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

ORIGINAL APPLICATION No. 73 OF 2021 (SZ)

In The Matter of:

Visakha Pawan Praja Karmika Sangham, Andhra Pradesh .....Applicant (s)

Verses

Union of India and others. ....Respondent (s)

Index

Dr. B. V. Prasad
Senior Environmental Scientist
Andhra Pradesh Pollution Control Board
Vijayawada

REPORT OF THE JOINT COMMITTEE ON THE FIRE ACCIDENT OCCURRED IN CDU – III OF M/s. HINDUSTAN PETROLEUM CORPORATION LTD., VISAKH REFINERY, MALKAPURAM, VISAKHAPATNAM, ANDHRA PRADESH IN THE MATTER OF O. A. NO. 73/2021 TITLED: VISAKHA PAWAN PRAJA KARMIKA SANGHAM Vs UNION OF INDIA AND OTHERS, SUBMITTED TO HON'BLE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE, CHENNAI IN COMPLIANCE TO HON'BLE NGT ORDER DATED MAY 27, 2021.

1. Preamble:

The Hon'ble NGT in its order dated 27.05.2021 in the case of OA 73 of 2021 (SZ) directed to the Committee as below:

.....11. "The committee as well as the Pollution Control Board are also directed to take this also into consideration while assessing the environmental compensation if any to be assessed if there is any violation found."....

The copy of the NGT order dated 27.05.2021 is enclosed as *Annexure - 1.*

2. Fire Accident at M/s HPCL, Visakh Refinery, Visakhapatnam, Andhra Pradesh:

A fire accident occurred at M/s HPCL, Visakh Refinery in Crude Distillation Unit – III(CDU – III) on May 25, 2021at 15:10 hrs.

2.1 Causes for fire accident:

The following are the causes for the fire accident at CDU –III:

i. The mechanical failure of one of the pipeline elbows on the pump discharge line caused leak in the 6" Carbon Steel (CS) pipeline carrying vacuum residue which contains fuel oil/ bitumen at a temperature of about 350^0 C & pressure of 16 kg/cm^2. A hole about 2.5" - 3" was formed (may be due to corrosion) and drained the fluid with high pressure, which resulted in the auto ignition of the hydrocarbon fluid (auto ignition temperature of the vacuum residue fluid is 280^0C) caused fire at deck 1(first floor) of the CDU-III.

ii. The fire further extended to deck2 and air fin coolers (deck 3) of the CDU-III. The flames at deck 3 resulted in the rupture of atmospheric column overhead pipeline carrying Naphtha and leading to fire from this location.

3. Measure taken by M/s. HPCL, District collector and APPCB after the fire accident:

3.1 Immediate measure taken by M/s. HPCL(Visakh Refinery):

When the unit noticed black smoke and fire at 15.06 hrs. from the ground floor (deck 1) of the CDU –III, the emergency shutdown of the CDU was taken at 15.07 hrs and all the motor pumps were stopped. The emergency siren was raised at 15.07hrs, the Emergency Response & Disaster Management Plan (ERDMP) of the Refinery was activated immediately and the fire & safety crew reached the area and carried out fire fighting activities using foam tender and dry chemical powder tender. The fire was extinguished at 16:10 hrs, cooling operations were continued in the surrounding area and all clear siren was given at 16:15 hrs. No injury or causalities were reported.

M/s. HPCL Visakh Refinery has submitted the investigation report, dated 03.06.2021 to the Director Refineries on the fire accident occurred in the CDU – III of the refinery on 25.05.2021, wherein reported the cause of the fire accident as,

3.1.1 The probable cause is mechanical failure of the 6" hydrocarbon (Vacuum residue) pipe line elbow. This has resulted in release of hydrocarbon (Vacuum residue) at $350^{O}C$.

3.1.2 The ignition source is the high temperature (above the auto ignition temperature) of the leaked vacuum residue itself.

Copy of the report enclosed (Annexure – 2).

3.2 Immediate measure taken by District Collector, Visakhapatnam, Andhra Pradesh:

On hearing the news of fire accident at HPCL, the officials from the distractive administration reached the unit around 15:25 hrs as per the instruction of District Collector. The RDO, Joint Chief Inspector of Factories, District Fire Officer, officials from the industries department and APPCB reached the site and given necessary instruction to combat the fire for the Emergency response team of HPCL.

The Collector and District Magistrate, Visakhapatnam Dt.25/05/2021 constituted a Committee with the following Members to enquire into the incident of fire at M/s HPCL, Visakh Refinery with a direction to inspect the incident place and to submit the report.

1	Revenue Divisional Officer, Visakhapatnam	Head of the Committee
2	General Manager, District Industries Centre, Visakhapatnam	Member
3	Joint Chief Inspector of Factories, Visakhapatnam	Member
4	District Fire Officer, Visakhapatnam	Member
5	Environmental Engineer, APPCB, Visakhapatnam	Member
6	HOD of Chemical Engineering, IIPE	Member
7	Associate Dean of Students Affairs & Assistant Professor, Chemical Engineering, IIPE	Member
8	Assistant Professor, Chemical Engineering, IIPE	Member
9	Professor, Chemical Engineering department, Andhra University	Member
10	Professor, Chemical Engineering department, Andhra University	Member

The committee constituted by the DC visited M/s HPCL on 28.05.2021 and the detailed report was submitted to the District Collector.

3.3 Immediate action taken by APPCB, Visakhapatnam, Andhra Pradesh:

APPCB immediately rushed to the incident site by 15:40 hrs along with scientific staff of Zonal Laboratory, Visakhapatnam and immediately started monitoring the ambient air in the surrounding areas through Mobile lab in the down wind direction. The Total Volatile Organic Carbons (TVOCs) were monitored in ambient air at various points from the fire accidents and also outside the unit premises. Samples of wastewater generated during fire-fighting operations and accumulated in the drain at CDU-III were collected. The values of TVOC recorded during fire accident were ranging from 0.2 PPM to 7.4 PPM and outside the premises, the maximum TVOC of 0.2 PPM was recorded. Analysis report enclosed as Annexure – 3.

Data of the 3 CAAQM Stations being operated by M/s. HPCL within the premises pertaining to the date of fire accident (25.05.2021) was also collected.The results are given below:

3.3.1 At Southgate CAAQM Station (South side to the Industry):

- PM10 values increased from 202 µg/m3 (14.00 hrs) to 319 µg/m3 (17.00 hrs) during the accident period. Minimum value of 93 and maximum value of 319 µg/m3 was observed during the day of accident on 25.05.2021.

- PM2.5 values increased from 37 µg/m3 (14.00 hrs) to 47.9 µg/m3 (16.00 hrs) during the accident period. Minimum value of 22 and maximum value of 52 µg/m3 was observed during the day of accident on 25.05.2021.

- NOx values increased from 17 µg/m3 (14.00 hrs) to 142 µg/m3 (16.00 hrs) during the accident period. Minimum value of 05 and maximum value of 132 µg/m3 was observed during the day of accident on 25.05.2021.

- No significant change in the SO2 concentrations were observed during the fire accident period. Minimum value of 05 and maximum value of 132 µg/m3 was observed during the day of accident on 25.05.2021.

- Average value of Air Quality Index (AQI) during the day of accident (25.05.2021) at this location found to be 143, i.e. moderate category.Value of PM10 is exceeding the standard limit prescribed for 24 hour average.

3.3.2 At store yard CAAQM Station (West side to the Industry)

- PM10 value increased from 365 µg/m3 (14.00 hrs) to 511 µg/m3 (15.00) during the accident period. Minimum value of 120 and maximum value of 608 µg/m3 was observed during the day of accident on 25.05.2021.

- PM2.5 values increased from 73 µg/m3 (14.00 hrs) to 99 µg/m3 (15.00 hrs) during the accident period. Minimum value of 37 and maximum value of 99 µg/m3 was observed during the day of accident on 25.05.2021.

- NOx values recorded 26.77 µg/m3 (13.15 hrs) and increased to 35.49 µg/m3 (17.30 hrs) during the accident period. Minimum value of 0.6 and maximum value of 11.84 µg/m3 was observed during the day of accident on 25.05.2021.

- No significant change in the SO2 concentrations were observed during the fire accident period. Minimum value of 11.76 and maximum value of 37.74 µg/m3 was observed during the day of accident on 25.05.2021.

- Average value of Air Quality Index (AQI) during the day of accident (25.05.2021) at this location found to be 204, i.e. poor category.Value of PM10 is exceeding the standard limit prescribed for 24 hour average.

3.3.3 At HLPH CAAQM Station (Northeast side to the Industry)

- PM10 value increased from 252 µg/m^3 (15.00 hrs) to 267 µg/m^3 (16.00) during the accident period. Minimum value of 130 and maximum value of 411 µg/m3 was observed during the day of accident on 25.05.2021.

- PM2.5 values increased from 26 µg/m3 (14.00 hrs) to 30 µg/m3 (16.00 hrs) during the accident period. Minimum value of 21 and maximum value of 153 µg/m3 was observed during the day of accident on 25.05.2021.

- NOx values increased from 15.8 µg/m3 (14.45 hrs) to 59.7 µg/m3 (15.45 hrs) during the accident period. Minimum value of 15.81 and maximum value of 110 µg/m3 was observed during the day of accident on 25.05.2021.

- As far as the SO2 concentrations are concerned, minimum value of 30.34 and maximum value of 510 µg/m3 was observed during the day of accident on 25.05.2021.

- Average value of Air Quality Index (AQI) during the day of accident (25.05.2021) at this location found to be 186, i.e. moderate category.Values of PM10, PM2.5 and SO2 are exceeding the standard limits prescribed for 24 hour average.

Ambient air quality data obtained from these CAAQM stations enclosed as Annexure – 4.

APPCB has deployed Mobile CAAQM Station Lab and monitored the ambient air quality in the neighboring residential area, Ajanta colony, Malkapuram for a period of 24 hours on 25.05.2021 and 26.05.2021 to assess the impact of fire accident occurred at M/s. HPCL and the values found to be:

- PM10 values: Minimum 70 µg/m3; maximum 177 µg/m3; average 124 µg/m3.
- PM2.5 values: Minimum 14 µg/m3; maximum 56 µg/m3; average 33 µg/m3.
- NOx values: Minimum 14.5 µg/m3; maximum 44.8 µg/m3; average 26.7 µg/m3.
- SO2 values: Minimum 6.3 µg/m3; maximum 34.1 µg/m3; average 21.8 µg/m3.
- AQI value: 116, i.e. moderate category.

Ambient air quality data obtained from the Mobile CAAQM station is enclosed as Annexure – 5.

The characteristics of wastewater generated during fire fighting operation found to be, TSS values ranging from 820 to 1160 mg/lit; COD values from 156 to 184 mg/lit and oil & grease from 8 to 14 mg/lit. Analysis report enclosed as Annexure – 6.

4. Site inspection and observations madeby the Joint Committee appointed by Hon'ble NGT:

The committee inspected the fire accident site at M/s HPCL on June 23, 2021 and observed the following:

a. The committee inspected the CDU-III area and physically verified the burnt pipelines and the impact area, deck 1, 2 & 3 floors, which were damaged due to the fire.

b. It was informed by the unit representative that about 78 MTs of hydrocarbons was burnt in the fire accident, out of which 35 tons of bitumen/furnace oil and 43 tons of Naphtha.

c. The cause for the fire was informed due to the hole in the 6" CS pipeline carrying the bitumen/furnace oil which may be due to the corrosion/erosion which led to mechanical failure. However, it was informed that the technical reasons for the sudden burst of the pipeline carrying bitumen/furnace oil is to be ascertained.

d. The refinery has to carryout hydro-testing of the pipelines once in 4 years as per the protocol and carried out the said test in the year, 2012 & 2016. The next testing has to be carried out during the year, 2020. However, it was not conducted and informed that due to COVID-19 situation it got delayed. Self certified copy of the hydro-test report of M/s. HPCL (Visakh Refinery) is enclosed as Annexure – 7.

e. During inspection, the debris from the fire accident was cleared and the preparation work for repair/ renovation was in progress.

f. The high oil sludge of 5 KL from the CDU-III was collected in drums and stored in the sludge lagoons for the recovery of oil. The sludge lagoons was inspected and observed that the drums used for collection was dumped along with the sludge.

g. The sea water of about 6000 KL was used for fire-fighting and informed that the wastewater collected in the drains of CDU-III was diverted to ETP-1 for treatment and discharged along with the cooling water.

h. To combat the fire, Dry Chemical Powder of 2000 kg and foam tender of 5200 litres along with 6000 KL sea water were used.

i. The detailed report from the Petroleum and Explosives Safety Organization (PESO), to ascertain the cause for fire accident is awaited.

5. Environmental damage assessment for contribution of emission into atmosphere:

During the fire accident on 25.05.2021 at CDU-III of M/s. HPCL, Visakhapatnam, an amount of 78 tons of hydrocarbons (35 tons Bitumen / Furnace oil and 43 tons of Naphtha) was burnt and emissions were let out into open atmosphere. The 78 tons of burnt hydrocarbons also contain an amount of 1.2 tons of sulphur (@3.4% Sulphur in Bitumen / furnace oil and 0.024% sulphur in Naphtha). Hence, an amount of 76.8 tons of *hydrocarbons and 1.2 tons of sulphur got burnt during the fire accident at M/s. HPCL on 25.05.2021 resulting in the emission of 211 tons of carbon dioxide and 2.38 tons of sulphur dioxide into the surroundings.

$$\text{*Hydrocarbons} + 2O_2 \longrightarrow CO_2 + 2H_2O + \text{Heat}$$

$$S + O_2 \longrightarrow SO_2$$

*While calculating the quantity of emission of CO_2, the burnt hydrocarbon during fire accident is considered as Methane (CH_4, the simplest hydrocarbon in the homologous series of alkanes) and 100% combustion.

Accordingly, the Joint Committee proposed to levy Environmental damage compensation on M/s. Hindustan Petroleum Corporation Ltd., (Visakh Refinery), Visakhapatnam as per theEuropean Union "Environmental Prices Handbook" EU28 version published in October 2018 wherein prices are expressed in Euros per kilogram pollutant emitted into the environment. The committee has used the document as a reference to calculate the prices of the pollutants emitted into environment. The document indicates three types of pricing, lower, central and upper depending uponmagnitude of emissions. The quantities of pollutants emitted were in considerable quantity, but, there was no significant damage to the surrounding environment, injury or casualties reported. Hence, the committee has used central limit environmental prices assigned to SO_2 & CO_2 whilecalculating the compensation for damage as detailed below. The environmental price of $SO_2$is 11.5€$_{2015}$/Kg emission and for CO_2 is 0.057 €$_{2015}$/Kg emission, for CO_2 which is a greenhouse gas also includes VAT and increase in 3.5% per annum.

		Calculation for SO_2 emission		**Calculation for CO_2 emission**
Environmental Compensation for emissions contributed	=	2,380 Kgs of SO_2X Environmental price of SO_2	+	2,11,000 Kgs of CO_2 X Environmental price of CO_2 with VAT of 3.5% per annum
	=	2,380 Kgs of SO_2 X 11.5 €/Kg	+	2,11,000 Kgs X (0.057 €/Kg X 0.21)
	=	27,370 € 1€ = Rs. 89.028 (As on 25.05. 2021)	+	2,525.67 € 1€ = Rs. 89.028 (As on 25.05.2021)
	=	Rs. 24,36,696/-	+	Rs. 2,24,855/-
	Total of Rs. 26,61,551/- (rupees twenty six lakhs sixty one thousand five hundred and fifty one only)			

6. Recommendations of the Committee:

i. The unit shall strictly follow the standard laid down protocols / Standard Operating Procedures (SOP) for Hydro testing of pipelines and immediately take precautionary

measures to avoid this type of fire accidents in future. The unit shall immediately take up hydro testing of the remaining two CDUs and confirm its efficiency.

ii. The unit shall treat the high oily sludge waste of 5KL generated and collected during the fire accident occurred at CDU-III and the status report shall be submitted to APPCB.

iii. The unit shall pay the compensation of Rs. 26,61,551/-(rupees twenty six lakhs sixty one thousand five hundred and fifty one only)towards damage of environment during the fire accident and the same shall be paid to APPCB.

iv. To regularly conduct mock-drills to the employees in controlled environment on actions to be taken during failures, gas leakage etc.

v. The committee humbly submits that the industries have to ensure self-compliance and the industry and its personnel are solely responsible for this negligent act which resulted in the accident. The industries have to adhere self-monitoring and self-compliance to avoid accidents or any other untoward incidents.

Report dated July 19, 2021.

Dr. Suresh Babu Pasupuleti
Scientist-C
Ministry of Environment, Forest & Climate Change, Vijayawada

Smt. Poornima B M
Scientist D
Central Pollution Control Board
Regional Directorate, Chennai

Dr. B. V. Prasad
Senior Environmental Scientist
Andhra Pradesh Pollution Control Board
Vijayawada

Dr. N. Lingaiah
Senior Principal Scientist
Dept. of Catalysis & Fine Chemicals,
CSIR-IICT, Hyderabad

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Annexure -1

Item No.01:

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN ZONE, CHENNAI

Original Application No. 73 of 2021 (SZ)

(Through Video Conference)

IN THE MATTER OF:

Visakha Pawan Praja Karmika

Sangam, Andhra Pradesh ...Applicant(s)

Verses

Union of India and Others. ....Respondent(s)

Date of hearing: 27.05.2021.

CORAM:

HON'BLE MR. JUSTICE K. RAMAKRISHNAN, JUDICIAL MEMBER

HON'BLE MR. Dr. K. SATYAGOPAL, EXPERT MEMBER

For Applicant(s): Sri. Sravan Kumar

For Respondent(s): Mr. G.M. Syed Nurullah Sheriff for R1
Smt. Maaduri Donti Reddy for R4 to R6
Mr. Kumaresan represented
M/s. King & Patridge for R7

ORDER

1. As per order dated 25.02.2021, this Tribunal had admitted the matter and appointed a joint committee to go into the question and submit a report and the case was originally posted to 12.04.2021 for appearance of

parties, completion of pleadings and consideration of reports. On 12.04.2021, at the request of the parties, the same has been adjourned.

2. When the matter came up for hearing today through Video Conference, Sri. Sravan Kumar represented the counsel for the applicant. Sri. G.M. Syed Nurullah Sheriff represented 1st respondent, Smt. Maduri Donti Reddy represented respondents 4 to 6 and Mr. Kumaresan represented M/s. King & Patridge for 7th respondent.

3. The 7th respondent had filed their reply statement along with the documents. The other respondents pray for some time.

4. The counsel appearing for the State of Andhra Pradesh and the Andhra Pradesh Pollution Control Board (APPCB) submitted that they got the report ready. But it will have to be signed by the concerned members and they will be able to file the same, if some time is granted.

5. Considering the circumstances, we feel that some more time can be granted to the committee as well as the other respondents to file their statements.

6. In the meantime the applicant is at liberty to file their rejoinder to the statement submitted by the 7th respondent.

7. The applicant had also sent an e-mail with the copy of the news report published in the News Minute in their Website dated 25.05.2021 regarding a fire incident that occurred in the 7th respondent unit on that day.

8. The learned counsel appearing for the applicant submitted that this has happened on account of non-compliance of the conditions imposed by the Andhra Pradesh Pollution Control Board (APPCB) as well as in the environmental clearance.

9. The learned counsel appearing for the Pollution Control Board submitted that they had conducted inspection and they may be permitted to file a detailed report regarding the same as well.

10. The 7th respondent as well as the Pollution Control Board are directed to file their independent reports regarding this issue apart from filing their reply and the report in the main matter and this also can be considered along with the main matter if there is any violation found. For fixing the quantum of compensation if any to be levied.

11. The committee as well as the Pollution Control Board are also directed to take this also into consideration while assessing the environmental compensation if any to be assessed if there is any violation found.

12. The committee, the party respondents and including the applicants are directed to file the report and complete the pleadings on or before 28.06.2021 by e-filing in the form of searchable PDF/OCR Support PDF and not in the form of Image PDF along with necessary hard copies to be produced as per rules.

13. The Registry is directed to communicate this order to the members of the committee as well as the official respondents and also to forward a copy of the e-mail received with the news item in respect of the incident happened on 25.05.2021 mentioned above immediately through e-mail, so as to enable them to comply with the direction

14. For completion of pleadings and for consideration of report, post on 28.06.2021

.....J.M.

(Justice K. Ramakrishnan)

.....E.M.

(Shri. Dr. K. Satya Gopal)

O. A. No. 73/2021, (SZ)
27.05.2021, Sr.

Annexure-2

Date: 03/06/2021

To,

Director Refineries (VSS)

Sub: Investigation Report of CDU-III Fire Incident occurred on 25-05-2021

This is with reference to Office Memorandum (OM) dated 25-05-2021, regarding Investigation of Fire Incident in CDU-III on 25-05-2021. The report of the Committee is enclosed herewith.

3.6.2021
P Veerabhadra Rao
ED-VRMP
Visakh Refinery

03/06/2021
Karan Vir Singh
GM (I/C) Fire and Safety,
Mumbai Refinery

A Tirupati Naidu
GM(I/C)-Technical
Visakh Refinery

REPORT ON CDU-III FIRE INCIDENT ON 25/05/2021 at HPCL VISAKH REFINERY

A. INTRODUCTION

CDU-III unit was running steadily at normal feed rate of 450 m3/hr till 15:05 hrs of 25.05.21. The crude was being taken from crude tank 120-T-01C (61.5 Arab Light+35.1 Arab Extra light+2.3 Murban+1.1 Slop).

At around 15:06 hrs, fire was noticed in the pipe rack above the pump bay area adjacent to the Air Fin Coolers/condensers/Reflux drums Technical Structure area. Simultaneously, emergency shutdown of the unit was taken. The fire was noticed from the pipe rack elevation near Kerosene Circulating Reflux pump (42-P-06C) and on decks 1 & 2 of the Technical Structure and propagated upwards towards the Air Fin Cooler area. The fire was extinguished at 16:10 hrs and all-clear siren was given at 16:15 hrs. No injuries and no casualties were reported.

B. DETAILS OF CDU-III UNIT

Visakh refinery configuration comprises of three Crude Distillation Units with total name plate capacity of 8.33 MMTPA, downstream secondary processing units & treating facilities and associated utilities.

Crude Distillation Unit- III (CDU-III) is one among the three primary processing units in the refinery and commissioned in the year 1999-2000.

The unit broadly consists of following sections:

- Crude preheat train & desalter
- Atmospheric section
- Naphtha stabilizer section
- Vacuum section

The crude received from offsite storage is pre-heated in series of exchangers (preheat trains I,II & III) before it is fed into a fired heater where the temperature of the crude is brought up to around 370 °C. At this temperature, it is flashed into an atmospheric distillation column to separate different oil products according to their boiling points.

The lighter hydrocarbon vapor mixture from overhead of the atmospheric distillation column is partly routed to a stabilizer through Air Fin Coolers and condensers. The balance part is routed as overhead reflux to the atmospheric distillation column.

The bottom Reduced Crude Oil from atmospheric distillation column is passed through a fired heater to increase the temperature to about 400°C and is fed to a Vacuum distillation column. The vacuum distillation column bottom stream known as Vacuum

Residue is routed through heat exchangers and coolers prior to routing to storage as a fuel oil or to Bitumen Blowing unit for producing bitumen.

The other products from the unit are routed to downstream units for further processing and storage.

The unit south Technical structure where the incident occurred has 3 deck levels. Level 1 has Overhead vessels & heat exchangers, Level 2 has Overhead condensers & coolers and Level 3 has Air Fin Coolers.

C. SITE OBSERVATIONS & ANALYSIS

The following are the major observations at the incident site and analysis:

1. The CDU-III unit was operating at 450 m3/hr feedrate at the time of incident. No critical activities were being carried out during the shift prior and during the fire incident and unit was operated within the normal operating conditions.

2. At the time of fire at 15:06 hrs, part of pipe rack area inside the unit premises was engulfed with thick black smoke and fire from ground floor, deck1 & 2 of Technical Structure extending to the Air Fin Cooler area impacting the atmospheric column overhead line.

3. Emergency shutdown of the unit was taken at 15:07 hrs. and all the unit motors were stopped.

4. Emergency Response & Disaster Management Plan (ERDMP) of refinery was activated immediately from Emergency Control Centre (ECC). Head-Visakh Refinery (I/C) and other designated personnel present in ECC carried out their roles and responsibilities.

5. The Vacuum column bottom (Vacuum Residue) is pumped using pumps, 42-P-19A/B to pre heat exchangers for heat recovery followed by coolers and routed to storage. Mechanical failure of one of the pipeline elbows on the pump discharge line caused leak on to the deck 1 and grade level and caught fire due to auto ignition.

6. The temperature of Vacuum residue at the leak location is 350 °C and the auto ignition temperature of the same fluid is 280 °C. Preliminary analysis indicates that the failed pipeline elbow metallurgy is Carbon steel.

7. This fire extended to deck 2 and Air Fin Coolers (deck 3) elevation through south and north of deck slabs of Technical Structure and available flow paths.

8. Due to the fire at ground floor extending to deck levels 1,2 & 3, damage to piping, valves, equipment, structures, instruments and instrument & electrical cables was observed.

9. The fire has resulted in rupture of 3 idle lines at deck 2 and one idle line in pipe rack. These ruptures resulted in hydrocarbon leak and fire.

10. The flames reached the Air Fin Cooler deck 3 level and resulted in non-condensation of vapors from the atmospheric column overhead line, which in turn resulted in increased column pressure. Also, the flames engulfed the atmospheric column overhead pipeline which is outside the deck 3 platform towards northside. Combination of fire and higher internal pressure has resulted in rupture of atmospheric column overhead pipeline and leading to fire from this location.

11. No injury or casualties were reported.

12. Fire & Safety crew reached site and carried out fire fighting activities from North & South directions and ambulance was kept as standby near to CDU-III area.

13. Refinery fire fighting facilities viz., foam tender and Dry Chemical Powder tender along with fixed long range monitors and High Volume Long Range (HVLR) monitor were utilized during the fire fighting.

14. External fire tenders from AP State Disaster Response & Fire Service department, Naval Dockyard, VPT and Hindustan Shipyard reached site for necessary assistance in fire fighting. These tenders were kept as standby.

15. Fire at deck level 1 & 2 was extinguished at around 15:40 hrs first. Fire at atmospheric column overhead line to Air Fin Cooler was allowed to continue in controlled way till the hydrocarbon is exhausted while cooling operations continued in the surrounding areas. The fire was extinguished at 16:10 hrs.

16. All clear siren was given at 16:15 hrs.

17. Response of Operations, Fire & Safety and other concerned personnel in handling the fire incident was adequate.

D. REASONS FOR FAILURE / PROBABLE ROOT CAUSE

The following is the cause of the fire incident:

1. The probable cause is mechanical failure of the 6" hydrocarbon (Vacuum Residue) pipeline elbow. This has resulted in release of hydrocarbon (Vacuum Residue) at 350 °C.

2. The ignition source is the high temperature (above the auto ignition temperature) of the leaked Vacuum Residue itself.

E. RECOMMENDATIONS

1. In view of the leak observed in Vacuum Residue line, mechanical integrity of the Vacuum Residue circuit to be ensured.

2. A detailed metallurgical/microstructural analysis of the failed pipeline elbow to be carried out to establish the nature of failure.

Annexure-3

ANDHRA PRADESH POLLUTION CONTROL BOARD
ZONAL LABORATORY, VISAKHAPATNAM

M. RAVI, M.Sc
SENIOR ENVIRONMENTAL SCIENTIST

D.No. 33-39-20/1/4, Behind RTA Office,
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Visakhapatnam – 530 018.
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Ph: 0891-2719480/380/481 Fax: 2719480

AMBIENT AIR QUALITY MONITORING REPORT

Sample location/Address : In and around M/s. Hindustan Petroleum Corporation Ltd., (Visakh Refinery), Malkapuram, Visakhapatnam.

Date of monitoring : 25.05.2021

Monitoring conducted by : Zonal Laboratory and Regional Office, APPCB, Visakhapatnam.

S.No	Location	Time (Hrs)	TVOC (ppm)
Within the Industry premises			
1	About 10m from the incident area (CDU-III)	15.40	7.4
2	About 50m from the incident area	15.45	4.0
3	About 100m from the incident area	15.50	1.1
4	Near Security gate	15.55	0.2
Outside the industry premises			
5	Sriharipuram	16.10	BDL
6	Near HPCL main gate	16.15	0.2
7	Malkapuram	16.20	BDL
8	Malkapuram road, Near Yarada bus stop (Southeast corner of HPCL)	16.25	BDL
9	Scindia junction	16.30	BDL
10	Naval main canteen	16.40	BDL
11	Sathavahana Bus stop	16.50	BDL
12	Coromandel Back gate	17.00	BDL
13	North west corner of HPCL (Near Coromandel 5th gate)	17.10	BDL

BDL: Below Detectable Limit (< 0.1ppm)

Remarks:

The TVOC monitoring was carried out using hand held PID GAS DETECTOR (make: ION Science, model: Phocheck Tiger). *The detection Range of the instrument is: 0.1 to 20,000 ppm.*

M. Ravi

SENIOR ENVIRONMENTAL SCIENTIST

Annexure-4

Ambient Air Quality Data - 25.05.2021

Industry : M/s. Hindustan Petroleum Corporation Limited (Refinery), Malkapuram, Visakhapatnam

Location: CAAQMS 1 - South Gate

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
1	2021-05-25 00:00	97.39	41.96	10.57	10.21	0.85	7.38	0.08	4.58
2	2021-05-25 00:15	97.39	41.95	12.18	8.4	0.81	7.47	0.07	1.25
3	2021-05-25 00:30	97.4	41.88	8.54	7.28	0.81	7.7	0.08	4.25
4	2021-05-25 00:45	97.39	41.8	7.77	7.85	0.8	8.35	0.07	0.79
5	2021-05-25 01:00	97.4	38.53	8.43	4.95	0.78	9.17	0.08	2.5
6	2021-05-25 01:15	97.39	38.5	9.51	5.98	0.78	9.89	0.08	0
7	2021-05-25 01:30	97.38	38.55	9.12	7.73	0.75	9.53	0.07	0
8	2021-05-25 01:45	97.18	38.26	8.87	7.99	0.73	9.02	0.08	0
9	2021-05-25 02:00	93.29	35.01	8.61	8.62	0.73	9.22	0.08	0
10	2021-05-25 02:15	93.29	34.94	8.34	9.43	0.73	9.46	0.08	0
11	2021-05-25 02:30	93.28	35.13	6.92	9.43	0.71	9.7	0.08	0
12	2021-05-25 02:45	93.93	35.44	6.93	9.39	0.7	10.15	0.08	0
13	2021-05-25 03:00	106.22	38.28	5.03	7.94	0.69	10.17	0.08	0
14	2021-05-25 03:15	106.22	38.36	7.14	7.83	0.69	10.43	0.08	0
15	2021-05-25 03:30	106.21	38.34	8.05	8.18	0.69	10.25	0.08	0.79
16	2021-05-25 03:45	106.42	39.04	8.97	8.37	0.69	10.55	0.07	4.06
17	2021-05-25 04:00	109.36	43.65	8.16	7.88	0.68	10.72	0.07	0
18	2021-05-25 04:15	109.36	43.61	7.71	8.66	0.68	10.28	0.08	0
19	2021-05-25 04:30	109.35	43.63	10.53	8.25	0.68	9.9	0.07	0
20	2021-05-25 04:45	109.77	43.57	8.14	8.95	0.69	9.99	0.07	0
21	2021-05-25 05:00	117.23	41.94	9.25	8.67	0.7	10.4	0.08	0.75
22	2021-05-25 05:15	117.24	41.87	13.21	8.4	0.71	9.94	0.07	4.25
23	2021-05-25 05:30	117.23	41.97	13.14	9.06	0.73	9.61	0.08	0
24	2021-05-25 05:45	117.42	42.32	12.64	9.1	0.75	9.64	0.07	0
25	2021-05-25 06:00	120.89	44.62	14.48	7.89	0.75	10.09	0.08	0
26	2021-05-25 06:15	120.89	44.51	12.22	8.59	0.74	10.66	0.07	0
27	2021-05-25 06:30	120.88	44.64	15.36	8.91	0.76	10.44	0.07	0
28	2021-05-25 06:45	120.89	44.21	12.2	8.27	0.77	9.71	0.08	0
29	2021-05-25 07:00	120.89	39.48	22.85	8.75	0.85	9.23	0.07	0
30	2021-05-25 07:15	120.89	39.59	17.41	8.62	0.85	9.22	0.07	0

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
31	2021-05-25 07:30	120.89	39.61	25.37	8.89	0.93	8.93	0.07	0
32	2021-05-25 07:45	121.62	39.76	21.39	9	0.95	9.04	0.08	0
33	2021-05-25 08:00	135.49	40.99	18.24	8.16	0.94	9.93	0.08	0
34	2021-05-25 08:15	135.48	40.99	21.5	8.29	0.98	10.09	0.08	0
35	2021-05-25 08:30	135.48	41.02	27.41	8.22	1.03	9.86	0.07	0
36	2021-05-25 08:45	135.88	41.32	28.07	8.11	1.08	9.4	0.07	0
37	2021-05-25 09:00	143.44	43.37	37.57	7.93	1.17	8.83	0.08	0
38	2021-05-25 09:15	143.44	43.36	28.9	8.04	1.12	8.43	0.07	0.75
39	2021-05-25 09:30	143.43	43.34	30.56	8.4	1.1	8.9	0.08	4.25
40	2021-05-25 09:45	147.22	43.73	29.45	7.99	1.03	11.07	0.08	0
41	2021-05-25 10:00	181.32	46.23	26.52	7.35	1.03	12.12	0.07	0
42	2021-05-25 10:15	181.34	46.08	29.43	7.97	1.02	12.09	0.08	0
43	2021-05-25 10:30	181.34	46.11	31.94	8.49	0.99	11.68	0.08	0
44	2021-05-25 10:45	183.07	46.35	31.09	8.85	1.03	12.02	0.07	0
45	2021-05-25 11:00	198.59	47.68	26.34	7.84	1.05	11.23	0.08	0
46	2021-05-25 11:15	198.6	47.68	23.14	7.68	1.01	11.82	0.08	0.75
47	2021-05-25 11:30	198.59	47.68	21.53	6.99	1.01	12.5	0.08	4.25
48	2021-05-25 11:45	199.73	47.45	24.49	7.33	0.96	12.63	0.07	0
49	2021-05-25 12:00	209.87	45.24	25.18	7.4	1.02	13.5	0.07	0
50	2021-05-25 12:15	209.87	45.24	26.8	7.1	0.99	14.07	0.08	0.75
51	2021-05-25 12:30	209.85	45.24	24.12	7.5	0.92	14.75	0.07	4.25
52	2021-05-25 12:45	210.9	46.01	20.69	7.59	0.89	15.59	0.07	0
53	2021-05-25 13:00	219.14	52.1	18.29	6.57	0.88	16.42	0.07	0
54	2021-05-25 13:15	219.15	52.08	16.65	6.29	0.78	17.36	0.08	0.75
55	2021-05-25 13:30	219.14	52.08	12.18	6.74	0.7	19.37	0.07	4.25
56	2021-05-25 13:45	217.36	50.55	12.64	6.44	0.58	19.88	0.07	0
57	2021-05-25 14:00	202.28	37.41	17.18	6.29	0.63	19.21	0.07	0.75
58	2021-05-25 14:15	202.28	37.41	22.63	6.47	0.57	17.05	0.07	4.25
59	2021-05-25 14:30	202.27	37.42	29.5	6.51	0.58	15.35	0.07	0
60	2021-05-25 14:45	202.56	36.93	24.93	6.42	0.64	13.32	0.07	0
61	2021-05-25 15:00	204.97	32.73	25.03	6.61	0.62	12.57	0.07	0
62	2021-05-25 15:15	204.95	32.7	67.8	7.26	1.03	8.81	0.07	0
63	2021-05-25 15:30	204.96	32.71	74.86	7.73	1.2	6.34	0.08	0
64	2021-05-25 15:45	228.27	37.07	87.58	8.87	1.37	4.63	0.07	0
65	2021-05-25 16:00	286.55	47.93	142.03	10.22	1.5	3.76	0.08	0
66	2021-05-25 16:15	286.55	47.92	118.6	10.45	1.52	3.33	0.08	0

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
67	2021-05-25 16:30	286.54	47.92	98.69	9.71	1.45	3.32	0.08	0
68	2021-05-25 16:45	289.84	47.45	88.52	9.21	1.41	3.38	0.07	0
69	2021-05-25 17:00	319.57	43.06	66.02	8.84	1.3	3.45	0.07	0
70	2021-05-25 17:15	319.57	43.06	68.96	8.93	1.29	3.82	0.08	0.75
71	2021-05-25 17:30	319.57	43.06	54.2	8.89	1.28	3.98	0.08	4.44
72	2021-05-25 17:45	307.96	41.95	37.19	9.49	1.09	5.01	0.08	0
73	2021-05-25 18:00	203.49	31.92	31.9	8.6	1.07	6.87	0.08	0
74	2021-05-25 18:15	203.5	31.92	26.06	7.5	0.93	8.71	0.08	0
75	2021-05-25 18:30	203.49	31.93	28.04	7.92	0.9	9.93	0.07	0.75
76	2021-05-25 18:45	196.42	31.3	23.86	7.85	0.81	10.17	0.07	4.25
77	2021-05-25 19:00	132.87	25.55	27.42	7.82	0.77	11.19	0.07	0
78	2021-05-25 19:15	132.86	25.56	23.45	7.36	0.79	11.02	0.07	0.75
79	2021-05-25 19:30	132.86	25.56	20.86	8.04	0.76	11.24	0.08	4.25
80	2021-05-25 19:45	135.63	25.14	21.38	8.15	0.73	11.75	0.07	0.79
81	2021-05-25 20:00	159.25	21.67	15.81	7.26	0.7	12.57	0.07	4.25
82	2021-05-25 20:15	159.25	21.67	12.97	6.97	0.66	15.7	0.07	0
83	2021-05-25 20:30	159.25	21.67	13.56	8.01	0.65	17.3	0.08	0
84	2021-05-25 20:45	156.04	22.12	11.09	7.88	0.62	16.93	0.07	0
85	2021-05-25 21:00	127.05	26.05	11.24	7.67	0.6	16.56	0.07	0
86	2021-05-25 21:15	127.05	26.04	18.79	7.89	0.66	17.1	0.07	0.75
87	2021-05-25 21:30	127.05	26.05	23.25	7.98	0.76	16.56	0.07	4.25
88	2021-05-25 21:45	132.27	26.77	16.99	7.54	0.7	16.74	0.07	0
89	2021-05-25 22:00	179.44	33.21	14.79	6.54	0.69	20.46	0.07	0
90	2021-05-25 22:15	179.43	33.19	11.81	5.95	0.69	21.37	0.06	0
91	2021-05-25 22:30	179.44	33.2	12.03	5.58	0.71	19.2	0.07	0.79
92	2021-05-25 22:45	178.35	34.7	9.8	6.19	0.69	17.66	0.07	4.25
93	2021-05-25 23:00	168.74	48.17	9.79	5.4	0.71	15.56	0.07	0
94	2021-05-25 23:15	168.72	48.16	10.59	5.3	0.7	12.93	0.07	0.75
95	2021-05-25 23:30	168.73	48.17	9.69	5.74	0.69	11.31	0.07	2.5
96	2021-05-25 23:45	166.52	47.54	8.99	6.51	0.69	10.45	0.07	0
24 hour Average		**164**	**39**	**24.9**	**7.9**	**0.9**	**11.2**	**0.1**	**0.9**
24 hour average Standards		**0 - 100**	**0 - 60**	**0 - 80**	**0 - 80**	**0 - 2**	**0 - 100**	**0 - 400**	**0 - 5**

Note: All values are expressed in ug/m3, except CO. CO is expressed in mg/m3.

Remarks: Value of PM10 is exceeding the standard limit prescribed for 24 hour average.

Ambient Air Quality Data - 25.05.2021

Industry : M/s. Hindustan Petroleum Corporation Limited (Refinery), Malkapuram, Visakhapatnam

Location: CAAQMS 2 - Store Yard

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
1	2021-05-25 00:00	156	53	18.48	11.84	0.82	2.46	81.3	0.39
2	2021-05-25 00:15	156	53	16.97	5.51	0.92	2.64	81.03	0.34
3	2021-05-25 00:30	156	53	17.16	3.92	0.95	2.84	80.85	0.38
4	2021-05-25 00:45	156	52.65	17.04	4.75	0.83	2.82	80.28	0.32
5	2021-05-25 01:00	158	47	16.54	4.62	0.79	3.35	81.14	0.29
6	2021-05-25 01:15	158	47	15.49	4.41	0.66	3.6	81.47	0.29
7	2021-05-25 01:30	158	47	14.76	4.18	0.66	3.72	80.54	0.25
8	2021-05-25 01:45	158	46.68	13.87	4.33	0.65	4.55	78.6	0.23
9	2021-05-25 02:00	158	41	13.43	4.7	0.69	5.28	79.56	0.28
10	2021-05-25 02:15	158	41	13.24	4.03	0.65	5.94	80.73	0.23
11	2021-05-25 02:30	158	41	13.66	4.89	0.66	5.23	81.83	0.23
12	2021-05-25 02:45	158	41.22	12.81	4.6	0.6	6.04	80.97	0.19
13	2021-05-25 03:00	120	45	12.45	5.09	0.66	5.94	81.74	0.23
14	2021-05-25 03:15	120	45	11.96	4.92	0.59	5.87	81.73	0.21
15	2021-05-25 03:30	120	45	11.89	4.94	0.61	6.57	80.45	0.16
16	2021-05-25 03:45	120	45.27	12.1	4.68	0.67	6.65	81.56	0.14
17	2021-05-25 04:00	153	49	11.76	4.93	0.58	6.62	82.04	0.18
18	2021-05-25 04:15	153	49	11.78	4.83	0.61	7.62	81.31	0.1
19	2021-05-25 04:30	153	49	11.97	5.43	0.54	7.64	81.86	0.11
20	2021-05-25 04:45	153	49.5	12.29	5.16	0.58	6.41	82.44	0.1
21	2021-05-25 05:00	122	57	13.29	5.96	0.58	6.75	81.1	0.11
22	2021-05-25 05:15	122	57	14.31	5.66	0.59	5.83	81.23	0.11
23	2021-05-25 05:30	122	57	14.71	5.85	0.6	5.53	80.98	0.12
24	2021-05-25 05:45	122	56.61	15.3	6.06	0.57	5.06	80.6	0.09
25	2021-05-25 06:00	189	50	15.42	6.08	0.56	6.16	81.96	0.06
26	2021-05-25 06:15	189	50	15.6	5.74	0.66	6.26	82.33	0.08
27	2021-05-25 06:30	189	50	16.39	6.37	0.67	5.88	81.88	0.1
28	2021-05-25 06:45	189	50.4	17.32	6.35	0.67	4.9	81.04	0.13
29	2021-05-25 07:00	305	56	16.49	6.04	0.57	5.98	80.08	0.17
30	2021-05-25 07:15	305	56	18.28	5.94	0.65	4.93	82.49	0.11
31	2021-05-25 07:30	305	56	17.86	6.36	0.72	4.73	82.26	0.09

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
32	2021-05-25 07:45	305	55.88	19.69	5.66	0.77	5.12	80.15	0.16
33	2021-05-25 08:00	246	54	20.98	5.88	0.85	4.73	80.18	0.18
34	2021-05-25 08:15	246	54	21.73	5.49	0.9	4.24	80.83	0.14
35	2021-05-25 08:30	246	54	22.77	6.16	0.97	4.2	80.72	0.11
36	2021-05-25 08:45	246	54.68	23.81	6.77	0.97	3.67	80.54	0.2
37	2021-05-25 09:00	346	67	24.11	5.79	1.05	4.07	80.11	0.18
38	2021-05-25 09:15	346	67	24.4	6.41	1.05	4.36	78.91	0.23
39	2021-05-25 09:30	346	67	23.24	6.25	1.04	5.46	79.03	0.22
40	2021-05-25 09:45	346	66.79	22.82	5.52	1.1	6.38	79.69	0.24
41	2021-05-25 10:00	273	63	24.14	1.9	1.22	8.88	77.27	0.27
42	2021-05-25 10:15	273	63	25.75	0.6	1.22	9.04	77.67	0.25
43	2021-05-25 10:30	273	63	28.53	2.68	1.17	6.24	77.91	0.23
44	2021-05-25 10:45	273	63.76	24.82	4.6	1.1	5.69	77.1	0.29
45	2021-05-25 11:00	414	76	22.02	4.44	1.14	6.87	76.97	0.26
46	2021-05-25 11:15	414	76	19.93	3.9	0.98	7.42	75.81	0.3
47	2021-05-25 11:30	414	76	18.44	4.93	1.06	8.93	78.11	0.27
48	2021-05-25 11:45	414	75.47	17.38	4.08	0.99	9.17	76.7	0.24
49	2021-05-25 12:00	198	66	16.61	4.94	1.03	8.82	75.28	0.24
50	2021-05-25 12:15	198	66	15.41	4.51	0.99	10.6	76.8	0.21
51	2021-05-25 12:30	198	66	14.89	4.89	0.79	10.72	76.5	0.23
52	2021-05-25 12:45	198	65.94	15.12	4.43	0.81	10.91	74.61	0.22
53	2021-05-25 13:00	205	65	14.66	4.54	0.9	11.35	74.78	0.18
54	2021-05-25 13:15	205	65	15.35	4.13	0.84	12.41	75.11	0.19
55	2021-05-25 13:30	205	65	20.7	4.62	0.66	10.9	74.05	0.11
56	2021-05-25 13:45	205	65.44	25.64	3.71	0.61	7.54	73.44	0.18
57	2021-05-25 14:00	365	73	29.89	3.96	0.49	6.04	71.95	0.14
58	2021-05-25 14:15	365	73	29.28	3.71	0.63	5.48	69.47	0.17
59	2021-05-25 14:30	365	73	32.7	3.48	0.44	3.55	67.42	0.11
60	2021-05-25 14:45	365	74.44	31.74	3.33	0.47	2.57	68.12	0.12
61	2021-05-25 15:00	511	99	31.02	3.32	0.55	2.6	69.45	0.11
62	2021-05-25 15:15	511	99	26.77	3.4	0.61	NA	NA	0.12
63	2021-05-25 15:30	511	99	25.94	3.38	0.62	NA	NA	0.13
64	2021-05-25 15:45	511	96.24	24.77	3.5	0.62	3.87	74.02	0.14
65	2021-05-25 16:00	219	52	22.32	3.87	0.62	4.68	75.65	0.09
66	2021-05-25 16:15	219	52	23.77	3.59	0.72	4.29	75.38	0.15
67	2021-05-25 16:30	219	52	26	3.76	0.75	2.54	74.36	0.17
68	2021-05-25 16:45	219	52.06	29.22	3.85	0.97	2.17	76.56	0.21

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
69	2021-05-25 17:00	225	53	30.71	4	1.07	1.8	76.62	0.19
70	2021-05-25 17:15	225	53	31.23	4.57	1.1	1.24	74.55	0.2
71	2021-05-25 17:30	225	53	35.49	4.11	1.13	1.58	73.19	0.25
72	2021-05-25 17:45	225	53.75	35.94	4.42	1.05	1.11	74.17	0.26
73	2021-05-25 18:00	452	68	33.52	4.2	1.07	1.17	72.71	0.32
74	2021-05-25 18:15	452	68	34.87	4.32	0.86	2.05	72.7	0.31
75	2021-05-25 18:30	452	68	37.59	4.54	0.76	1.61	73.59	0.31
76	2021-05-25 18:45	452	67.35	37.74	4.22	0.64	1.88	72.41	0.32
77	2021-05-25 19:00	608	55	36.28	4.42	0.53	3.04	74.15	0.28
78	2021-05-25 19:15	608	55	33.7	3.52	0.5	2.31	75.28	0.21
79	2021-05-25 19:30	608	55	31.75	2.97	0.65	2.6	75.22	0.19
80	2021-05-25 19:45	608	54.28	29.55	3.36	0.77	3.05	76.11	0.21
81	2021-05-25 20:00	144	42	27.49	3.72	0.72	3.68	79.22	0.22
82	2021-05-25 20:15	144	42	26.02	3.53	0.74	3.73	79.93	0.24
83	2021-05-25 20:30	144	42	21.77	3.11	0.78	5.27	80.28	0.3
84	2021-05-25 20:45	144	41.72	22	3.24	0.72	5.53	82.1	0.37
85	2021-05-25 21:00	168	37	20.66	2.59	0.6	5.64	82.4	0.37
86	2021-05-25 21:15	168	37	19.51	2.63	0.71	7.32	82.09	0.32
87	2021-05-25 21:30	168	37	19.45	2.78	0.78	7.09	83.3	0.34
88	2021-05-25 21:45	168	38.06	18.66	2.72	0.77	6.02	81.17	0.34
89	2021-05-25 22:00	156	55	19.01	2.94	0.88	5.29	81.63	0.33
90	2021-05-25 22:15	156	55	19.95	2.76	0.83	3.6	83.84	0.29
91	2021-05-25 22:30	156	55	18.29	3.13	0.92	3.84	83.99	0.22
92	2021-05-25 22:45	156	55.56	20.3	3.05	0.94	3.51	85	0.4
93	2021-05-25 23:00	212	65	25.78	3.67	1.02	1.69	84.56	0.37
94	2021-05-25 23:15	212	65	27.05	3.3	0.98	0.85	84.52	0.27
95	2021-05-25 23:30	212	65	27.67	3.35	1	0.76	83.03	0.48
96	2021-05-25 23:45	212	65.5	28.2	3.48	0.96	0.58	82.25	0.52
24 hour Average		**254**	**58**	**21.7**	**4.4**	**0.8**	**5.1**	**78.6**	**0.2**
24 hour average Standards		**0 - 100**	**0 - 60**	**0 - 80**	**0 - 80**	**0 - 2**	**0 - 100**	**0 - 400**	**0 - 5**

Note: All values are expressed in ug/m3, except CO. CO is expressed in mg/m3.

Remarks: Value of PM10 is exceeding the standard limit prescribed for 24 hour average.

Ambient Air Quality Data - 25.05.2021

Industry : M/s. Hindustan Petroleum Corporation Limited (Refinery), Malkapuram, Visakhapatnam

Location: CAAQMS 3 - HLPH

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
1	2021-05-25 00:00	130	56	28.56	113.42	0.52	4.66	4.92	0
2	2021-05-25 00:15	130	56	24.68	85.36	0.53	5.64	5.58	0
3	2021-05-25 00:30	130	56	24.63	113.91	0.51	5.38	5.55	0
4	2021-05-25 00:45	132.84	54.12	24.48	69.33	0.37	5.02	5.57	0
5	2021-05-25 01:00	133	51	24.24	73.25	0.49	5.11	5.77	0
6	2021-05-25 01:15	133	51	23.64	118.14	0.48	5.8	5.86	0
7	2021-05-25 01:30	133	51	22.1	195.44	0.5	5.59	6.13	0
8	2021-05-25 01:45	156.26	51.35	23.83	234.93	0.45	5.32	5.84	0
9	2021-05-25 02:00	159	52	30.31	277.05	0.44	4.71	4.45	0
10	2021-05-25 02:15	159	52	44.52	347.09	0.48	2.45	0.79	0
11	2021-05-25 02:30	159	52	56.21	390.48	0.49	1.03	0	0
12	2021-05-25 02:45	217.56	86.24	64.58	457.5	0.47	1.09	0	0
13	2021-05-25 03:00	221	149	65.85	384.92	0.44	1.2	0	0
14	2021-05-25 03:15	221	149	64.47	301.23	0.43	0.66	0	0
15	2021-05-25 03:30	221	149	64.07	295.14	0.47	1.07	0	0
16	2021-05-25 03:45	219.21	133.76	63.8	289.18	0.44	1.75	0	0
17	2021-05-25 04:00	219	112	65.79	307.29	0.44	1.63	0	0
18	2021-05-25 04:15	219	112	71.12	319.3	0.47	0.82	0	0
19	2021-05-25 04:30	219	112	74.59	328.38	0.44	1.31	0	0
20	2021-05-25 04:45	223.47	118.25	76.06	348.38	0.46	1.34	0	0
21	2021-05-25 05:00	224	132	78.14	393.79	0.44	0.55	0	0
22	2021-05-25 05:15	224	132	79.11	428.18	0.44	0.73	0	0
23	2021-05-25 05:30	224	132	78.27	355.85	0.43	1.15	0	0
24	2021-05-25 05:45	232.82	128.33	75.56	463.31	0.45	1.03	0	0
25	2021-05-25 06:00	234	121	75.17	509.99	0.45	0.62	0	0
26	2021-05-25 06:15	234	121	74.56	360.61	0.41	1.03	0	0
27	2021-05-25 06:30	234	121	69.75	218.03	0.47	1.59	0	0
28	2021-05-25 06:45	215.21	108.56	65.66	217.87	0.49	2.23	0	0
29	2021-05-25 07:00	213	89	65.98	291.8	0.51	2.31	0	0
30	2021-05-25 07:15	213	89	64.14	209.69	0.5	3.13	0	0
31	2021-05-25 07:30	213	89	58.05	177.65	0.58	4.32	0	0

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
32	2021-05-25 07:45	200.47	82.78	50.59	156.49	0.55	5.57	0.42	0
33	2021-05-25 08:00	199	73	47.41	108.19	0.59	7.32	0.91	0
34	2021-05-25 08:15	199	73	48.05	118.34	0.59	7.51	0.6	0
35	2021-05-25 08:30	199	73	47.01	117.08	0.59	5.45	0.68	0
36	2021-05-25 08:45	221.22	68.33	43.77	122.82	0.6	5.43	1.36	0
37	2021-05-25 09:00	224	61	41.54	121.51	0.64	5.67	1.86	0
38	2021-05-25 09:15	224	61	43.29	148.81	0.66	5.18	1.24	0
39	2021-05-25 09:30	224	61	58.55	261.28	0.59	3.13	0	0
40	2021-05-25 09:45	235.63	73.83	71.14	299.13	0.65	2.43	0	0
41	2021-05-25 10:00	237	94	77.97	358.77	0.66	1.5	0	0
42	2021-05-25 10:15	237	94	81.09	145.21	0.68	1.42	0	0
43	2021-05-25 10:30	237	94	78.79	154.62	0.7	2.32	0	0
44	2021-05-25 10:45	274.33	95.24	81.12	392.12	0.69	2.16	0	0
45	2021-05-25 11:00	279	97	86.62	326.01	0.74	1.74	0	0
46	2021-05-25 11:15	279	97	90.59	423.39	0.68	1.85	0	0
47	2021-05-25 11:30	279	97	97.79	390.72	0.73	1.53	0	0
48	2021-05-25 11:45	364.94	122.67	104.86	370.99	0.71	1.25	0	0
49	2021-05-25 12:00	370	163	107.64	365.96	0.68	1.22	0	0
50	2021-05-25 12:15	370	163	109.51	400.82	0.6	1.3	0	0
51	2021-05-25 12:30	370	163	109.46	356.11	0.6	1.24	0	0
52	2021-05-25 12:45	406.44	153.94	108.67	216.78	0.56	1.5	0	0
53	2021-05-25 13:00	411	141	103.54	120.87	0.52	4.14	0	0
54	2021-05-25 13:15	411	141	93.2	150.89	0.52	7.43	0	0
55	2021-05-25 13:30	411	141	75.94	82.21	0.45	9.86	0	0
56	2021-05-25 13:45	288.33	97.69	53.63	66.32	0.37	8.77	0.34	0
57	2021-05-25 14:00	273	42	36.17	60.32	0.37	8.35	2.94	0
58	2021-05-25 14:15	273	42	25.53	56.78	0.38	6.63	4.85	0
59	2021-05-25 14:30	273	42	18.98	60.94	0.33	5.91	5.83	0
60	2021-05-25 14:45	254.33	36	15.81	56.4	0.33	5.04	6.15	0
61	2021-05-25 15:00	252	26	16.66	56.09	0.38	4.19	5.85	0
62	2021-05-25 15:15	252	26	32.2	54.05	0.42	2.43	1.89	0
63	2021-05-25 15:30	252	26	51.81	53.04	0.38	1.2	0	0
64	2021-05-25 15:45	265.24	27.75	59.76	52.07	0.4	1.6	0	0
65	2021-05-25 16:00	267	30	59.01	50.07	0.4	1.69	0	0
66	2021-05-25 16:15	NA	NA	NA	NA	NA	NA	NA	NA
67	2021-05-25 16:30	NA	NA	NA	NA	NA	NA	NA	NA
68	2021-05-25 16:45	NA	NA	NA	NA	NA	NA	NA	NA

S. No.	Time	PM10	PM2.5	Nox	SO2	CO	O3	NH3	Benzene
69	2021-05-25 17:00	251	22	48.92	59.3	0.46	2.5	0	0
70	2021-05-25 17:15	251	22	44.61	49.68	0.4	2.4	0.04	0
71	2021-05-25 17:30	251	22	35.96	61.19	0.45	3.75	1.53	0
72	2021-05-25 17:45	186.78	25.71	34.35	80.86	0.46	3.64	1.92	0
73	2021-05-25 18:00	183	31	44.47	105.79	0.52	1.13	0.13	0
74	2021-05-25 18:15	183	31	53.39	64.31	0.42	1.55	0	0
75	2021-05-25 18:30	183	31	47.45	60.75	0.4	3.87	0.15	0
76	2021-05-25 18:45	199.76	27.67	40.59	37.95	0.35	5.02	1.38	0
77	2021-05-25 19:00	202	21	32.34	34.3	0.33	6.91	3.11	0
78	2021-05-25 19:15	202	21	24.35	52.85	0.35	5	4.19	0
79	2021-05-25 19:30	202	21	22.35	50.99	0.39	4.2	4.3	0
80	2021-05-25 19:45	168	21.39	21.99	43.46	0.43	7.3	4.93	0
81	2021-05-25 20:00	164	22	21.87	42.45	0.44	8.48	5.49	0
82	2021-05-25 20:15	164	22	21.82	67.3	0.48	9.32	5.82	0
83	2021-05-25 20:30	164	22	20.57	48.48	0.47	10.79	6.32	0
84	2021-05-25 20:45	171.11	24.12	19.28	30.34	0.46	11.98	6.68	0
85	2021-05-25 21:00	172	28	20.46	48.97	0.46	11.78	6.39	0
86	2021-05-25 21:15	172	28	20.67	91.09	0.53	10.38	6.35	0
87	2021-05-25 21:30	172	28	23.86	77.13	0.55	8.96	5.73	0
88	2021-05-25 21:45	174.65	33.33	27.63	74.87	0.54	9.4	5.07	0
89	2021-05-25 22:00	175	40	35.87	136.33	0.64	7.35	3.41	0
90	2021-05-25 22:15	175	40	45.35	53.46	0.75	4.02	1.55	0
91	2021-05-25 22:30	175	40	45.69	45.61	0.74	1.55	1.48	0
92	2021-05-25 22:45	294.06	51.28	46.69	48.15	0.75	0.63	1.19	0
93	2021-05-25 23:00	302	69	47.77	50.49	0.77	1.46	1.05	0
94	2021-05-25 23:15	302	69	46.81	47.22	0.71	1.68	1.15	0
95	2021-05-25 23:30	302	69	42.96	39.54	0.64	2.42	1.81	0
96	2021-05-25 23:45	275.33	63.65	40.41	41.14	0.57	2.46	2.24	0
24 hour Average		**229**	**73**	**53.0**	**178.4**	**0.5**	**3.9**	**1.8**	**0.0**
24 hour average Standards		**0 - 100**	**0 - 60**	**0 - 80**	**0 - 80**	**0 - 2**	**0 - 100**	**0 - 400**	**0 - 5**

Note: All values are expressed in ug/m3, except CO. CO is expressed in mg/m3.

Remarks: Values of PM10, PM2.5 and SO2 are exceeding the standard limits prescribed for 24 hour average.

Annexure - 5

A.P. POLLUTION CONTROL BOARD, ZONAL LABORATORY, VISAKHAPATNAM

CONTINUOUS AMBIENT AIR QUALITY MONITORING STATION-MOBILE VAN

Location : Ajanta colony, near Coramandel main gate (South west side to M/s HPCL)

Period of monitoring: 25.05.2021 to 26.05.2021

Time (hrs)	CO mg/m³	O3 µg/m³	NO µg/m³	NO2 µg/m³	NOx µg/m³	NH3 µg/m³	SO2 µg/m³	PM 2.5 µg/m³	PM 10 µg/m³	AT °C	RH %	WS m/s	WD deg	BP mmHg
18:00	0.6	92.9	3.9	10.5	14.5	8.8	20.2	24	101	34.9	34	0.4	226	751
19:00	0.6	103.5	4.7	9.8	14.5	13.7	32.2	34	121	34.9	35	0.6	220	751
20:00	0.6	105.4	5.5	12.2	17.8	39.6	34.1	37	139	34.7	38	0.6	161	751
21:00	0.6	103.9	6.3	13.3	19.6	29.5	28.6	45	171	34.6	43	1.9	199	751
22:00	0.8	95.3	7.5	16.2	23.7	35.8	26.5	56	177	33.6	49	0.8	186	751
23:00	0.8	98.4	6.6	16.5	23.2	28.8	21.0	44	134	33.0	53	0.5	156	751
0:00	0.7	101.1	5.5	22.7	28.3	24.6	25.4	39	114	32.7	52	0.5	118	751
1:00	0.6	108.4	8.0	28.6	36.6	32.3	26.2	34	119	33.2	46	0.8	198	750
2:00	0.6	107.8	5.5	14.1	19.6	34.7	27.0	39	132	33.8	40	1.0	202	750
3:00	0.6	107.2	8.1	26.7	34.8	35.4	29.1	38	128	33.5	41	1.4	214	750
4:00	0.6	105.6	10.1	30.3	40.4	32.1	28.0	34	127	33.3	40	1.4	192	750
5:00	0.7	102.3	8.7	24.6	33.4	24.2	29.6	28	116	32.6	41	1.3	196	750
6:00	0.8	105.1	8.5	24.6	33.1	31.9	29.1	34	122	32.6	41	0.9	190	751
7:00	1.3	101.1	7.1	30.3	37.4	7.4	16.8	54	155	32.7	43	1.0	180	751
8:00	1.4	120.1	4.2	13.7	17.9	8.6	14.7	51	167	34.5	41	1.5	194	751
9:00	0.9	160.7	3.0	12.6	15.5	15.7	14.9	34	143	37.2	34	1.7	236	750
10:00	0.7	155.8	4.6	32.5	37.1	37.5	12.3	27	130	39.3	29	1.6	234	750
11:00	0.9	159.2	5.3	39.5	44.8	30.5	8.4	29	114	40.2	28	1.6	228	749
12:00	0.7	158.4	3.8	30.1	33.9	32.1	6.3	27	107	41.3	25	1.5	232	748
13:00	0.4	153.1	3.0	14.5	17.4	31.9	13.1	21	114	42.6	23	1.3	234	747
14:00	0.5	146.8	3.3	14.9	18.2	33.7	20.7	17	117	43.1	22	1.1	230	746
15:00	0.4	145.0	4.7	19.0	23.7	35.8	18.6	15	88	42.9	22	0.8	221	746
16:00	0.5	147.0	7.5	22.7	30.3	39.5	20.4	16	75	42.5	22	1.1	220	746
17:00	0.5	139.2	6.6	19.0	25.6	37.4	19.4	14	70	42.1	25	0.9	216	746
Average	**0.7**	**121.8**	**5.9**	**20.8**	**26.7**	**28.4**	**21.8**	**33**	**124**	**36**	**36**	**1**	**203**	**750**
Minimum	0.4	92.9	3.0	9.8	14.5	7.4	6.3	14.0	70.0	32.6	21.6	0.4	118.0	746.0
Maximum	1.4	160.7	10.1	39.5	44.8	39.6	34.1	56.0	177.0	43.1	53.0	1.9	236.0	751.0
Capture	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NAAQ Stadard(24 hours aerage)	2*	100*	--	80	--	400	80	60	100	--	--	--	--	--

*CO and Ozone standard is for 8 hours average

M. Rao

SENIOR ENVIRONMENTAL SCIENTIST

A.P. POLLUTION CONTROL BOARD, ZONAL LABORATORY, VISAKHAPATNAM

CONTINUOUS AMBIENT AIR QUALITY MONITORING STATION-MOBILE VAN

Location : Ajanta colony, near Coramandel main gate (South west side to M/s HPCL)

Period of monitoring: 25.05.2021 to 26.05.2021

Time (hrs)	Methylmercaptan (ppb)	Ethylmercaptan (ppb)	Dimethylsulfide (ppb)	Carbon disulfide (ppb)	Diethylsulfide (ppb)	Dimethyldisulfide (ppb)	Diethyldisulfide (ppb)	2-methylpentane (ppb)	3-methylpentane (ppb)	2,4-dimethylpentane (ppb)	benzene (µg/m³)	cyclohexane (ppb)	2-methylhexane (ppb)	2,3-dimethylpentane (ppb)	3-methylhexane (ppb)	n-heptane (ppb)
18:00	0.0	0.0	0.4	0.1	0.3	0.5	0.4	3.4	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0
19:00	0.1	0.0	0.4	0.0	0.3	0.5	0.4	0.3	0.0	0.1	0.6	0.1	0.0	0.1	0.0	0.4
20:00	0.2	0.0	0.4	0.0	0.3	0.5	0.4	0.8	0.1	0.2	1.1	1.5	0.0	0.4	0.0	0.4
21:00	0.2	0.0	0.4	0.0	0.3	0.5	0.4	0.8	0.1	0.2	0.9	1.8	0.0	0.4	0.0	0.0
22:00	0.2	0.0	0.4	0.0	0.3	0.5	0.4	0.9	0.0	0.0	1.5	0.8	0.0	0.0	0.0	0.1
23:00	0.1	0.0	0.4	0.0	0.3	0.5	0.4	0.8	0.0	0.1	1.6	0.8	0.0	0.0	0.0	0.0
0:00	0.0	0.0	0.4	0.0	0.3	0.6	0.4	0.9	0.2	0.3	0.2	0.3	0.0	0.4	0.6	0.1
1:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.7	0.1	0.0	0.1	0.5	0.0	0.2	0.9	0.1
2:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.7	0.1	0.3	0.1	0.2	0.5	0.9	0.4	0.1
3:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.6	0.1	0.6	0.2	0.3	0.3	0.9	0.6	0.2
4:00	0.0	0.1	0.4	0.0	0.3	0.5	0.4	0.7	0.1	1.0	0.2	0.0	1.0	1.9	0.0	0.3
5:00	0.0	0.1	0.4	0.0	0.3	0.5	0.4	0.7	0.1	1.0	0.2	0.0	1.0	3.5	0.0	0.4
6:00	0.1	0.1	0.4	0.0	0.3	0.5	0.4	0.6	0.2	0.7	0.1	0.0	0.9	1.9	0.0	0.5
7:00	0.0	0.1	0.4	0.0	0.3	0.5	0.4	0.3	0.1	0.3	0.2	0.6	0.3	0.9	0.1	0.2
8:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.5	0.0	0.0	1.6	0.6	0.0	0.0	0.0	0.0
9:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.8	0.1	0.1	2.0	0.5	0.1	0.2	0.0	0.2
10:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	1.0	0.1	0.1	1.2	0.2	0.1	0.2	0.1	0.1
11:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.7	0.1	0.3	1.0	0.1	1.1	0.1	0.1	0.2
12:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.9	0.2	0.4	0.4	1.7	0.1	0.3	0.2	0.5
13:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	1.3	0.2	0.5	0.4	0.0	2.2	0.1	0.0	0.4
14:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.8	0.2	0.5	0.5	0.0	1.0	0.1	0.4	0.3
15:00	0.1	0.0	0.4	0.0	0.3	0.5	0.4	0.6	0.1	0.3	0.5	0.0	1.2	0.0	0.0	0.3
16:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.6	0.2	0.3	0.4	0.0	1.2	1.5	0.0	0.3
17:00	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.3	0.1	0.3	0.4	0.0	1.0	0.8	0.0	0.3
Average	**0.1**	**0.0**	**0.4**	**0.0**	**0.3**	**0.5**	**0.4**	**0.8**	**0.1**	**0.3**	**0.7**	**0.4**	**0.5**	**0.6**	**0.1**	**0.2**
Minimum	0.0	0.0	0.4	0.0	0.3	0.5	0.4	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Maximum	0.2	0.1	0.4	0.1	0.3	0.6	0.4	3.4	0.2	1.0	2.0	1.8	2.2	3.5	0.9	0.5

A.P. POLLUTION CONTROL BOARD, ZONAL LABORATORY, VISAKHAPATNAM

CONTINUOUS AMBIENT AIR QUALITY MONITORING STATION-MOBILE VAN

Location : Ajanta colony, near Coramandel main gate (South west side to M/s HPCL)

Period of monitoring: 25.05.2021 to 26.05.2021

Time (hrs)	2,3,4-trimethylpenta (ppb)	methylcyclohexane (ppb)	toluene (µg/m³)	2-methylheptane (ppb)	3-methylheptane (ppb)	n-octane (ppb)	ethylbenzene (ppb)	m,p-xylene (ppb)	styrene (ppb)	o-xylene (ppb)	n-nonane (ppb)	n-propylbenzene (ppb)	1,3,5-trimbenzene (ppb)	1,2,4-trimbenzene (ppb)	n-decane (ppb)	1,2,3-trimbenzene (ppb)
18:00	0.1	0.0	2.1	0.0	0.6	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.2	0.1	0.9	0.3
19:00	0.0	0.0	7.0	0.0	0.0	0.0	0.2	0.3	0.2	0.0	0.0	0.1	0.6	0.2	1.9	0.3
20:00	0.0	0.1	26.8	0.0	0.0	0.0	0.2	0.5	0.2	0.0	0.0	0.0	1.4	0.2	3.9	0.0
21:00	0.0	0.1	34.8	0.0	0.0	0.0	0.1	0.4	0.2	0.0	0.0	0.0	1.7	0.2	4.0	0.0
22:00	0.0	0.0	21.8	0.0	0.0	0.0	0.1	0.3	0.2	0.0	0.0	0.0	1.9	0.2	4.2	0.1
23:00	0.0	0.4	23.5	0.0	0.0	0.0	0.1	0.3	0.2	0.0	0.0	0.0	1.7	0.2	3.8	0.0
0:00	0.0	5.3	0.0	7.7	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.7	0.1	1.7	4.6
1:00	0.0	0.0	0.0	4.9	4.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.3	8.0
2:00	0.0	0.0	0.0	0.0	8.0	0.2	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.3	7.4
3:00	0.0	0.0	0.0	0.0	12.0	0.2	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.8	0.4	8.6
4:00	0.0	0.0	0.0	0.0	20.1	0.2	0.0	0.1	0.0	0.2	0.0	0.0	0.1	1.6	0.5	10.3
5:00	0.0	0.0	0.0	0.0	17.5	0.2	0.0	0.1	0.0	0.2	0.0	0.0	0.1	1.6	0.5	10.5
6:00	0.0	0.0	0.0	0.0	12.7	0.3	0.0	0.1	0.0	0.2	0.0	0.0	0.1	1.7	0.6	10.8
7:00	0.0	0.0	6.0	0.0	5.9	0.1	0.1	0.3	0.1	0.2	0.5	0.0	0.9	1.0	2.5	5.0
8:00	0.1	0.0	13.3	0.0	0.0	0.0	0.2	0.7	0.1	0.0	0.0	0.0	1.5	0.3	3.3	0.0
9:00	0.1	0.1	13.2	0.0	0.0	0.1	0.2	0.9	0.1	0.2	0.1	0.0	1.9	0.4	3.6	0.0
10:00	0.1	0.1	8.6	0.0	0.0	0.0	0.1	0.5	0.1	0.1	0.0	0.0	2.3	0.3	4.2	0.0
11:00	0.1	0.1	6.1	11.9	0.1	0.1	0.1	0.5	0.1	0.4	0.0	0.1	3.2	0.4	5.6	0.1
12:00	0.0	0.0	0.1	24.0	0.0	0.0	0.3	0.7	0.2	0.4	0.1	0.0	3.0	0.4	5.5	0.1
13:00	0.0	0.0	0.1	13.2	0.0	0.0	0.1	0.5	0.2	0.3	0.1	0.0	3.1	0.4	5.8	0.1
14:00	0.0	0.0	0.0	10.9	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	3.3	0.3	6.2	0.2
15:00	0.0	0.0	0.0	9.5	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	3.5	0.3	6.3	0.2
16:00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	2.0	0.5	5.9	0.2
17:00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	2.3	0.5	5.5	0.4
Average	0.0	0.3	6.8	3.4	3.4	0.1	0.1	0.3	0.1	0.2	0.0	0.0	1.5	0.5	3.2	2.8
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Maximum	0.1	5.3	34.8	24.0	20.1	0.3	0.3	0.9	0.2	0.4	0.5	0.1	3.5	1.7	6.3	10.8

A.P. POLLUTION CONTROL BOARD, ZONAL LABORATORY, VISAKHAPATNAM

CONTINUOUS AMBIENT AIR QUALITY MONITORING STATION-MOBILE VAN

Location : Ajanta colony, near Coramandel main gate (South west side to M/s HPCL)

Period of monitoring: 25.05.2021 to 26.05.2021

Time (hrs)	Ethane-FID (ppb)	Propane-FID (ppb)	iso-Butane-FID (ppb)	n-Butane-FID (ppb)	trans-2-butene (ppb)	1-butene (ppb)	cis-2-butene (ppb)	cyclopentane-FID (ppb)	iso-Pentane-FID (ppb)	n-Pentane-FID (ppb)	trans-2-pentene (ppb)	1-pentene (ppb)	cis-2-pentene (ppb)	2,2-dimethylbutane (ppb)	2,3-dimethylbutane (ppb)	isoprene (ppb)	methylcyclopentane (ppb)	1-Hexene (ppb)
18:00	8.8	94.9	0.5	5.7	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.0	0.0
19:00	6.9	16.2	5.6	4.4	0.0	0.8	0.0	2.5	2.0	0.0	0.2	0.1	0.0	0.0	21.4	0.0	0.0	1.2
20:00	5.7	2.6	5.3	0.5	0.5	0.6	0.0	0.0	1.3	0.0	0.2	0.1	0.0	0.2	31.9	0.3	0.0	0.1
21:00	5.5	5.0	5.2	0.7	0.9	0.1	0.0	0.0	0.9	0.0	0.1	0.1	0.0	0.2	30.2	0.4	0.0	0.0
22:00	2.6	6.8	2.1	0.4	0.7	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.3	49.2	0.1	0.0	0.1
23:00	2.8	6.6	2.1	0.4	0.6	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.5	49.2	0.0	0.0	0.1
0:00	2.5	6.7	1.8	0.4	0.6	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.1	0.2	14.8	0.2	0.3	0.3
1:00	2.3	5.0	0.9	0.2	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.4	2.5	0.9	0.0	0.1	0.4
2:00	2.2	5.3	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.5	0.2	0.3	14.2	0.0	0.5	3.4
3:00	2.1	1.1	0.0	0.0	0.0	0.2	0.8	0.0	0.2	0.0	0.1	0.4	1.8	0.0	0.1	0.0	0.6	0.9
4:00	3.3	1.0	0.0	0.0	0.0	0.2	0.5	0.0	0.3	0.0	0.1	0.1	1.7	0.0	0.8	0.0	0.1	14.3
5:00	1.8	1.0	0.0	0.0	0.0	0.2	0.6	0.0	0.2	0.0	0.1	0.8	0.9	0.0	0.0	0.0	0.1	0.2
6:00	2.5	3.4	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.9	0.2	0.1	0.0	0.0	1.3	0.1
7:00	2.9	5.2	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.2	0.0	0.5	0.5	0.5	12.3	0.0	0.1	0.2
8:00	4.2	5.6	0.2	0.0	0.2	0.0	0.0	1.5	0.0	0.0	0.1	0.0	0.2	2.8	0.7	0.0	0.1	0.8
9:00	4.4	4.2	0.2	0.0	0.0	0.2	0.0	2.3	0.0	0.0	0.1	0.0	0.3	0.1	1.5	0.0	0.3	0.8
10:00	2.7	4.6	0.2	0.0	0.2	0.0	0.1	1.0	0.0	0.1	0.1	0.0	0.2	4.7	1.7	0.0	0.3	1.2
11:00	2.5	3.9	0.2	0.0	0.2	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.5	11.3	2.0	0.0	0.1	0.4
12:00	2.7	2.1	0.3	0.0	0.2	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.5	14.2	2.0	0.0	0.2	0.5
13:00	2.1	4.2	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	17.8	0.4	0.1	0.2	1.0
14:00	2.2	3.8	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.2	21.4	1.4	0.0	0.3	0.0
15:00	3.9	2.6	0.2	0.0	0.1	0.0	0.0	1.2	0.0	0.0	0.1	0.0	0.2	20.0	0.3	0.0	0.4	0.1
16:00	2.6	2.5	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.9	0.2	0.1	0.0	0.0	1.3	0.1
17:00	2.5	3.5	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.2	0.0	0.5	0.5	0.5	0.0	0.0	0.1	0.2
Average	**3.4**	**8.2**	**1.1**	**0.5**	**0.2**	**0.1**	**0.1**	**0.4**	**0.3**	**0.1**	**0.1**	**0.2**	**0.4**	**4.1**	**9.8**	**0.1**	**0.3**	**1.1**
Minimum	1.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	8.8	94.9	5.6	5.7	0.9	0.8	0.8	2.5	2.0	0.3	0.2	0.9	1.8	21.4	49.2	0.4	1.3	14.3

M.Rao

SENIOR ENVIRONMENTAL SCIENTIST

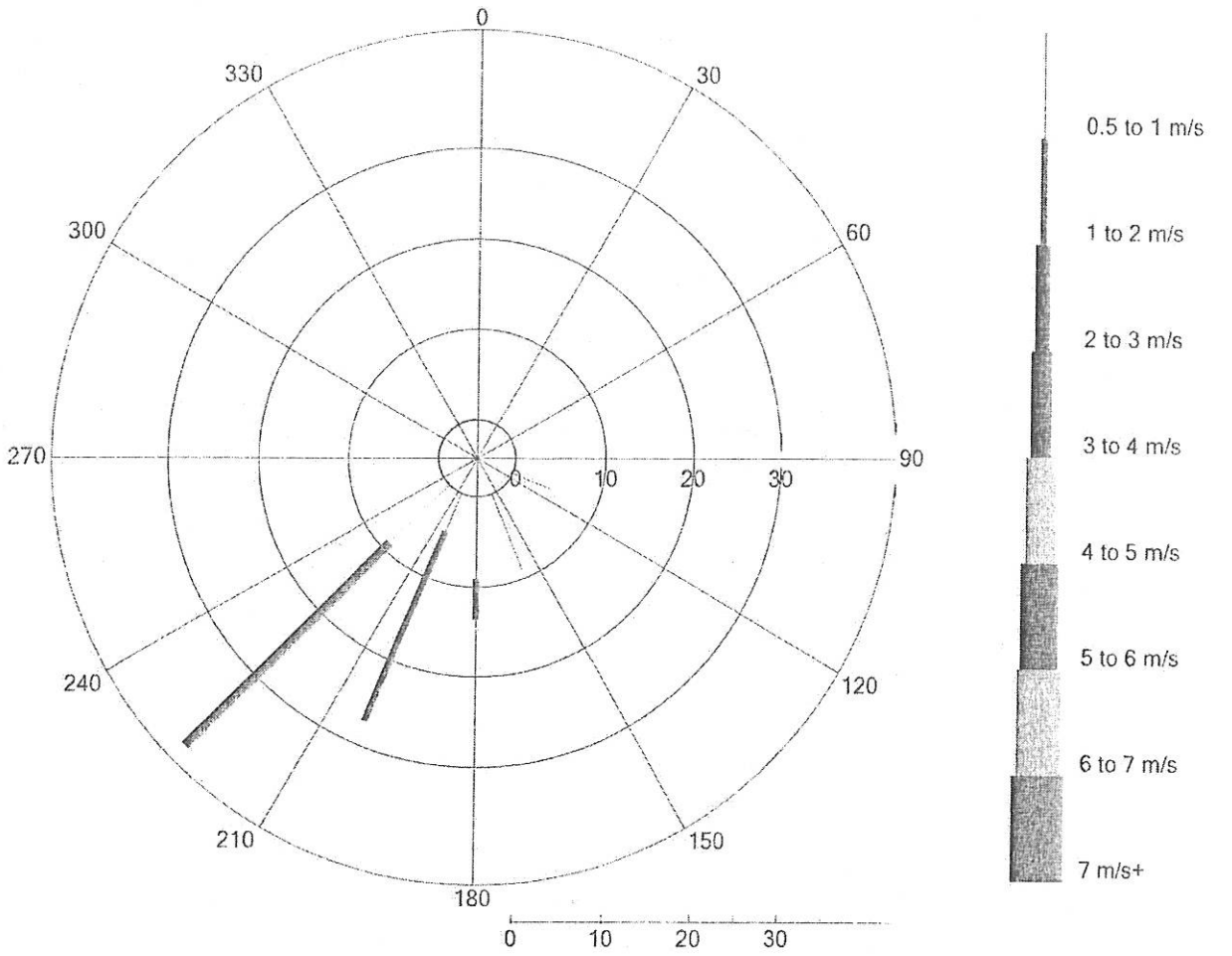
Andhra Pradesh Pollution Control Board

Continuous Ambient Air Quality Monitoring Station : Mobile Van

Near Coromandel Gate,Visakhapatnam

Wind Rose

25-05-2021 18:00 to 26-05-2021 17:00



4.5% calm

95.7% valid data present

Annexure -6

ANDHRA PRADESH POLLUTION CONTROL BOARD
ZONAL LABORATORY:: VISAKHAPATNAM
D.No.39-33-20/1/4,Madhavadhara VUDA Colony, Visakhapatnam - 530018.

M.RAVI, M.Sc.,
SENIOR ENVIRONMENTAL SCIENTIST

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ANALYSIS REPORT

Sample No. : 2021 – 05 – E – 131, 131A, 131B & 131C

Sample location/Address : M/s Hindustan Petroleum Corporation Ltd., (Visakh Refinery), Malkapuram, Visakhapatnam.

Sample Source : E-131 : Fire Fighting Water
E-131A : Fire Fighting Water
E-131B : Fire Fighting Water
E-131C : Fire Fighting Water

Sample collected on : 25.05.2021

Sample received on : 26.05.2021

Sample collected by : EE, AEE-1 & Analyst (OS), Regional Office, Visakhapatnam

Purpose of monitoring : Fire Accident occured at CDU-III

Sl. No.	Parameters	E-131	E-131A	E-131B	E-131C
1.	pH	7.19	7.02	7.54	7.32
2.	Total Suspended Solids	1162	880	840	820
3.	Total Dissolved Solids	50616	48100	49160	50220
4.	Total Organic Carbon (TOC)	73.8	65.6	68.8	62.4
5.	Chemical Oxygen Demand	184.0	164.0	172.0	156.0
6.	Oil & Grease	12	14	10	8

Note: - All values are expressed in mg/l except pH

M Ravi
SENIOR ENVIRONMENTAL SCIENTIST

Annexure-7

SUMMARY REPORT OF INSPECTIONS CARRIED OUT FOR 6" SHORT RESIDUE (SR) LINE IN CDU-III

I) **Pipeline description:** Short Residue line

- Line size: 6"
- Original thickness: 7.11 mm
- Operating Pressure: 16.5 kg/cm2g
- Operating temperature: 350 deg.C
- Hydro test pressure: 45.1 kg/cm2g.

Inspection history of 6" SR line:

1. Oct 2012 Turnaround:

Comprehensive Ultrasonic Thickness Gauging (UTG) and external visual inspection carried out.

- Measured thickness in the range of 6.0mm to 7.8mm and found satisfactory.
- Hydro test of the pipe line done at 45.1 kg/cm2g and found satisfactory.

2. May 2016 Turnaround:

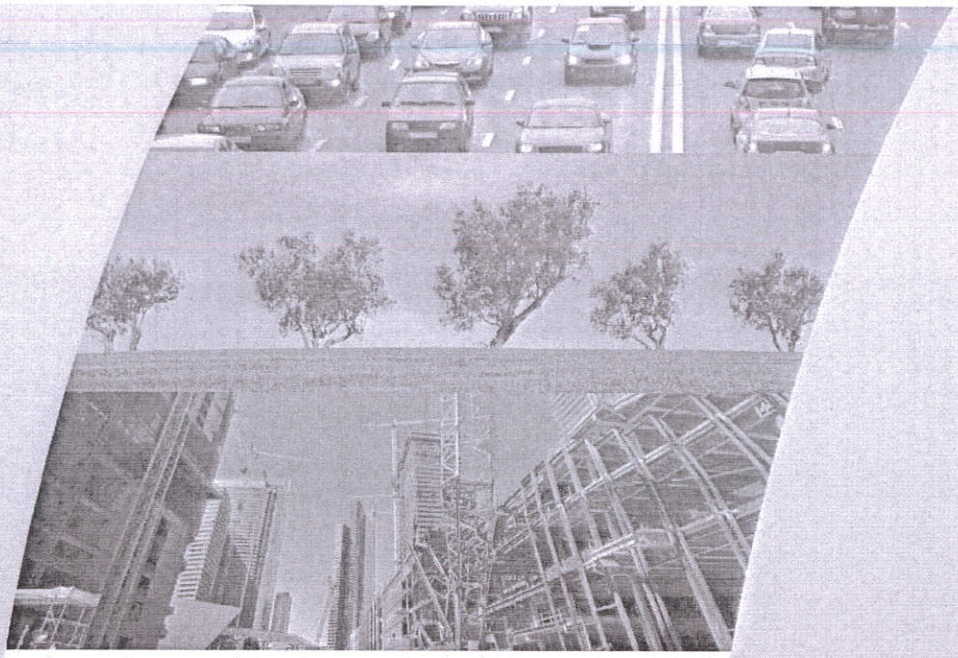
- Pre-T&I: Comprehensive UTG and external visual inspection carried out. Measured thickness in the range of 7.0mm to 7.5mm and found satisfactory.
- Hydro test done at 45.1 kg/cm2g and found satisfactory.

24/06/21

Hindustan Petroleum Corp. Ltd. Visakh Refinery INSPECTION DEPT.

(MANAGER)

Annexure - 8



Environmental Prices Handbook

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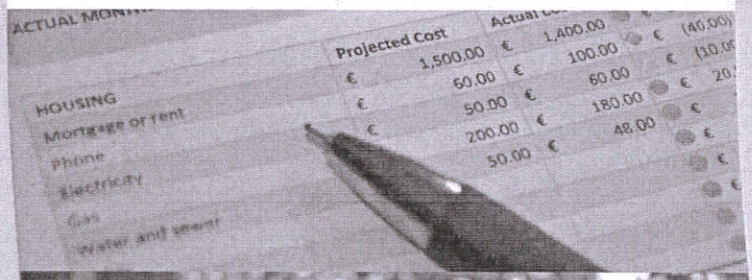

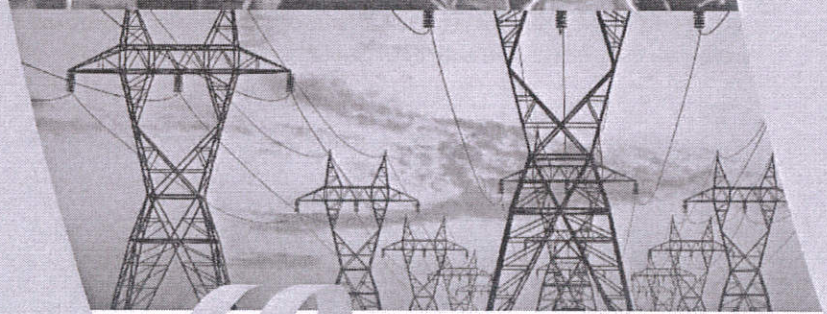

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Committed to the Environment

Environmental Prices Handbook

EU28 version

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Appraise / Evironment / Effects / Emissions / Economic factors / Measuring methode

CE Delft
Committed to the Environment

Through its independent research and consultancy work CE Delft is helping build a sustainable world. In the fields of energy, transport and resources our expertise is leading-edge. With our wealth of know-how on technologies, policies and economic issues we support government agencies, NGOs and industries in pursuit of structural change. For 40 years now, the skills and enthusiasm of CE Delft's staff have been devoted to achieving this mission.

Contents

3.2 Environmental prices: a brief synopsis

This section reports environmental prices for several commmon pollutants. The majority are expressed in €/kg pollutant, in 2015 prices. The two exceptions are noise and ionizing radiation, expressed respectively in € per decibel and € per kiloBequerel (measuring the intensity of emitted radiation).

As stated earlier, the environmental prices reported in this chapter are average values for the EU28. The damage costs of environmental pollution (etc.) can vary widely according to local circumstances (particularly population density) and the nature of the emission (from industrial stacks versus vehicle tailpipes, for example). Environmental prices make no allowance for these differences.[15] For this reason, these environmental prices cannot simply be applied to specific cases of local pollution, for pollution in other countries or for pollution by non-average emission sources. In Chapter 6 these issues are considered in more detail, as well as the background to the calculations (neither of which issues are discussed in the present chapter).

3.2.1 Environmental prices for emissions to the atmosphere

Table 5 reports the values for the most frequently encountered atmospheric emissions in €/kg emission.

Table 5 Environmental prices for key atmospheric emissions (€2015 per kg emission)

Pollutant		Environmental price (€/kg emission)			Relevant midpoints[1]							Endpoints[1]		
		Lower	Central	Upper	PM formation	Smog formation	Acidification	Climate change	Ozone layer	Human toxicity	Ecotox./ Eutrophication	Human health	Ecosystem services	Materials/ Buildngs
Carbon dioxide[2]	CO_2	€ 0.022	€ 0.057	€ 0.094				x				nc	nc	nc
Chlorofluorocarbons[2]	CFC11	€ 130	€ 306	€ 504				x	x	x	x	x	x	
Fine particulates, 2.5 µ or less	$PM_{2.5}$	€ 27.7	€ 38.7	€ 59.5	x			nc				x		x
Coarse particulates, 10 µ or less	PM_{10}	€ 19	€ 26.6	€ 41	x			nc				x		x
Nitrogen oxides	NO_x	€ 9.97	€ 14.8	€ 22.1	x	x	x	nc			x	x	x	x
Sulphur dioxide	SO_2	€ 8.3	€ 11.5	€ 17.9	x	x	x	nc				x	x	x
Ammonia	NH_3	€ 10	€ 17.5	€ 25.2	x		x				x	x	x	
Volatile organic compounds	NMVOC	€ 0.84	€ 1.15	€ 1.84		x						x	x	X
Carbon monoxide	CO	€ 0.0383	€ 0.0526	€ 0.0918		x						x		
Methane[2]	CH_4	€ 0.673	€ 1.74	€ 2.91		x		x				nc	nc	nc
Cadmium	Cd	€ 371	€ 589	€ 869						x	x	x	x	
Arsenic	As	€ 586	€ 862	€ 963						x	x	x	x	
Lead	Pb	€ 3631	€ 5367	€ 5761						x	x	x	x	
Mercury	Hg	€ 24680	€ 34490	€ 52920						x	x	x	x	
Formaldehyde	CH_2O	€ 9	€ 12.3	€ 19		x				x	x	x	x	

[1] An x indicates the pollutant has been characterized on the midpoint or endpoint; nc = not calculated, climate emissions being priced using abatement costs rather than damage costs.

[2] The value reported for greenhouse gases includes VAT and increases at 3.5% per annum from the 2015 baseline. These values can therefore only be be used for 2015 emissions. For valuation in later years, see Section 6.3.

[15] With the exception of $PM_{2.5}$; see Section 6.4.

Plate – 1: View of the fire accident – CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam.

Plate – 2: View of the fire accident – CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam

Plate – 3: Fire accident area – CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam.

Plate – 4: Six inches carbon steel pipe line where the leakage of butimen / furnace oil occurred resulting in fire accident at deck 1, CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam.

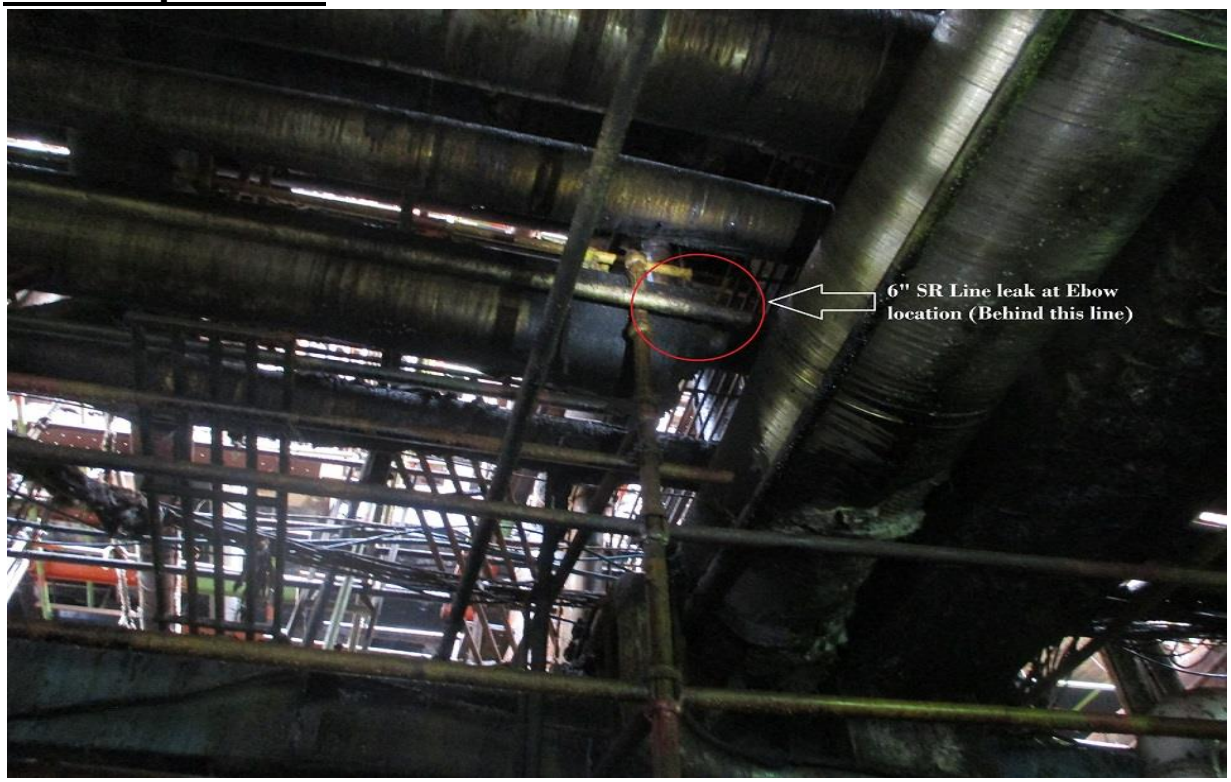

Plate – 5: Blown up of pipe line carrying naphtha vapours at deck 3 as a result of excessive heat generated during fire accident from deck 1, CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam.

Plate – 6: Oily sludge stored in the lagoons, which is generated as a result of fire accident at CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam.

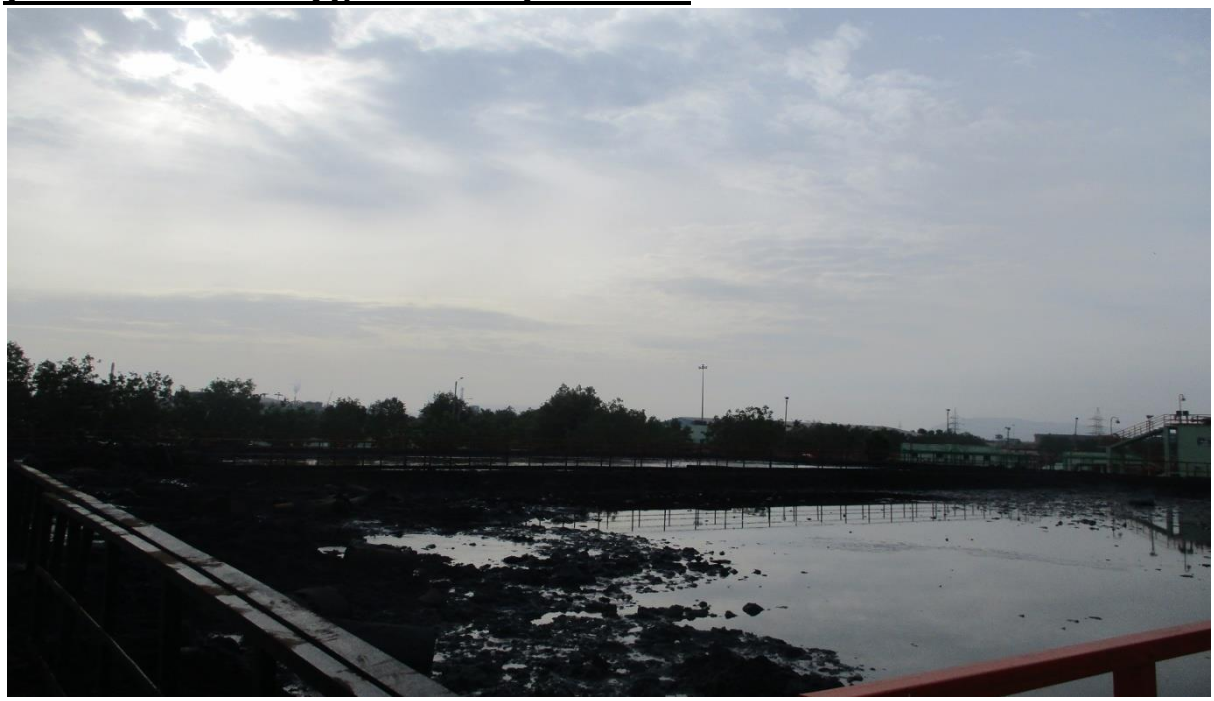

Plate – 7: Oily sludge stored in the lagoons, which is generated as a result of fire accident at CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam.

Plate – 8: Oily sludge stored in the lagoons, which is generated as a result of fire accident at CDU – III, M/s HPCL (Visakh Refinery), Visakhapatnam.