provide update on status of action taken by 05/03/2020 so that the same can be filed before Hon'ble NGT prior to upcoming hearing on March 18, 2020.

Yours faithfully

(Dr. M. Madhusudanan)
Regional Director

Copy to:

Mr. K. B. Reddy
Chief Installation Manager
Bharat Petroleum Corporation Ltd.,35, Vaidynathan Street, Tondairpet
Chennai - 600081 : For necessary action Pl

The District Environmental Engineer
Tamilnadu Pollution Control Board
1st floor, 6/1, Sri Jothi Complex
Murugesan Street, Bala Vinayagar Nagar
Arumbakkam, Chennai - 600106 : For follow up pl.

Divisional Head, WM -1,
CPCB, Delhi - 32 : For Kind Information Please

28/02/2020

(Dr. M. Madhusudanan)
Regional Director

Health Impact of Petroleum Oil Leak among residents of Tondiarpet, Chennai – A Cross Sectional Study

Background:

Petroleum products contain more than 1000 chemicals, which are considered as carcinogens. The exposure (both acute and chronic) to chemical components of petroleum products can affect the health and cause illness. Although pipeline transportation of natural gas and petroleum is considered safer and cheaper than ground transportation, pipeline failures, failing infrastructure, human errors, and natural disasters can result in major pipeline disasters. As such, previous incidents have been shown to cause detrimental effects to the environment and the public's safety. Oil spills have major environmental and economic effects as well affects human health.

Northern part of Chennai is a major industrial hub and many petroleum refineries, storage terminals are also located. The petroleum products are transported to the storage terminals from the refineries using underground pipelines, which traverse through residential and commercial areas. Leakage in the petroleum carrying pipeline systems had been reported in news papers in the past. One such leakage incidence took place in an underground pipeline of Bharat Petroleum Corporation Limited (BPCL), at Tondiarpet area of Chennai during the year 2013. That underground pipeline was laid between Chennai Port and BPCL terminal and transporting motor spirit and high speed diesel petroleum products. A public complaint was filed by the residents of Tondiarpet regarding contamination of groundwater. The complaint was investigated by Tamil Nadu Pollution Control Board (TNPCB) on 13/07/2013 and the inspection revealed presence of petroleum products in groundwater. A public interest litigation (PIL) petition was filed in Hon'ble National Green Tribunal (NGT), South Bench, Chennai by residents, which was admitted as Application No. 176 of 2013 in August 2013. Following, BPCL has dummied and abandoned that pipeline and the initiated remediation works as per the directions of Central Pollution Control Board. Some of remediation work include provision of water to the public residing in the complained area and to measures to extract the spilled petroleum products from the ground.

A joint meeting was conducted by the stakeholders on 1st March 2018 to take stock of the remediation work and finalize further action plan for expediting the remediation process. As decided by the Committee, TNPCB has requested ICMR-National Institute of Epidemiology/ICMR-National Institute for Research in Environmental Health/ICMR-National Institute of Occupational Health to work in coordination to conduct a study to

assess the health impact due to oil leakage in the population living in the affected area and submit the report.

ICMR-NIE conducted a consultative meeting involving experts in General Medicine (Madras Medical College), Environmental Engineering (IIT-Madras), Occupational Health (ICMR-NIOH) and Epidemiology (ICMR-NIE) on 6th January 2020 to discuss and finalize the plan for assessing the health impact of the residents living in the affected area. As decided in the meeting, we propose to conduct the study with the objective to assess the health impact of the population exposed to oil pipeline-leak in Tondiarpet area and unexposed population in Royapuram area in Chennai in collaboration with IIT-Madras, Madras Medical College, ICMR-NIOH-ROHC(S), ICMR-NIREH.

Study design: Cross-sectional study

Study population: Residents (aged 5 years and above) of the oil pipeline leaked area in Tondiarpet (exposed to oil leak) and residents of Royapuram area (unexposed to oil pipeline leak). Approximate number of population: 3332 each in exposed and unexposed areas (Calculated based on the population density in Chennai). We assume 20% of population will not provide consent to participate or absent during two attempts.

The sampling area is based on the plume boundaries of the environmental study conducted by IIT-M. (Fig 1)

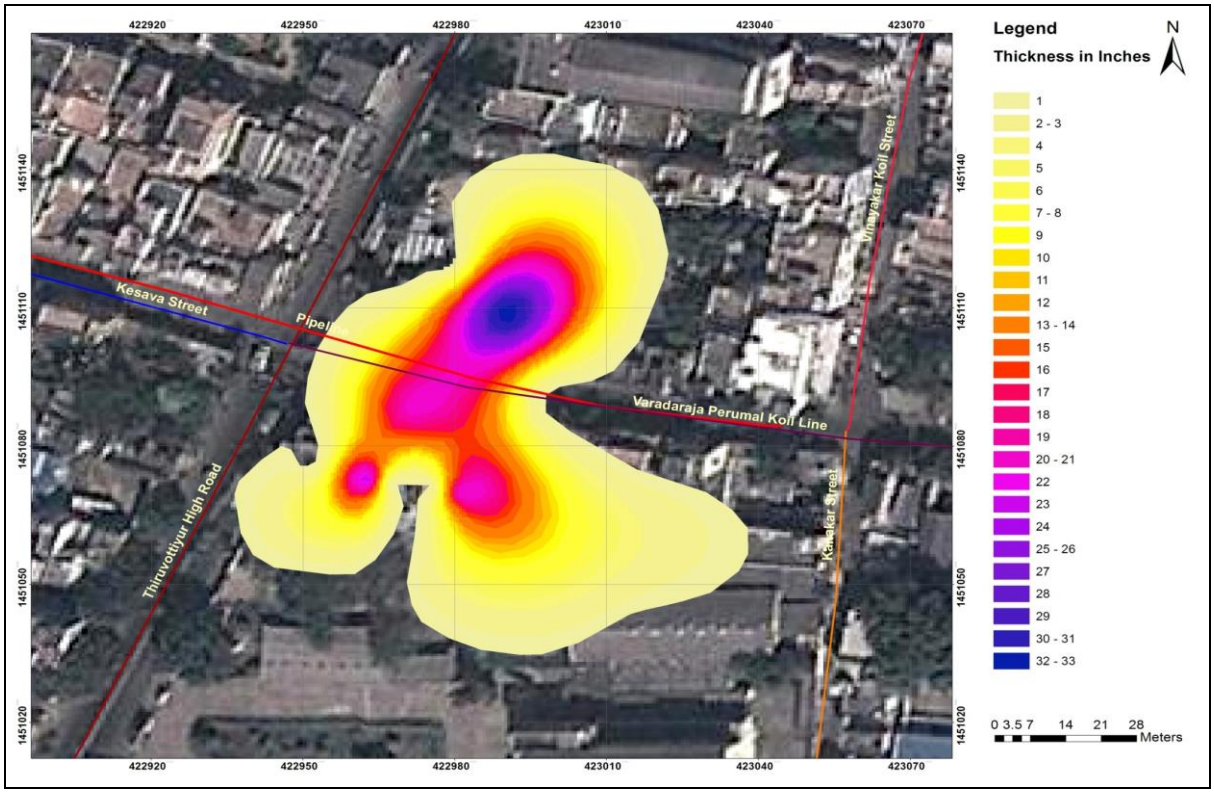

Figure 1: Spread of oil plume in study area

Definitions:

Residents: living in the study area

- Residents of Tondiarpet area (200 meters radius from the main site of Oil leak in Varadaraja Perumal Street) (Figure 2)

Exclusion Criteria

- Refusal to provide written informed consent

Controls:

- Residents of Royapuram area residing within the radius of 200 meters from St. Anne's Girls Higher Secondary School, Royapuram. The area was chosen, since the exposure parameters are similar to case area except underground petroleum pipelines.

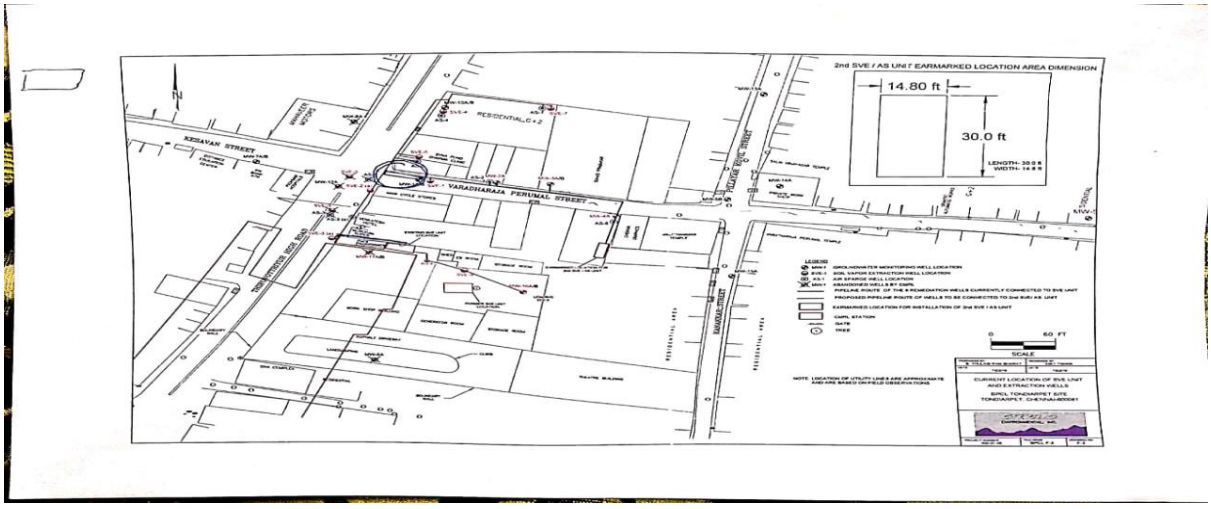

Figure 2: Oil leak area in Tondiarpet (marked in circle)

Sampling method:

We will recruit all the population residing in the exposed and unexposed areas. If any resident is not available during the survey, only one more attempt will be done on next day for recruiting.

Data collection:

Socio-demographic details including duration of their stay in the area, occupational details, self reported morbidity details will be collected from all the participants. Venous blood (10 ml) and urine (50 ml) samples will be collected from randomly chosen 10% of the study population aged 5 years and tested for biochemical parameters and metabolites of the petrochemicals. In a 10% of population aged ≥18 years, spirometry and resting state heart rate variability tests will also be done. (10% of population in

exposed and unexposed area [(3332+3332)-20% non response/absence during the visits=1066 rounded to 1100]

List of investigations:

- Complete Blood Count
- Lipid profile
- Liver function test
- Renal Function Test
- Lung function – spirometry
- Heart Rate Variability
- Urinary metabolite -Polycyclic aromatic hydrocarbons
- Blood petroleum metabolites (PAH metabolites as per environmental protection agency, USEPA)

Attempts will be made to obtain the Health Management Information System data from the hospitals in the area such as Department of dermatology of Stanley Medical College, MMC, KMC, Government Peripheral hospital, CDH and major private health facilities to assess the trend of morbidities before and after the oil leak events and will be analysed.

Environmental and biomonitoring data:

The report of environmental sample testing particularly ground water, soil and ambient air will be obtained from IIT-M to assess the presence of petrochemicals and their concentration in the exposed area. ICMR-NIOH-ROHC(S) will involve in assessing the urinary biomarkers of polycyclic aromatic hydrocarbons (PAHs).

Human participant protection:

We will obtain approval from Ethics Committee of ICMR-NIE before initiating the study. The written informed consent/assent from all the study participants before study enrolment. We will provide suitable referral services to the nearest public health facility to the participants, if necessary.

Expected Outcome:

Generate a report of morbidity pattern among the residents of oil leak exposure to be submitted to Tamil Nadu Pollution Control Board.

To develop scientific manuscripts from the study findings for wider scientific dissemination.

Study duration: ***Total: 6 months***

Data collection: 2.5 months

Lab testing: 2.5 months

Data analysis and report preparation: 1 month

Budget:

S No	Head	Amount
1	Non recurring	3,70,000
2	Recurring	97,97,500
3	Contingency	4,89,875
4	Institutional overhead	9,79,750
	Total	1,12,67,125

		Item	Number	Rate	Duration	Amount	
A		**Non-recurring**					
	1	Tabs for data collection	6	20000	-	₹	1,20,000.00
	2	Spirometer	1	250000	-	₹	2,50,000.00
		Sub-total non-recurring					3,70,000.00
B		**Recurring**					
	1	*Manpower*					
a		Scientist B Medical	2	70000	6	₹	8,40,000.00
		Staff Nurse	4	32000	4	₹	5,12,000.00
		Field Investigator	6	31000	4	₹	7,44,000.00
		Lab Technician - grade III	2	18000	4	₹	1,44,000.00
		Technical Officer (Lab) (NIOH-ROHCS, Bengaluru)	1	32000	6	₹	1,92,000.00
		Multi Tasking Staff	2	16000	4	₹	1,28,000.00
	2	CBC	550	300	-	₹	1,65,000.00
		Lipid profile	550	400	-	₹	2,20,000.00
		Liver function test (Bilirubin, AST, ALT, protein)	550	500	-	₹	2,75,000.00
		Renal Function Test	550	800	-	₹	4,40,000.00
		Lung function – spirometry	550	100	-	₹	55,000.00
		HRV	550	50	-	₹	27,500.00
		Urinary – Polycyclic aromatic hydrocarbon	550	4000	-	₹	22,00,000.00
		Blood petroleum metabolites (PAH metabolites as per environmental protection agency, USEPA)	550	5500	-	₹	30,25,000.00
		Travel					
		Field travel	60	4000	-	₹	2,40,000.00
		Supervision/monitoring/sample shipment	1	100000		₹	1,00,000.00
		Consumables:					
		Sample collection kit: 200/sample	600	200		₹	1,20,000.00
		Sub total recurring				₹	94,27,500.00
		Contingency	5%			₹	4,89,875.00
		Institutional overhead	10%			₹	9,79,750.00
		Grand total				₹	112,67,125.00

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN ZONAL BENCH

CHENNAI

Application No. 176 of 2013 (SZ)

And

M. A. No. 128 of 2014 (SZ)

V.P. Krishnamoorthy
S/o Late Mr. Ponnusamy Nadar
Old No.5, New no. 13 A
Kalingarayan street, Old Washermanpet
Chennai- 21 ....**Applicant**

Vs.

1. Union of India
   Represented by its Secretary
   Ministry of Petroleum and Natural Gas
   Shastri Bhavan
   New Delhi- 110 001

2. The State of Tamil Nadu
   Represented by its Director
   Department of Environment and Forest
   Fort St. George, Chennai

3. The Member Secretary
   Tamil Nadu Pollution Control Board
   Anna Salai
   Chennai- 32

4. Indian Oil Corporation Limited
   Indian oil Bhavan
   139, Nugambakkam High Road
   Chennai- 600 034

5. Chennai Petroleum Corporation Limited
   New No.536, Anna Salai, Teynampet
   Chennai- 600 018

6. Bharat Petroleum Corporation limited
   Bharat Bhavan
   4 and 6 Currimbhoy Road
   Ballard Estate
   Mumbai- 400 001

7. Ministry of environment and forest
   Represented by its Secretary
   CGO Complex, Lodhi Road
   New delhi-110 003

8. The Hidustan Petroleum Corporation Ltd.
   98/99, Elaiya Mudali Street
   P.B.No.1170
   Washermenpet post
   Chennai

9. The Chief Controller of Explosives
   Nagpur

10. The Secretary to Government
    Ministry of Industries, New Delhi

11. The Deputy Salt Commissioner
    Chennai ....**Respondents**

Counsel for the Applicant

Mr. Yogeshwaran

Counsel for the Respondents

1. Mr. Su. Srinivasan (Asst. Solicitor General) - Counsel for respondent Nos. 1, 9 and 10
2. Mr. M. K . Subramanian - Counsel for respondent No. 2
3. Mrs. Rita Chandrasekar - Counsel for respondent No.3
4. M/s. Vijaymehanath and Mrs. Vidyalakshmi - Counsel for Respondent No. 4
5. Mr. Senthil Kumar and Mr. S. Arjun Suresh - Counsel for respondent No. 5
6. M/s.Ramasubramani & Associates - Counsel for respondent No. 6
7. M/s. Sangamithrai - Counsel for Respondent No.7
8. M/s. King and Partridge - Counsel for respondent No. 8

Application No. 34 of 2014 (SZ)

K.S. Jayaraman
S/o. Late K.N. Subramni
No.222/697, T.H Road
Tondiarpet
Chennai- 600 081 ...**Applicant**

Vs.

1. Union of India
   Represented by its Secretary
   Ministry of Petroleum and Natural Gas
   Shastri Bhavan
   New Delhi- 110 001

2. Ministry of Environment and Forests
   Represented by its Secretary
   CGO Complex
   Lodhi Road
   New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
   Bharat Bavan
   4 and 6 Currimbhoy Road
   Ballard Estate
   Mumbai- 400 001

4. The State of Tamil Nadu
   Represented by its Director
   Department of Environment and Forests
   Fort St. George, Chennai

5. The Member Secretary
   Tamil Nadu Pollution Control Board
   Anna Salai
   Chennai – 32

6. Hindustan Petroleum Corporation Limited
   98/99, Elaiya Mudali Street
   P.B. No. 1170, Washermanpet Post
   Chennai

7. Indian Oil Corporation Limited
   Indian oil Bhavan
   139, Nungambakkam High Road
   Chennai- 600 034

8. Chennai Petroleum Corporation Limited
   New No. 536, Anna Salai
   Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

M/s. E. Maharajan and M/s. D. Gently Rathnaraj

Counsel for the Respondents

1. Mr. Su. Srinivasan (Asst. Solicitor General) - Counsel for respondent No. 1
2. M/s. Sangamithrai - Counsel for Respondent No.2
3. M/s.Ramasubramanian & Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4
5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra Ross Divakar - Counsel for Respondent No. 8

Application No 35 of 2014 (SZ)

R. Selvi
W/o. S.Rajkumar
No.223/699, T.H. Road
Thondiarpet
Chennai- 600 081 **...Applicant**

Vs.

1. Union of India
   Represented by its Secretary
   Ministry of Petroleum and Natural Gas
   Shastri Bhavan
   New Delhi- 110 001

2. Ministry of Environment and Forests
   Represented by its Secretary

CGO Complex
Lodhi Road
New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
Bharat Bavan
4 and 6 Currimbhoy Road
Ballard Estate
Mumbai- 400 001

4. The State of Tamil Nadu
Represented by its Director
Department of Environment and Forests
Fort St. George, Chennai

5. The Member Secretary
Tamil Nadu Pollution Control Board
Anna Salai
Chennai – 32

6. Hindustan Petroleum Corporation Limited
98/99, Elaiya Mudali Street
P.B. No. 1170, Washermanpet Post
Chennai

7. Indian Oil Corporation Limited
Indian oil Bhavan
139, Nungambakkam High Road
Chennai- 600 034

8. Chennai Petroleum Corporation Limited
New No. 536, Anna Salai
Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

M/s. E. Maharajan and M/s. D. Gently Rathnaraj

Counsel for the Respondents

1. Mr. Su. Srinivasan
(Asst. Solicitor General) - Counsel for respondent No. 1
2. M/s. Sangamithrai - Counsel for Respondent No.2
3. M/s.Ramasubramanian
& Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4

5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra
   Ross Divakar - Counsel for Respondent No. 8

Application No 36 of 2014 (SZ)

K. Umachandran

S/o. Late K. Kuppusamy

No. 225/703, T.H. Road

Tondiarpet, Chennai- 600 081 **.....Applicant**

Vs.

1. Union of India
   Represented by its Secretary
   Ministry of Petroleum and Natural Gas
   Shastri Bhavan
   New Delhi- 110 001

2. Ministry of Environment and Forests
   Represented by its Secretary
   CGO Complex
   Lodhi Road
   New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
   Bharat Bavan
   4 and 6 Currimbhoy Road
   Ballard Estate
   Mumbai- 400 001

4. The State of Tamil Nadu
   Represented by its Director
   Department of Environment and Forests
   Fort St. George, Chennai

5. The Member Secretary
   Tamil Nadu Pollution Control Board
   Anna Salai
   Chennai – 32

6. Hindustan Petroleum Corporation Limited
   98/99, Elaiya Mudali Street

P.B. No. 1170, Washermanpet Post
Chennai

7. Indian Oil Corporation Limited
Indian oil Bhavan
139, Nungambakkam High Road
Chennai- 600 034

8. Chennai Petroleum Corporation Limited
New No. 536, Anna Salai
Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

M/s. E. Maharajan and M/s. D. Gently Rathnaraj

Counsel for the Respondents

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2. M/s. Sangamithrai - Counsel for Respondent No.2
3. M/s.Ramasubramanian & Associates - Counsel for respondent No. 3
4. Mr. M. K. Subramanian - Counsel for respondent No. 4
5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra Ross Divakar - Counsel for Respondent No. 8

Application No.37 of 2014 (SZ)

S. Shanthi
W/o. V.R. Sekar
No.221/695, T.H .road
Tondiarpet
Chennai-600 081 **...Applicant**

Vs.

1. Union of India
Represented by its Secretary
Ministry of Petroleum and Natural Gas
Shastri Bhavan
New Delhi- 110 001

2. Ministry of Environment and Forests
Represented by its Secretary
CGO Complex

Lodhi Road
New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
Bharat Bavan
4 and 6 Currimbhoy Road
Ballard Estate
Mumbai- 400 001

4. The State of Tamil Nadu
Represented by its Director
Department of Environment and Forests
Fort St. George, Chennai

5. The Member Secretary
Tamil Nadu Pollution Control Board
Anna Salai
Chennai – 32

6. Hindustan Petroleum Corporation Limited
98/99, Elaiya Mudali Street
P.B. No. 1170, Washermanpet Post
Chennai

7. Indian Oil Corporation Limited
Indian oil Bhavan
139, Nungambakkam High Road
Chennai- 600 034

8. Chennai Petroleum Corporation Limited
New No. 536, Anna Salai
Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

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3. M/s.Ramasubramanian & Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4
5. Mrs. Rita Chandrasekar - Counsel for respondent No.5

6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra
   Ross Divakar - Counsel for Respondent No. 8

Application No. 38 of 2014 (SZ)

G. Mahesh Kumar

S/o. M. Gulabchand Bohra

No.229/711, T.H. Road

Tondiarpet

Chennai-600 081 **...Applicant**

Vs.

1. Union of India
   Represented by its Secretary
   Ministry of Petroleum and Natural Gas
   Shastri Bhavan
   New Delhi- 110 001

2. Ministry of Environment and Forests
   Represented by its Secretary
   CGO Complex
   Lodhi Road
   New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
   Bharat Bavan
   4 and 6 Currimbhoy Road
   Ballard Estate
   Mumbai- 400 001

4. The State of Tamil Nadu
   Represented by its Director
   Department of Environment and Forests
   Fort St. George, Chennai

5. The Member Secretary
   Tamil Nadu Pollution Control Board
   Anna Salai
   Chennai – 32

6. Hindustan Petroleum Corporation Limited
   98/99, Elaiya Mudali Street

P.B. No. 1170, Washermanpet Post
Chennai

7. Indian Oil Corporation Limited
Indian oil Bhavan
139, Nungambakkam High Road
Chennai- 600 034

8. Chennai Petroleum Corporation Limited
New No. 536, Anna Salai
Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

M/s. E. Maharajan and M/s. D. Gently Rathnaraj

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3. M/s.Ramasubramanian & Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4
5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra Ross Divakar - Counsel for Respondent No. 8

Application No. 39 of 2014 (SZ)

R. Vijaya
W/o. T. Ravi
No.227/2, 705, T.H Road
Tondiarpetu
Chennai-600 081 **...Applicant**

Vs.

1. Union of India
Represented by its Secretary
Ministry of Petroleum and Natural Gas
Shastri Bhavan
New Delhi- 110 001

2. Ministry of Environment and Forests
Represented by its Secretary
CGO Complex

Lodhi Road
New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
Bharat Bavan
4 and 6 Currimbhoy Road
Ballard Estate
Mumbai- 400 001

4. The State of Tamil Nadu
Represented by its Director
Department of Environment and Forests
Fort St. George, Chennai

5. The Member Secretary
Tamil Nadu Pollution Control Board
Anna Salai
Chennai – 32

6. Hindustan Petroleum Corporation Limited
98/99, Elaiya Mudali Street
P.B. No. 1170, Washermanpet Post
Chennai

7. Indian Oil Corporation Limited
Indian oil Bhavan
139, Nungambakkam High Road
Chennai- 600 034

8. Chennai Petroleum Corporation Limited
New No. 536, Anna Salai
Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

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3. M/s.Ramasubramanian & Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4
5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6

7. M/s. Raghavendra
   Ross Divakar - Counsel for Respondent No. 8

Application No. 40 of 2014 (SZ)

K. Sampath Kumar

S/o. P. Kanniappan

No. 217/3/687, T.H Road

Tondiarpet,Chennai- 600 081 **...Applicant**

Vs.

1. Union of India
   Represented by its Secretary
   Ministry of Petroleum and Natural Gas
   Shastri Bhavan
   New Delhi- 110 001

2. Ministry of Environment and Forests
   Represented by its Secretary
   CGO Complex
   Lodhi Road
   New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
   Bharat Bavan
   4 and 6 Currimbhoy Road
   Ballard Estate
   Mumbai- 400 001

4. The State of Tamil Nadu
   Represented by its Director
   Department of Environment and Forests
   Fort St. George, Chennai

5. The Member Secretary
   Tamil Nadu Pollution Control Board
   Anna Salai
   Chennai – 32

6. Hindustan Petroleum Corporation Limited
   98/99, Elaiya Mudali Street

P.B. No. 1170, Washermanpet Post

Chennai

7. Indian Oil Corporation Limited

Indian oil Bhavan

139, Nungambakkam High Road

Chennai- 600 034

8. Chennai Petroleum Corporation Limited

New No. 536, Anna Salai

Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

M/s. E. Maharajan and M/s. D. Gently Rathnaraj

Counsel for the Respondents

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2. M/s. Sangamithrai - Counsel for Respondent No.2
3. M/s.Ramasubramanian & Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4
5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra Ross Divakar - Counsel for Respondent No. 8

Application No. 41 of 2014 (SZ)

K. Kamalakannan

S/o. Late K.Kuppusamy

No. 224/701/1

T.H.Road, Tondiarpet

Chennai- 600 081 **...Applicant**

Vs.

1. Union of India

Represented by its Secretary

Ministry of Petroleum and Natural Gas

Shastri Bhavan

New Delhi- 110 001

2. Ministry of Environment and Forests

Represented by its Secretary

CGO Complex
Lodhi Road
New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
Bharat Bavan
4 and 6 Currimbhoy Road
Ballard Estate
Mumbai- 400 001

4. The State of Tamil Nadu
Represented by its Director
Department of Environment and Forests
Fort St. George, Chennai

5. The Member Secretary
Tamil Nadu Pollution Control Board
Anna Salai
Chennai – 32

6. Hindustan Petroleum Corporation Limited
98/99, Elaiya Mudali Street
P.B. No. 1170, Washermanpet Post
Chennai

7. Indian Oil Corporation Limited
Indian oil Bhavan
139, Nungambakkam High Road
Chennai- 600 034

8. Chennai Petroleum Corporation Limited
New No. 536, Anna Salai
Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

M/s. E. Maharajan and M/s. D. Gently Rathnaraj

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3. M/s.Ramasubramanian
& Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4

5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra
   Ross Divakar - Counsel for Respondent No. 8

Application No. 42 of 2014(SZ)

G. Purusothaman

S/o. S. Govindarajulu

No.227/1/707 & 228/709, T.H Road

Tondiarpet

Chennai- 600 081 **...Applicant**

Vs.

1. Union of India
   Represented by its Secretary
   Ministry of Petroleum and Natural Gas
   Shastri Bhavan
   New Delhi- 110 001

2. Ministry of Environment and Forests
   Represented by its Secretary
   CGO Complex
   Lodhi Road
   New Delhi- 110 003

3. Bharat Petroleum Corporation Limited
   Bharat Bavan
   4 and 6 Currimbhoy Road
   Ballard Estate
   Mumbai- 400 001

4. The State of Tamil Nadu
   Represented by its Director
   Department of Environment and Forests
   Fort St. George, Chennai

5. The Member Secretary
   Tamil Nadu Pollution Control Board
   Anna Salai

Chennai – 32

6. Hindustan Petroleum Corporation Limited
   98/99, Elaiya Mudali Street

   P.B. No. 1170, Washermanpet Post
   Chennai

7. Indian Oil Corporation Limited
   Indian oil Bhavan
   139, Nungambakkam High Road
   Chennai- 600 034

8. Chennai Petroleum Corporation Limited
   New No. 536, Anna Salai
   Teynampet, Chennai-600 018 **....Respondents**

Counsel for the Applicant

M/s. E. Maharajan and M/s. D. Gently Rathnaraj

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2. M/s. Sangamithrai - Counsel for Respondent No.2
3. M/s.Ramasubramanian & Associates - Counsel for respondent No. 3
4. Mr. M. K . Subramanian - Counsel for respondent No. 4
5. Mrs. Rita Chandrasekar - Counsel for respondent No.5
6. M/s. King and Partridge - Counsel for respondent No. 6
7. M/s. Raghavendra Ross Divakar - Counsel for Respondent No. 8

ORDER

QUORAM

Hon'ble Justice Dr. P. Jyothimani (Judicial Member)

Hon'ble Professor Dr. R. Nagendran (Expert Member)

Delivered by Justice Dr. P. Jyothimani dated 17th March, 2016

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1) Whether the judgement is allowed to be published on the internet ----- yes / no

2) Whether the judgement is to be published in the All India NGT Report -----yes /no

1. The issue involved in these cases relate to leakage of petroleum oil manufactured and supplied by the various Oil Corporations which are respondents, resulting in the contamination of drinking water in North Chennai particularly in Thondiarpet and the petroleum impact in wells on TH Road and BP Koil Street.

   The oil leakage came to be known on the basis of a newspaper report dated 16-07-2013 which was also preceded by various newspaper reports on 24-04-2013, 09-02-2013 and 01-10-2012 as also on 16-09-2013. According to the applicants, the leakage is due to the reason of improper maintenance of pipe lines, damaged tankers, non replacement of old pipelines etc., and even during cleanup effort shows that the residual oil was declining at the rate of less than 4% annually and that causes damage to the people in the surrounding areas and therefore the applications came to be filed before this Tribunal in July 2013.The Tribunal, while admitting the application No. 176 of 2013, in the order dated 24-07-2013 directed the 1st respondent namely, the Ministry of Petroleum and Natural Gas to produce all records regarding the steps taken for rectifying the said position and also directed the Tamilnadu Pollution Control Board (TNPCB) to inform the Tribunal about the steps taken in consultation with the oil corporations.

2. Consequently, the TNPCB convened a meeting on 19-08-2013 to discuss about the status of oil leake at Thondiarpet and measures to be taken for remediation. It appears that the Chairman of the TNPCB requested the Indian Institute of Technology, Madras (IIT-M) Madras to extent its Technical support to resolve the issue and accordingly Dr. Indumathi M. Nambi, Department of Civil Engineering of IIT-M is stated to have participated in the said meeting and explained the seriousness of the situation. In the said meeting, certain decisions were taken regarding the follow up actions to be pursued immediately and decided that the contaminated area to be again inspected by JCEE 1 of the corporate office along with other officials and the BPCL to extend all support and cooperation to IIT-M and that IIT-M after the studies are effected should finalise an Action Plan for the work.. It was also decided in the said meeting that M/s. BPCL is solely responsible for the contamination and shall bear the entire cost of investigation and remediation apart from ensuring adequate drinking water supply to the affected people till the ground water is remediated. In the preliminary investigation report on Tondiarpet oil spill site

submitted by the IIT-M to the TNPCB dated 9th August 2013, the IIT-M had arrived at the following:

i. "The product spilled matches closely with diesel as conducted from the GCMS analysis and comparison with commercial diesel.

ii. Oil is continuously being bailed out for the past twenty days and has not stopped until date which indicates the presence of free flowing oil pool.

iii. The groundwater is severely contaminated with petroleum products and will continue to be so for several decades, if no remediation is done.

iv. The presence of large quantity of oil trapped in the unsaturated and saturated soil zone even after the free flowing product is bailed out is inevitable.

v. Delineation of the contaminated zone has to be done immediately and remediation initiated at the earliest.

vi. Considering the density of the population in the spill vicinity, the risk due to volatile hydrocarbons and dissolved hydrocarbons in groundwater is quite high".

3. It was informed before this Tribunal on 16-09-2013 that the 6th respondent BPCL has not complied with the conditions stipulated by the TNPCB. Show cause notice came to be issued on 11-09-2013 as direction under Section 33 A of the Water (Prevention and Control of Pollution) Act, 1974 which are as follows:

"1. M/s. Bharat Petroleum Corporation Limited should extend all the support and co-ordination to IIT-M to collect and analyse the soil core from the contaminated area simultaneously. M/s. Bharat Petroleum Corporation Limited shall finalise the scope of work provided by IIT-M early and proceed further.

2. M/s. Bharat Petroleum Corporation Limited, is solely responsible for the contamination and shall bear the entire cost of investigation and remediation.

3. M/s. Bharat Petroleum Corporation Limited shall ensure adequate water supply to the affected people till the ground water is remediated".

4. The BPCL replied to the said show cause notice informing that the BPCL has proposed to carry out bioremediation through M/s. Spilcare-O-Metacart Ltd. India, an authorised supplier of M/s. Oil Spill Heater Osei International Corporation. It was informed on behalf of BPCL before this Tribunal on 11-10-2013 that out of the three pipelines belonging to BPCL, one was closed in July 2010, another in November 2010 and the third pipe line was closed in July 2013 as per the direction of the Central Pollution Control Board (CPCB).

5. The Tribunal in the order dated 11-10-2013 taking note of the fact that pipelines are being shifted and with an intention to evolve an interim action plan, both short term and long term action to provide solution to the problem directed convening of a meeting consisting of the following:

1. Secretary, Ministry of Petroleum and Gas, Government of India, New Delhi
2. Secretary, Ministry of Environment and Forest, Government of India, New Delhi
3. Secretary, Ministry of Industries, Government of India, New Delhi
4. Chief Secretary, Government of Tamil Nadu
5. Chairman and Managing Director, Indian Oil Corporation Limited
6. Chairman and Managing Director, Chennai Petroleum Corporation Limited
7. Chairman and Managing Director, Bharat Petroleum Corporation Limited and
8. Chairman and Managing Director, Hindustan Petroleum Corporation Limited

The said Committee filed a report on 16th December 2013 giving both short and long term measures which included shifting/realignment activity and shifting of the entire white oil lines to the new terminal at Ennore.

6. The TNPCB in its reply dated 14th September 2013 has stated that during enquiry with BPCL about the cause of contamination, it was informed that the pipelines used for conveying motor spirit and high speed diesel were not in operation since 2010 and 2012, respectively due to pressure drop in the pipeline and the products in the pipeline emptied and filled with water. The analysis of water indicated that the ground water in Varadharaja Perumal Street is contaminated by petroleum product which has leaked from the unused pipelines. On 16-07-2013, the Board instructed BPCL to take immediate action to clean up all the contaminated bore wells and soil and supply drinking/domestic water to the affected people till the ground water quality in the area is restored. It was also directed to identify the exact location of the leakage and arrest the same. Ultimately the Board is stated to have given the following directions:

   i. The unit shall carryout the cleaning of all the contaminated wells in the Varadharaja Perumal Street , Tondiarpet and make them fit for domestic use.

   ii. The CMWSSB shall test water samples from the wells which were cleaned by BPCL. The water samples shall be compared with the quality of water fit for bathing and washing purposes, this shall be completed within a week.

   iii. The unit shall provide adequate water supply to the people in the affected area till the wells are restored to the original quality.

   iv. The unit shall find the cause for the above oil leak and take remedial measures immediately.

   v. The oil companies shall jointly carry out a scientific study for deducting the point of oil leak and the area of ground water contamination through reputed institutions like NGRI, Ground Water Research Institute etc., so as to take remedial action.

   vi. All the oil companies shall take all precautions to ensure that no such incidents occur in future.

7. It is stated that the CPCB by its proceeding dated 19-07-2013 has also issued the following directions:

i. The unit shall immediately stop pumping of the petroleum products in the pipeline passing through the Tondiarpet area till such time it is ensured that there are no leakages in the pipelines and those leakages will not recur in future

ii. The unit will submit a Credible action plan, along with timelines to CPCB for the contaminated site

iii. The unit can restart the operations only after the compliance of the directions at para (i) & (ii) above to the satisfaction of CPCB.

8. As stated above, in the meantime, the Board also sought the help of IIT-M which gave its recommendation dated 9th August 2013 as elicited above. Again, as stated above in the meeting held on 19-10-2013 certain decisions including "BPCL is solely responsible for contamination" has been taken.

9. At this juncture, it is relevant to note that in the reply filed by the BPCL dated 10th October 2013 it is admitted that the said Corporation has laid three pipelines for product transfer purposes from Chennai Port Oil Jetty to Tondiarpet installation of the BPCL. One pipeline was used for transportation of motor spirit, another for transportation of high speed diesel as well as motor spirit depending upon the requirement and the third one for the transportation of furnace oil mainly by IOC Ltd., for evacuation of product of Chennai Petroleum Corporation Ltd and the said pipelines were laid in the year 1998 and are stated to have been tested once in a year at the rate of 1.5 times of the operating pressure. The said pipelines run underground for around 2.3 km and above ground for around 1.5 km with the total length of pipelines being 3.8 km. It is stated that in respect of pipe line No.1 a routine inspection was conducted in July 2010 and it was observed that the pipeline was not holding hydro test pressure which is 1.5 times the normal operating pressure. Therefore, as abundant caution the BPCL had taken a decision to stop the usage of the said pipe line. Regarding pipeline No. 2, the maintenance test revealed that the said pipeline was not holding hydro test pressure, which is 1.5 times the normal operating pressure and therefore a decision was taken to stop usage of the said pipeline as well. It is sated that in order to clean oil presence in the said pipe line, the mandatory procedure of flushing out the pipe line with water 3 times the line quality was done and

the pipe line was filled with water and valves were kept closed at both the ends with effect from November 2012 and it remains the same as on date. Regarding pipeline No. 3, there was no report of any leakage during routine inspection and maintenance and last pressure test was conducted on 05-03-2013 and based on the directions issued by CPCB, the 6th respondent has closed the said pipeline with effect from 20-07-2013 as also the other pipelines. It is also stated that the Board in the letters dated 22-07-2013 and 06-08-2013 requested the BPCL to contact Dr. Indhumathi M. Nambi, Professor, ERWE Division, Civil Engineering Department, IIT-M to coordinate regarding collection of samples and also pay the charges for analysis of samples done by IIT-M and accordingly the 6th respondent contacted Dr. Indumathi for collection of samples and admittedly even as on date the IIT-M Scientists are guiding the BPCL as it is seen in various reports including the preliminary report and recommendations elicited above.

10. It is also stated in the said reply that during the last 3 years, around 70% of the activities of BPCL have been shifted by hiring tankers of Ennore. The BPCL has also stated that it has engaged one of its registered contractors, M/s. Murugan Contractors for cleaning the bore wells from 16-07-2013 to 05-10-2013 and around 6930 man hours have been spent on this. The BPCL has also stated with tabulated sheet about the status of each bore well with reference to quantum of contaminants removed on weekly basis. It is further stated that the BPCL has awarded a purchase order dated 07-09-2013 to IIT-M for allowing the scope of work namely:

    a. Sampling and identifying the free product obtained in the 12 bore wells through GCMS.
    b. Sampling and evaluating the extent of contamination of the ground water in 50 bore wells through GCMS analysis.
    c. Conducting bore hole logs (about 20 shallow bore well) in the vicinity of the contaminated zone to determine oil trapped in unsaturated zone.
    d. Mapping the extent of oil layer spread using interface probe in exiting bore wells.
    e. Conducting geo physical investigation for determining the spread of oil, soil and ground water characteristics.

11. In the final report submitted by IIT-M in February 2014, the IIT-M concluded regarding oil contamination of the aquifer as follows;

1. A large volume of oil is floating as a pool on top of the ground water table as a light non aqueous phase liquid.

2. A significant volume of oil entrapped to the soil as blobs in the vicinity of the water table both above and below in the vadose zone and saturated layer.

3. Dissolved phase in the ground water in the vicinity oil blobs and oil pool and moving downstream.

12. In the concluding remark, the IIT-M has stated as follows:

"oil spills are quite common in areas where oil is handled. Recent report of the American Petroleum Industry (2009) reports the following data (Table 3) which indicates the figures for volume of oil spilled in U.S.A from various sources in billion barrels. It is important to take preventive measures to ensure that quantum spilled due to human errors is minimum. Leak detection systems with online monitoring and alarm systems can prevent major spills. The oil facilities should be located away from residential areas to minimize disasters and health impacts. The spill response plan should be prepared and action taken immediately in the event of a spill to mitigate environmental damage".

13. Finding, that as per the expert of IIT-M no effective remediation method was taken by the BPCL, the Tribunal in the order dated 02-04-2014 directed the BPCL to engage an outside agency having expertise in the field to take remediation measures by following tender process. In the meantime, it was informed to the Tribunal that to have an effective short term measure the bailing out of contaminated water commenced on 11-02-2015. By following the tender process, the BPCL has appointed M/s. Stratus Environmental Inc. for remediation work who is stated to have made some presentation on the action plan to the Board in a meeting attended by Dr. Indhumathi M. Nambi, IIT-M.

14. The status report filed by the Board dated 23rd April 2015 shows certain activities carried out as per the schedule furnished by the BPCL which are as follows:

"Background & preliminary assessment (up to 2nd week of Feb 2015):

1. The unit has completed the gridline survey of the affected area between 31.01.2015 and 02.02.2015. The survey included the plotting of a) Existing affected bore well, b) proposed the ground water monitoring well location, c) proposed soil vapour extraction well location, d) proposed air spurge well location and e) other features located in the affected area.
2. GPR Survey conducted to identify underground utility corridors such as location of cable line, underground pipelines etc., has been completed.
3. The unit has furnished the site lay out map as submitted in Annexure- 1
4. The unit has collected bore well samples from the 19th existing bore well on 18.02.2015 & 25.02.2015 and analysed for presence of petroleum products. The ROA is yet to be furnished by the unit.

Free product removal: (2nd Week of Feb 2015 to 4th Week of July 2015)

1. Absorbent socks were installed on 18.02.2015 in three wells namely Door No.5/20, 115/6 of VP Kovil Street & Door NO.223 of TH road as thin layer of products were identified when checked with interface meter.
2. These socks were monitored on 18.02.1015, 25.02.2015 & 11.03.2015 and about 565 g, 525 g and 666 g of oil was removed from the wells in Door No.5/20, 115/6 & Door No.223, respectively. The photographs of socks absorbed with oil are submitted in Annexure II is kept in the premise of BPCL.
3. Also, fresh socks were installed in the above said wells on 19.03.2015 and monitored on 02.04.2015 and 04.04.2015 and the monitoring is being continued".

15. The 6th respondent, BPCL Ltd., has filed an action taken report as on 24-05-2014 in which it is stated that as on the said date, the BPCL has supplied 48,000 L of drinking water, used 19640 man hours for cleaning activities and removed 6160 L of contaminant from 18 bore wells. It is further stated in the said report that the BPCL is continuously removing the contaminant by bail out process from the said bore wells. Along with a letter dated 23rd March 2015 M/s. Stratus Environmental Inc., addressed to the Chief Installation Manager of Bharat Petroleum Corporation Ltd., the said contractor of the BPCL has submitted a Detailed Project Report (DPR). There was an action taken plan filed by BPCL regarding the cleaning of the contaminated bore well located at BP Koil Street, Tondiarpet.

16. The expert from IIT-M has submitted a review report on remediation of oil contamination in soil in ground water at Tondiarpet in September 2015 with a remark and conclusion as follows:

> "During the 9 month period between December 2014 and September 2015, Status has completed site characterization, initiated and continuing oil removal from the aquifer and constructed remediation wells in place. They have installed 17 monitoring bore wells, 4 vapour extraction wells and 5 air spurge wells. Using the absorbent socks, a total of 13.5 kilograms of petroleum product has been removed. Work progress although slower than anticipated is acceptable, given the constraints identified above. Work quality and attention to detail is commendable.
>
> IIT-M is waiting for a Detailed Site Characterization Report (DSCR) from Straus Inc. The DSCR should discuss the extent of contamination based on soil and groundwater samples collected during the site characterization activity. Based on this report IIT-M will recommend future course of remedial action in consultation with the Board and BPCL".

17. In the memo filed by the applicant dated 17th December 2015 in Application No. 176 of 2013 it is stated while commenting on the report of February 2014 wherein it was stated:

> "the areal extent of the oil spread in the aquifer is around 7141 m^2 to -7580 m^2 and the volume of free phase hydro carbon is approximately 270 M3 – 320 m^3 respectively"

that the said quantum amounts to 27000, 320000 L of free product. It is further stated that the ground water monitoring of wells has not accomplished any worthy result compared to the actual damage caused. Ultimately, the applicant has chosen to state that despite several years have gone by no proper steps have been taken and thousands of people are exposed to cacinogens like benzene and toluene and therefore the MoEF and CC has to strictly act as no concrete result has been accomplished

18. In such scenario, the expert from IIT-M in her letter dated 22-12-2015 has chosen to state as follows;

> "8. However, IITM identified the following discrepancy in the results reported: DSCR report on diesel concentrations in groundwater reported by Stratus is on the lower side given the high mass trapped in the soil. IITM team is working with the lab to understand their analytical procedure and will be giving them guidelines to improve the analysis. This procedure, if corrected may increase the groundwater concentrations".

The expert in above said letter has also stated in Para 6 as follows:

> "The boundary of the contamination zone is yet to be fixed based on ongoing investigations. This may throw some light on queries like i- Is there more lateral spread of the oil plume. But it is highly unlikely that the oil is present in free flowing phase since no house in the region is reporting oil in their bore wells".

Therefore, it is clear that even without finalising the boundary of contamination zone remediation works have been carried on as informed to this Tribunal at the supervision and guidance of the experts from IIT-M. Even though the reports made by the experts of IIT-M are all based on scientific studies, we are of the considered view that while executing the remediation process it has not given any fruitful result. This view of ours is also confirmed as it is seen in the report of the Board dated 11th January 2016 wherein the Board has stated that the unit has not carried out any remediation after 04-09-2015, in the following words:

> "It is respectfully submitted that during inspection of the unit and the contaminated site on 05/01/2016 by the District Environmental Engineer and Assistant Environmental Engineer of Chennai District it was noticed that the unit has not carried out any remediation work after 04-09-2015 in the contaminated site".

The report further stated by letter dated 08-12-2015, that the Board has requested BPCL to take following actions:

i. The unit has to furnish the report of analysis of the 19 bore well samples collected on 18-02-2015 consolidated immediately.

ii. The unit has to furnish the report of analysis of the soil samples collected during drilling of remaining 31 remediation bore wells.

iii. The unit has to furnish the report of analysis of the collected soil samples during drilling of remediation bore wells as analysed through TNWML for hazardous characteristics immediately.

iv. The unit has to take necessary action to remove the oil phase of quantity 7.287 KL from the slop tank No. 23 and store separately under prior intimation to TNPCB.

v. The unit has to get analysed the said oil phase through M/s. Chennai Petroleum Corporation Ltd., Manali, Chennai, so as to find out the suitability of blending for further beneficial use.

vi. The unit has to furnish suitable proposal for the treatment of the water phase of quantity 207.395 KL stored in slop tank No.23 so as to remove the traces of hydro carbon present and the treated water shall be utilised for fire fighting purpose within the premises.

vii. The unit has to furnish the time schedule for next six months with respect to the remediation process to be carried out at the contaminated site.

viii. The unit has to ensure that the time schedule furnished by the unit is adhered strictly for compliance.

However the unit has not taken any action for compliance and to furnish the above said details till now.

19. In such view of the matter and taking into consideration the fact that the oil contamination in the drinking water was found as early as in July 2013 when it was

reported in News Paper reports and till date no remediation measure worthy of speaking has been taken in the interest of the residents in the area, we discharge the experts from IIT-M from any further supervision over the remediation efforts and direct the CPCB to take up the supervision of remediation work of erasing oil contamination in the water aquifer in Tondiarpet taking into consideration all the reports of experts of IIT-M as well as the Board and file its report by next date of hearing. In this exercise the CPCB is permitted to avail the service and/or expertise from any recognized Organization/Institute located in the Country. The cost involved for the said purpose shall be fully borne by the BPCL. We make it clear that the contractor appointed by the BPCL shall continue to carry on the remediation process based on the report of the expert from IIT-M till the remediation proposal is submitted by the CPCB. We make it clear that on the CPCB submitting remediation measures by way of report, the contractor appointed by BPCL shall act in accordance with the same. Before finalising the remediation measures the CPCB shall inspect the concerned area and make a thorough study in the presence of both the parties. The CPCB shall also have a meeting with the present contractor of BPCL to get input for evolving the remediation proposal, as directed. As we have entrusted the supervisory work of remediation to be done by the contractor of BPCL, to the CPCB we *suo motu* implead the CPCB represented by its Member Secretary, New Delhi as 12th respondent in Application No. 176 of 2013. The applicant shall file fresh memo of parties. Mr. Ekambaram learned Counsel appearing for CPCB takes notice for newly added party. The CPCB shall file its report in the form of proposal as stated above before the date of next hearing after serving a copy of the said report to both the parties to enable this Tribunal to pass further orders.

Post all the applications on 02-05-2016. Respondents who have not filed reply shall file the same within 2 weeks from today after serving copies to the other side who shall be entitled to file rejoinder if any within 1 week thereafter.

There shall be no order as to cost.

Dated 17th March 2016 Justice Dr. P. Jyothimani (JM)

Prof. Dr. R. Nagendran (EM)

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA

SPEED POST

F.No.B-29016/1/2016/HWMD/ April 27, 2016

To

Mr. V. Vetrivel
Chief Manager Ops. (Retail) – South
Bharat Petroleum Corporation limited
35 Vaidyanathan Street
Tondiarpet, Chennai-600081

Sub: Visit of CPCB and TNPCB officials at Tondiarpet oil contaminated site in Chennai during 05th April, 2016-regarding.

Sir,

This has reference to order of Hon'ble NGT dated 17/3/2016 (OA No. 176 of 2013) and the inspection of oil contaminated site at Tondiarpet by the officials of Central Pollution Control Board and Tamil Naidu Pollution Control Board on 05/04/2016 to review the status of remediation works. It is directed to convey the salient observations vis-a-vis recommendations made from the aforesaid visit are as below:

1. The scope of work envisaged with consultant is to carry out detailed site assessment followed by installation of a set number of monitoring wells, air sparging wells and soil vapour extraction wells. This indicates that the scope of remediation has been decided prior to detailed site investigations, without actually setting any remediation objectives and standards for remediation. Therefore, there is a need to re-evaluate the objectives and scope of remediation works.

2. The typology of contaminated site is a light non-aqueous phase liquid in permeable soils in combination with groundwater contamination. Most likely remediation objectives in this scenario are;
   - Exposure/Explosion risk reduction
   - Control of spreading by mass removal
   - Control of spreading by containment of contaminants

3. Initiative was already been taken by M/s BPCL for exposure risk reduction by abandoning the oil pipelines and by removing the material from pipelines. Soil vapor extraction (SVE) systems are under installation for removal of residual mass from soil voids and groundwater. However, the need for taking additional measures to contain the risk due to spread of residual contaminants is required to be assessed.

4. The remedial measures initiated are not based on any quantifiable risk reduction. There is need to set standards for remediation based on reduction in risk at the receptor rather than just operating a soil vapor extraction systems. It is therefore suggested that the scope of work to the consultant should include a quantitative risk assessment. Tier-1 screening of the soil and groundwater may be carried out using Canadian screening standards and Dutch intervention values.

5. It was observed that some of the monitoring wells at farther distance from source of contamination found to have traces of organic compounds (e.g. monitoring well MW06A), whereas the monitoring should have been carried out beyond such points (where there is no contamination), to establish a clear delineation of contaminated plume.

   In view of above, the scope of work may be amended to include few additional boreholes for soil / groundwater quality monitoring to delineate the contaminated plume. The scope of work should also include producing 3-D maps showing the plume of contamination.

6. The contaminated area indicates the following most likely remediation measures;
   - Excavation of highly contaminated soil
   - Vapour proof sealing in building floor in case of acute risk
   - Mass recovery – excavation, skimming, pump extraction
   - Mass recovery by phase change - soil vapour extraction, air-sparging, bio-slurping
   - Containment – sub-surface barrier, trench, wells
   - Specialized in-situ techniques such as chemical oxidation, surfactant-enhanced sub-surface remediation, co-solvent flushing, steam/hot air injection, radio-frequency heating, electrical resistance heating may be worth considering the risk at receptors.
   - Monitored natural attenuation in areas having low risk

   It is suggested that, consultant should evaluate all the above options including any other options (that may suite site conditions) and SWOT analysis shall be applied on all possible remediation options including the SVE system being implemented.

7. M/s BPCL shall therefore revise the scope of work with consultant and submit a copy of the same to TNPCB and CPCB within a period of 1 month.

8. Based on site specific target levels derived from risk assessment, the consultant shall evaluate multiple remedial options that may be required beyond soil vapour extraction system including proposal for long term plan for assessment and monitoring may be submitted to TNPCB and CPCB within a period of 4 months. Short term findings on performance of SVE system may be included in this report.

9. It is recommended that upon commissioning of SVE system, the effectiveness of SVE based remediation shall be reviewed for duration of about 06 months to ascertain the results which shall form the basis for specifying the need for taking up additional remediation measures.

10. Target levels for remediation shall be set based on quantitative risk assessment and such target levels shall be authorized by TNPCB to monitor the remediation works.

11. Since monitoring of remediation works by CPCB/TNPCB may require collection and analysis of soil and groundwater samples, it is requested that samples collected during assessment of remediation work shall be analyzed through any EPA/NABL/ISO17025 accredited laboratory and the cost of analysis shall be borne by M/s BPCL.

Yours faithfully,

(B. Vinod Babu)
AD & I/c HWMD

BEFORE THE NATIONAL GREEN TRIBUNAL (SOUTHERN ZONE) CHENNAI

APPLICATION NO. 176 OF 2013

IN THE MATTER OF:

V.P Krishnamoorthy

...APPLICANT

VERSUS

Union of India & Others ...RESPONDENTS

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Signed and Verified on this 16th day of November, 2016 at Bengaluru.

COUNSEL FOR
12th RESPONDENT

S. Suresh
16/11/2016

DEPONENT
S. SURESH
ZONAL OFFICER
CENTRAL POLLUTION CONTROL BOARD
SOUTH ZONAL OFFICE
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU-560079. MOB : 9480672128

BEFORE THE NATIONAL GREEN TRIBUNAL (SOUTHERN ZONE) CHENNAI
APPLICATION NO. 176 OF 2013

IN THE MATTER OF:

V.P Krishnamoorthy

...APPLICANT

VERSUS

Union of India & Others

...RESPONDENTS

STATUS REPORT ON BEHALF OF RESPONDENT NO. 12, CENTRAL POLLUTION CONTROL BOARD WITH REGARD TO HON'BLE TRIBUNAL ORDER DATED SEPTEMBER 20, 2016

I, S. Suresh, Son of S.R. Sathyanarayana, Hindu, aged about 54 years, having office at the Zonal Office, Central Pollution Control Board, 1st& 2nd Floors, Nisarga Bhavan, A- Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Bengaluru – 560 079 do hereby solemnly affirm and sincerely state as follows:-

2. That I am presently working as Scientist 'E' & Incharge, Zonal Office (South), Central Pollution Control Board (hereafter called as CPCB), Bengaluru and have been authorized to file the present compliance affidavit. I am fully conversant with the facts of the case and hence, competent and authorized to depose and swear the present compliance affidavit as under:

3. That the Hon'ble National Green Tribunal, Southern Zone Bench, Chennai, in the matter of Application No. 176/2013, V.P Krishnamoorthy Vs. Union of India & Ors, passed orders dated 20/09/2016 and 17/10/2016 directing CPCB to produce latest report on the next date of hearing so as to enable the tribunal to pass appropriate order. In compliance to the said orders, the present status report on Tondairpet contaminated site is enclosed as Appendix.

S. Suresh 16/11/2016

DEPONENT
S. SURESH
ZONAL OFFICER
CENTRAL POLLUTION CONTROL BOARD
SOUTH ZONAL OFFICE
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU-560079. MOB : 9480672128

VERIFICATION

It is verified that the content of this report is based on actual field observations. Nothing has been concealed therein.

Signed and verified on this 16th day of November 2016 at Bengaluru

S. Suresh 16/11/2016

DEPONENT
S. SURESH
ZONAL OFFICER
CENTRAL POLLUTION CONTROL BOARD
SOUTH ZONAL OFFICE
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU-560079. MOB : 9480672128

COUNSEL FOR
12th RESPONDENT

दक्षिणी आँचलिक कार्यालय केन्द्रीय प्रदूषण नियंत्रण बोर्ड
SOUTH ZONAL OFFICE CENTRAL POLLUTION CONTROL BOARD
MINISTRY OF ENVIRONMENT & FORESTS GOVT. OF INDIA
B'LORE-10
बेंगलूर-560 010

Appendix

Report on Performance of Soil Vapour Extraction (SVE) System and Remediation of M/s Bharat Petroleum Corporation Ltd. Oil Contaminated site at Tondiarpet

Background:

The Hon'ble National Green Tribunal, Southern Zone Bench, Chennai, in the matter of Application No 176 of 2013, V.P. Krishnamoorthy Vs. Union of India & Ors, passed orders on 17.03.2016 directing CPCB to supervise the remediation work of Oil Contaminated site at Tondiarpet site.

In compliance of Hon'ble Tribunal order, the officials from CPCB and TNPCB inspected the site and also held meeting with representatives of Bharat Petroleum Corporation Ltd. (BPCL) and M/s Stratus Environment Ltd.,(Consultant) during April 04-05, 2016 and reviewed the measures taken for remediation of contaminated site and also the scope of work identified with consultant for remediation of soil and groundwater. Accordingly, CPCB recommended following (i) the need for setting remediation objectives and standards for remediation (ii) Assessing the need for implementing additional remediation measures apart from Soil Vapour Extraction (SVE) system, (iii) Inclusion of quantitative risk assessment,(iv) Review of the scope of work for installation of additional monitoring wells and 3D maps, (v) Preparation of long term plan for assessment and monitoring and (vi) Short-term findings on performance of SVE system.

Accordingly, M/s BPCL submitted a revised scope of work vide letter dated 29.06.2016 and also schedule of activities for completion of additional tasks as a supplement to their revised scope of work vide letter dated 18.07.2016. CPCB examined the revised scope of work as well as scheduled activities and the CPCB observations are submitted to Hon'ble Tribunal vide CPCB affidavit dated July 26, 2016 alongwith request to direct M/s BPCL to execute revise scope of work in-line with observation of CPCB.

Subsequently, officials from CPCB supervised the remediation work and monitored the Ground water as well as SVE performance twice during June-October, 2016. The status of remediation work carried out at oil contaminated site at Tondiarpet is summarized as below:

Status of Remediation work of Oil Contaminated site at Tondiarpet

i. M/s Stratus Environmental India Ltd., (consultant engaged by BPCL) installed 19 nos. of Shallow (35- 40 ft) Screened Monitoring Wells, 8 nos. of deeper (50-89 ft) screened Monitoring wells, 9 nos. of Soil Vapor Extraction (around 30 feet depth) Wells and 9 nos of Air sparge wells(30 – 40 ft depth).

ii. CPCB observed that some of the monitoring wells are at farther distance from source of contamination found traces of organic compounds, hence suggested to install additional monitoring wells in outer periphery to establish a clear delineation of contaminated plume. Consultant submitted a proposal to install 5 shallow and 4 deep wells, ***however they installed 03 shallow and 03 deep wells and informed that due to CMRL ongoing metro work remaining wells were not installed.***

iii. As per CPCB recommendations, it is required to set Site Specific Target levels (SSTL) to be derived from quantitative risk assessment using any suitable model based on the human health risk associated with both inhalation and incidental ingestion of specific contaminants at the exposure concentration and SPR (Source-Pathway-Receptor) linkages. M/s BPCL has not made any progress in developing of SSTL, however, excavation of contaminated soil for the proposed metro construction may alter the south pathway receptor considerations for developing the SSTL, therefore, it may be appropriate to develop SSTL at later stage.

iv. The proposed 20 soil vapour sampling probes for monitoring the efficacy of Soil Vapour Extraction (SVE) system, not yet installed, however, the said sampling probes may be installed after completion of metro work.

v. To reduce the mass of petroleum hydrocarbons from soil and ground water, the consultant installed SVE system with 10 hp blower to extract petroleum hydrocarbons laden soil vapour from extraction wells and to destruct the same in catalytic oxidiser @ 250 cubic feet per minute (cfm). The SVE system is connected to a network of 14 wells, SVE-1, SVE-2, SVE-3, SVE-4, SVE-5, SVE-7, SVE-8, SVE-9, SVE-10 and monitoring wells MW- 2A, MW-3A, MW-4A, MW-16A and MW-17A.

vi. The SVE system was commissioned and started operating since May 05, 2016, as per the record maintained by the consultant, the SVE system was operated for an average of 16 hrs/day and extracted soil vapours from different wells in the tune of 18-26 CFM and system flow rate is in the tune of 81-96 CFM, the field data sheet is enclosed at ***Annexure – 1***.

vii. As per the CPCB recommendations, M/s BPCL submitted the monthly performance data of soil vapour extraction system to CPCB and TNPCB, a complete performance data is submitted below;

Date	**Cumulative Time Elapsed in Hr.**	**SVE System Flow rate in CFM**	**Influent Concentration in mg/m^3**			**Effluent Concentrations in mg/m^3**			**Destruction Efficiency in %**	**Mass Extraction rate**	**Cumulative Mass Extracted**
			DRO	GRO	TPH	DRO	GRO	TPH		**DRO in Kg/hr**	**DRO in Kg**
20.05.16	13.2	91	814.64	<2.5	23038.24	186.012	<2.5	4607.65	77	0.126	1.66
25.05.16	49.2	84	22215.33	<2.5	72.855	0.123			100		
4.06.16*	126	94	1.23	0.037	<1.0	0.322	<2.5	<1.0	74		
06.06.16	150.3	79	0.617	NA	NA	0.0417	NA	NA	93		
16.06.16	271.5	92	NA	NA	NA	NA	NA	NA	99		
18.07.16	704.8	80	3462.4	1075.8	3462.4	829.2	0	829.2	76	0.471	
30.07.16	842.7	96									198.40
31.08.16	1267.75	94.58	715.5	1185.33	715.5	BDL	BDL	BDL	100	0.115	295.87
26.09.16	1591.05	96.23	BDL	1258	BDL	BDL	BDL	BDL	100	0.206	381.14
*SVE was under repair, Carbon adsorption system was in operation											
NA- Lab analysis reports are not available											
On 26.09.16 Mass extraction calculated based on GRO concentration											

viii. As per CPCB recommendation, M/s BPCL required to prepare Site Conceptual Model including 3- dimensional model illustrating the extent of impact to the subsurface and distribution of contaminating relative to site geological conditions. M/s BPCL has not yet submitted such documents to CPCB for further review and delineate the adequacy of remediation measures.

ix. CPCB officials monitored the ground water quality in contaminated site as well as performance of SVE system on June16, 2016 (immediate after installation of SVE system) and October 04, 2016(after 05 month of installation of SVE system) to assess the impact of remediation steps taken by BPCL. The monitoring was carried out by CPCB team by engaging third party for analysis of specific parameters, the details of samples taken and analysis results are depicted in ***Annexure – 2 & 3.***

x. Based on the analysis results of samples taken on June 16, 2016 and October 04, 2016, it is observed that the concentration of TOC is reduced marginally in 06 locations and other parameters are found varying in nature in all locations. As per BIS drinking water standards the concentration of Mineral Oil shall be 0.5 mg/l, however in all location the mineral oil concentration found exceeding the drinking water standards and hence it is not fit for drinking water.

xi. The graphical representation of concentration of Mineral Oil, Total Petroleum Hydrocarbons, Diesel Range Organics (DRO) and Total Organic Carbon (TOC) in different locations and different time intervals are depicted in the ***Annexure – 4***. It

indicates that no reduction of concentration of Mineral oil, DRO and TPH in many locations.

xii. As per the analysis results of performance of SVE system, destruction efficiency of SVE system was found between 98-100% baring few occasions w.r.t VOC, TPH, BTEX, GRO and DRO.

Conclusion & Recommendations:

(i) The Soil Vapour Extraction (SVE) System operated by M/s BPCL did not show any substantial reduction in concentration of Chemicals of Concern namely TPH and DRO, the values of which were rather increased in most of the wells. However, concentration of Total Organic Carbon (TOC) values decreased marginally in 06 out of the 08 monitoring wells. The performance of SVE System may not be assessed based on the results of TPH, DRO, GRO, etc., since only two sets of samples are available and also, the methodology for analysis has been standardized for these parameters after collection of first set of samples. Therefore, at this stage the efficacy of SVE system may be reliably assessed based on TOC analysis where a standardized test method was followed. Considering the same, it can be stated that during the last 04 months of operation, the SVE system installed by M/s BPCL, it could not show any substantial reduction in groundwater contamination levels.

(ii) It was observed that soil vapour was not extracted simultaneously from all the extraction wells. Only 04 out of 14 extraction wells were operated in a month due to limitation of the existing SVE system w.r.t high VOC concentration and overheating of the combustion chamber. As a result, the system was operated at a flow rate of 18-26 CFM against designed capacity of 250CFM. This problem can be overcome by installing multiple vapor handling units or by augmenting the capacity of existing vapor handling unit so as to achieve simultaneous extraction from all the wells..

(iii) The existing SVE system has so far extracted about 381 kgs of DRO till 29 September, 2016 at an average of about 100 kgs DRO per month.

(iv) The proposed metro excavation work by M/s CMRL is going to impact the existing SVE system including some of the monitoring and extraction wells. It is, therefore, suggested that M/s BPCL may be directed to comply the following;

a) They may continue to operate the SVE system till the time of commencement of M/s CMRL work.
b) The SVE system may be operated round the clock against the present operating hours between 10-16 hrs.
c) On commencement of metro work, BPCL should take steps to operate SVE unit for the remaining network.
d) Monitoring should be carried out during excavation, the constituents of soil should be analyzed for TPH and based on the concentration, the excavated earth with traces of TPH should be disposed in environmentally safer manner. In case the concentration of TPH is soil is > 5000 mg/Kg, the same should be sent to TSDF for disposal.
e) During metro construction activity, it is required to monitor the quality of extracted water for any contamination. It is also required to locate those extraction wells in such a position that contaminated plume does not pass through uncontaminated areas, further appropriate treatment system should be envisaged for treatment of oil contaminated water.
f) Since the metro work is going to alter the levels of groundwater contamination and the hydro-geology of contaminated area, augmentation of SVE systems may not be undertaken till completion of metro work. However, once the work is completed, the resulting contamination levels should be assessed and SVE systems should be re-commissioned with additional or new extraction wells.
g) SSTLs for remediation may be developed after completion of metro work after conducting a fresh assessment of the site and Source Pathway Receptor studies.

h) The data on soil quality in the excavated contaminated area should be made available to TNPCB and CPCB to decide the appropriate disposal pathway of such soil from the construction area.

i) May submit the revised scope of work taking into account digging of earth by CMRL and installation of new wells including detail plan of remediation work.

(v) TNPCB may direct the CMRL to ensure safe storage of contaminated excavated earth till treatment and to disposal of the same through as per the authorization of TNPCB. They may further be directed to take necessary precautions, so that the workers of metro construction area protected from possible release of VOC's from contaminated soil, risk of fire, etc., while handling of contaminated soil.

H. D. Varalaxmi

(H.D. Varalaxmi)
SEE, CPCB
ZO, Bengaluru

SVE System Performance Summary
Bharath Petroleum Corporation Ltd.
VPK Street, Tondiarpet, Chennai

Date	Beginning Time	Ending Time	BeginningHour Meter	Ending Hour Meter	Time Elapsed per day	Cumulative Time Elapsed	System Flow Rate	Field Influent Flow	Wells being used for Extraction	System Influent PID	Field Influent PID*	Effluent PID
					Hours	Hours	(CFM)	(CFM)		(ppm)	(ppm)	(ppm)
20-05-2016	10:30AM	11:45PM	8262.3	8275.5	13.2	13.2	91	22.9	SVE-8	119	124	0
*5/21/2016	9:00AM	9:00PM	8275.5	8287.5	12	25.2	87	20.7	SVE-8,9,MW-17A	173	173	0
23-05-2016	6:30AM	6:30PM	8287.5	8299.5	12	37.2	91	18	SVE-8 , SVE-9	136	140	0
25-05-2016	6:30AM	6:30PM	8299.5	8311.5	12	49.2	84	24.8	SVE-8 , SVE-9	54	58	0
26-05-2016	9:30AM	9:00PM	8311.5	8323	11.5	60.7	88	18.7	SVE-8 , SVE-9	135	151	0
27-05-2016	9:00AM	9:30PM	8323	8335.5	12.5	73.2	85	19.6	SVE-8 , SVE-9	185	191	0
28-05-2016	9:30AM	3:30PM	8335.5	8341.5	6	79.2	87	21.4	SVE-8,9,MW-17A	147	150	0
29-05-2016	8:00AM	11:45PM	8341.5	8356.9	15.4	94.6	77	21.8	SVE-8,9,MW-17A	115	85	0
30-05-2016	8:00AM	12:00AM	8356.9	8360.9	4	98.6	88.1	22	SVE-8,9,MW-17A	77	90	0
31-05-2016	6:30AM	6:30PM	8360.9	8372.9	12	110.6	91.7	23.8	SVE-8,9,MW-17A	150	165	0
04-06-2016	6:30AM	11:45PM	8372.9	8388.3	15.4	126	94	24.8	SVE-8 , SVE-9	147	165	0
05-06-2016	5:01AM	5:00PM	8388.3	8400.3	12	138	83	18.4	SVE-8 , SVE-9	429	429	0
06-06-2016	9:30AM	10:00PM	8400.3	8412.6	12.3	150.3	79	19.6	SVE-8 , SVE-9	480	410	0
07-06-2016	8:00AM	10:00PM	8412.6	8425.6	13	163.3	85	19.2	SVE-8 , SVE-9	185	185	0
08-06-2016	8:00AM	10:00PM	8425.6	8439.6	14	177.3	78	18.68	SVE-8,9,MW-17A	168	173	0
09-06-2016	9:00AM	10:00PM	8439.6	8450.6	11	188.3	84	22.45	SVE-8,9,MW-17A	185	260	0
10-06-2016	8:45AM	10:00PM	8450.6	8463.7	13.1	201.4	85	22.1	SVE-8,9,MW-17A	305	305	0
11-06-2016	9:00AM	10:00PM	8463.7	8474.8	11.1	212.5	88	22.8	SVE-1, MW-4A	380	380	0
12-06-2016	10:00AM	9:00PM	8474.8	8485.8	11	223.5	88	24.6	SVE-1, MW-4A	400	376	0
13-06-2016	9:00AM	9:00PM	8485.8	8497.8	12	235.5	81	18.7	SVE-1, MW-4A	480	510	0
14-06-2016	9:00AM	9:00PM	8497.8	8509.8	12	247.5	81	22.9	SVE-1	510	510	0
15-06-2016	9:00AM	9:00PM	8509.8	8521.8	12	259.5	86	23.7	SVE-1	434	442	0
16-06-2016	9:30AM	9:30PM	8521.8	8533.8	12	271.5	92	24.5	SVE-8,9,MW-17A, SVE-1	684	685	0
17-06-2016	9:00AM	9:30PM	8533.8	8545.8	12	283.5	86	19.4	SVE-8,9,MW-17A	498	489	0
18-06-2016	9:30AM	8:30PM	8545.8	8556.8	11	294.5	86	24.6	SVE-1,6,MW-16A	225	154	0
19-06-2016	8:00AM	10:00PM	8556.8	8570.8	14	308.5	88	24.5	SVE-1,6,MW-16A	424	438	0
20-06-2016	9:00AM	9:00PM	8570.8	8582.8	12	320.5	81	23.8	SVE-1,6,MW-16A	186	175	0
21-06-2016	8:30AM	9:30PM	8582.8	8595.8	13	333.5	82	24.6	SVE-1,6,MW-16A	118	121	14.8
22-06-2016	8:30AM	10:00PM	8595.8	8609.3	13.5	347	88	22.8	SVE-1,6,MW-16A	144	144	10.8
23-06-2016	8:30AM	11:30PM	8609.3	8624.3	15	362	88	24.8	SVE-1,6,MW-16A	185	185	10
24-06-2016	5:30PM	1:00AM	8624.3	8631.8	7.5	369.5	92	24.9	MW-2A	89.8	89.8	2.8
25-06-2016	9:00AM	1:00AM	8631.8	8647.8	16	385.5	88	28.9	MW-2A	106.7	89.6	0
26-06-2016	9:00AM	1:00AM	8647.8	8663.8	16	401.5	88	28.6	MW-2A	113.8	113.8	0
27-06-2016	9:00AM	1:00AM	8663.8	8679.8	16	417.5	88	28.6	MW-2A,MW-2A	113.8	113.8	0
28-06-2016	9:30AM	1:00AM	8679.3	8694.8	15.5	433	88	26.3	MW-16A,MW-2A	116.8	164	0

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Annexure - 1

SVE System Performance Summary
Bharath Petroleum Corporation Ltd.
VPK Street, Tondiarpet, Chennai

Date	Beginning Time	Ending Time	BeginningHour Meter	Ending Hour Meter	Time Elapsed per day	Cumulative Time Elapsed	System Flow Rate	Field Influent Flow	Wells being used for Extraction	System Influent PID	Field Influent PID*	Effluent PID
29-06-2016	9:00AM	1:00AM	8694.8	8710.8	16	449	88	24	MW-16A,MW-2A	102.8	133.9	0
30-06-2016	9:00AM	1:00AM	8710.8	8726.8	16	465	88	24	MW-16A,MW-2A	97.6	126.9	0
01-07-2016	9:00AM	1:00AM	8726.8	8742.8	16	481	88	24	MW-16A,MW-2A	116.2	181.2	7.2
02-07-2016	9:00AM	1:00AM	8742.8	8758.8	16	497	96	24.8	MW-16A,MW-2A	172	124.6	4.8
03-07-2016	9:00AM	1:00AM	8758.8	8774.8	16	513	96	25	MW-16A,MW-2A	78.5	84.3	5.5
04-07-2016	9:00AM	1:00AM	8774.8	8790.8	16	529	96	25	MW-16A,MW-2A	72.3	88.4	1.2
05-07-2016	6:00PM	1:00AM	8790.8	8797.8	7	536	96	25.4	MW-16A,MW-2A	79.1	90.1	3.4
06-07-2016	9:00AM	2:00AM(Midnight)	8797.8	8812.8	15	551	96	24.6	MW-16A,MW-2A	51.8	62	8.1
07-07-2016	9:00AM	1:00AM	8812.8	8828.8	16	567	96	24.8	MW-16A,MW-2A	28.2	74.8	5.2
08-07-2016	10:15AM	22:15PM	8828.8	8840.8	12	579	88	30.4	MW-16A,MW-2A	27.2	47	4.2
09-07-2016	9:00AM	1:00AM	8840.8	8856.8	16	595	88	32.8	MW-16A,MW-2A	31.3	65.2	6.5
10-07-2016	10:00AM	11:00PM	8856.8	8869.8	13	608	88	30.4	MW-16A,MW-2A	27.8	64.2	2.1
11-07-2016	9:00AM	2:00AM	8869.8	8886.8	17	625	88	32.8	MW-16A,MW-2A	22.4	59.6	6.2
12-07-2016	9:00AM	10:00PM	8886.8	8899.8	13	638	88	30.8	MW-16A,MW-2A	38.4	63.1	1.8
13-07-2016	9:30AM	1:00AM	8899.8	8911.3	11.5	649.5	80	28.9	MW-16A,MW-2A	22	87.4	2.5
14-07-2016	9:00AM	11:00PM	8911.3	8923	11.7	661.2	80	30.1	MW-16A,MW-2A	29.2	72.8	2.8
15-07-2016	9:00AM	9:30PM	8923	8931.3	8.3	669.5	80	28	MW-16A,MW-2A	22.4	68.4	0
16-07-2016	8:00PM	12:00AM	8931.3	8935.3	4	673.5	80	20.8	MW-16A,MW-2A	4.9	60.8	0
17-07-2016	9:30AM	10:00PM	8935.3	8947.6	12.3	685.8	80	20.8	MW-16A,MW-2A	10.2	61.2	0
18-07-2016	10:00AM	9:00AM(next day)	8947.6	8966.6	19	704.8	80	20.8	SVE-8	48.2	78.2	0
19-07-2016	9:00AM	1:00AM	8966.6	8986.6	20	724.8	80	20.8	SVE-8	20.1	58.3	5.1
20-07-2016	12:00PM	1:00AM	8986.6	8999.6	13	737.8	96	24.2	SVE-8	52.4	75.1	5.1
21-07-2016	9:00AM	1:00AM	8999.6	9012.6	13	750.8	96	24.2	SVE-8	31.6	50.9	3.2
22-07-2016	10:00AM	10:15PM	9012.6	9021.6	9	759.8	96	24.2	SVE-8	25.9	49	1.2
23-07-2016	3:30PM	1:00AM	9021.6	9030.9	9.3	769.1	96	24.2	SVE-8	35.1	55	0.2
25-07-2016	6:00PM	11:00PM	9030.9	9035.9	5	774.1	96	23.8	SVE-9	58.2	62.1	0
26-07-2016	5:30PM	9:30PM	9035.9	9039.9	4	778.1	96	24.2	SVE-9	43.6	63.6	0.4
27-07-2016	9:00AM	1:00AM	9039.9	9055.9	16	794.1	96	25.2	SVE-9	50.6	78.3	0.2
28-07-2016	9:30AM	1:00AM	9055.9	9071.4	15.5	809.6	96	24.2	SVE-9	29.7	62.5	0
29-07-2016	9:00AM	22:10PM	9071.4	9084.5	13.1	822.7	96	22.6	SVE-9	28.6	54.7	2.6
30-07-2016	9:00AM	5:00AM next day	9084.5	9104.5	20	842.7	96	21.9	SVE-9	20.6	47.2	0
01-08-2016	9:00AM	1:00AM	9104.5	9115.5	11	853.7	96	25.1	MW-4A	60.1	78.6	0
02-08-2016	9:00AM	1:00AM	9115.5	9126.8	11.3	865	96	24.8	MW-4A	54.8	65.8	0.8
03-08-2016	9:00AM	1:00AM	9126.8	9142.8	16	881	96	26	MW-4A	58.1	74.1	1.4
04-08-2016	7:00AM	12:00AM	9142.8	9159.8	17	898	96	26.2	MW-4A	55.9	68.7	3.1
05-08-2016	5:00PM	2:00AM	9159.8	9168.8	9	907	96	26.5	MW-4A	53.6	68	0.9

SVE System Performance Summary

Bharath Petroleum Corporation Ltd.

VPK Street, Tondiarpet, Chennai

Date	Beginning Time	Ending Time	BeginningHour Meter	Ending Hour Meter	Time Elapsed per day	Cumulative Time Elapsed	System Flow Rate	Field Influent Flow	Wells being used for Extraction	System Influent PID	Field Influent PID*	Effluent PID
06-08-2016	9:00AM	3:00:00AM	9168.8	9186.8	18	925	96	26	MW-4A	45	70.3	0.6
07-08-2016	11:30AM	11:00:00PM	9186.8	9199.1	12.3	937.3	96	26.1	MW-4A	34	72.4	0.9
08-08-2016	9:00AM	4:45AM(Next day)	9199.1	9218.55	19.45	956.75	90	22.1	MW-2A	45.3	83.2	0.3
09-08-2016	9:00AM	1:00:00AM	9218.55	9234.55	16	972.75	90	21.6	MW-2A	49.1	78.2	0
10-08-2016	9:00AM	1:00:00AM	9234.55	9250.55	16	988.75	90	21.2	MW-2A	46	75	1.9
11-08-2016	9:00AM	1:00:00AM	9250.55	9266.55	16	1004.75	96	21.3	MW-2A	43.1	71.8	0.5
12-08-2016	9:00AM	1:00:00AM	9266.55	9281.55	15	1019.75	94	21.5	MW-2A	41.8	68.1	1.4
13-08-2016	9:00AM	1:00:00AM	9281.55	9297.55	16	1035.75	94	23	MW-2A	38	61.3	0.9
14-08-2016	7:00AM	1:00:00AM	9297.55	9315.55	18	1053.75	94	23	MW-2A	35	60	0
15-08-2016	9:00AM	1:00:00AM	9315.55	9331.55	16	1069.75	93	23	MW-17A	58.4	72.1	0
16-08-2016	9:00AM	1:00:00AM	9331.55	9347.55	16	1085.75	94	23	MW-17A	53.4	78.1	0.2
17-08-2016	9:00AM	1:00:00AM	9347.55	9363.55	16	1101.75	94	24.3	MW-17A	53.4	80.3	1.2
18-08-2016	9:00AM	1:00:00AM	9363.55	9379.55	16	1117.75	94	24	MW-17A	50.1	79.6	0.4
19-08-2016	9:00AM	1:00:00AM	9379.55	9395.55	16	1133.75	95	24.3	MW-17A	42.4	65.6	0.1
20-08-2016	9:00AM	1:00:00AM	9395.55	9411.55	16	1149.75	95	24.3	MW-17A	38.3	72.1	0.1
22-08-2016	9:00AM	1:00:00AM	9411.55	9427.55	16	1165.75	94	23	SVE-2,SVE-10	109.2	175.6	1
23-08-2016	9:00AM	1:00:00AM	9427.55	9443.55	16	1181.75	95	23	SVE-2,SVE-10	107.6	177	0.1
24-08-2016	7:00AM	8:30:30PM	9443.55	9457.05	13.5	1195.25	95	24.5	SVE-2,SVE-10	90.3	157.8	0.5
25-08-2016	6:30AM	7:30:30PM	9457.05	9470.05	13	1208.25	95	23	SVE-2,SVE-10	85.2	150.6	0
26-08-2016	6:00AM	7:00:00PM	9470.05	9483.05	13	1221.25	95	24.5	SVE-2,SVE-10	85.9	145.9	1
27-08-2016	10:00AM	6:00:00PM	9483.05	9491.05	8	1229.25	96	24.6	SVE-2,SVE-10	80.9	140.8	0
29-08-2016	8:00AM	22:30:30PM	9491.05	9505.55	14.5	1243.75	96	25	SVE-2,SVE-10	78.6	121.5	0
30-08-2016	9:00AM	12:00:00AM	9505.55	9520.55	15	1258.75	96	25.1	SVE-2,SVE-10	95.6	139.1	0.3
31-08-2016	9:00AM	6:00:00PM	9520.55	9529.55	9	1267.75	96	25.4	SVE-2,SVE-10	82	112.6	0
01-09-2016	9:00AM	1:00:00AM	9529.55	9545.55	16	1283.75	96	25.3	SVE-2,SVE-10	97.8	139.6	0
02-09-2016	9:30AM	1:00:00AM	9545.55	9561.05	15.5	1299.25	96	25.3	SVE-2,SVE-10	85.3	146.8	0
03-09-2016	9:00AM	1:00:00AM	9561.05	9577.05	16	1315.25	96	25.4	SVE-2,SVE-10	82	112.6	0
04-09-2016	10:30AM	9:00:00PM	9577.05	9587.55	10.5	1325.75	96	25.5	SVE-2,SVE-10	76	128.1	0
06-09-2016	9:00AM	1:00:00AM	9587.55	9603.55	16	1341.75	96	25.4	MW-17A,SVE-8	85.1	180.1	0.3
07-09-2016	9:00AM	1:00:00AM	9603.55	9619.55	16	1357.75	97	21.4	MW-17A,SVE-8	84.2	115.3	0.4
08-09-2016	9:00AM	1:00:00AM	9619.55	9635.55	16	1373.75	97	21.4	MW-17A,SVE-8	65.8	115.8	0
09-09-2016	9:00AM	1:00:00AM	9635.55	9651.55	16	1389.75	96	25.4	MW-17A,SVE-8	57.5	104.5	0
10-09-2016	9:00AM	1:00:00AM	9651.55	9667.55	16	1405.75	96	25.4	MW-17A,SVE-8	45.6	98.5	0
12-09-2016	9.00AM	1:00:00AM	9667.55	9683.55	16	1421.75	97	25.5	SVE-9,MW-16A	98.4	149.1	0
13-09-2016	9.00AM	1:00:00AM	9683.55	9699.55	16	1437.75	96	25	SVE-9,MW-16A	95.6	140.6	0.3
14-09-2016	9.00AM	1:00:00AM	9699.55	9715.55	16	1453.75	96	25.1	SVE-9,MW-16A	80	131	0.3

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SVE System Performance Summary

Bharath Petroleum Corporation Ltd.

VPK Street, Tondiarpet, Chennai

Date	Beginning Time	Ending Time	BeginningHour Meter	Ending Hour Meter	Time Elapsed per day	Cumulative Time Elapsed	System Flow Rate	Field Influent Flow	Wells being used for Extraction	System Influent PID	Field Influent PID*	Effluent PID
15-09-2016	9.00AM	1.00AM	9715.55	9731.55	16	1469.75	96	25.4	SVE-9,MW-16A	75.3	120	0
16-09-2016	9.00AM	11.30PM	9731.55	9745.85	14.3	1484.05	97	25.4	SVE-9,MW-16A	69	108.9	0
17-09-2016	9.00AM	12.00AM	9745.85	9760.85	15	1499.05	97	25.4	SVE-9,MW-16A	63.6	102.1	0
18-09-2016	10.00AM	10.00PM	9760.85	9772.85	12	1511.05	97	25.4	SVE-9,MW-16A	56.3	91	0
19-09-2016	9:00AM	1:00AM	9772.85	9788.85	16	1527.05	96	24.8	SVE-9,MW-16A	49.9	78.4	0.2
20-09-2016	9:00AM	1:00AM	9788.85	9804.85	16	1543.05	96	24.6	SVE-9,MW-16A	48.4	72.4	0.8
21-09-2016	9:00AM	1:00AM	9804.85	9820.85	16	1559.05	96	24.6	SVE-9,MW-16A	45.9	65.6	1.2
22-09-2016	9:00AM	1:00AM	9820.85	9836.85	16	1575.05	96	25.2	SVE-9,MW-16A	38.1	59.6	0.2
26-09-2016	9:00AM	1:00AM	9836.85	9852.85	16	1591.05	96	25.4	SVE-2, SVE-3	195.8	290.35	5.6
27-09-2016	9:00AM	1:00AM	9852.85	9868.85	16	1607.05	96	25.4	SVE-2, SVE-3	189.9	285.4	3.9
28-09-2016	9:00AM	1:00AM	9868.85	9884.85	16	1623.05	96	24.8	SVE-2, SVE-3	185.6	282.5	3.5
29-09-2016	9:00AM	1:00AM	9884.85	9900.85	16	1639.05	96	24.8	SVE-2, SVE-3	178.6	269.4	0.4
30-09-2016	9:00AM	1:00AM	9900.85	9916.85	16	1655.05	96	25.2	SVE-2, SVE-3	168.8	255.9	1.2
01-10-2016	9:00AM	1:00AM	9916.85	9932.85	16	1671.05	96	25.2	SVE-2, SVE-3	162.7	259.6	0
03-10-2016	9:00AM	1:00AM	9932.85	9948.85	16	1687.05	96	25.2	SVE-2, SVE-3	158.9	242.8	0.4
04-10-2016	9:00AM	1:00AM	9948.85	9964.85	16	1703.05	96	25.2	SVE-2, SVE-3	149.8	235.4	1.2
05-10-2016	9:00AM	1:00AM	9964.85	9980.85	16	1719.05	96	25.2	SVE-2, SVE-3	141.1	222.8	0
06-10-2016	9:00AM	1:00AM	9980.85	9996.85	16	1735.05	96	25.2	SVE-2, SVE-3	132.9	201.8	1.5
07-10-2016	9:00AM	1:00AM	9996.85	10012.85	16	1751.05	96	25.2	SVE-2, SVE-3	128.4	187.2	0.2
08-10-2016	9:00AM	1:00AM	10012.85	10028.85	16	1767.05	96	25.2	SVE-2, SVE-3	122.7	165.4	0
10-10-2016	9:00AM	1:00AM	10028.85	10044.85	16	1783.05	96	24.8	SVE-2, SVE-3	122.8	178.4	0
11-10-2016	9:00AM	1:00AM	10044.85	10060.85	16	1799.05	96	25.2	SVE-2, SVE-3	118.6	175.8	0.2
12-10-2016	9:00AM	1:00AM	10060.85	10076.85	16	1815.05	96	25.2	SVE-2, SVE-3	107.4	189.7	0
13-10-2016	9:00AM	1:00AM	10076.85	10092.85	16	1831.05	96	24.9	SVE-2, SVE-3	102.7	155.9	1.5
14-10-2016	9:00AM	1:00AM	10092.85	10108.85	16	1847.05	96	25.1	SVE-2, SVE-3	95.7	165.7	0.4
15-10-2016	9:00AM	1:00AM	10108.85	10124.85	16	1863.05	96	25.1	SVE-2, SVE-3	89.2	166.9	0
17-10-2016	9:00AM	1:00AM	10124.85	10140.85	16	1879.05	96	26.5	MW-16A,17A,SVE-8,9	210.9	255.6	1.3
18-10-2016	9:00AM	1:00AM	10140.85	10156.85	16	1895.05	96	26.5	MW-16A,17A,SVE-8,9	196.4	203	1.3
19-10-2016	9:00AM	1:00AM	10156.85	10172.85	16	1911.05	96	24.8	MW-16A,17A,SVE-8,9	184.6	245.7	0.6
20-10-2016	9:00AM	1:00AM	10172.85	10188.85	16	1927.05	96	24.8	MW-16A,17A,SVE-8,9	172.1	263.5	1.2
21-10-2016	9:00AM	1:00AM	10188.85	10204.85	16	1943.05	96	26.5	MW-16A,17A,SVE-8,9	169.4	238.9	0
22-10-2016	9:00AM	1:00AM	10204.85	10220.85	16	1959.05	96	26.5	MW-16A,17A,SVE-8,9	151.6	237.4	0
23-10-2016	9:00AM	1:00AM	10220.85	10236.85	16	1975.05	96	26.5	MW-16A,17A,SVE-8,9	144.1	238	0

Note: From 01/06/2016 till 03-06-2016 - system was not in operation because of sudden failure of catalytic cell

* small correction in hour meter reading done

We have collected air samples on 18.07.2016 (1 - field influent , 1 - system influent and 1 - system effluent samles)

We have collected air samples on 24.08.2016 (1 - field influent , 1 - system influent and 1 - system effluent samples) waiting for lab results

SVE System Performance Summary

Bharath Petroleum Corporation Ltd.

VPK Street, Tondiarpet, Chennai

Date	Beginning Time	Ending Time	BeginningHour Meter	Ending Hour Meter	Time Elapsed per day	Cumulative Time Elapsed	System Flow Rate	Field Influent Flow	Wells being used for Extraction	System Influent PID	Field Influent PID*	Effluent PID
Due to huge fluctuation in voltage and power cut in entire neighbourhood somedays system ran less otherwise we are running system approx. 16 hours/day												
24.07.2016 system was not running because of power cut and voltage flactuation in entire area												
Dates in Blue colour indicates - samples collected, On**16.06.2016, 04.10.2016- CPCB collected samples(Groundwater and Air samples from SVE system)**												
Due to Access issue we are not able to run machine on Sunday, National Holidays and sometime not more than 12 to 13 hours in weekdays												
We are Running SVE-2 & 10 for longtime because these wells have high concentration based on PID readings												
Remediation Wells comes in CMRL earmarked and Devi-polymer area e.g MW-17A, SVE-8, SVE-9, SVE-2, SVE-3, MW-16A primary focus wells for remediation **because** of CMRL construction work												
23.09.2016 & 24.09.2016 - No current in whole area because TNEB changing all the transformer in the area												
Date in bold format **(17.10.2016 to 23.10.2016)** are readings for last week												

SVE System Mass Extraction
BPCL Tondiarpet Oil Contamination Site
Tondiarpet, Chennai

Date	Cumulative Time Elapsed	Flow Rate	Influent Concentrations			Effluent Concentrations			Destruction Efficiency	Mass Extraction Rate	Cumulative Mass Extracted
			DRO	GRO	TPH	DRO	GRO	TPH		DRO	DRO
	Hours	CFM	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3	mg/m^3	%	Kgs/hr	Kilograms
20-May-16	13.2	91	814.64	<2.5	23038.24	186.012	<2.5	4607.65	77%	0.126	1.66
25-May-16	49.2	84	22215.33	<2.5	72.855	0.123			100.00%		
4-6-2016*	126	94	1.23	0.037	<1.0	0.322	<2.5	<1.0	74%		
6-Jun-16	150.3	79	0.617	NA	NA	0.0417	NA	NA	93%		
16-Jun-16	271.5	92	NA	NA	NA	NA	NA	NA	***99%***		
18-Jul-16	704.8	80	3462.4	1075.8	3462.4	829.2	0	829.2	76%	0.471	
30-Jul-16	842.7	96									198.40
31-Aug-16	1267.75	94.58	715.5	1185.33	715.5	BDL	BDL	BDL	100%	0.115	**295.87**
26-Sep-16	1591.05	96.23	BDL	1258	BDL	BDL	BDL	BDL	100%	0.206	**381.14**

CFM - cubic feet per minute of air flow
*- Samples collected on June 4, 2016 were during operation of the Carbon adsorption system
NA - Samples collected and delivered to lab but no analytical data provided by lab
mg/m3 - milligram per meter cubed of air
Data from June 16 is extracted from CPCB affadavit
BDL- Below laboratory method detection limit
NC- Not calculated
A concentration of 1 mg/m3 in the effluent was used to calculate mass destruction rates, although reported BDL.
The concentration of GRO was used to calculate mass extraction for the month of september 2016, Since we believe the lab switched DRO and GRO concentration

TPH - Total Petroleum Hydrocarbons
DRO - Diesel Range Organics C_{10}-C_{23}
GRO - Gasoline Range Organics C_6-C_{10}

Mass Extraction Rate Formula

ft3	60 min	m3	kg
min	hour	35.31 ft3	10,00,000 mg

Annexure -2

Second set of ground water samples taken from extraction & monitoring wells on October 04, 2016

WATER SAMPLE LOCATION												
Sl.No	Parameter	Unit	Well Water MW – 16A	Well Water SVE - 09	Well Water SVE - 08 (duplicated)	Well Water MW -17 A	Well Water SVE - 10 (duplicated)	Well Water SVE - 05	Well Water MW - 3A	Well Water MW - 4A	Well Water SVE - 01 –(duplicated)	Bore well at Residential Alley duplicated
1	**TOC**	mg/L	20.0	29.0	38.0	11.0	6.1	61.0	26.0	1.5	91.0	37.0
2	**VOC**	mg/L	1.1	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL:20)	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL:20)	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL: 20)
3	**TPH**	mg/L	0.42	1.65	0.41	1.72	2.46	2.33	2.22	3.11	1.7	1.97
4	**BTEX**	mg/L	1.1	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL:20)	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL:20)	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL: 20)
5	**GRO**	mg/L	1.1	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL:20)0.12	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL:20)	*BDL(DL: 20)	*BDL(DL: 20)	*BDL(DL: 20)
6	**DRO**	mg/L	0.38	1.52	0.39	1.6	2.35	2.2	0.06	2.94	1.6	1.85
7	**MINERAL OIL**	mg/L	4.23	3.84	4.91	0.45	0.81	0.58	0.72	0.64	6.38	0.52
8	**OIL & GREASE**	mg/L	8.0	6.5	10.0	BDL(DL:4.0)	BDL(DL:4.0)	BDL(DL:4.0)	BDL(DL:4.0)	BDL(DL:4.0)	12.0	BDL(DL:4.0)

Note :

*** BDL (DL-20) in µg/L**

i. MW -16, MW – 17 A, MW-4A are monitoring well but these are used for dual purpose i.e as a monitoring well as for extraction well

ii. In SVE -01, SVE-08 and SVE-10 and alley, two samples were taken as duplicity

iii. SVE – 03 is not access to collect ground water samples because Chennai Metro corporation laid divider curb on the well but extraction of gasses can be carried out.

iv. SVE – 02, also not access to collect samples because it exist in the mid of traffic road

v. SVE – 04 & 07 are installed in private property, they laid floor tiles and not to access to collect ground water but extraction of gasses can carried out.

Page No. 12
Annexure-2

Performance of SVE system by taking samples from inlet and out let				
Parameter	**Unit**	**Obserbant used ----Tenax + Carbopack**		
		SVE Field inlet	**SVE System inlet (dilution with air)**	**SVE outlet**
VOC	mg/m3	1345	682.13	BDL(DL0.1)
TPH	mg/m3	1345	682.13	BDL(DL0.1)
BTEX	mg/m3	1345	682.13	BDL(DL0.1)
GRO	mg/m3	BDL(DL0.1)	BDL(DL0.1)	BDL(DL0.1)
DRO	mg/m3	BDL(DL0.1)	BDL(DL0.1)	BDL(DL0.1)

Annexure - 3

First set of Ground water samples taken from monitoring & extraction well on June 16, 2016

GROUND WATER SAMPLE LOCATION											
Sl.No	**Parameter**	**Unit**	Well Water MW - 16	Well Water SVE - 09	Well Water SVE - 08 (2 samples taken)	Well Water MW -17 A	Well Water SVE - 10 (2 Samples taken)	Well Water SVE - 05	Well Water MW - 3A	Well Water MW - 4A	Well Water SVE - 01 –(2 samples taken)
1	**TOC**	mg/L	23	32.4	21.6	25	8	37	20	8	123
2	**VOC**	µg/L	2.16	BDL(DL:20)	9.72	0.12	BDL(DL:20)	16.13	2.12	BDL(DL:20)	4.71
3	**TPH**	mg/L	0.12	0.11	0.11	0.39	2.78	0.26	0.73	0.23	0.488
4	**BTEX**	µg/L	1.99	BDL(DL:20)	9.36	BDL(DL:20)	BDL(DL:20)	15.54	2.12	BDL(DL:20)	4.5
5	**GRO**	mg/L	2.16	BDL(DL:0.01)	9.72	0.12	BDL(DL:0.01)	16.13	2.12	BDL(DL:0.01)	4.71
6	**DRO**	mg/L	0.07	0.08	0.07	0.36	1.56	0.18	0.47	0.13	0.464
7	**MINERAL OIL**	mg/L	1.63	2.31	1.49	9.61	2.01	2.51	2.39	1.76	5.91
8	**OIL & GREASE**	mg/L	4.2	BDL(DL:1.0)	2.40	4.6	7.6	8.00	7.4	4.2	14.8

Note : i. MW -16, MW – 17 A, MW-4A are monitoring well but these are used for dual purpose i.e as a monitoring well as for extraction well

ii. In SVE -01, SVE-08 and SVE-10 two samples were taken as duplicity

iii. SVE – 03 is not access to collect ground water samples because Chennai Metro corporation laid divider curb on the well but extraction of gasses can be carried out.

iv. SVE – 02, also not access to collect samples because it exist in the mid of traffic road

v. SVE – 04 & 07 are installed in private property, they laid floor tiles and not to access to collect ground water but extraction of gasses can carried out.

Page no. 14
Annexure – 3

Performance of SVE system by taking samples from inlet and out let												
Sl.No	Parameter	Absorbent	charcoal		Tenax + Poropack		Tenax + Carbopack		Tenax + charcoal		Tenax + Poropack	
		Unit	Inlet	outlet	Inlet -1	outlet -1	Inlet	outlet	Inlet	outlet	Inlet -2	outlet -2
1	VOC	mg/m3	32782.4	BDL(DL:0.1 mg/l)	37896	724.7	41455.4	448	6265.4	50.0	44587.4	51
2	TPH	mg/m3	1528.4	BDL(DL:0.1 mg/l)	534.8	BDL(DL:0.1mg/l)	565.6	BDL(DL:0.1 mg/l)	130.4	BDL(DL:0.1mg/l)	508.4	BDL(DL:0.1mg/l)
3	BTEX	mg/m3	23598.8	BDL(DL:0.1 mg/l)	36325.6	232.2	3632560	87	4219.2	50.0	24236.2	51
4	GRO	mg/m3	29020.8	BDL(DL:0.1 mg/l)	36325.6	315.3	36575.2	87	5652.6	50.0	38170.2	51
5	DRO	mg/m3	1528.4	BDL(DL:0.1 mg/l)	534.8	BDL(DL:0.1mg/l)	565.6	BDL(DL:0.1 mg/l)	130.4	BDL(DL:0.1mg/l)	508.4	BDL(DL:0.1mg/l)

Annexure -4

Graphical representation of concentration of Mineral Oil and TPH in ground water

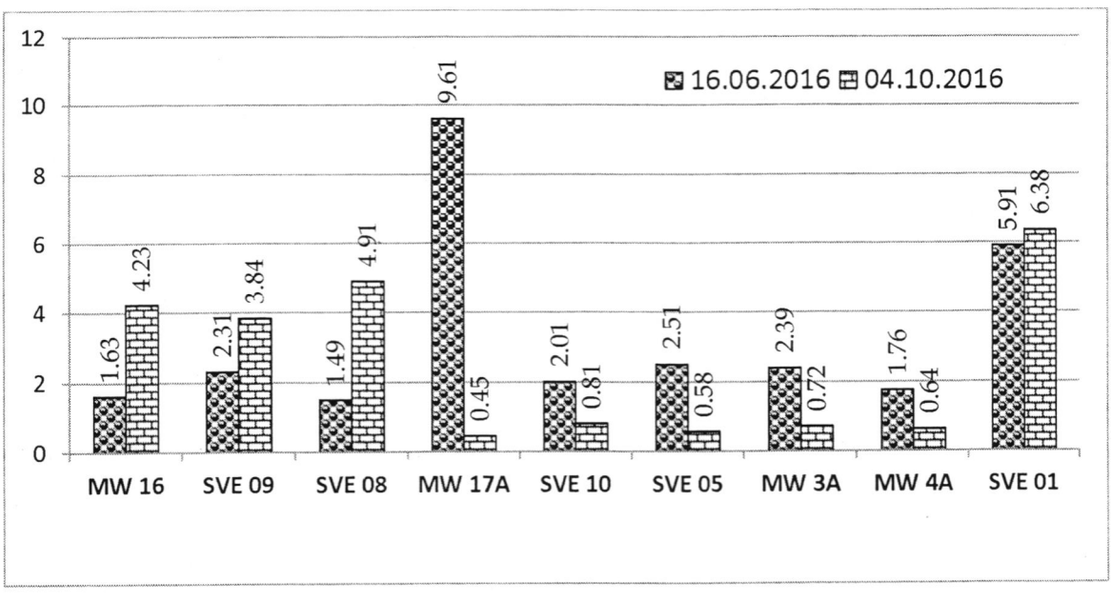

Figure 1: Concentration of Mineral Oil in ground water samples taken from different locations

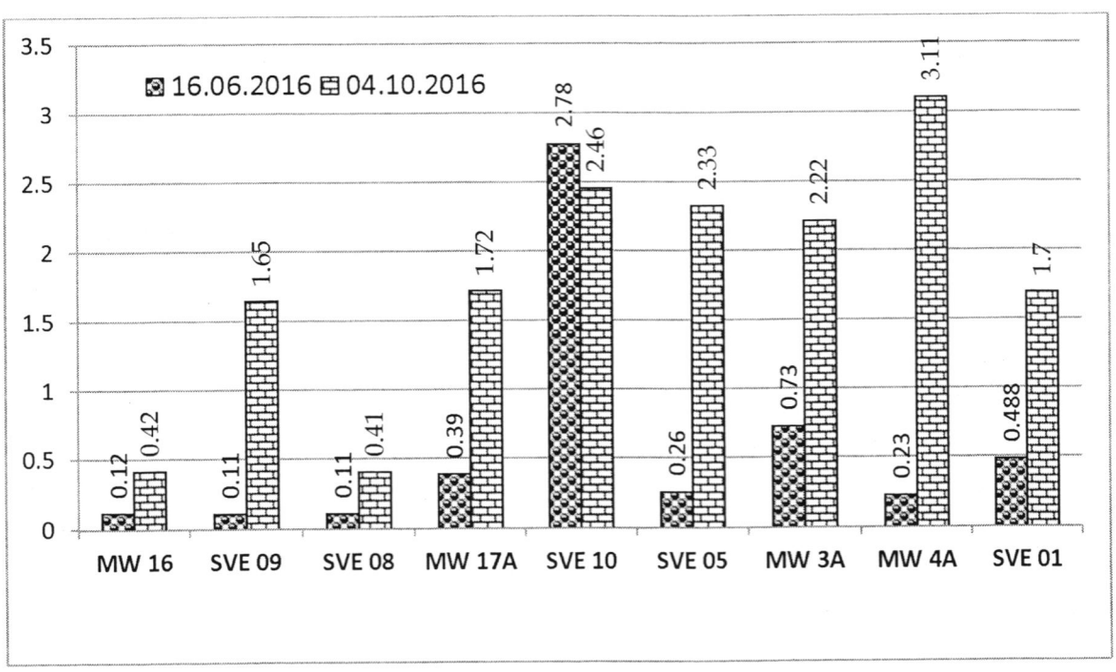

Figure 2: Concentration of TPH in ground water samples taken from different locations

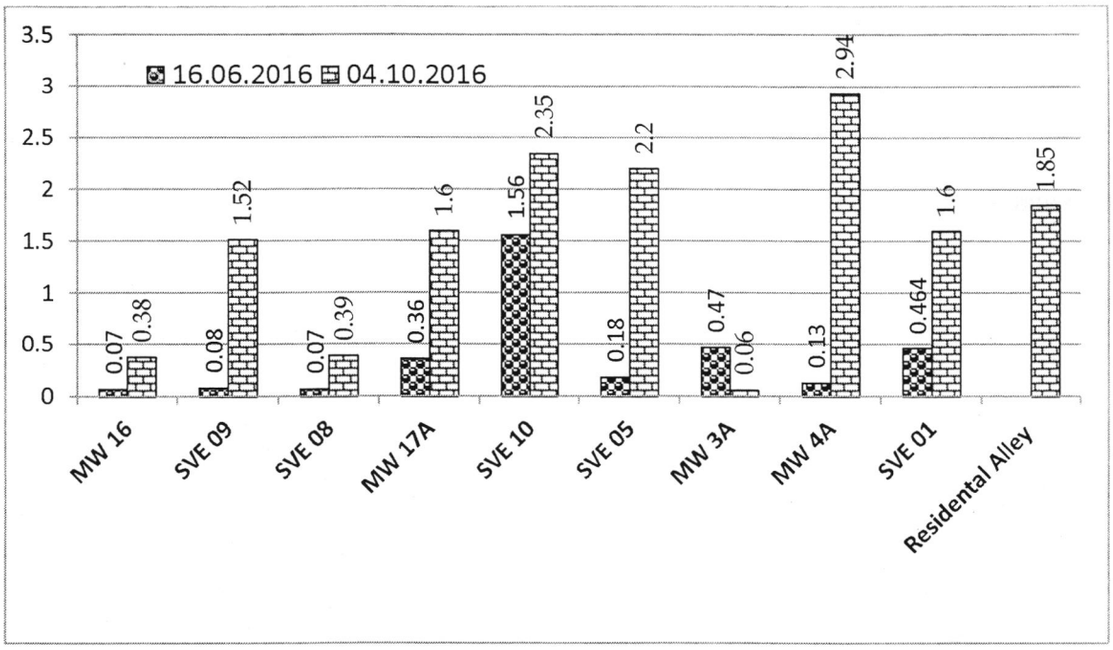

Figure 3: Concentration of DRO in ground water samples taken from different locations

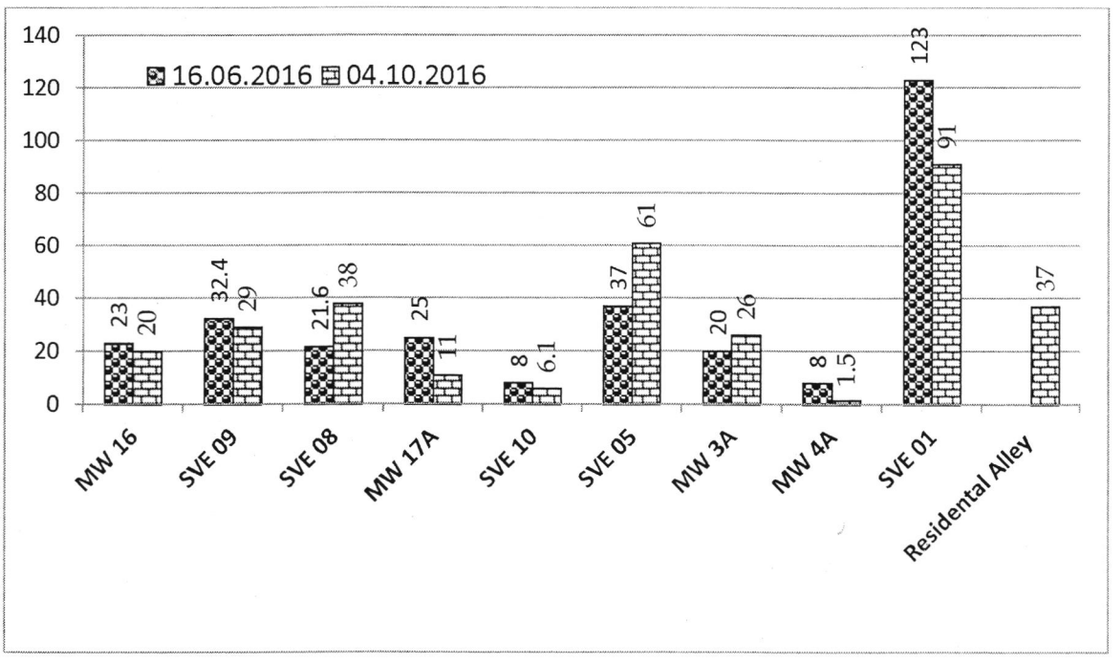

Figure 4: Concentration of TOC in ground water samples taken from different locations

BEFORE THE NATIONAL GREEN TRIBUNAL (SOUTHERN ZONE) CHENNAI

APPLICATION NO. 176 OF 2013

V.P Krishnamoorthy

APPLICANT

VERSUS

Union of India & Others

RESPONDENTS

STATUS REPORT ON BEHALF OF RESPONDENT No. 12, CENTRAL POLLUTION CONTROL BOARD

Advocate D. S. Ekambram

&

Advocate P. Jayalakshmi

COUNSELS FOR 12th RESPONDENT

BEFORE THE NATIONAL GREEN TRIBUNAL (SOUTHERN ZONE)
CHENNAI

APPLICATION NO. 176 OF 2013

IN THE MATTER OF:

V.P Krishnamoorthy

...APPLICANT

VERSUS

Union of India & Others

...RESPONDENTS

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02	**Annexure – R12/1** Report on status of remediation work carried out at oil contaminated site at Tondiarpet, Chennai	05-17

Signed and Verified on this 5th day of January, 2018 at Bengaluru.

COUNSEL FOR
12th RESPONDENT

S. Suresh
5/1/2018

DEPONENT
S. SURESH
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE (SOUTH)
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU-560079, MOB : 9480672128

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN ZONAL BENCH, CHENNAI

Application No. 176 of 2013

In the matter of:

Shri V. P. Krishnamoorthy

.....Applicant

Versus

Union of India & Ors.

.....Respondents

Compliance affidavit on behalf of Central Pollution Control Board (Respondent No. 12) with regard to order dated 17/10/2017 of the Hon'ble National Green Tribunal, Southern Zone Bench, Chennai.

1. I, S. Suresh, Son of S.R. Sathyanarayana, Hindu, aged about 55 years, having office at the Regional Directorate, Central Pollution Control Board, 1st & 2nd Floors, Nisarga Bhavan, A- Block, Thimmaiah Main Road, 7th D Cross, Shivanagar, Bengaluru – 560 079 do hereby solemnly affirm and sincerely state as follows:-

2. That I am presently working as Scientist 'E' & Regional Director (South), Central Pollution Control Board (hereafter called as CPCB), Bengaluru and have been authorized to file the present compliance affidavit. I am fully conversant with the facts of the case and hence, competent and authorized to depose and swear the present compliance affidavit as under:

S. Suresh 5/11/2018

Regional Director
Central Pollution Control Board
1st& 2nd Floors, Nisarga Bhavan
Thimmaiah Main Road, 7th D Cross
Shivanagar, Bengaluru – 560 079

Corrn:
Initial:

3. That the Hon'ble National Green Tribunal, Southern Zone Bench, Chennai, in the matter of Application No. 176/2013; Shri V. P. Krishnamoorthy Vs. Union of India & Ors., passed order dated 17/10/2017 directing that "***CPCB to conduct another inspection and find out the correctness of the compliance and file a status report by the next date of hearing***".

4. That in compliance to the said orders of the Hon'ble Tribunal, a team of officials from CPCB and Tamil Nadu Pollution Control Board (TNPCB) monitored the oil contaminated site on November 22, 2017 and collected the samples from Monitoring and Extraction wells (13 water samples) to assess the status of contamination and also assessed the performance of Soil Vapour Extraction (SVE) system by engaging third party laboratory that is M/s SMS Laboratory. The monitoring work was delayed due to rains in Chennai during 01-14th November, 2017. Joint team of CPCB & TNPCB has also visited the site to visualize ongoing CMRL works. Report on status of remediation work carried out at oil contaminated site at Tondiarpet is given at **Annexure R12/1**.

5. That, the following observations are made during site inspection;

   a. The operation of Soil Vapour Extraction (SVE) System was found not optimised based on the concentration of vapours drawn from different wells, the system was operated at a field flow rate of 18 – 29.2 cfm and system flow rate of 77 – 99 cfm against the designed capacity of 250 cfm. The concentration of vapours fed to SVE system found very low (15 – 285 ppm) during September, 2017 – October, 2017 which also confirms the non-optimisation of operation of SVE system even after long experience of 18 months.

   b. The concentration of Mineral oil and Gasoline Range of Organics (GRO) found less than 0.01 mg/L and 20µg/L respectively in most of the monitoring well locations. However, the concentration of Diesel Range of Organics (DRO), Total Petroleum Hydrocarbon (TPH) and Total Hydrocarbon (THC) in ground water indicates that the present system of operation of SVE could not establish the satisfactory reduction.

S. Suresh 5/1/2018

Regional Director
Central Pollution Control Board
1st& 2nd Floors, Nisarga Bhavan
Thimmaiah Main Road, 7th D Cross
Shivanagar, Bengaluru – 560 079

Corrn:
Initial:

c. The vapours from different wells were extracted without operating Air sparging system, based on the field data maintained by the operator indicates that the extracted vapours has only having GRO which is having lower carbon ranges. But the analysis results of ground water indicates the presence of DRO, TPH and THC which are having higher carbon ranges and demands the air sparging system.

d. As per the data collected from SVE system so far about 8698.75 kg of GRO has been extracted from soil and groundwater till October 27, 2017 at an average of about 543.67 kg of GRO per month.

6. That as per the findings of site inspection and the on-going excavation works of M/s CMRL, it is humbly submitted that the Hon'ble Tribunal may pass appropriate orders to direct M/s BPCL to comply with the following;

a) To optimize the operation of SVE system based on the concentration of vapour extracted and to take immediate steps to operate air sparging system to mobilize the extraction of DRO, TPH and THC from sub-soil as well as in groundwater.

b) To carry out soil testing in the contaminated areas falling within about 300 m from the abundant oil pipelines in a grid space of 30m x 20m (5 locations in each grid) by drilling sample borehole up to a depth of 10m to 25m (minimum of 3 samples in each location), where M/s CMRL is planning to carryout excavation. Soil analysis report with respect to the parameters; TPH, DRO and GRO along with details of sampling location shall be submitted to CPCB and TNPCB.

c) Contaminated water, if extracted from construction site should be collected in separate tanks and treated with activated carbon filters prior to disposal. The analysis reports shall be submitted for CPCB and TNPCB.

S. Suresh 5/11/2018

Regional Director
Central Pollution Control Board
1st & 2nd Floors, Nisarga Bhavan
Thimmaiah Main Road, 7th D Cross
Shivanagar, Bengaluru – 560 079

Corrn:
Initial:

7. That as per the findings of site inspection and the on-going excavation works of M/s CMRL, it is humbly submitted that the Hon'ble Tribunal may pass appropriate orders to direct M/s CMRL to comply with the following:

a) To ensure safe storage of contaminated excavated earth till treatment and to disposal of the same by M/s BPCL as per the authorization of TNPCB.

b) To take necessary precautions to ensure that the metro workers are protected from possible release of VOCs from contaminated soil, risk of fire, etc., while handling of contaminated soil.

c) To provide access to representatives of M/s BPCL and their consultants to enter premises for the purpose of collection, testing of water and soil samples before excavation as well as during excavation from metro construction site.

d) To allow M/s BPCL to set-up necessary facilities for collection, treatment and disposal of contaminated soils or groundwater extracted from metro construction site.

e) To ensure minimal damage to SVE system during execution of CMRL works.

PRAYER

This answering Respondent No.12 shall abide by any direction passed by Hon'ble Tribunal.

S. Suresh 5/1/2018

DEPONENT
S. SURESH
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE (SOUTH)
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU-560079, MOB : 9480672128

VERIFICATION

It is verified that the content of this Counter Affidavit which is based on official record and information available in the office are true and correct. Nothing has been concealed therein.

Signed and verified on this 5th Day of January, 2018 at Bengaluru

S. Suresh 5/1/2018

DEPONENT
S. SURESH
REGIONAL DIRECTOR
CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE (SOUTH)
MIN. OF ENV, FORESTS & CC, GOVT. OF INDIA
BENGALURU-560079, MOB : 9480672128

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Annexure-R12/1

Report on status of Remediation of oil contaminated site at Tondairpet, Chennai by M/s Stratus Environmental Inc. (consultant of M/s Bharat Petroleum Corporation Ltd.)

Background:

The Hon'ble National Green Tribunal, Southern Zone Bench, Chennai, in the matter of Application No. 176 of 2013, V.P. Krishnamoorthy Vs. Union of India & Ors, passed order dated 17/10/2017 that *"the CPCB to conduct another inspection and find out the correctness of the compliance and file a status report by the next date of hearing"*.

In compliance of the Hon'ble Tribunal order dated 17/10/2017, a team of officials from Central Pollution Control Board (CPCB) and Tamil Nadu Pollution Control Board (TNPCB) monitored the oil contaminated site at Tondairpet, Chennai on November 22, 2017 and collected the samples from Monitoring & Extraction Wells (13 water samples) to assess the status of contamination and also assessed the performance of Soil Vapour Extraction (SVE) system. Joint team of CPCB & TNPCB has also visited the site to visualize on-going CMRL works. The status of remediation work carried out at oil contaminated site at Tondiarpet is summarized as below:

Status of Monitoring/SVE wells disused due to on-going CMRL work

a) Out of 13 SVE wells, 2 extractions well have been disused due to M/s Chennai Metro Rail Limited (CMRL) works, these are MW-17A & SVE-10. Three more vapour extraction wells namely; SVE-2, SVE-3 & SVE-8 will also be disused from the date of initiation of excavation works of M/s CMRL.

b) 6 monitoring wells (MW-6A, MW-17B, MW-17A, MW-8A, MW-12A, MW-19A) and 2 air sparging wells (AS-8 & AS-10) were also disconnected or disused from existing SVE system due to on-going M/s CMRL works. It was reported that M/s CMRL excavation

works will start shortly in the zones where these wells are located. 2 more air sparging wells (AS-1 & AS-3) also have to be closed in near future to facilitate M/s CMRL works.

c) Displacement of soil due to on-going M/s CMRL works may impact the on-going SVE remediation system and also change the hydrogeological of subject site. Out of 13 SVE wells; only 8 wells (MW-2A, MW-4A, MW-16A, SVE-1, SVE-4, SVE-5, SVE-7 & SVE-9) will be available for vapour extraction. Similarly, out 9 air sparging wells, 5 may be unaffected due to M/s CMRL works.

d) The M/s CMRL was in process of sheet piling and excavation of pits for inspection of existing utilities in the site, the representatives of M/s CMRL informed that no soil from the subject site being taken out. However, the consultant engaged by M/s Bharat Petroleum Corporation Limited (BPCL) have informed that they are verifying the Volatile Organic Compound (VOC) in excavated soil by using Photo Ionization Detector (PID) instrument and maintaining the record. The data indicates that some quantity of soil is having total VOCs in the range of 0.9 to 35 ppm, which indicates contamination of soil with hydrocarbons. However, it is required to carry out analysis of soil w.r.t. Total Petroleum Hydrocarbon (TPH) to ascertain the contamination intervention values exceeding 5000 mg/kg, to decide disposal pathway.

Status of Remediation work of Oil contaminated site at Tondiarpet, Chennai

i. Soil Vapour Extraction (SVE) with 10 HP capacity blower was installed to extract mass of petroleum hydrocarbons from soil and groundwater. The vapours extracted from wells are disposed by incineration in catalytic oxidizer of 250 cubic feet per minute (cfm) capacity. The SVE system was connected to a network of 13 wells i.e. SVE-1, 2, 3, 4, 5, 7, 8, 9 & 10 and monitoring wells i.e. MW- 2A, 4A, 16A & 17A. Due to the on-going M/s CMRL works, SVE-10 was closed and not in use, during inspection 12 extraction wells were found available to extract mass of petroleum hydrocarbons.

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ii. As per records, the SVE system was being operated round the clock since September 22, 2017 and soil vapours were extracted using 9 - 10 extraction wells at a time in the tune of 27–29 cfm and system flow rate in the tune of 97-99 cfm (after dilution). As per the field data maintained by the operator, daily monitored the number of hours operated, field flow rate and its concentrations (based on hand held photo-ionization detector (PID) readings, system flow rate & its concentrations and the gist of field data is as below;

Month & Year	Average time of operation per day (hrs/day)	No. of Wells used for extraction in a day	Field inlet (without dilution)		System Inlet (inlet to SVE system, after dilution)	
			Flow in cfm	Concentration in ppm (using PID)	Flow in cfm	Concentration in ppm (using PID)
May, 2016	9.5 (10d)	2 - 3	18 - 24.8	58 - 191	77 - 91.7	54 - 185
June, 2016	13 (27d)	1 - 3	18.4 - 28.9	85 - 685	78 - 94	89.8 - 684
July, 2016	13.5(29d)	1 - 2	20.8 - 32.8	47.2 - 181.2	80 - 96	22 - 116.2
Aug., 2016	13 (29d)	1 - 2	21.5 - 26.5	60 - 175.6	90 - 96	34 - 109
Sept., 2016	15.5 (24d)	1 - 2	21 - 25	65 - 290	96 - 97	38 - 195.8
Oct., 2016	16 (26d)	2 - 4	24 - 26	156 - 298	94 - 96	89 - 210
Nov., 2016	16 (25d)	4	24 - 26	128 - 325	94 - 96	39 - 235
Dec., 2016	16 (21d)	4 - 5	24.2 - 28	132 - 489	94 - 98	51 - 380
Jan., 2017	16 (28d)	5 - 6	25.8 - 28.1	102 - 385	96 - 98	71 -289
Feb., 2017	16 (28d)	6 - 7	26 - 28.5	158 - 365	98	96 - 272
Mar., 2017	16 (31d)	7 - 8	26.4 - 29	155 - 485	95 - 99	63 - 367
April, 2017	16 (30d)	7 - 8	26.5 - 28.9	111 - 496	96 - 98	41 - 385
May, 2017	16 (31d)	9	27.9 - 28.9	411 - 715	98	235 - 538
June, 2017	16 (30 d)	9	28.2 - 29.2	137 - 685	97 - 98	25 - 425
July, 2017	16 (31d)	9	27.2 - 28.9	299 - 629	96 - 98	105 - 374
Aug., 2017	16(31d)	9	27.3 - 28.9	237 - 598	96 - 99	53 - 489
Sept., 2017	18.4 (30d)	9	28.2 - 29.2	157 - 487	97 - 99	37 - 285
Oct, 2017	24 (31d)	10	27.8 - 28.5	175 - 435	98 - 99	15 - 227

From the above table it is observed that, when only 2 wells in a day were used for extracting vapours in the tune of 18 - 32.8 cfm (field flow) having concentration in the range of 58 - 290 ppm and the same was fed to SVE system after dilution with air in the tune of 77 - 97 cfm having concentration in the range of in the range of 54 - 195.8 ppm.

During November, 2016 – April, 2017 i.e. for the period of six month, four to eight wells in a day were used for extracting vapours in the tune of 24- 29 cfm having concentration in the range of 102 - 496 ppm and the same was fed to SVE system after dilution with air in the tune of 94 - 99 cfm having concentration in the range of 39 - 385 ppm.

Month of May, 2017 onwards, nine wells in a day were used (except October, 2017, wherein 10 wells were used) for extracting vapours in the tune of about 27.2 – 29.2 cfm having concentration in the range of 137 - 715 ppm and the same was fed to SVE system after dilution with air in the tune of 96–99 cfm having concentration in the range of 15–538 ppm.

Above data indicates that no consistency in concentration of vapour fed to SVE system either by regulating the flow by increasing extraction rate (number wells in a day) or by sparging air through air sparging wells.

iii. From the above daily data, it is observed that vapours having concentration of 715 ppm also fed to SVE system in some occasions which indicates that existing SVE is adequate to destruct vapour having high concentration but the same appears not properly optimised.

iv. As per the mass removed and differential efficiency data **(Annexure – 1)**, the mass extraction rate found in the range of 0.12 – 2.81 kg/hr which also indicates the poor operation of SVE system without optimising the rate of extraction. After September 2016, the vapour extracted has only Gasoline Range of Organics, which indicates that lower carbon range organics were extracted.

v. CPCB team monitored the groundwater quality of contaminated site as well as performance of SVE system on June 16, 2016 (immediate after installation of SVE system), October 04, 2016 (after 05 month of installation of SVE system), May 30, 2017 (after 11 month of installation of SVE system) and November 22, 2017 (after 18 month of installation of SVE system) to assess the impact of remediation steps taken by M/s BPCL.

vi. During the latest monitoring in November 2017, water samples from 12 monitoring wells & 01 bore well (residential alley) were collected and also monitored the performance of SVE System. Samples for specific parameters were analyzed by engaging third party laboratory. The details of samples taken and analysis results are depicted in **Annexure –**

2 (a & b). The graphical representation of concentration of Mineral Oil, Total Petroleum Hydrocarbons (TPH), Diesel Range of Organics (DRO), Gasoline Range Organics (GRO) and Total Organic Carbon (TOC) in different locations and in different occasions are depicted in the **Annexure – 3**.

ix. It is observed that the concentration of Mineral Oil found less than 0.01 mg/L in all monitoring locations, while concentration of TPH, GRO and DRO found in reduction trend in all location except one location (i.e. SVE-08). However, TOC concentration was found increased in water samples taken from MW- 1A, 16A & 4A.

x. As per the analysis results, the destruction efficiency of gases drawn from extraction wells system was found 100%.

Conclusions & Recommendations:

1. The operation of Soil Vapour Extraction (SVE) System was found not optimised based on the concentration of vapours drawn from different wells, the system was operated at a field flow rate in the range of 18 - 29.2 cfm and system flow rate of 77 - 99 cfm against the designed capacity of 250 cfm. The concentration of vapours fed to SVE system found very low (15 - 285 ppm) during September, 2017, - October, 2017 which also confirms the non-optimisation of operation of SVE system even after long experience of 18 months.

2. The concentration of Mineral oil & GRO found less than 0.01 mg/L & 20µg/L respectively, in most of the monitoring well locations. However, the concentration of DRO, TPH and THC in ground water indicates that the present system of operation of SVE could not establish the satisfactory reduction.

3. The vapours from different wells were extracted without operating Air Sparging system, based on the field data maintained by the operator indicates that the extracted vapours has only GRO which is having lower carbon ranges. But the analysis results of groundwater indicate the presence of DRO, TPH and THC which are having higher carbon ranges and demands the air sparging system.

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4. As per the data collected from SVE system so far about 8698.75 kg of GRO has been extracted from soil and groundwater till October 27, 2017 at an average of about 543.67 kg of GRO per month.

5. That as per the findings of site inspection and the on-going excavation works of M/s CMRL, it is humbly submitted that the Hon'ble Tribunal may pass appropriate orders to direct M/s BPCL to comply with the following;

   a. To optimize the operation of SVE system based on the concentration of vapour extracted and to take immediate steps to operate Air Sparging system to mobilize the extraction of DRO, TPH and THC from sub-soil as well as in groundwater.

   b. To carry out soil testing in the contaminated areas falling within about 300 m from the abundant oil pipelines in a grid space of 30m x 20m (5 locations in each grid) by drilling sample borehole up to a depth of 10m to 25m (minimum of 3 samples in each location), where M/s CMRL is planning to carryout excavation. Soil analysis report with respect to the parameters TPH, DRO and GRO along with details of sampling location shall be submitted to CPCB and TNPCB.

   c. Contaminated water, if extracted from construction site should be collected in separate tanks and treated with activated carbon filters prior to disposal. The analysis reports shall be submitted for CPCB and TNPCB.

6. That as per the findings of site inspection and the on-going excavation works of M/s CMRL, it is humbly submitted that the Hon'ble Tribunal may pass appropriate orders to direct M/s CMRL to comply with the following;

   a) To ensure safe storage of contaminated excavated earth till treatment and to disposal of the same by M/s BPCL as per the authorization of TNPCB.

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b) To take necessary precautions to ensure that the metro workers are protected from possible release of VOCs from contaminated soil, risk of fire, etc., while handling of contaminated soil.

c) To provide access to representatives of M/s BPCL and their consultants to enter premises for the purpose of collection, testing of water and soil samples before excavation as well as during excavation from metro construction site.

d) To allow M/s BPCL to set-up necessary facilities for collection, treatment and disposal of contaminated soils or groundwater extracted from metro construction site.

e) To ensure minimal damage to SVE system during execution of CMRL works.

H. D Varalaxmi

(H.D Varalaxmi)
Senior Environmental Engineer

Annexure-I

The monthly performance data of SVE system submitted by M/s BPCL

Date	Cumulative Time Elapsed in Hr	SVE System flow rate in CFM	Influent concentration in mg/m^3			Effluent concentrations in mg/m^3			Destruction Efficiency in %	Mass Extraction rate	Cumulative Mass Extracted
			DRO	GRO	TPH	DRO	GRO	TPH		GRO in kg/hr	GRO in kg
20.05.16	13.2	91	814.64	<2.5	23038.24	186.012	<2.5	4607.65	77	0.13	1.66
25.05.16	49.2	84	22215.33	<2.5	72.855	0.123			100		
04.06.16*	126	94	1.23	0.037	<1.0	0.322	<2.5	<1.0	74		
06.06.16	150.3	79	0.617	NA	NA	0.0417	NA	NA	93		
16.06.16	271.5	92	NA	NA	NA	NA	NA	NA	99		
18.07.16	704.8	80	3462.4	1075.8	3462.4	829.2	0	829.2	76	0.47	
30.07.16	842.7	96									198.40
31.08.16	1267.75	94.58	715.5	1185.33	715.5	BDL	BDL	BDL	100	0.12	295.87
26.09.16	1591.05	96.23	BDL	1258	BDL	BDL	BDL	BDL	100	0.21	381.14
24.10.16	1991.05	96.24	0	5701.3	0	0	0	0	100	0.93	553.49
28.11.16	2439.05	95.71	0	9880	0	0	0	0	100	1.61	1273.26
27.12.16	2743.05	96.71	0	13027.2	0	0	0	0	100	2.14	1923.98
28.01.17	3195.35	97.77	0	16660	0	0	0	0	100	2.77	3175.69
24.02.17	3531.35	97.85	0	11710.4	0	0	0	0	100	1.95	3829.83
30.03.17	4004.35	97.45	0	6319.57	0	0	0	0	100	1.05	4324.75
29.04.17	4484.35	97.64	BDL	16939.00	BDL	BDL	BDL	BDL	100	2.81	5673.57
30.05.17	4980.35	98.00	BDL	2102.01	BDL	BDL	BDL	BDL	100	0.35	5847.16
28.06.17	5444.35	98.00	BDL	7236.00	BDL	BDL	BDL	BDL	100	1.20	6406.20
25.07.17	5876.35	98.00	BDL	7870.11	BDL	BDL	BDL	BDL	100	1.31	6972.30
28.08.17	6414.35	99.00	BDL	6330.14	BDL	BDL	BDL	BDL	100	1.06	7545.13
27.09.17	6942.35	98.29	BDL	5443.83	BDL	BDL	BDL	BDL	100	0.91	8025.14
27.10.17	7662.35	98.51	BDL	5589.40	BDL	BDL	BDL	BDL	100	0.94	8698.75

Note:BDL - means below detectable limit in

*SVE was under repair, Carbon adsorption system was in operation

NA- Lab analysis reports are not available

Annexure -2a

Fourth set of groundwater samples taken from extraction & monitoring wells on November 22, 2017

WATER SAMPLE LOCATION														
S. No.	**Parameter**	**Unit**	**Well Water MW – 1A**	**Well Water MW-2A**	**Well Water Mw-3A**	**Well Water MW -4A**	**Well Water MW-5B**	**Well Water MW-13A**	**Well Water MW – 15A**	**Well Water MW - 16A**	**Well Water MW-7A**	**Well Water MW-11A**	**Well Water MW-9A**	**Well Water SVE-8**	**Bore well Residential alley D. No 225**
1	TOC	mg/L	390	77	14	195	14	48	270	360	27	24	76	21	22
2	VOC	µg/L	BDL (DL: 20)	244.00	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	87.00	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20	1108	BDL (DL: 20
3	TPH	mg/L	0.289	0.206	0.392	0.201	0.183	0.208	0.191	0.672	0.197	0.215	0.205	0.790	0.228
4	BTEX	µg/L	BDL (DL: 20	BDL (DL: 20	BDL (DL: 20	BDL (DL: 20	BDL (DL: 20	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	869	BDL (DL: 20)
5	GRO	µg/L	BDL (DL: 20	216.00	BDL (DL: 20	BDL (DL: 20	BDL (DL: 20	BDL (DL: 20)	BDL (DL: 20)	87.0	BDL (DL: 20)	BDL (DL: 20)	BDL (DL: 20)	1076	BDL (DL: 20)
6	DRO	mg/L	0.139	0.162	0.327	0.125	0.089	0.136	0.103	0.358	0.102	0.080	0.092	0.705	0.145
7	MINERAL OIL	mg/L	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)	BDL (DL:0.01)
8	OIL & GREASE	mg/L	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)	BDL (DL: 4)
9	THC	mg/L	0.428	0.368	0.719	0.326	0.272	0.344	0.294	1.03	0.299	0.295	0.297	1.495	0.373

Note:

*BDL - means Below detectable limit
DL:20 - means Detectable Limitof 20 µg/L
DL:4.0 - means Detectable Limitof 4.0 mg/L

Annexure -2b

Performance of SVE system by taking samples from inlet & out let						
Parameter	**Unit**	**Obserbant used ----Tenax + Carbopack**				
		Field inlet			**SVE System inlet (dilution with air)**	**SVE outlet**
		SVE-8, 9 & MW-17 A	**SVE-1, MW-2A, 4A &16A**	**SVE 2, 3**		
VOC	mg/m^3	390.52	342.01	19.16	71.71	BDL (DL:0.1)
TPH	mg/m^3	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)
BTEX	mg/m^3	186.01	342.01	19.16	23.63	BDL (DL:0.1)
GRO	mg/m^3	186.01	342.01	19.16	23.63	BDL (DL:0.1)
DRO	mg/m^3	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)	BDL (DL:0.1)

Note:

BDL - means below detectable limit in
DL - means Detectable Limit

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Annexure -3

Graphical representations of concentration of Mineral Oil, TPH, DRO and TOC in groundwater:

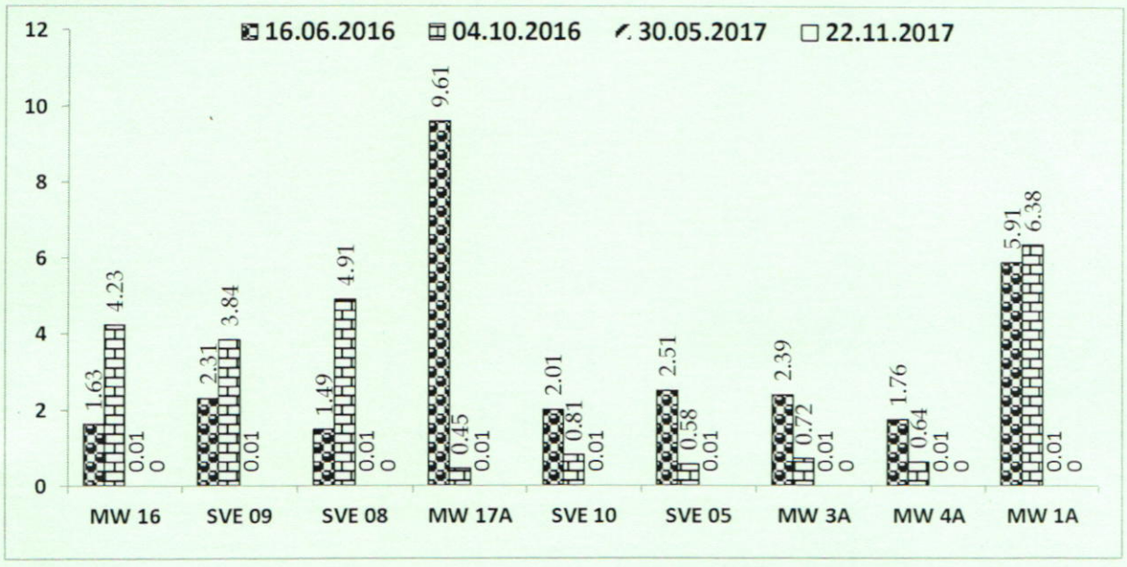

Figure 1: Concentration of Mineral Oil in groundwater samples taken from different locations

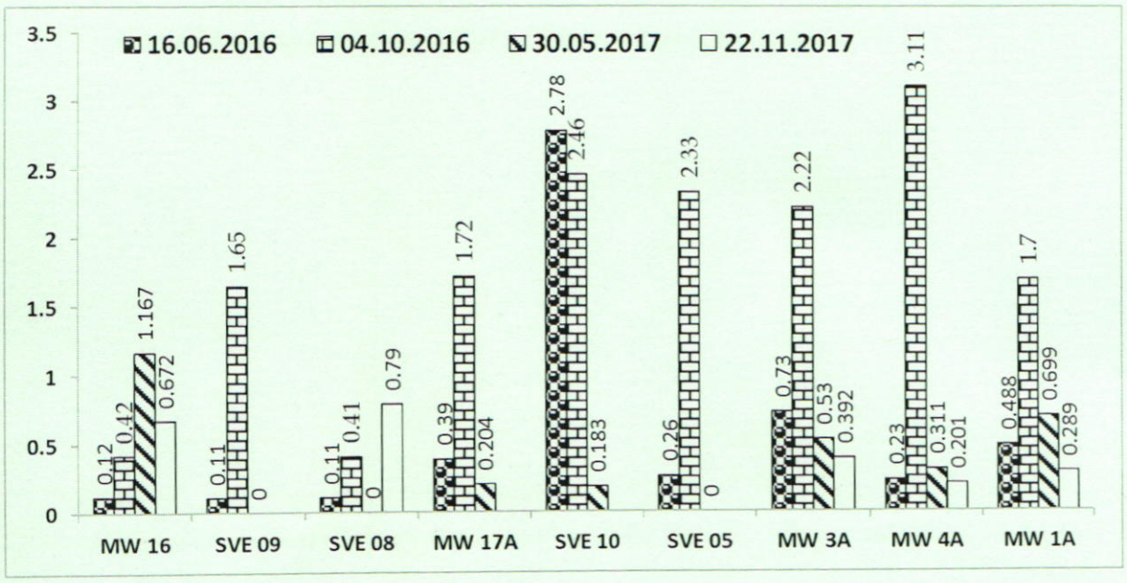

Figure 2: Concentration of TPH in groundwater samples taken from different locations

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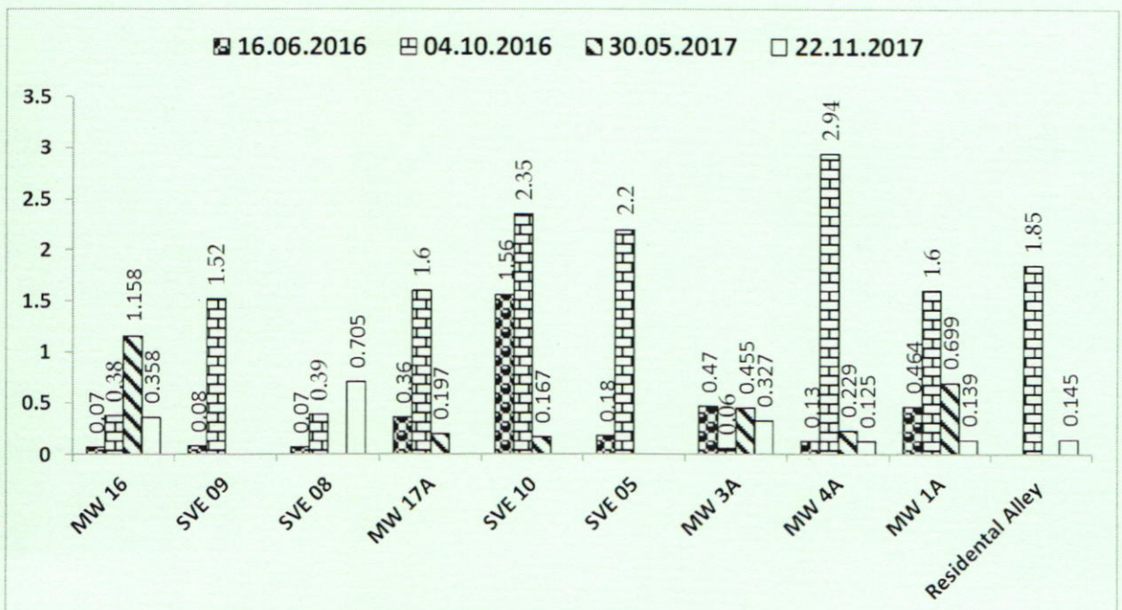

Figure 3: Concentration of DRO in ground water samples taken from different locations

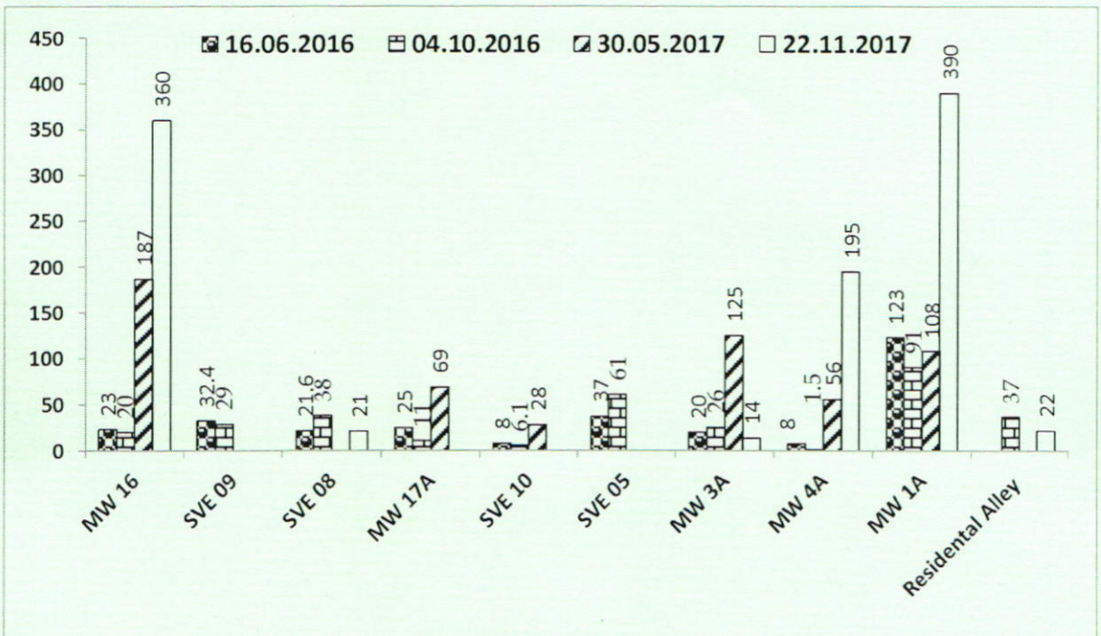

Figure 4: Concentration of TOC in ground water samples taken from different locations

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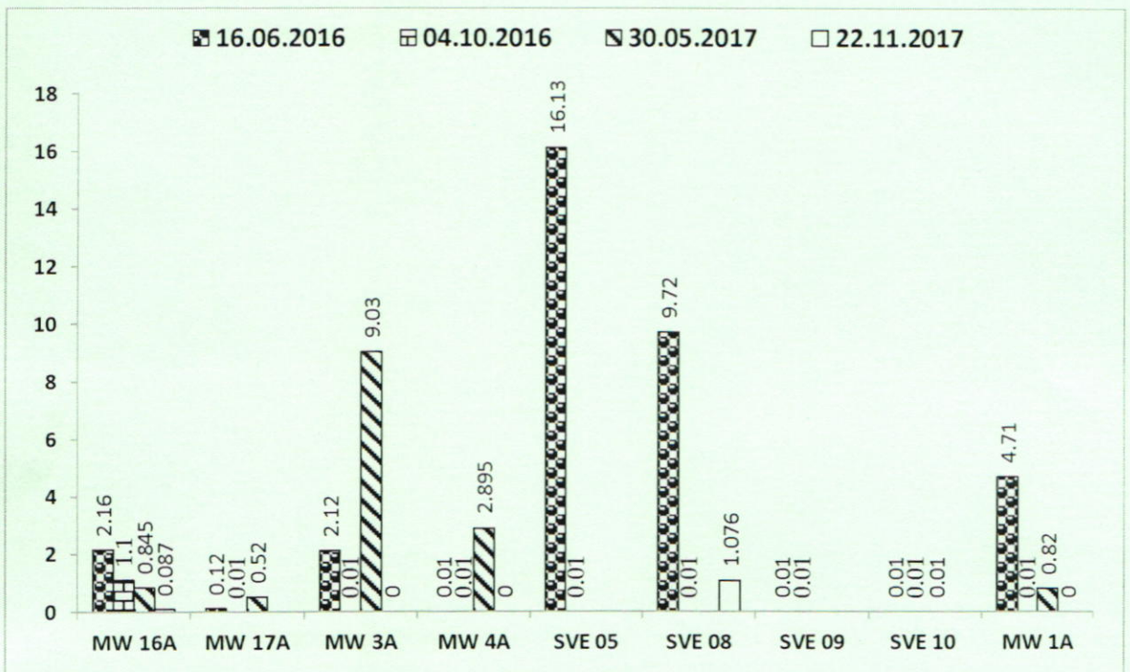

Figure 5: Concentration of GRO in ground water samples taken from different location

BEFORE THE NATIONAL GREEN TRIBUNAL (SOUTHERN ZONE) CHENNAI

APPLICATION NO. 176 OF 2013

V.P Krishnamoorthy

APPLICANT

VERSUS

Union of India & Others

RESPONDENTS

COMPLIANCE AFFIDAVIT ON BEHALF OF CENTRAL POLLUTION CONTROL BOARD (RESPONDENT NO. 12) WITH REGARD TO ORDER DATED 17/10/2017

Advocate D. S. Ekambaram

COUNSEL FOR 12th RESPONDENT