39

Dr Rajesh Kumar, IPS
Member Secretary

West Bengal Pollution Control Board
(Department of Environment,
Government of West Bengal)

Memo No 21/3L/WPB-H(III)/2021 Dated: 30/01/2023

To
The Registrar General,
National Green Tribunal,
Faridkot House,
Copernicus House,
New Delhi – 110001.

Sub: Report of the Committee constitute by the Hon'ble National Green Tribunal, Principal Bench, New Delhi.
Ref: O.A. NO. 440/2021/PB (News Item Published in Economic Times dt. 21.12.2021 titled "3 dead, 44 injured in flash fire at IOC's Haldia Refinery")

Sir,

Enclosed please find copy of the report of the Committee along with all the annexures, which speaks for itself.

Mrs. Madhumita Bhattacharjee, Ld. Advocate-on-Record, Supreme Court has been appointed by the State Board for any further action.

This is for your kind perusal and necessary action.

Yours faithfully,

Enclo. As stated above

Sd/-
Member Secretary
West Bengal Pollution Control Board

Memo No 21/3L/WPB-H(III)/2021 Dated: 30/01/2023

Copy forwarded to :
Mrs. Madhumita Bhattacharjee, Advocate-On-Record, Supreme Court – For information and necessary action. She is hereby requested to take all necessary steps in this regard.

Ld. R. Cr. 06.02.2023 con. (D)

NATIONAL GREEN TRIBUNAL
Principal Bench, New Delhi
Receipt & Issue Branch
Received
06 FEB 2023
593
Dairy No.....

Member Secretary
West Bengal Pollution Control Board

Paribesh Bhawan, Bldg. 10A, Block LA, Sector III, Salt Lake, Kolkata 700 106
Tel: 2335-8213, *Fax:* 2335 2813/6730, Email: ms.wbpcb-wb@bangla.gov.in, Website: www.wbpcb.gov.in

74/23/Judl. 07/02/23

123/RG/PAK 06/02/2023

OA 440/21 Pl Partculars

40

Dr Rajesh Kumar, IPS
Member Secretary

West Bengal Pollution Control Board
(Department of Environment,
Government of West Bengal)

Memo No 21/3L/WPB-H(III)/2021 Dated: 30/01/2023

To
The Registrar General,
National Green Tribunal,
Faridkot House,
Copernicus House,
New Delhi – 110001.

Sub: Report of the Committee constitute by the Hon'ble National Green Tribunal, Principal Bench, New Delhi.
Ref: O.A. NO. 440/2021/PB (News Item Published in Economic Times dt. 21.12.2021 titled "3 dead, 44 injured in flash fire at IOC's Haldia Refinery")

Sir,

Enclosed please find copy of the report of the Committee along with all the annexures, which speaks for itself.

Mrs. Madhumita Bhattacharjee, Ld. Advocate-on-Record, Supreme Court has been appointed by the State Board for any further action.

This is for your kind perusal and necessary action.

Yours faithfully,

Enclo. As stated above

31/1/2023

Member Secretary
West Bengal Pollution Control Board

Inspection Report

In the matter OA 440/2021/PB "In re: News item published in Economic Times dt 21/12/2021 titled 3 dead, 44 injured in flash fire at IOC's Haldia Refinery"

Hon'ble NGT, in the matter OA 440/2021/PB, directed "constitution of a joint Committee comprising CPCB, State PCB and District Magistrate. The joint Committee may meet within two weeks and undertake visit to the site and interact with the stake holders. It may identify measures required to be taken for compliance of law, including compensation for the victims and for damage to environment, if any and to identify measures for preventing such incident in future. The Committee may also consider reports of industrial accidents in recent past on directions of this Tribunal which are available on the website of CPCB. The State PCB will be the Nodal Agency for coordination and compliance".

Accordingly, following Officials are deputed from the said Departments

1. Dr Prasun Kumar Mondal, Assistant Environmental Engineer & In-Charge, Haldia Regional Office, WBPCB
2. Mr Shantanu Das, Officer in Charge, Disaster Management, Purba Medinipur
3. Mr Sandeep Roy, Sc D, CPCB, Kolkata

The committee had its 1st Meeting at District Magistrate Office, Purba Medinipur on 21st February, 2022 which is attended by concerned Officials. During the meeting the cause of Incident and information available with individual department was discussed and further Inspection was carried out on 25th February, 2022.

During inspection following Officials were present from M/s IOCL, Haldia Refinery, Haldia, Purba Medinipur

1. Mr Partha Ghosh, Executive Director
2. Mr Praveen Jayant, General Manager, TS & HSE
3. Mr I Daniel Raj, Dy. General Manager, HSE
4. Ms J Behera, Sr. Mgr., HSE

The committee inspected the site of the said industry on 25th February 2022 and observed that the Motor Spirit Quality (MSQ) unit, where the incident took place, was not in operation. The committee requested the M/s IOCL to provide necessary documents of compensation paid to the victims, fugitive analyses reports and process safety management for scrutiny as per direction of the Hon'ble NGT.

M/s IOCL engaged a private laboratory to conduct fugitive analyses at different equipments. Most of the fugitive analyses were carried out at pump's suction & discharge valves, their flanges, pressure gauges and seals. In 99.9% cases, values of analyses showed 0 ppm. Very few fugitive analyses were performed at some heat exchangers. Results show that analyses were carried out at suction & discharge valves, their flanges, pressure gauges and seals of heat exchangers and in all cases, results were reported to be 0 ppm. But suction point, discharge point and seal of a heat exchanger are meaningless. However, fugitive emission monitoring was not performed to any other equipment in the industry. The above mentioned fugitive emissions were carried out on yearly basis employing same private laboratory year after year. As per the Ministry of Environment and Forests notification vide G.S.R. 186(E) dt. 18.03.2008, fugitive emission as well as LDAR are to be checked at:

Block valve, control valve, compressor seals, pressure relief valves, pipe flanges and pipe connections along with the above mentioned points which the industry was monitoring.

The industry was not able to show LDAR test data. The industry is reluctant about measuring of fugitive emission of different equipments.

During investigation of major fire incident to the unit on 21.12.21, Oil Industry Safety Directorate (OISD) pointed out that there was blockage at inlet flange of stabilizer reboiler of MSQ section of the unit. Opening of inlet flange of stabilizer reboiler caused naphtha to come out along with flushing water results fire by source of ignition of gas cutting job in the vicinity. In this case, hydrocarbon sensors were either not installed or were non-functional there during such operation.

When process operation of the unit was running, blockage of any line or equipment was being reflected through DCS as well as field sensors for improper level or temperature or flow rate of that part of the equipment. During shut down job of the unit, the said blockage portion of the equipment is to be supervised properly through DCS monitoring as well as through field monitoring during water flushing.

A series of fire incidents occurred during December 2021 such as (i) on 15.12.21 at Fluidized Catalytic Cracking (FCC) unit, (ii) on 19.12.21 between MSQ and FCC units and (iii) on 20.12.21 for naphtha dripping from Stabilizer column. All these incidents occurred just before the major fire incident happened on 21.12.21 indicating the reluctance of the industry about hazard and consequence of fire incident leading to casualties.

During inspection of the committee on 25th February, 2022, two nos. Effluent Treatment Plant (ETP) of the industry were found running with wastewater treatment of 450-500 m^3/hr (plant capacity 600 m^3/hr) and 600-620 m^3/hr (plant capacity 650 m^3/hr). Surface drain lines at four sides surrounding MSQ section, was found to carry water with traces of oil floating. The industry has 2 nos. guard pond where oil contaminated storm water was being collected for treatment at ETP. One guard pond was found empty and the other one contained wastewater for treatment. WBPCB collected wastewater samples from individual outlet of two ETPs and final industry outlet for analyses on 10th February, 2022 and results in the three cases show compliance for BOD, COD and O & G as per environmental discharge standard of oil refinery industry. Analyses results of ambient air quality monitoring stations of WBPCB installed at different locations of Haldia show no remarkable increase in concentrations of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 during the period from 21st December, 2021 to 31st December, 2021. Therefore, no damage to environment for the fire incident of the industry on 21st December, 2021, was observed during inspection.

M/s IOCL confirms that the industry follows process safety management as per OISD standards and guidelines for petroleum refinery.

M/s IOCL awarded the work order to M/s Shilpi Engg. Pvt. Ltd. for maintenance work of the MSQ Section during its shut down period. During visit, committee also interacted with M/s Shilpi Engg. Pvt. Ltd. and as informed, all the laborer engaged in the maintenance work were having minimum 4-10 yrs of experience in similar field. They were given proper training for safe field work. M/s IOCL also organizes the training on regular basis for Permanent & Contract Workers.

Due to flash fire incident, total 5 nos. causalities occurred from Contract Labor. Following may be considered as compensation amount to their Dependent family members for satisfactory living:

Name of deceased	Age (Yrs)	Salary per month	Salary after deduction	Future Prospect	Loss of monthly income to the dependents	Annual Income	Loss of future income	Expenses for shifting mortal remains and loss of estate & funeral expenses	Loss of love and affection	Hon'ble Supreme court Judgement in civil appeal no.6339 of 2019 and civil appeal no. 3483 of 2008 compensation (in INR)
		A	B	C	D^T = 50% of (B+C)	E=DX12	F#ExM	G	H	I=F+G+H
Late Pargat Singh	38	22490	22490	8996	15743	188916	2833740	100000	200000	3133740
Late Shamsad Ali	33	22490	22490	8996	15743	188916	3022656	100000	200000	3322656
Late Sarabjit Singh	28	22490	22490	8996	15743	188916	3211572	100000	200000	3511572
Late Lal Babu Mahato	37	22490	22490	8996	15743	188916	2833740	100000	200000	3133740
Late Kulfeep Singh	37	22490	22490	8996	15743	188916	2833740	100000	200000	3133740

 # - depending on the age, the factor (M) is fixed. 17 for age group 25-30, 16 for age group 31-35, 15 for age group 36-40 and 14 for age group 41-45.

Status of regulatory compliances:

Sl No.	Particular	Status
1	Consent to Operate - CTO	Valid till: 31.05.2024
2	Hazardous Waste Authorization	Valid till: 31.12.2025
3	Public Liability Insurance	Valid till: 31.03.2022

Recommendation:

1. Fugitive emissions of the industry were carried out on yearly basis employing same private laboratory year after year. Most of the fugitive analyses were monitored at pump's suction & discharge valves, their flanges, pressure gauges and seals and in some cases heat exchanger's suction & discharge valves, their flanges, pressure gauges and seals. In 99.9% cases, values of analyses showed 0 ppm. But suction point, discharge point and seal of a heat exchanger are meaningless.

   As per the Ministry of Environment and Forests notification vide G.S.R. 186(E) dt. 18.03.2008, fugitive emission as well as LDAR are to be checked at:

   Block valve, control valve, compressor seals, pressure relief valves, pipe flanges and pipe connections along with the above mentioned points which the industry was monitoring.

   The industry was not able to show LDAR test data. The industry is reluctant about measuring of fugitive emission of different equipments.

2. When process operation of the unit was running, blockage of any line or equipment was being reflected through DCS as well as field sensors for improper level or temperature or flow rate of that part of the equipment. During shut down job of the unit, the said blockage portion of the equipment is to be supervised properly through DCS monitoring as well as through field monitoring during water flushing.

3. Hydrocarbon sensors already installed at different locations of the industry probably were not able to sense the leakage of hydrocarbon. Hence, modernized sensors may be installed after proper checking so as to ensure such incidents do not occur in future.

4. After occurrence of a series of fire incidents (i) on 15.12.21 at Fluidized Catalytic Cracking (FCC) unit, (ii) on 19.12.21 between MSQ and FCC units and (iii) on 20.12.21 for naphtha dripping from Stabilizer column just before the major fire incident happened on 21.12.21 indicating the reluctance of the industry about hazard and consequence of fire incident leading to casualties.

5. No damage to environment for the fire incident of the industry on 21st December, 2021, was observed during inspection.

6. The industry was following process safety management as per OISD standards and guidelines for petroleum refinery.

7. For 5 Nos. of causalities in total for fire incident on 21st December, 2021, compensation amount to their Dependent family members for satisfactory living is recommended through calculation.

8. Different process sections of the industry was installed in close proximity to each other, therefore any small fire incident of one section may spread out rapidly within its surrounding sections resulting a massive disaster to the locality.

9. As per recommendation of OIDS, MSQ block units comprising Prime-g unit, isomerization unit, naphtha hydrotreating unit and vacuum distillation unit -II, were not meeting the inter distance requirement and their shut down are to be taken simultaneously as single block.

13/04/2022

Mr Shantanu Das
Officer in Charge, Disaster Management, Purba Medinipur

Mr Sandeep Roy
Sc D, CPCB, Kolkata

Prasun Kr. Mondal

Dr Prasun Kumar Mondal,
Assistant Environmental Engineer & In-Charge, Haldia Regional Office, WBPCB

तेल उद्योग सुरक्षा निदेशालय
OIL INDUSTRY SAFETY DIRECTORATE
ISO 9001:2015 certified

आज़ादी का अमृत महोत्सव

भारत सरकार, पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
8वां तल, टॉवर–ए, ओ.आई.डी.बी. भवन,
प्लॉट नं. 2, सैक्टर–73, नोएडा–201301
Government of India, Ministry of Petroleum & Natural Gas
8th Floor, Tower-A, OIDB Bhawan
Plot No. 2, Sector-73, NOIDA - 201301
दूरभाष/Tel. : +91-120-2593800
वेबसाइट/Website : www.oisd.gov.in

No: OISD/ EDS/ ACCI-05

21.02.2022

To
The Chairman
Indian Oil Corporation Limited,
3079/3, Sadiq Nagar,
J.B. Tito Marg,
New Delhi-110049

SUB: INVESTIGATION COMMITTEE REPORT ON FIRE INCIDENT AT MSQ BLOCK UNIT OF IOCL HALDIA REFINERY ON 21.12.2022

Dear Sir,

As per information received from IOCL, Haldia Refinery (IOCL-HR), an incident of fire took place at around 14:50 hrs on 21st December, 2021 at the MSQ unit of Refinery. The fire was extinguished in about 15 minutes duration. The incident caused injuries to 44 nos. of personnel, out of which 05 nos. succumbed to their injuries. There was damage of material at the incident site.

Vide letter ref. OISD/EDS/ACCI/05 dt. 22.12.2021 a committee comprising of members from OISD and PNGRB was constituted to investigate the incident. The committee visited plant on 23.12.2021 to 24.12.2021 to investigate the incident.

The primary cause of incident was inadequate flushing of the Reboiler circuit and lack of site supervision by IOCL during execution of non-routine activities. Final checking for ensuring 'nil' hydrocarbon presence at reboiler bottom was not carried out properly. So, after the bottom flange of Stabilizer Re-boiler inlet line was opened for blanking job, Naphtha from inside the re-boiler started spilling out, which subsequently caught fire possibly from the nearby other hot job activity or the non-sparking tools used for blanking job.

Following are some of the major recommendations emerging out of the incident as noted by the investigating team:

- Proper purging of the Hydrocarbon circuits, equipment before undertaking any M&I related activities is an extremely critical step in any Refinery process unit. Adequacy of Standard Operating Procedure (SOPs) for flushing to be reviewed to ensure incorporation of equipment wise flushing plan and to include physical checking/ verification to confirm that system has been made hydrocarbon free.
- Maintenance crew engaged for various shutdown jobs to be properly made aware and sensitized (through supervisory control, tool box talks etc.) about the potential job hazards, Do's & Don'ts in case of any unforeseen abnormal condition like oil/ gas leakage in and around the job site.

- Adequate numbers of Safety supervisors shall be ensured all the time during the shutdown/ start-up activities of the units. Critical non-routine activities to be carried out under close supervision by Contractor supervisor and company personnel.
- Deployment of skilled manpower suitable for the respective job and commensurate with contract condition to be ensured. It is suggested to include suitable clauses in the shut-down tender document to ensure that only qualified and experienced workman are entering into refinery premises for shutdown job.
- OWS and CBD drain lines of equipment are to be always maintained de-choked/ operational to facilitate proper draining during steaming & flushing and ensuring positive confirmation that all hydrocarbons are drained.
- A multidisciplinary team (MDT) should be constituted to carry out surprise checks during shutdown activities, to identify the unsafe acts and unsafe conditions. Due diligence to be accorded for review/ analysis of unsafe acts/ conditions reported by MDT, fire & safety and operational personnel to take immediate corrective action.
- There may be some instance where CCTV cameras and HC Gas monitoring system (GMS) may not be available to cover critical maintenance activities. To take care of such instance, IOCL to explore the feasibility of providing portable CCTV camera and GMS sensor.

Detailed report of the investigation carried out by the investigation team is enclosed herewith.

Compliance of the recommendations given in the investigation committee report may please be sent to OISD at the earliest. We hope suitable instructions to this effect would be issued to all concerned.

Thanking you.

Yours sincerely,

21/02/2022

(Arun Mittal)
Executive Director

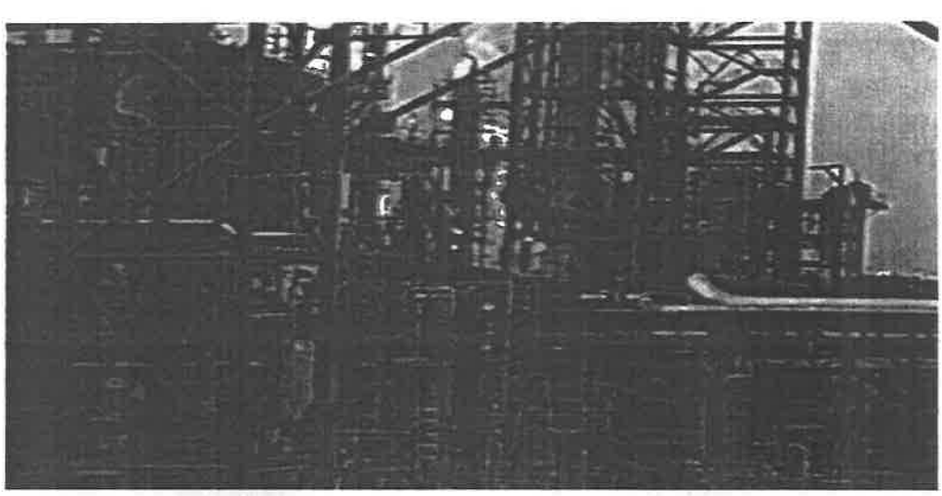
Encl.: Report of the Investigation team

---

cc: Joint Secretary (Refinery), MoP&NG, New Delhi: for kind information please.
cc: Member (Technical), PNGRB: for kind information please.

जांच समिति की रिपोर्ट
आग की घटना आई ओ सी एल, हल्दिया रिफाइनरी
घटना की तिथि 21st दिसम्बर, 2021

INVESTIGATION COMMITTEE REPORT
ON FIRE INCIDENT AT IOCL - HALDIA REFINERY
DATE OF INCIDENT: 21st DECEMBER, 2021



ISO 9001:2015 certified

PNGRB

तेल उद्योग सुरक्षा निदेशालय
OIL INDUSTRY SAFETY DIRECTORATE
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय, भारत सरकार
Ministry of Petroleum and Natural Gas, Government of India
8 वीं मंजिल, ओआईडीबी भवन, प्लॉट संख्या 2, सेक्टर -73, नोएडा, उत्तर प्रदेश, 201301
8th Floor, OIDB Bhawan, Plot no. 2, Sector -73, Noida-201301 (U.P.)
वेबसाइट: www.oisd.gov.in / टेलीफोन: 0120-2593800
Website: www.oisd.gov.in / Tele: 0120-2593800

OIL INDUSTRY SAFETY DIRECTORATE

EDS: OISD: ACCI/ 06 **Dt: 14.02.2022**

Sub: INVESTIGATION COMMITTEE REPORT ON FIRE INCIDENT AT IOCL–HALDIA REFINERY ON 21.12.2021.

1.0 INTRODUCTION

MSQ units were under planned shutdown since 13.12.2021 and various shutdown jobs were being carried out after normal shutdown and hand over of the units to Maintenance.

Indian Oil Corporation Limited, Haldia Refinery (IOCL-HR) vide FIR dated 21.12.2021 (Ref. **Annexure-1**), informed that at around 14:50 hrs on 21st December 2021, a fire had occurred in the area of MSQ Block (Isomerization) of the Refinery while grating/ structure cutting job was being carried out in the first platform of Stabilizer area.

The fire was put-off by applying water by personnel working in the vicinity and subsequently by Firefighting crew. The duration of the fire was less than 15 minutes as per FIR copy received from IOCL-HR.

There were 3 fatalities and 44 injuries of contract personnel due to the incident as reported in the FIR. However, IOCL subsequently revised the casualty figure to 3 fatalities and 41 injuries. At the time of release of this report, total fatalities increased to 5. There was no injury to any of the IOCL personnel.

1.1 To investigate the incident, a committee comprising of the below mentioned officers was constituted by ED, OISD, vide letter ref. OISD/EDS/ACCI-05 dated 22/12/2021 (**Annexure-2**).

1. Shri Udit Nandi, CGM (Safety), HPCL- Visakh Refinery
2. Shri S Giridharan, GM (Maint.), BPCL- Kochi Refinery
3. Shri Jamunalal Rout, Dy. Director, PNGRB
4. Shri Harendra Kumar Yadav, Addl. Director (P&E), OISD

The terms of reference of the committee is as under:

- Investigate the incident
- Identify the lapses and root cause(s) of the incident;
- Recommend corrective action to avoid recurrence of such incidents.

2.0 INVESTIGATION MODALITIES

The committee members visited the incident site from 23rd to 24th December, 2021 and carried out the investigation following the below noted methodology:

- Visit to MSQ Plant.
- Visit to Field Room
- Visit to Main Control Room of MSQ Block.
- Visit to Fire Station
- Interaction with concerned stakeholders as mentioned below:

S. No.	Name of the Person	Designation	Company
1	Shri A Sanyal	CGM(TS&HSE)	IOCL
2	Shri D Dutta	CGM (T)	IOCL
3	Shri I. Daniel Raj	DGM (HSE)	IOCL
4	Shri Shubham Jain	AMPS (Technical Service)	IOCL
5	Shri Mridul Deka	ITM	IOCL
6	Shri Ashok Kumar Raghuvanshi	CMFS	IOCL
7	Shri Panner Selvam Ponnusamy	SPNE	IOCL
8	Shri Golap Thakuria	SPNE	IOCL
9	Shri Amit Binwal	SPNE	IOCL
10	Shri Shahrukh Husain Ansari	AMPN	IOCL
11	Shri K.S. Paul	DGM (PN)	IOCL
12	Shri S.M. Raut	SMFS	IOCL
13	Shri Jaydip Chattaraj	SMNM	IOCL
14	Shri Sreekuttan M.S	AMFS	IOCL
15	Shri Neelabh Gupta	SF & SO	IOCL
16	Shri Saurabh Mukherjee	SPNM	IOCL
17	Shri Samaresh Biswas	MNMEL	IOCL
18	Shri Mulakala Venkata Niranjan	AM (Mechanical Manager)	IOCL
19	Shri Himagna Sen	AM-ML (Mechanical Maintenance)	IOCL

S. No.	Name of the Person	Designation	Company
20	Shri Naveen Kumar	SIPM	IOCL
21	Shri Mukesh	FO (Field Operator)	IOCL
22	Shri Ankit Chaturvedi	FO (Field Operator)	IOCL
23	Shri Susanta Das	FO (Field Operator)	IOCL
24	Shri Kanak Kanti Sahoo	FO (Field Operator)	IOCL
25	Shri Krishnanand Kharwal	FO (Field Operator)	IOCL
26	Shri Saroj Dey	FO (Field Operator)	IOCL
27	Shri Rangan Datta	FO (Field Operator)	IOCL
28	Shri Ranjit Pratap Singh	FO (Field Operator)	IOCL
28	Shri Devendra Dhar Dwivedi	FO (Field Operator)	IOCL
29	Shri MD. Mahasin Khan	FO (Field Operator)	IOCL
30	Shri Rajib Kuiti	FO (Field Operator)	IOCL
31	Shri Sanjoy Mandal	FO (Field Operator)	IOCL
32	Shri Daruknath Mandal	FO (Field Operator)	IOCL
33	Shri Dipanjan Mal	FO (Field Operator)	IOCL
34	Shri Sanjay Sahai	Site Incharge	M/s Shilpi
35	Shri Konshik Gole	Project Manager	M/s Shilpi
36	Shri Zanaklal	Safety Officer	M/s Shilpi
37	Shri Rishin Raj	Supervisor	M/s Shilpi

Note: *Injured personnel could not be contacted for interaction as all were under treatment at Kolkata.*

- Review of documents viz. DCS logbooks/ Field logbooks/ maintenance register/ Work permits/ registers in the control room/ Operating manuals/ F&S logbook/ Contract document/ SOPs.
- Review of CCTV footage from camera DHDS-508, DHDS-509, DHDS-510, DHDS-701, DHDS-515 etc.
- Review of IOCL's internal investigation report findings.

3.0 BACKGROUND

Haldia Refinery is situated on the banks of river Hoogly in the Haldia town of East Midnapore District in West Bengal and is about 130 km from Kolkata by road. It is a combination of both fuel and lube refinery. Apart from normal fuel distillates like, LPG (Liquefied Petroleum Gas), MS (Motor Spirit), ATF (Aviation Turbine Fuel), Kerosene, Diesel etc., the refinery also produces various grades of Lube Oil Base Stocks (LOBS) for production of different grades of lubricating oils.

Refinery was commissioned in the year 1975 with a crude processing capacity of 2.5 MMTPA. The LOBS production facility was commissioned in 1977. With time, the refinery has been revamped in phases to the present capacity of 8.0 MMTPA. The Refinery processes approx. 70% high Sulphur and 30% low Sulphur crude.

The MSQ block comprising of the NHT (unit no. 85), ISOM (Unit 86), Prime G (unit no. 87) was commissioned in year 2005 and Prime-G was revamped in 2019 for BS-VI projects. Last turnaround of the MSQ Units was taken in November 2017.

The manning of MSQ units on the day of the incident was as given below: - .

	Normal Manning	Manning on 21.12.2021
Field operator (JEA)	4	7
Panel	1	1
Shift In-charge (SIC)	1	2 *
Contract personnel		Approx. 340

** Two Production officer deployed in shift; Single SIC not designated .*

4.0 INCIDENT DESCRIPTION AND CHRONOLOGY OF EVENTS

MSQ block comprises of VDU-II, Prime-G, Isomerization and NHT units. These units were having the planned shutdown as below:

Unit	Shut down duration
NHT	24 days (13th Dec – 5th Jan 2022)
ISOM	24 days (13th Dec – 5th Jan 2022)
Prime-G	52 days (1st Dec – 21th Jan 2022)
VDU-2	4 days (13th Dec – 16th Dec 2021)

Isomerization unit shut down activities were going on since 13.12.2021 as per the shutdown work plan along with other units of the MSQ block. As per IOCL-HR:-

a. The ISOM unit was (including the Stabilizer column, 86-C-01 circuits) made hydrocarbon free by N2 purging, water flushing and steam purging.

b. Stabilizer column (86-C-01) was blinded on 20.12.2021. On 21.12.2021, stabilizer reboiler (86-E-06) inlet flanges were being opened to facilitate blinding for hydrotest of reboiler inlet circuit as one of the shutdown jobs. (Refer Fig. 1).

c. During the flange opening activity of Reboiler inlet line, Naphtha along with water started coming out through the opening.

d. At 14:50 hrs, there was an explosion followed by fire on the first floor of Unit 86 (ISOM) at the Stabilzer column area; Fire continued for less than 15 minutes as per FIR intimation by IOCL-HR.

   Fire call was received from MCP 609 and simultaneously message was received on a walkie-talkie regarding fire in MSQ unit. Subsequently fire call received from MCP 640, 610, 625, 611, 620, 612, 606, 751, 736, 622 and 644.

e. Initial fire fighting activities started with water spray from nearby ground monitors and fire hydrants by contractor personnel. Fire tender-1 from the main fire station and Fire tender-4 from the satellite fire station reached the site and responded in fire fighting activities.

f. Simultaneously rescue operation was started and casualties were shifted to Occupational Health Centre for first aid by ambulance and other available vehicles. Subsequently injured were shifted to Hospitals at Kolkata.

g. Shutdown manpower from the surrounding areas were evacuated and affected area was cordoned off.

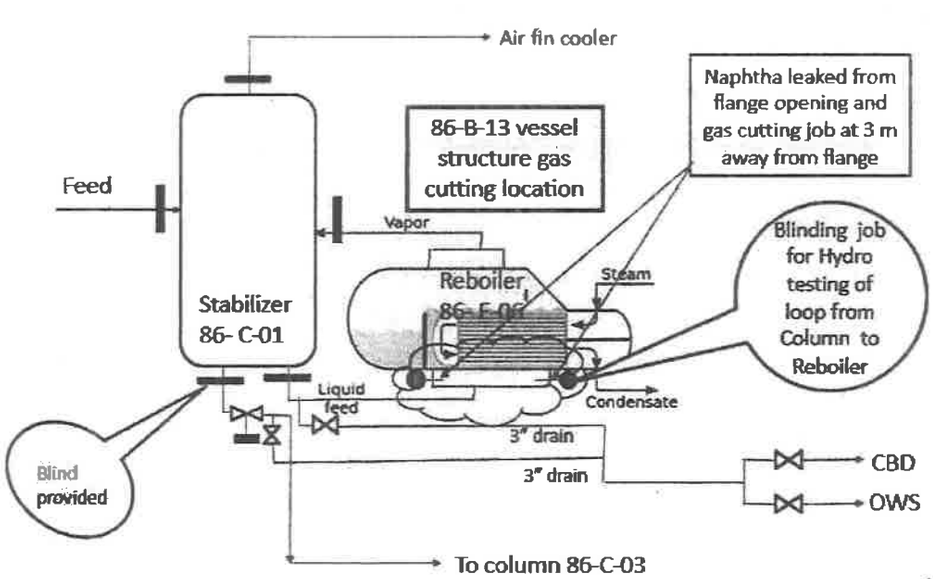


Fig.1 (Site activities being carried out on the day at the time of incident)

5.0 Scene of Accident as noted during investigation team's visit to site:

1) At the time of site visit, it was observed that no activities were going on as PESO has given order not to carry out any job in the unit.

2) CISF had cordoned off the unit and all personnel entry to the unit were being recorded in a register.

3) Stabilizer column (86-C-01) shell flanges including reboiler inlet and outlet lines were noted in blinded condition.

4) Considerable material damage at incident site was noticed as can be seen from the photographs below. It was observed that the anchoring hooks of safety belt of the deceased along with tools and tackles (wrench, spanner, hammer etc.) were found still present at site. Tools and tackles were found to be of normal metallic design (i.e. not of 'Non sparking' type).

Safety belt anchor of deseased personnel

5) Details of deceased and injured personnel is given in the Annexure-3.

6.0 Observations by investigation committee:

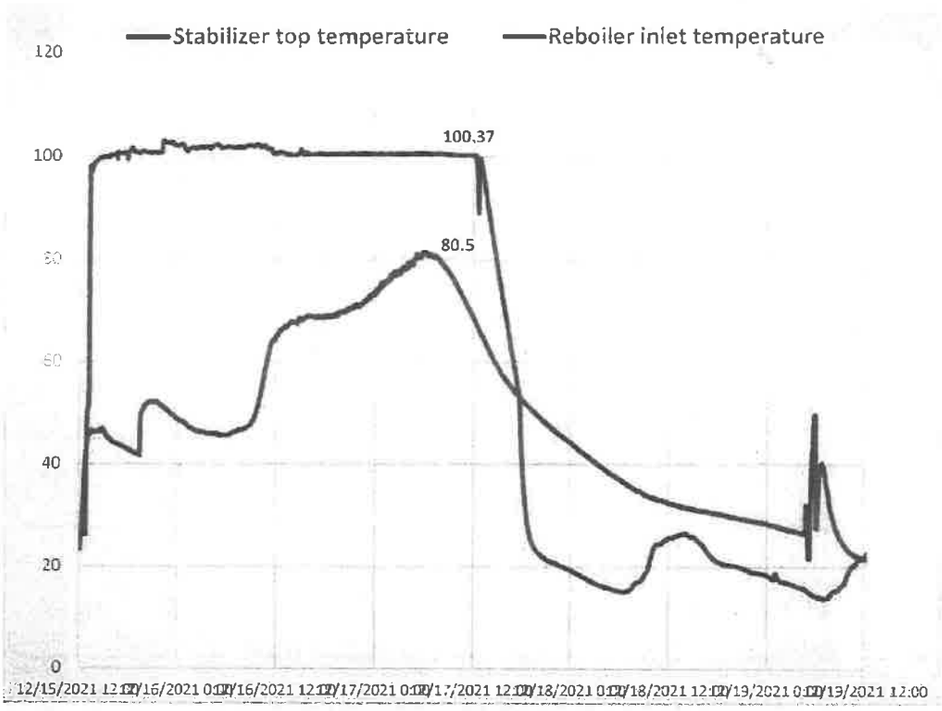
6.1 Observations based on DCS trends (Ref. Annexure-4) and CCTV footages

1) Isomerization unit feed was reduced at 2200 hrs. on 12.12.2021 and feed cut out was done at 00:00 hrs on 13.12.2021.

2) Steaming of Stabilizer column (86-C-01) was carried out from 15.12.2021 (12:45 hrs.) to 17.12.2021 (12:55 hrs.) as per DCS history data (Ref. stabilizer top temperature 86TI0614-PV).

3) Column 86-C-01 bottom level remained low between 13.12.2021 to 19.12.2021 in the range of 4 – 5%. On 19.12.2021 level increased to 104% at 13:50 hrs. and again came down to 0% at 16:35 hrs.

4) Reboiler 86-E-06 inlet temperature reached maximum of 81°C (TI-0616 tag) on 17.12.2021 during the steam purging phase. It is inferred that reboiler circuit did not get steam purged adequately.

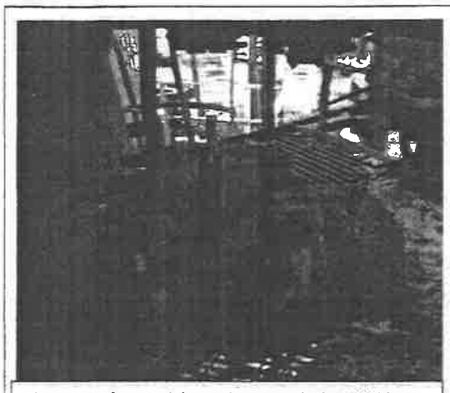


5) It was noted that for the sequence of events of the said incident, there was difference w.r.t. timing (varying between days/ minutes) amongst the time record of DCS clock, CCTV footages, alarm server time.

6) On 24.12.2021, in presence of investigating team and IOCL internal investigation team, water was poured in the reboiler vapour return line by opening a thermo-well flange (86TI0604). Naphtha was observed coming out from the reboiler inlet flanges at reboiler bottom (which were in open condition).

   Sample was collected and sent to laboratory for testing; Same was found to be having Light Naphtha properties (IBP 52°C / FBP 75°C).

   During these activities, reboiler and stabilizer column common drain line was found choked. This observation indicated that naphtha was still remaining inside the reboiler vessel/ circuit, although steaming / N2 purging activities had been done as per shutdown procedure.



Flange joint from Stabilizer column to reboiler with blank, Referred in 4.0b)

Reboiler inlet flange: Gap created by opening the bolts, Referred flange in para 6.1.6)

7) From alarm summary, it was observed that HC gas detector 82006AI0301A got activated for high-high alarm at 13:10:27 hrs. on 21.12.2021. IOCL should ensure that all the critical alarms are given due attention and necessary actions/ checking of root cause for such alarms are addressed accordingly.

8) On CCTV camera (tag no. DHDS-515), record was not available after about 14:00 hrs. As stated by Instrumentation department, subject CCTV outage was due to non-availability of power; This was in contradiction with the statement of the Electrical Maintenance department that additional power source was provided before UPS outage and UPS was also handed over to Instrumentation at 05:30 hrs on 21.12.2021). IOCL-HR may review the fact.

9) No historical trend was available for the HC detectors (86-AE-1003, 86-AI-0701 near pump 86-PM-06B) in DCS system. All the gas detector should have historical trend.

6.2 Observations based on the interaction with personnel:

1) The committee was informed during site visit that 14:00 hrs was the operator shift change-over time. Seven field operators were deployed in each shift in the MSQ plant during M&I. On the incident day of 21st December 2021, 3 nos. of field operators were continued in the evening shift and rest four operators were to be relieved.

2) On that day (i.e. 21/12/2021), a mock drill was conducted from around 11:00 to 14:15 hrs in another refinery process unit SRU; Accordingly, vehicles entry to the refinery was restricted resulting in delay in arrival of four Evening Shift operators for change-over. However, during interactions, it was revealed that 4 field operators of the morning shift left the plant prior to arrival of their relievers

9040CL21075294 for flange opening of the stabilizer reboiler but the Production engineers stated in contradiction. The fact could not be established as the file containing the clearance was found burnt in the incident. It was informed that during M&I, as the volume of jobs were higher than usual, daily clearance in work permits were given manually without maintaining any record of list of clearances issued.

7) All the witnesses have informed and CCTV footage of DHDS-508 camera has confirmed that there was an explosion followed by fire. The intensity of explosion was felt even at 100 m away.

8) It was noted that operation of the incident control room was not activated subsequent to the subject emergency. IOCL stated that emergency control room was not activated as fire was less than 15 minutes. However, the incident involved an explosion followed by fire and as per IOCL-HR ERDMP chapter 10.1e. (Major Disaster Scenarios), fire & explosion in unit area is categorized as Level-2. The organization's emergency protocol should be put into action from the initial stages as per chapter 16 of ERDMP.

6.3 Additional / other observations and Analysis related to the Incident

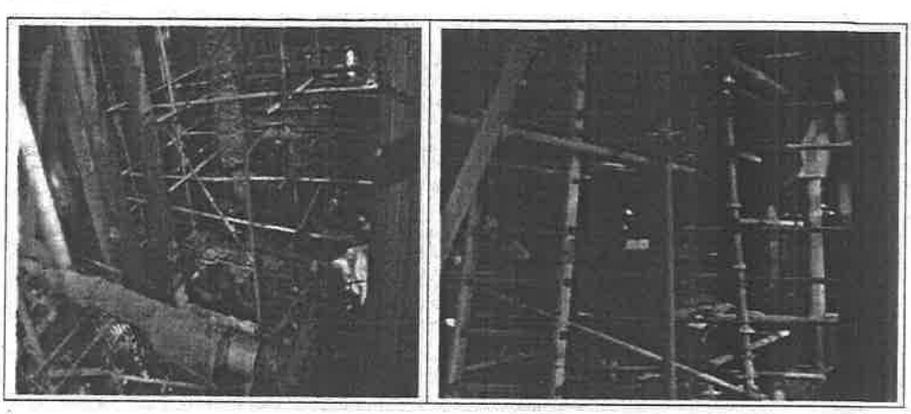
The committee noted the following additional relevant information based on site visit (23rd & 24th December-2021), discussion and analysis of various records/ documents: -

1) The chlorine guard bed (86-B-13) grating, adjacent to the incident area, was being cut for removal of the vessel from the Isomerization Unit; This activity was already in progress when the parallel job of blinding of Stabilizer Reboiler bottom was started on 21.12.2021;

2) Refinery could not produce approval of the statutory authority (PESO) for removal of the chlorine guard, which is essential for any change of Layout as per Petroleum Rules 2002.

3) It was also observed that the MSQ block units (namely Prime-G unit, Isomerization Unit, NHT unit, VDU-II) were not meeting the inter distance requirement as per OISD-STD-118 Table-1; So these units are to be considered as single block and their shutdown to be taken simultaneously as per clause 5.1 c) of OISD-STD-118. However, this philosophy was not followed in the current shutdown. The Prime-G unit was shut down for M&I on 1st December 2021 whereas the Isomerization unit and the adjacent VDU-II were operating till 12th December 2021. This is also a violation of commissioning permission issued by statutory authority (PESO) and OISD-STD-118 Table-1.

4) ISOM unit was observed to be congested with scaffolding without having proper escape routes for the large numbers of contract workmen deployed in the unit for maintenance activities. The Operation, Maintenance and Fire & Safety team should have carried out the Hazard Identification and Risk Assessment (HIRA) for such high number of manpower deployed in the unit. The job scheduling should commensurate with the available space for working and escape provisions.



5) During interaction, it was revealed that due to level-III mock drill in the morning shift (as noted in para 6.2.2), the jobs were stopped for about 3 hrs; So more people were there in the second shift to finish the scheduled jobs for the day. The casualty/ injury might have been less if proper job scheduling was done, thereby staggering the manpower deployment.

6) It was observed on 23.12.2021 by investigation team that in VDU-2, hot job (Hot permit no. 9040H2113262) was going on for carrying out welding job at height without proper booth (enclosure); Also, some personnel were found not wearing the boiler suit / apron.

7) Column 86-C-01 & 86-C-03 overhead AFCs (86EA01, 86EA 02 A/B) have not been provided with water sprinkler system. As per OISD-STD-116 clause no. 4.2.5, AFCs in hydrocarbon service located above pipe racks / elevated location shall be provided with water sprinkler system.

8) During visit to the MSQ operator room, the Log book was checked and it was noticed that neither the Shift-in-charge nor the Operators had signed in the log sheet. IOCL senior officers should be involved in cross checking.

9) From the list of injured personnel, it is observed that 50% of the workers were in the twenties (lowest age being 19 yrs.). Also, two safety supervisors for 340

contract personnel appeared to be low. Experience criteria of these workers and number of safety supervisors need a thorough review.

10) As per the Work Order no. 27152457 for shutdown activities of MSQ units; skilled manpower shall be verified by Engineer-in-charge before deployment on the job. Minimum one Safety-in-charge and two safety supervisors to be provided in each shift by the Contractor. No job specific PPEs was mentioned in the work order.

11) The total casualty reported in FIR was 47 (fatality-3 & injured 44) , the same reported in ERDMP Schedule-VI (Incident Reporting Format) was 41 (fatality-3 & injured 38) and IOCL-HR subsequently corrected the total casualty to 44 (fatality-3 & injured 41). IOCL-HR could not produce the name of the three injured workmen who were released on the same day after preliminary treatment.

12) Two production engineers were deployed in each shift during M&I of MSQ unit. However, none of them were designated as Shift-in-charge of the unit. In absence of identified in-charge of shift, it was difficult to ensure proper emergency command and control especially during odd hours.

7.0 PROBABLE REASONS OF FAILURE / ROOT CAUSE

1) Inadequate flushing of the Reboiler circuit and lack of site supervision by IOCL during execution of non-routine activities were the primary cause of incident. Final checking for ensuring 'nil' hydrocarbon presence at reboiler bottom was not carried out properly.

2) Inadequate risk awareness/ sensitization among the contract workmen/ IOCL employees contributed to the incident. As soon as Naphtha started spilling out from the reboiler bottom flange, concerned personnel could have alerted all people in the vicinity (particularly the ones involved in grating cutting job of chlorine guard vessel).

3) Due diligence w.r.t. suitable action against early sign/ unsafe condition was not displayed after noticing the Naphtha leak from 86-C-01 feed inlet blinding shell flange on 20th December 2021 at 10:30 hrs for making the stabilizer bottom circuits hydrocarbon free.

JKyadav

8.0 CONCLUSION

1) Based on the observations and discussions noted above, it is concluded that source of fuel for the fire was the spilled out residual Naphtha present in the reboiler (86-E-06) and connected piping during opening of reboiler inlet flanges while carrying out the blinding activity.

2) The source of ignition most likely was from (a) the hot job going on in the vicinity (gas cutting job of grating for removal of chlorine guard 86-B-8) or (b) spark generated due to use of normal metallic tools.

9.0 RECOMMENDATIONS

Based on the findings, the committee hereby proposes the following recommendations:

1. Adequacy of Standard Operating Procedure (SOPs) for flushing to be reviewed to ensure incorporation of equipment wise flushing plan and to include physical checking/ verification to confirm system is hydrocarbon free.
2. Hazard Identification and Risk Assessment (HIRA) shall be conducted by Operation, Maintenance and Fire & Safety team before start of non-routine activities.
3. Maintenance crew engaged for various shutdown jobs to be properly made aware (through supervisory control, tool box talks etc.) about the potential job hazards, Do's & Don'ts in case of any unforeseen abnormal condition like oil/ gas leakage in and around the job site. They should be sensitized about their individual role as a `Safety watchdog' for protection of self and others in the vicinity of work.
4. Deployment of skilled manpower suitable for the respective job and commensurate with contract condition to be ensured. It is suggested to include suitable clauses in the shut-down tender document to ensure that only qualified and experienced workman are entering into refinery premises for shutdown job.
5. In line with OISD-STD-155, it is recommended that IOCL shall carry out hazard and risk assessment and develop a PPE policy. Fire retardant/ flame resistant coverall shall be included as mandatory PPE in the policy based on risk assessment.

   Implementation of PPE policy should also be ensured for contractor's workforce, through incorporation of suitable requirements in the tender/ contract.
6. OWS and CBD drain lines of equipment are to be always maintained de-choked/ operational to facilitate proper draining during steaming & flushing and ensuring positive confirmation that all hydrocarbons are drained.

7. Sufficient numbers of Safety supervisors shall be ensured all the time during the shutdown/ start-up activities of the units. Critical non-routine activities shall be carried out under supervision by IOCL along with fire watch assistance.
8. A multidisciplinary team (MDT) should be constituted to carry out the surprise checks during shutdown activities, to identify the unsafe acts and unsafe conditions. Due diligence to be accorded for review/ analysis of unsafe acts/ conditions reported by MDT, fire & safety team and operational personnel to take immediate corrective action.
9. Availability of CCTV cameras installed at all units to be reviewed and suitably augmented (if required) to record the critical site activities. Use of Artificial Intelligence (AI) equipped CCTV system may be explored, so that there is auto-orientation of the cameras towards the site of abnormality/ Fire.
10. There may be some instance where CCTV cameras and HC Gas monitoring system (GMS) may not be available to cover critical maintenance activities. To take care of such instance, IOCL to explore the feasibility of providing portable CCTV camera and GMS sensor.
11. Date/ time difference between alarm server, DCS system, CCTVs to be rectified and all time to be synchronized to a master clock (GPS time synchronization) to facilitate accurate interpretation of the recorded data.
12. Man-to-man relieving in the unit to be ensured for proper handover and takeover of duties.
13. Logging, entry of daily activities and sequence of operation performed in respective areas for all critical activities are to be ensured in the log book. Logbooks shall be reviewed and countersigned by the role holder officers on daily basis.
14. Scaffolding of erection for shut down unit shall be reviewed for easy access and escape route. Number of simultaneous activities to be regulated based on the site condition/ congestion.
15. Prior approval of the statutory authority (PESO) shall be taken for any change of approved layout as per Petroleum Rules 2002.
16. MSQ block units (including VDU-II) shall be operated on simultaneous shutdown philosophy as a single block, considering that the inter distance criteria of OISD-STD-118 is not complied. Single block philosophy, wherever established, to be strictly adhered in other process units during shutdown.
17. All the detectors (hydrocarbon, toxic etc.) shall be configured in the history trend of DCS system.

18. Incident control center operation to be ensured appropriately as per ERDMP.
19. All the Air Fin Coolers (AFCs) in hydrocarbon service located above pipe racks/ elevated location shall be provided with water sprinkler system in line with OISD-STD-116 clause no. 4.2.5.
20. All the observations/ recommendations submitted through the reports of IOCL Internal Investigation, PESO, other investigating authorities are to be reviewed and suitably addressed.

Udit Nandi	S Giridharan	Jamunalal Rout	Harendra Kumar Yadav
CGM (Safety) HPCL, Visakh Refinery	GM (Maint.) BPCL, Kochi Refinery	Dy. Director (Tech) PNGRB	Addl. Director (P&E) OISD, NOIDA

ABBREVIATIONS:

AFC : Air Fin Cooler	NDT : Non-destructive testing
CCTV: Closed Circuit Television Camera	NHT: Naphtha Hydro-treater
CR : Circulating Reflux	OISD : Oil Industry Safety Directorate
CS : Carbon steel	OWS : Oily Water Sewer
DCS : Distributed Control Systems	Prime G: Gasoline Treatment
FT : Fire Tender	PPE: Personal Protective Equipment
IWL : Inspection Work List	PMI : Positive material identification
HIRA: Hazard Identification and Risk Assessment	TA : Turn Around
HOD : Head of Department	TPI : Third Party Inspection
MSQ : Motor Spirit Quality	UT : Ultrasonic thickness
MOV : Motor Operated Valve	VDU : Vacuum Distillation Unit

ANNEXURES

Annexure -1: FIR by IOCL- HR

Annexure -2: OISD Committee Constitution note

Annexure -3: List of injured personnel

Annexure -4: DCS data

Annexure -5: Statement of F&S.

Annexure-1

Annexure-IV

FIR on Major Incidents to OISD / PNGRB / PESO

1.Name of reporting Organisation	IOCL	2. Sector (Refinery)	Refinery Division
3.Location	Haldia Refinery, Haldia, Purba Medinipur ,West Bengal		
4. Date of Incident	21.12.2021	5. Time of Incident	14:50 hrs
6. Fire / Accident	Fire	7. Duration of fire - Hrs / Min	Less than 15 minutes
8 Whether plant shutdown/caused outage of the facility			Yes ' Under M&I Shutdown'
9.Reason for categorization as Major incident (Tick one or more from the factors mentioned below)			Fatalities
a. Fatality/permanent loss of body part or permanent disability			03 fatalities, 44 Injured
b. Shutdown of plant/facility			Yes
c. Blow out or explosion			-
d. Fire more than 15 minutes duration			No
e. Failure of rig critical equipment like draw-works			-
10. Fatalities (In Nos.) =03	a) Employees = Nil	b) Contractor = 03	c) Others-Nil
11. Brief Description of the incident including post incident measures.(if any) in separate signed sheet.	Grating cutting job at first platform was being Carried out, fire at 14:50 Hrs occurred in MSQ unit.		
13. Whether similar incident has occurred in past at the same location, if yes, give brief description of the incident and attach details in separate sheet.	No		

Signature:
Designation: Executive Director & Refinery Head
Location : Haldia Refinery, Indian Oil Corporation Ltd
Date : 21.12.2021

Annexure-2

भारत सरकार, पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
9वां तल, टॉवर–ए, ओआईडीबी भवन,
प्लॉट नं. 2, सैक्टर–73, नोएडा–201301
Government of India, Ministry of Petroleum & Natural Gas
9th Floor, Tower-A, OIDB Bhawan
Plot No. 2, Sector-73, NOIDA – 201301
दूरभाष/Tel. : +91-120-2593800
वेबसाईट/Website : www.oisd.gov.in

ISO 9001:2015 certified

तेल उद्योग सुरक्षा निदेशालय
OIL INDUSTRY SAFETY DIRECTORATE

ओआईएसडी/ईडीएस/ACCI-05 22.12.21

प्रति,
अध्यक्ष,
इंडियन ऑयल कॉर्पोरेशन लिमिटेड,

विषय: आईओसीएल, हल्दिया रिफाइनरी में घटित घटना की जांच हेतु ओआईएसडी एवं पीएनजीआरबी की संयुक्त समिति का गठन।

महोदय,

आईओसीएल, हल्दिया रिफाइनरी से प्राप्त जानकारी के अनुसार दिनांक 21 दिसम्बर 2021 को दोपहर लगभग 1450 बजे, हल्दिया रिफाइनरी के मोटर स्पिरिट क्वालिटी अपग्रेडेशन यूनिट में एक स्ट्रक्चर की कटाई के समय विस्फोट की घटना हुई। इस दुर्घटना में कुल सैंतालिस लोग घायल हुए थे, जिनमें से तीन लोगों की मृत्यु हो गयी हैं। घटना के दौरान यूनिट में मेंटेनेंस एवं इंस्पेक्शन शटडाउन चल रहा था।

इस घटना की जांच करने के लिए ओआईएसडी एवं पीएनजीआरबी की एक संयुक्त समिति का गठन किया गया है जिसका विवरण इस प्रकार से है:

1. श्री उदित नंदी, मुख्य महाप्रबंधक (प्रमुख -सेफ्टी), एचपीसीएल-विसाख रिफाइनरी – लीडर
2. श्री एस गिरिधरन, महाप्रबंधक (मेंटेनेंस), बीपीसीएल- कोच्ची रिफाइनरी –सदस्य
3. श्री जमनालाल राउत, उप निदेशक (टेक्निकल), पीएनजीआरबी
4. श्री हरेन्द्र कुमार यादव, अपर निदेशक (पी एंड ई), ओआईएसडी-सदस्य समन्वयक

समिति के जांच के दायरे में घटना की जांच करना, घटना की खामियों और मूल कारणों की पहचान करना, ऐसी घटनाओं की पुनरावृत्ति से बचने के लिए सुधारात्मक कार्रवाई की सिफारिश करना शामिल है।

समिति घटना स्थल पर 23.12.2021 तक पहुंच जाएगी और 30 दिनों के भीतर अपने जाँच-परिणाम प्रस्तुत करेगी।

23/12/2021
(अरुण मित्तल)
कार्यकारी निदेशक

अध्यक्ष, आईओसीएल: जाँच दल को सभी आवश्यक मदद जैसे संबंधित दस्तावेज, सीसीटीवी फुटेज उपलब्ध कराने, घटना से संबंधित व्यक्तियों की उपलब्धता सुनिश्चित करने के अनुरोध के साथ।

प्रतिलिपि: सूचनार्थ

1. संयुक्त सचिव (आर), पेट्रोलियम और प्राकृतिक गैस मंत्रालय
2. संयुक्त सचिव (म), पेट्रोलियम और प्राकृतिक गैस मंत्रालय
3. सदस्य (टेक्निकल), पीएनजीआरबी

OISD/EDS/ACCI-05 22.12.21

To,
Chairman,
Indian Oil Corporation Ltd.,

Sub: Formation of Joint committee of OISD & PNGRB for investigation of incident at IOCL, Haldia Refinery.

Dear Sir,

As per information received from IOCL, Haldia Refinery, there was an incident of blast during cutting of a structure in Motor Spirit Quality Upgradation (MSQ) Unit of Haldia Refinery at about 1450 Hrs. on 21 December 2021.The said unit was under Maintenance and Inspection (M&I) shutdown. The incident resulted in injury to 47 persons, out of which 3 persons succumbed to their injuries.

To investigate the said incident, a joint committee of OISD & PNGRB comprising of following members has been constituted:

1. Sh. Udit Nandy, CGM (Head-Safety), HPCL-Visakh Refinery – Team Leader
2. Sh. S.Giridharan, GM (Maintenance), BPCL-Kochi Refinery -Member
3. Sh. Jamunalal Rout, Deputy Director (Tech.), PNGRB -Member
4. Sh. Harendra Kumar Yadav, Additional Director (P&E), OISD – Member Coordinator

The terms of reference of the committee includes investigate the incident, identify the lapses and root cause(s) of the incident, recommend corrective actions to avoid recurrence of such incidents.

The committee will reach the site by 23.12.2021 and submit the findings within 30 days.

23/12/2021
(Arun Mittal)
Executive Director

Chairman, IOCL: With the request to extend all necessary support to the investigating team providing necessary documents, CCTV footages and interview with concerned personnel.

Copy for information to:

1. Joint Secretary (R) MoP&NG: for Information please
2. Joint Secretary (M) MoP&NG
3. Member(Technical), PNGRB

Annexure-3

List of Injured

SL.NO	NAME	CONTRACTOR NAME	AGE	NAME OF THE HOSPITAL
1	LAL BABU MAHATO	SHILPI	37	Desun
2	NAG NARAYAN SAL	SHILPI	41	Medica
3	SANTU SOME	SHILPI	32	Medica
4	RAJ BALLAV KUMAR	SHILPI	22	Desun
5	KULDEEP SINGH	SHILPI	35	Desun
6	AMRIT SINGH	SHILPI	34	Medica
7	HARI MOHAN THAKUR	SHILPI	54	Desun
8	VIJAY KUMAR ROUT	SHILPI	22	Desun
9	KULVARTH SINGH	SHILPI	44	Techno
10	MANOJ KUMAR PRAJAPATI	SHILPI	53	Desun
11	ACHELAL PRAJAPATI	SHILPI	23	Medica
12	SASHI KUMAR	SHILPI	30	Desun
13	DHARMENDRA KUMAR	SHILPI	27	Techno
14	RANJITH KUMAR	SHILPI	30	Techno
15	NEEROJ KUMAR	SHILPI	21	Desun
16	DHARMENDRA CHOUDHURY	SHILPI	27	Desun
17	PROMOD KUMAR	SHILPI	33	Desun
18	AVINASH SINGH	SHILPI	38	Desun
19	SHYAM BISEN	SHILPI	50	Techno
20	UMESH KUMAR NATHIYA	SHILPI	25	Desun
21	RAM NARAYAN SINGH	SHILPI	30	Techno
22	KAPIL SHARMA	SHILPI	35	Desun
23	BIPIN KUMAR	SHILPI	30	Techno
24	RAJ KUMAR	SHILPI	21	Medica
25	SIMERJEET SINGH	SHILPI	24	Desun
26	DEEPAK KUMAR GUPTA	SHILPI	27	Techno
27	SATYA NARAYAN SINGH	SHILPI	24	Desun
28	MAHESH SAH	SHILPI	33	Desun
29	ANIL KUMAR SATYAM	SHILPI	27	Medica
30	VIRENDRA PAL SINGH	SHILPI	27	Techno

31	ASHOK SAH	SHILPI	41	Techno
32	SANTOSH KUMAR AGRAWAL	SHILPI	26	Medica
33	DEBABRATA MAJI	MCB	50	Desun
34	MANAS DHARA	MCB	43	Techno
35	AMAR KUMAR	SHILPI	19	Techno
36	SUDAMA GUPTA	SHILPI	26	Medica
37	MANMOHAN SAH	SHILPI	26	Medica
38	ANGREJ SINGH	SHILPI	25	Medica

Name of the Hospital	NOS
DESUN , KOLKATA	17
TECHNO , KOLKATA	11
MEDICA, KOLKATA	10
	38

	DEATH CASE DETAILS			
	NAME	CONTRACTOR NAME	AGE	STATE
	PARGAT SINGH	SHILPI	39	PUNJAB
	SARABJIT SINGH	SHILPI	29	PUNJAB
	SHAMSHAD ALI	SHILPI	35	BIHAR

From: "DANIELRAJ I(डेनियलराज आई)" <DANIELRAJI@INDIANOIL.IN>
To: "Harendra Kumar Yadav" <yadavhk.oisd@gov.in>, "JAMUNALAL ROUT" <jrout@pngrb.gov.in>
Cc: JAYANTP@indianoil.in, SANYALA@INDIANOIL.IN, beheraj@indianoil.in, KUMARA8@indianoil.in, CHITTEPN@INDIANOIL.IN
Sent: Tuesday, February 15, 2022 3:15:13 PM
Subject: Actual casulaties in MSQ Fire incident

Sir,
As asked for the FIR given to OISD on 21.12.2021 on casualties was factually not correct. However, revised FIR as per PNGRB format was resubmitted to PNGRB on 22.12.2021 and copy attached above. Also FIR to DM is attached for reference wherein total casualties is 44 including 03 nos. deceased contractual workers and 03 nos. released on same day after preliminary treatment. So, total 38 nos admitted in the Hospital (37 in Kolkata and 01 in Tamluk).

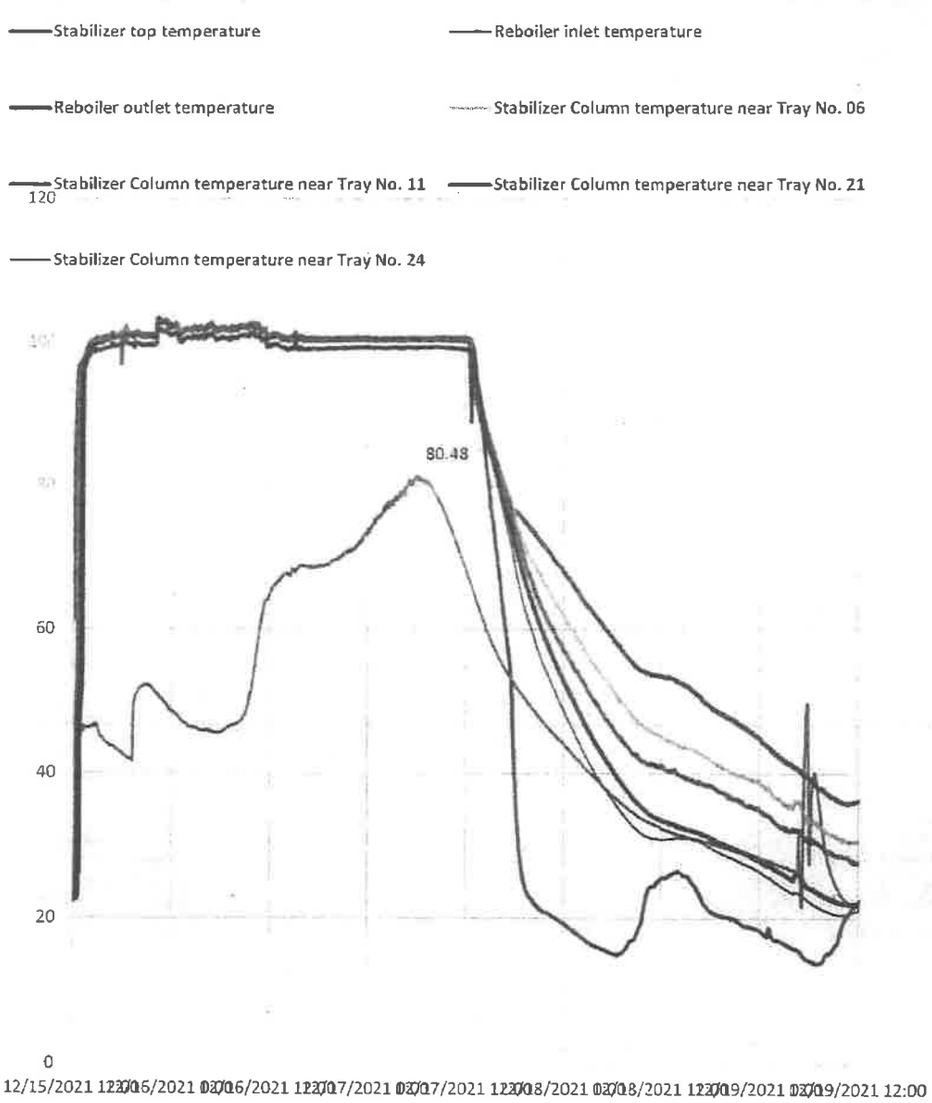
Present status:
Succumbed to Injury: 05
Release on same day:03
Released to native place after treatment: 24
Under observation : 09
Under treatment in Hospital: 03

Deceased workers detail:

DECEASED WORKERS	CONTRACTOR NAME	AGE	PERMANENT ADDRESS	HOSPITAL NAME	Demise Date
LATE PARGAT SINGH	SHILPI ENGG. PVT. LTD	38	AMRITSAR, PUNJAB	-	Expired on 21.12.2021
LATE SHAMSHAD ALI	SHILPI ENGG. PVT. LTD	33	EAST CHAMPARAN, BIHAR	-	Expired on 21.12.2021
LATE SARARBJIT SINGH	SHILPI ENGG. PVT. LTD	28	AMRITSAR, PUNJAB	-	Expired on 21.12.2021
LATE LAL BABU MAHTO	SHILPI ENGG. PVT. LTD	37	MUZAFFARPUR, BIHAR	Desun	Expired on 31.12.2021
KULDEEP SINGH	SHILPI ENGG. PVT. LTD	36	TARN TARAN, PUNJAB	Desun	Expired on 08.01.2022

Greetings of the day
I.Daniel Raj
DGM(HSE)
Haldia Refinery
West Bengal -721606
Mobile: 9687914853

Annexure-4


Stabilizer top temperature
Reboiler inlet temperature
Reboiler outlet temperature
Stabilizer Column temperature near Tray No. 06
Stabilizer Column temperature near Tray No. 11
Stabilizer Column temperature near Tray No. 21
Stabilizer Column temperature near Tray No. 24
120
80.48
60
40
20
0
12/15/2021 12:00
12/16/2021 12:00
12/17/2021 12:00
12/18/2021 12:00
12/19/2021 12:00

Annexure-5

Date. 24.12.21

I am Ashok Kumar Raghwanshi, working as Com(Fel) of Haldia Refinery. On 21.12.21 during fire at the call received. I reached at site on the Jeep & after seeing some injured on Rd. D2 along msg, I send them to First Aid on the Jeep Immediately. Simultaneously the training was going on at site with the CSO & other fire & safety officers. Fire was tested within few minutes & simultaneously rescue & search operation was also continued till ensuring transferring of all injured to first Aid / hospital. During the training all senior management official DGM(PN), GM(PW) GM (T&S, HSE), EGM(T) etc also reached at site & started their action & coordination. After completing rescue operation. Area was reached several times and on ensuring normalcy in the area. Area was barricaded from all sides & person also deputed at site.

Regarding 20.12.21 oil leakage point in msg area, it was observed by our SLO officer Amit(Fel) Srivastava & he has suspended all the jobs in close vicinity & informed area incharge / engineer for ensuring safety at site. The point was also discussed in SLO/GM morning meeting at Dhobi SLO South at 11.00hrs which was chaired by CGM(T) & all other official. DGM (PW) of area, GM(PW) SPNM, GM(PN), SMNM, DGM (PW) of area. In meeting PN incharge informed that he will not issue any clearance in the area. Further area incharge informed in meeting that it was flushed water, which was leakage in the area. However, area visit by our Fel officers was also done in the evening & found no job in progress. They have also observed no leakage from the nearby side. On gas testing it was found zero. On the same site visit was done by Amit (Srivastava) & Somit (Sm Rout).

Ashok Kumar Raghwanshi
CMFt

इंडियन ऑयल कॉर्पोरेशन लिमिटेड
हल्दिया रिफाइनरी, डाकघर : हल्दिया ऑयल रिफाइनरी
जिला: पूर्व मेदिनीपुर, पश्चिम बंगाल - 721606
Indian Oil Corporation Limited
Haldia Refinery, P. O. : Haldia Oil Refinery
Dist. : Purba Medinipur, West Bengal - 721606
Tel. : 03224-223201 / 252151, Fax: 03224-252141
E-mail : ghoshp3@indianoil.in

ISO 9001 / ISO 14001 / OHSAS 18001 CB-035-MS

पार्थो घोष
कार्यकारी निदेशक एवं रिफाइनरी प्रमुख

Partha Ghosh
Executive Director & Refinery Head

Date: 24.02.2022

Ref: **HR/TS/HSE/CCE/240222/02**

To,

The Chief Controller of Explosives,
Petroleum and Explosives Safety Organization,
CGO Complex, Block –A, 5th Floor,
Seminary Hills,
Nagpur-440006

Subject: **Observation of OISD's Investigation Committee Fire Incident at MSQ Block unit of IOCL Haldia Refinery on 21.12.21 and action thereof**

Respected Sir,

This has reference to OISD Investigation Committee report received vide letter number OISD/EDS/ACCI-05 dated 21.02.2022 on fire incident at MSQ unit of Haldia Refinery on 21.12.2021.

Action taken status against all recommendations marked in the OISD committee report is attached as required by PESO.

This is further to mention that Haldia Refinery has taken various mitigation measures/proactive measures to avoid such type of incidents in future and expeditiously implementing measures to mitigate all recommendations related to investigation by various agencies.

Thanking you,

Yours faithfully

(Partha Ghosh)

Copy to:
Jt. Chief Controller of Explosives, East Circle, Kolkata

ANNEXURE

S. No.	Recommendations	Action taken Status	FPR
1	Adequacy of Standard Operating Procedure (SOPs) for flushing to be reviewed to ensure incorporation of equipment wise flushing plan and to include physical checking/ verification to confirm system is hydrocarbon free.	Complied. As per requirement, adequacy of SOP has been reviewed and approved by competent authority for equipment wise flushing plan for MSQ (Attached as Annexure) with physical checking/ verification to confirm system is hydrocarbon free	GM (Production)
2	Hazard Identification and Risk Assessment (HIRA) shall be conducted by Operation, Maintenance and Fire & Safety team before start of non-routine activities.	Completed and report received from State Productivity Council(SPC) , West Bengal (Attached). Action plan of implementation: By April 22	GM (TS,HS&E)
3	Maintenance crew engaged for various shutdown jobs to be properly made aware (through supervisory control, tool box talks etc.) about the potential job hazards, Do's & Don'ts in case of any unforeseen abnormal condition like oil/ gas leakage in and around the job site. They should be sensitized about their individual role as a 'Safety watchdog' for protection of self and others in the vicinity of work.	Tool box talks regularly being conducted and record of attendance maintained. This will be cross-checked at the job site by safety supervisor/ F&S officers and record maintained.	GM(MN-ML)
4	Deployment of skilled manpower suitable for the respective job and commensurate with contract condition to be ensured. It is suggested to include suitable clauses in the shut-down tender document to ensure that only qualified and experienced workman are entering into refinery premises for shutdown job.	Suitable clause for experience of workmen to be engaged by the contractor shall be included in the future maintenance contracts - For immediate compliance	GM(MN-ML) GM (MN-CL) GM (P&U) GM (PN) GM (INST)
5	In line With OISD-STD-155, it is recommended that IOCL shall carry out hazard and risk assessment and develop a PPE policy. Fire retardant/ flame resistant coverall shall be included as mandatory PPE in the policy based on risk assessment.Implementation of PPE policy should also be ensured for contractor's workforce, through incorporation of suitable requirements in the tender/ contract.	It shall be implemented in all future Tenders – for immediate compliance For ongoing contracts, IOCL will reimburse for IFR suits for contract workers up on production of invoice/ bill by contractor. For immediate compliance	GM(M&C) Engineer in-charge of respective contracts
6	OWS and CBD drain lines of equipment are to be always maintained de-choked/ operational to facilitate proper draining during steaming & flushing and ensuring positive confirmation that all hydrocarbons are drained.	For immediate compliance	GM (Production)
7	Sufficient numbers of Safety supervisors shall be ensured all the time during the shutdown/ start-up activities of the units. Critical non-routine activities shall be carried out under supervision by IOCL along with fire watch assistance.	F&S has already lined up 10 numbers of safety supervisors for day-to-day activities of refinery. A separate contract for safety supervisors is lined up for each M&I. Already in practice. 20 safety supervisors were provided for last M&I, vide a separate contract. In addition to the above, safety supervisors of Service Contracts in M&I was employed by the vendor as per IOCL requirement of 1 no. safety supervisor for 25 nos. of workers.	GM (TS , HS&E) GM(MN-ML)
8	A multidisciplinary team (MDT) should be constituted to carry out the surprise checks during shutdown activities, to identify the unsafe acts and unsafe conditions. Due diligence to be accorded for review/ analysis of unsafe acts/ conditions reported by MDT, fire & safety team and operational personnel to take immediate corrective action	Already implemented during current M&I shutdown	GM (MN-ML)

S. No.	Recommendations	Action taken Status	FPR
9	Availability of CCTV cameras installed at all units to be reviewed and suitably augmented (if required) to record the critical site activities. Use of Artificial Intelligence (AI) equipped CCTV system may be explored, so that there is auto- orientation of the cameras towards the site of abnormality/ Fire.	Compliance by Dec'22 before next M&I in Jan-Feb'23 since cabling for new location for CCTV might be required	GM (PN) in coordination with GM(INST) & GM(TS,HS&E)
10	There may be some instance where CCTV cameras and HC Gas monitoring system (GMS) may not be available to cover critical maintenance activities. To take care of such instance, IOCL to explore the feasibility of providing portable CCTV camera and GMS sensor.	3 nos. portable Multi Gas Detectors (GMS) sensors are available. 60 numbers of portable Multi Gas Detectors (GMS) to be procured before next M&I of Jan-Feb'23	GM(INST) GM(TS,HS&E)
11	Date/ time difference between alarm server, DCS system, CCTVs to be rectified and all time to be synchronized to a master clock (GPS time synchronization) to facilitate accurate interpretation of the recorded data.	AF proposal (Additional facilities) shall be obtained from competent authority and expected to be completed by Dec'22	GM(ES & IP) GM (INST)
12	Man-to-man relieving in the unit to be ensured for proper handover and takeover of duties.	Immediate Compliance	GM (HR) GM (PN)
13	Logging, entry of daily activities and sequence of operation performed in respective areas for all critical activities are to be ensured in the log book. Logbooks shall be reviewed and countersigned by the role holder officers on daily basis.	Immediate compliance	GM (PN)
14	Prior approval of the statutory authority (PESO) shall be taken for any change of approved layout as per Petroleum Rules 2002.	Shall be taken up wherever applicable	GM(TS,HS&E)
15	MSQ block units (including VDU-II) shall be operated on simultaneous shutdown philosophy as a single block, considering that the inter distance criteria of OISD- STD-118 is not complied. Single block philosophy, wherever established, to be strictly adhered in other process units during shutdown.	For immediate compliance	GM(TS, HS &E) GM (MN-ML)
16	All the detectors (hydrocarbon, toxic etc.) shall be configured in the history trend of DCS system.	Immediate compliance	GM (INST)
17	Incident control center operation to be ensured appropriately as per ERDMP.	Immediate compliance	Chief Incident Controller
18	All the Air Fin Coolers (AFCs) in hydrocarbon service located above pipe racks/ elevated location shall be provided with water sprinkler system in line with OISD-STD-116 clause no. 4.2.5.	Available at some locations. Alternate mitigation of HVLRM was already provided in all locations. Schemes for all Air Fin Coolers water sprinkler system will be completed by Jun'22. Execution by Aug'23	GM (TS, HS&E GM (MN-ML)
19	All the observations/ recommendations submitted through the reports of IOCL Internal Investigation, PESO, other investigating authorities are to be reviewed and suitably addressed.	Immediate compliance	GM (TS, HS&E)
20	Scaffolding of erection for shut down unit shall be reviewed for easy access and escape route. Number of simultaneous activities to be regulated based on the site condition/ congestion.	Immediate compliance	GM(MN-ML) GM (MN-CL) GM (PN)

Dated: 22.02.2022

Ref No: HR/DHDS/MSQ/Dec'21/02

Subject: **Supplementary report on MSQ incident on 21.12.2021**

Reference – **Haldia refinery incident report number HR/DHDS/MSQ/Dec'21/01 dated 25.12.2021**

As discussed in reference incident report, under Para.5 - Root Cause Analysis

Quote

The root cause of the chokage of reboiler circuit drain is considered as debris, which might have accumulated during plant operation. This possibility can be established after opening of reboiler channel head & pulling out of the U tube bundle.

Unquote

PESO - Nagpur, vide letter number P(EC)Accdt./412/21 P-5(2)52/Refinery/IX dated 14.02.2022, gave clearance to Haldia Refinery for starting maintenance jobs in MSQ unit of Haldia Refinery.

Subsequently, drain valve of stabilizer column bottom (86-C-01) - reboiler circuit (86-E-06) circuit to OWS was dropped for inspection.

During inspection of the dropped valve a piece of cloth inside the valve. This has led to inadequate flushing of the 86-C-01/ 86-E-06 circuit.

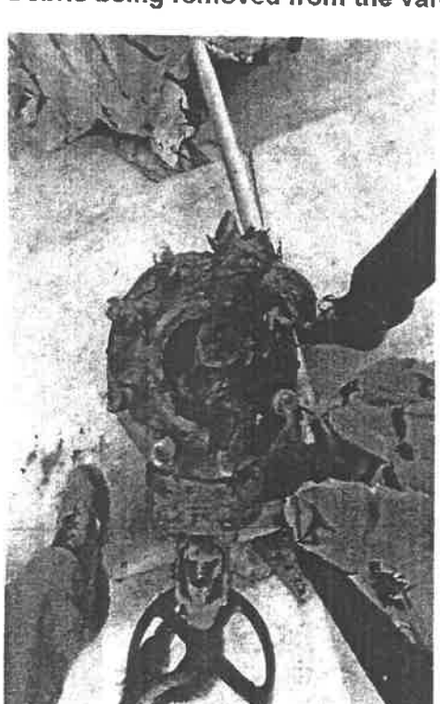
Photographs of the dropped valve with piece of cloth found inside the valve is attached for reference.

****

Annexure

Inside valve view after dropping the valve for inspection

Debris being removed from the valve



Recommendation Summary

Company: INDIAN OIL CORPORATION LIMITED, HALDIA REFINERY
Facility: ISOMERISATION UNIT (U-86)

Revision: (2) 5/9/2015

Node: (1) Light Reformate and Light Hydrotreated Naphtha enters Feed Surge Drum (86-B-01) is pumped by (86-P-01A/B) to Dryers (86-B-02A/B) to remove any traces of water. Hydrogen from Compressors (86-K-01A/B) is cooled in Cooler (86-E-01) dried in Dryers (86-B-03A/B). Combined Naphtha Feed and Hydrogen is Preheated in (86-E-02,03,04,05) before entering Hydrogenation Reactor (86-R-01), bottoms cools (86-E-04) and is fed to first stage (86-R-02), bottoms cools in (86-E-03) before feeding to Second stage (86-R-02)

Intention: Drying of mixed feed of Light Reformate and Light Hydrotreated Naphtha and Hydrogen and Hydrogenation and Isomerisation of Light Reformate and Light Hydrotreated Naphtha Feeds & Hydrogen

Drawings: 10118-PEIN02-86-7001-P0013A Rev 4; 10118-PEIN02-86-7001-P0012B Rev 4; 10118-PEIN02-86-7001-P0011A Rev 4; 10118-PEIN02-86-7001-P008B Rev 4; 10118-PEIN02-86-7001-P006B Rev 4; 10118-PEIN02-86-7001-P006A Rev 4; 10118-PEIN02-86-7001-P005B Rev 4; 10118-PEIN02-86-7001-P005A Rev 4; 10118-PEIN02-86-7001-P004 Rev 4; 10118-PEIN02-86-7001-P003 Rev 4; 10118-PEIN02-86-7001-P002 Rev 4; 10118-PEIN02-86-7001-P001B Rev 4; 10118-PEIN02-86-7001-P001A Rev 4

GW	DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	CATEGORY
Less	1.7. Low Pressure in Surge Drum (86-B-01)	1.7.1. PV-0101A stuck close due to malfunctioning of PT-0101	1.7.1.1. Surge drum will see low pressure, likely air ingress forming explosive mixture in the vessel. Since malfunction of PT-0101 will cause PV-0101B also to open	1.7.1.1.1. PI-0108 available	1.7.1.1.1. Consider provision of Pressure alarm low with PT on PI-0108	Hardware Change
More	1.9. High Pressure in Surge Drum (86-B-01)	1.9.1. PV-0101A stuck open due to malfunctioning of PT-0101	1.9.1.1. Surge drum will see high pressure from Nitrogen system since malfunction of PT-0101 will cause PV-0101B also to close	1.9.1.1.1. PI-0108 available 1.9.1.1.2. PSV-0101 available	1.9.1.1.1. Consider provision of Pressure alarm high with PT on PI-0108	Hardware Change
Less	1.14. Low interphase level of water in surge drum (86-B-01) boot	1.14.1. Manual draining valve not closed appropriately	1.14.1.1. Gas blowdown to CBD upsetting the draining system	1.14.1.1.1. LT/LI-0102 available 1.14.1.1.2. LG-0105 available	1.14.1.1.1. Consider OWS drain valve as NC type or ensure end blind in the flange	Hardware Change
Other Than	1.18. Engineering issues	1.18.1. Malfunction of interlocks due to transmittal malfunctioning	1.18.1.1. Wrong signal from transmittal leading to maloperation causing Hazardous situation	1.18.1.1.1. Instrument interlocks indicated in P&IDs with IS number identification	1.18.1.1.1. P&ID needs to be updated to incorporate instrument interlock details instead of only IS number.	Operating Philosophy /P&ID Change

Revision: (2) 5/9/2015

Node: (4) Off Gas from B/L is preheated In (86-E-22), passed through Dryer (86-B-14A/B) is mixed with the overhead vapors from (86-B-07) is contacted with cold lean oil in Separator drum (86-B-11), a refrigeration system (86-E-14) provided for Off gas. Lean oil from bottom of (86-C-03) is pumped by pumps (86-P-07A/B) to exchangers (86-E-15,16,17) and passes through refrigeration system (86-E-14) to maintain low temperature and is fed counter currently to off gases in Separator drum (86-B-11)

Intention: Off gas from stabilizer is mixed with off gas from battery limits is fed to cold separator drum with Lean oil for recovery of LPG

Drawings: 10118-PEIN02-86-7001-P0011A Rev 4; 10118-PEIN02-86-7001-P0010B Rev 4; 10118-PEIN02-86-7001-P0010A Rev 4; 10118-PEIN02-86-7001-P009 Rev 4; 10118-PEIN02-86-7001-P008B Rev 4; 10118-PEIN02-86-7001-P008A Rev 4; 10118-PEIN02-86-7001-P006B Rev 4

GW	DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	CATEGORY
No/Less	4.1. No/Less flow of C-01 off gas to LPG separator drum	4.1.1. PV-0604 stuck close due to malfunctioning of PT-0604	4.1.1.2. Likely overcooling in E-14 leading to more handling loss of refrigerant	4.1.1.2.1. LIC provided in refrigerant system 4.1.1.2.2. TIC-1020 with temperature alarm low available	4.1.1.2.1. 86-E-33/34 nomenclature and instrument numbers/identification of this equipment is not available in this P&ID. This P&ID to be updated accordingly	Operating Philosophy /P&ID Change
More	4.4. More flow of C-01 off gas to LPG separator drum	4.4.1. PV-0604 wide opens due to malfunctioning of PT-0604	4.4.1.1. Refrigenrant will be overloaded. Increased temperature at inlet of separator drum leading to less absorption of LPG consequently the less recovery of LPG	4.4.1.1.1. FT/FI-0603 with flow alarm high available 4.4.1.1.2. TIC-1020 with temperature alarm high available	4.4.1.1.1. P&ID donot provide instrument logic for UV-1001 and P&ID to be updated	Operating Philosophy /P&ID Change

Revision: (2) 5/9/2015
Node: (7) Deisohexanizer distillate product supplied from pumps 86-P-08 A/B is completely vaporised in Vaporiser (86-E-13) passes through superheater (86-F-01) and is sent to dryers Dryers (86-B-02A/B,03A/B,14A/B) for their regeneration, the hot vapor leaving the dryers is condensed in air cooler (86-EA-03) and in the trim cooler (86-E-12) passes through degasser (86-B-10) and regenerant is sent to storage
Intention: Regeneration of Feed, Hydrogen and off gas from battery limits dryers
Drawings: 10118-PEIN02-86-7001-P0013B Rev 4; 10118-PEIN02-86-7001-P0013A Rev 4; 10118-PEIN02-86-7001-P009 Rev 4; 10118-PEIN02-86-7001-P008B Rev 4; 10118-PEIN02-86-7001-P005A Rev 4; 10118-PEIN02-86-7001-P004 Rev 4; 10118-PEIN02-86-7001-P002 Rev 4

GW	DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	CATEGORY
More	7.8. Higher temperature at Regenerant vaporiser	7.8.1. FV-1301 wide opens due to malfunctioning of FT-1301	7.8.1.1. Pressure build up in Vaporiser leading to loss of gas to flare header	7.8.1.1.1. TI-1309 available 7.8.1.1.2. PT-1302 available 7.8.1.1.3. PSV-1301 available	7.8.1.1.1. Consider provision of High pressure alarm on PT-1302	Software Change
	7.9. Higher temperature at Regenerant super heater	7.9.1. Heater short circuit	7.9.1.1. Refer above	7.9.1.1.1. TIC-1301 available 7.9.1.1.2. PT-1306 available 7.9.1.1.3. PSV-1303 available	7.9.1.1.1. Consider provision of High pressure alarm on PT-1306	Software Change
Other Than	7.22. Lower Interphase level of water in Degasser	7.22.1. Manual draining valve not closed appropriately	7.22.1.1. Gas blowdown to CBD upsetting the draining system	7.22.1.1.1. LI-1302 available	7.22.1.1.1. Consider OWS drain valve as NC type 7.22.1.1.2. The process manual provided for HAZOP study states that "Free water collected at the bottom of the Regenerant Degasser is periodically drained to oily water sewer". But draining should be done to CBD only and the process manual should be changed accordingly	Hardware Change Operating Philosophy /P&ID Change

Company: INDIAN OIL CORPORATION LIMITED, HALDIA REFINERY
Facility: ISOMERISATION UNIT (U-86)

Revision: (2) 5/9/2015
Node: (8) Tetra Chloro ethylene from drum (86-B-05) is injected continuously to the Isomerization reactors by pumps (86-P-02A/B)
Intention: Injection of Chlorine to isomerization reactors for make up of Chloring losses from the chorinated platinum catalyst
Drawings: 10118-PEIN02-86-7001-P0012B Rev 4; 10118-PEIN02-86-7001-P005B Rev 4; 10118-PEIN02-86-7001-P004 Rev 4; 10118-PEIN02-86-7001-P002 Rev 4

GW	DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	CATEGORY
Other Than	8.12. Chloriding agent release during unloading	8.12.1. Flexible hose rupture	8.12.1.1. Toxicity hazard & injury to the operator due to flying objects	8.12.1.1.1. SOP addressed the handling of chemicals 8.12.1.1.2. PPE exits	8.12.1.1.1. Consider selection of flexible hose with reference to OISD-135 and asses the hose life by peroidic pressure testing to avoid any pre mature failure	Hardware Change

HAZOP Recommendations for ISOM Unit (Unit -86) : HAZOP study carried out in 2015					
S.No	Recommendation No.	Recommendations	Type	Status	Updation in P&ID
1	1.7.1.1.1.	Provision of pressure alarm low with PT on PI-0108	Hardware Change	Liquidated	Updated
2	1.9.1.1.1.	Provision of pressure alarm high with PT on PI-0108	Hardware Change	Liquidated	Updated
3	1.14.1.1.1.	OWS Drain valve to be made NC type or ensure end blind in the flange	Hardware Change	Liquidated	Updated
4	1.18.1.1.1.	P&ID needs to be updated to incorporate instrument interlock details instead of only IS number.	P& ID Updation	Liquidated	Updated
5	4.1.1.2.1.	86-E-33/34 nomenclature and instrument numbers/identification of this equipment is not available in this P&ID. This P&ID to be updated accordingly	P& ID Updation	Liquidated	Updated
6	4.4.1.1.1.	P&ID donot provide instrument logic for UV-1001 and P&ID to be updated	P& ID Updation	Liquidated	Updated
7	7.8.1.1.1	Provision of High pressure alarm on PT-1302	Software Change	Liquidated	Updated
8	7.9.1.1.1	Provision of High pressure alarm on PT-1306	Software Change	Liquidated	Updated
9	7.22.1.1.1	OWS Drain valve to be made NC type or ensure end blind in the flange	Hardware Change	Liquidated	Updated
10	7.22.1.1.2.	The process manual provided for HAZOP study states that "Free water collected at the bottom of the Regenerant Degasser is periodically drained to oily water sewer". But draining should be done to CBD only and the process manual should be changed accordingly	SOP	Liquidated	Updated
11	8.12.1.1.1.	Consider selection of flexible hose with reference to OISD-135 and asses the hose life by peroidic pressure testing to avoid any pre mature failure	Hardware Change	Liquidated	Updated

Following methods may be used for measurement of pollutant concentrations in the emissions:

S. No.	Parameter	Method of measurement
1	Sulphur Dioxide (SO_2)	USEPA CFR - 40 Part 60 Appendix A Method 6
2	Oxides of Nitrogen (NO_x)	USEPA CFR - 40 Part 60 Appendix A Method 7
3	Particulate Matter (PM)	USEPA CFR - 40 Part 60 Appendix A Method 5
4	Carbon Monoxide (CO)	USEPA CFR - 40 Part 60 Appendix A Method IOA / Combustion analyzer with electro chemical detector / NDIR detector
5	Nickel + Vanadium (Ni + V)	USEPA CFR - 40 Part 60 Appendix A Method 29
6	Hydrogen Sulphide (H_2S)	USEPA CFR - 40 Part 60 Appendix A Method 15

Following methods may be used for measurement of pollutant concentrations in the effluent:

S. No.	Parameter	Method	Reference
1	pH	By electrometric method using pH meter	APHA, 20th edition 1998 4500 - H+B page 4-87 to 4-91
2	Oil & Grease	Soxhlet solvent extraction method	APHA, 20th edition 1998, 5520 D page 5 - 38
3	$BOD_{3\ days,\ 27^0C}$	Incubation followed by Winkler's Idometric titration using Azide modification	BIS, 1993, 3025 (part 44)
4	COD	Dichromate oxidation open reflux method followed by titration	APHA, 20th edition 1998 5520 - B page 5-14 to 5-15
5	SS	By Gravimegtric method 103-105 °C	APHA, 20th edition 1998, 2540 D Page 2-57 to 2-58
6	Phenols	Distillation followed by Direct Photometric method	APHA, 20th edition 1998 5530B & D Page 5-41 & 5-43 to 5-44
7	Sulphides	Iodometric Titration method	APHA, 20th edition 1998 4500 S^{2-} F Page 4-167
8	CN	Distillation followed by Argentometric titration	APHA, 20th edition 1998 4500 CN-C & D Page 4-37 to 4-39
9	Ammonia as N	Distillation followed by phenate method	APHA, 20th edition 1998 4500 NH_3 B & F Page 4-104, 105 and 108 & 109
10	TKN	Digestion followed by distillation and titration	APHA, 20th edition 1998 4500 N org B Page 4-124 to 125
11	PO_4-P (available)	Spectrophotometric method using stannous chloride reduction method	APHA, 20th edition 1998 4500 P D Page 4-145 to 146
12	Cr (VI)	Spectrophotometric method using Diphenyl Carbazide	APHA, 20th edition 1998 3500 Cr B Page 3-66 to 3-68
13	Total Cr	Oxidation followed by spectrophotometric method using Diphenyl Carbazide	APHA, 20th edition 1998 3500 Cr B Page 3-66 to 3-68
14	Pb	Nitric Acid Digestion followed by AAS method (Direct Air-Acetylene Flame)	APHA, 20th edition 1998 3030E & 311 B Page 3-8 & 3-17 & 18
15	Hg	By mercury analyzer (cold vapour generation technique)	APHA, 20th edition 1998 3112 B Page 3-22 to 24
16	Zn	Nitric acid digestion followed by ASS method	APHA, 20th edition 1998 3030E & 311 B Page 3-8 & 3-17 & 18
17	Ni	Nitric acid digestion followed by ASS method	APHA, 20th edition 1998 3030E & 311 B Page 3-8 & 3-17 & 18
18	Cu	Nitric acid digestion followed by ASS method	APHA, 20th edition 1998 3030E & 311 B Page 3-8 & 3-17 & 18
19.	V	Acid digestion followed by AAS method (Direct Nitrous Oxide -Acetylene flame)	APHA, 20th edition 1998 3111 B & D Page 3-17 & 18 and 3-20 to 21
20.	Benzene	Gas chromatograph Method (Purge and Trap Technique) or Liquid-liquid extraction GC/MS Method	6410 B Page 6-59 to 72
21.	Benzo(a) Ppyrene	Liquid-liquid extraction Chromatographic Method	APHA, 20th edition 1998, 6440 B Page 6-79 to 84

SIL, SUMIT (सिल, सुमित)

From: BAGCHI, MALAY (□□□, □□□□□)
Sent: 02 July 2021 12:57
To: SIL, SUMIT (□□□, □□□□□)
Subject: FW: EBMS production requirement- Urgent

Regards

Malay Bagchi,
DGM(TS),
Haldia Refinery
9416783977

From: SANYAL, ATANU (सान्याल, अतनु)
Sent: Friday, July 2, 2021 12:36 PM
To: BAGCHI, S K.
Cc: BAGCHI, MALAY (मलय, बागची); Mandal, Pralay K. (मंडल, प्रलय के.); Baidya, Nilratan (बैदया, निलरतन); JAYANT, PRAVEEN (जयंत, प्रवीण)
Subject: EBMS production requirement- Urgent

During PRM, it was mandated that EBMS production has to be carried out by all refineries as per MoP&NG directive.

Haldia pointed out that it does not have IFR tanks and unloading facility for ethanol. Also there is no designated tank for Ethanol .

RHQ wanted that MS tanks going for M&I will have to be converted as there is no space for new tanks.
In this context please indicate , how to go about the change of tank to IFR.
Tk 419 is scheduled for M&I in current year.

Further, to have a tank for storing Ethanol, it has to be conical bottomed and IFR . We will require about 400 KL of Ethanol per day. So we will need a tank if 2000KL at least. What is the probability of such capacity tank being available in a compatible dyke (probably, we failed to get PESO clearance of Tk-910).

Need you advise regarding this as Inspection deptt. has all the capability of determining so. Thereafter we can either make the tank convert to ethanol service or make a new tank by cutting out some idle tanks..

This is important.

Regards,
A sanyal

II. COMPLIANCE OF EFFLUENT STANDARDS (Quantum based)

(Figs. in Kg/1000 Ton Crude processed)

QUARTER : Q3 (Oct'17-Dec'17)

PLEASE ENTER THE AVERAGE VALUES FOR THE RESPECTIVE MONTHS (KG/1000 TON CRUDE PROCESSED)

PARAMETER	LIMIT	Oct'17			Nov'17			Dec'17			AVERAGE FOR Q-3
Effluent discharge,M3/TMT of crude		83.0			81.6			186.30			
Parameters		Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	
pH	--	--	--	--	--	--	--	--	--	--	--
Oil & Grease	2.0	0.17	0.42	0.276	0.163	0.408	0.2953	0.373	0.932	0.6185	0.396
BOD	6.0	0.66	1.16	0.76	0.571	0.979	0.761	1.304	1.863	1.565	1.027
COD	50	3.32	8.6	5.29	3.916	9.789	5.947	8.942	20.120	11.215	7.484
TSS	8.0	1.08	2.9	1.412	1.142	1.713	1.428	2.236	4.471	2.720	1.853
Phenols	0.14	0.00	0.006	0.004	0.003	0.006	0.004	0.007	0.011	0.021	0.010
Sulphides	0.2	0.01	0.100	0.023	0.013	0.039	0.023	0.030	0.078	0.013	0.020
CN	0.08	0.00	0.002	0.002	0.002	0.002	0.002	0.004	0.006	0.008	0.004
Ammonia as N	6.0			0.042			0.024			0.006	0.024
TKN	16			0.174			0.139			0.065	0.126
P	1.2			0.004			0.004			0.005	0.004
Cr (Hexavalent)	0.04			0.004			0.004			0.009	0.006
Cr (Total)	0.8			0.004			0.004			0.009	0.006
Pb	0.04			0.004			0.004			0.009	0.006
Hg	0.004			0.0001			0.0001			0.0002	0.0001
Zn	2.0			0.004			0.004			0.009	0.006
Ni	0.4			0.004			0.004			0.009	0.006
Cu	0.4			0.004			0.004			0.009	0.006
V	0.8			0.004			0.004			0.009	0.006
Benzene	0.04			0.004			0.004			0.009	0.006
Benzo (a) - Pyrene	0.08			0.004			0.004			0.009	0.006

II. COMPLIANCE OF EFFLUENT STANDARDS (Quantum based)

(Figs. in Kg/1000 Ton Crude processed)

QUARTER : Q1 (Apr'21-June'21)

PLEASE ENTER THE AVERAGE VALUES FOR THE RESPECTIVE MONTHS (KG/1000 TON CRUDE PROCESSED)

PARAMETER	LIMIT	Apr-21			May-21			Jun-21			AVERAGE FOR Q-2
Effluent discharge,M3/T MT of crude processed		115.9			110.9			92.60			
Parameters		Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	AVERAGE
pH	--	--	--	--	--	--	--	--	--	--	--
Oil & Grease	2.0	0.21	0.51	0.385	0.288	0.443	0.3565	0.278	0.454	0.3656	0.369
BOD	6.0	1.16	1.51	1.30	1.109	1.330	1.204	0.926	1.389	1.1298	1.212
COD	50	8.81	15.8	11.31	8.425	13.302	10.110	8.520	11.483	10.4013	10.606
TSS	8.0	1.85	3.2	2.182	1.330	1.884	1.561	1.204	1.667	1.4817	1.741
Phenols	0.14	0.02	0.021	0.018	0.016	0.020	0.017	0.011	0.016	0.0137	0.016
Sulphides	0.2	0.04	0.056	0.044	0.033	0.050	0.039	0.026	0.043	0.0366	0.040
CN	0.08	0.01	0.016	0.011	0.009	0.012	0.010	0.007	0.015	0.0113	0.011
Ammonia as N	6.0			1.183			1.197			1.2076	1.196
TKN	16			2.549			0.033			0.6297	1.071
P	1.2			0.100			0.083			0.0222	0.068
Cr (Hexavalent)	0.04			0.001			0.001			0.0009	0.001
Cr (Total)	0.8			0.001			0.001			0.0009	0.001
Pb	0.04			0.001			0.001			0.0005	0.001
Hg	0.004			0.0001			0.0001			0.0001	0.0001
Zn	2.0			0.010			0.002			0.0019	0.005
Ni	0.4			0.002			0.001			0.0019	0.002
Cu	0.4			0.002			0.002			0.0019	0.002
V	0.8			0.023			0.002			0.0185	0.015
Benzene	0.04			0.006			0.006			0.0046	0.005
Benzo (a) - Pyrene	0.08			0.000			0.000			0.0000	0.000

II. COMPLIANCE OF EFFLUENT STANDARDS (Quantum based)

(Figs. in Kg/1000 Ton Crude processed)

QUARTER : Q2 (July'21-Sept'21)

PLEASE ENTER THE AVERAGE VALUES FOR THE RESPECTIVE MONTHS (KG/1000 TON CRUDE PROCESSED)

PARAMETER	LIMIT	Jul-21			Aug-21			Sep-21			AVERAGE FOR Q-2
Effluent discharge,M3/TMT of crude processed		83.24			74.52			76.32			
Parameters		Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	AVERAGE
pH	--	--	--	--	--	--	--	--	--	--	--
Oil & Grease	2.0	0.27	0.40	0.320	0.261	0.350	0.3007	0.275	0.366	0.3193	0.313
BOD	6.0	0.92	1.17	1.05	0.745	0.969	0.873	0.763	0.992	0.8249	0.917
COD	50	8.66	10.3	9.33	5.962	8.943	7.673	6.716	8.242	7.2683	8.090
TSS	8.0	1.17	1.7	1.360	0.969	1.341	1.212	0.763	1.374	1.1203	1.231
Phenols	0.14	0.01	0.015	0.011	0.013	0.017	0.015	0.011	0.017	0.0143	0.014
Sulphides	0.2	0.03	0.037	0.033	0.028	0.034	0.031	0.027	0.037	0.0309	0.032
CN	0.08	0.01	0.014	0.012	0.007	0.013	0.011	0.007	0.014	0.0096	0.011
Ammonia as N	6.0			0.961			0.602			0.6960	0.753
TKN	16			0.716			0.062			0.0633	0.280
P	1.2			0.033			0.046			0.0389	0.039
Cr (Hexavalent)	0.04			0.001			0.001			0.0008	0.001
Cr (Total)	0.8			0.001			0.001			0.0008	0.001
Pb	0.04			0.000			0.000			0.0004	0.000
Hg	0.004			0.0001			0.0001			0.0001	0.0001
Zn	2.0			0.002			0.001			0.0015	0.002
Ni	0.4			0.002			0.001			0.0015	0.002
Cu	0.4			0.002			0.001			0.0015	0.002
V	0.8			0.017			0.015			0.0153	0.016
Benzene	0.04			0.004			0.004			0.0038	0.004
Benzo (a) - Pyrene	0.08			0.000			0.000			0.0000	0.000

II. COMPLIANCE OF EFFLUENT STANDARD (Quantum based)

(Figs. in Kg/1000 Ton Crude processed)

QUARTER : Q3 (Oct'21-Dec'21)

PLEASE ENTER THE AVERAGE VALUES FOR THE RESPECTIVE MONTHS (KG/1000 TON CRUDE PROCESSED)

PARAMETER	LIMIT	Oct-21			Nov-21			Dec-21			AVERAGE FOR Q-3
Effluent discharge,M3/ TMT of crude processed		69.77			74.28			174.99			
Parameters		Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	Min value observed	Max value observed	Average value for month	AVERAGE
pH	--	--	--	--	--	--	--	--	--	--	--
Oil & Grease	2.0	0.21	0.33	0.271	0.223	0.357	0.2994	0.612	0.735	0.6825	0.418
BOD	6.0	0.63	0.84	0.75	0.743	0.891	0.803	1.750	2.100	1.9249	1.158
COD	50	3.91	8.1	5.88	4.754	7.428	6.480	10.500	20.999	14.8394	9.065
TSS	8.0	0.63	1.3	0.888	0.520	1.263	0.937	1.575	3.150	2.5829	1.469
Phenols	0.14	0.01	0.014	0.013	0.012	0.019	0.015	0.026	0.045	0.0350	0.021
Sulphides	0.2	0.02	0.029	0.027	0.026	0.031	0.029	0.042	0.084	0.0665	0.041
CN	0.08	0.01	0.009	0.008	0.007	0.010	0.009	0.017	0.024	0.0210	0.013
Ammonia as	6.0			0.050			0.305			0.5425	0.299
TKN	16			0.065			0.416			1.0675	0.516
P	1.2			0.036			0.070			0.0630	0.056
Cr	0.04			0.001			0.001			0.0017	0.001
Cr (Total)	0.8			0.001			0.001			0.0017	0.001
Pb	0.04			0.000			0.000			0.0009	0.001
Hg	0.004			0.0001			0.0001			0.0009	0.0003
Zn	2.0			0.001			0.001			0.0035	0.002
Ni	0.4			0.001			0.001			0.0035	0.002
Cu	0.4			0.001			0.001			0.0035	0.002
V	0.8			0.014			0.015			0.0350	0.021
Benzene	0.04			0.003			0.004			0.0087	0.005
Benzo (a) - Pyrene	0.08			0.000			0.000			0.0000	0.000

STACK EMISSION PARAMETERS OF HALDIA REFINERY

Sl. No.	Source Name	Height	Diameter	ANNUAL AVG (2019-20) Pollutants' Concentration (kg/hr)					
		(M)	(M)	PM	SO_2	NO_x	H_2S	CO	HC
1	CDU # 1	53.8	1.94	5.7	15.8	12.0	0.0	0.4	0.5
2	CDU # 1 Trim Heater	60	1.402	1.5	3.8	3.7	0.0	0.1	0.2
3	CDU # 2	53.8	1.968	4.7	37.2	12.6	0.0	0.4	0.5
4	CDU # 2 Trim Heater	60	1.402	1.0	9.5	3.0	0.0	0.1	0.1
5	VDU # 1	47.8	2.4	5.4	22.2	12.3	0.0	0.3	0.3
6	VDU # 1 Trim Heater	60	1.8	1.4	7.6	4.7	0.0	0.1	0.1
7	FEU	35.2	1.1	0.0	0.0	0.0	0.0	0.0	0.0
8	FPU	60	1.1	1.5	2.2	0.0	0.0	0.0	0.0
9	GAS TURBINE(GT#1)	60	3	3.5	7.5	7.2	0.0	0.2	0.3
10	GAS TURBINE(GT#2)	60	3	5.0	9.9	9.4	0.0	0.2	0.3
11	GAS TURBINE(GT#3)	60	3	3.2	3.1	6.4	0.0	0.2	0.2
12	VBU	39	1.3	2.1	15.9	4.8	0.0	0.2	0.2
13	HGU-1 (PDS)	60	0.35	0.0	0.0	0.0	0.0	0.0	0.0
14	HGU # 1 Reformer	60	1.15	0.7	0.7	0.0	0.0	0.0	0.0
15	HGU # 2 Reformer	60	2.65	2.0	3.0	0.9	0.0	0.2	0.2
16	HGU # 2 PDS	60	0.55	0.0	0.1	0.0	0.0	0.0	0.0
17	FCCU (Heater)	60	1.48	0.2	1.1	1.1	0.0	0.0	0.0
18	FCCU (Regenarator)	100	2	6.6	66.3	14.7	0.0	0.7	0.8
19	SRU - II	63	0.8	0.9	23.7	2.1	0.0	0.1	0.1
20	SRU - III	63	0.8	0.8	21.1	2.1	0.0	0.1	0.1
21	SRU - IV(NEW)	60	1.06	1.4	40.7	3.6	0.0	0.2	0.2
22	TPS (Boiler-I)	80	2.5	14.8	33.8	40.2	0.0	1.7	1.8
23	TPS (Boiler-II)	80	2.5	16.4	131.6	38.7	0.0	1.8	2.1
24	TPS (Boiler-III)	80	2.5	17.9	80.8	38.1	0.0	1.8	2.1
25	TPS (Boiler-IV)	80	2.5	18.6	139.9	45.6	0.0	2.1	2.5
26	CRU	40.5	1.77	0.4	1.9	1.6	0.0	0.0	0.0
27	KHDS	30.3	1.55	0.3	1.2	1.0	0.0	0.0	0.0
28	HFU	21.5	0.65	0.1	0.2	0.2	0.0	0.0	0.0
29	VDU # 2	60	2.38	4.3	39.5	13.7	0.0	0.6	0.7
30	MSQU	65	1.4	0.3	1.3	1.1	0.0	0.0	0.0
31	DHDS	60	1.35	0.2	0.8	0.7	0.0	0.0	0.0
32	CIDW	60	1.5	0.2	0.7	1.2	0.0	0.0	0.0
33	PDA	35.7	1.25	1.1	7.5	3.2	0.0	0.1	0.1
34	OHCU	60	2.65	2.8	11.6	8.0	0.0	0.2	0.3
	AVG			**125.1**	**742.1**	**293.8**	**0.0**	**11.9**	**13.7**
				ANNUAL AVG VALUE OF EACH PARAMETER					

STACK EMISSION PARAMETERS OF HALDIA REFINERY

Sl. No.	Source Name	Height	Diameter	ANNUAL AVG (2018-19)					
				Pollutants' Concentration (kg/hr)					
		(M)	(M)	PM	SO_2	NO_x	H_2S	CO	HC
1	CDU # 1	53.8	1.94	5.8	23.8	11.1	0.0	0.3	0.4
2	CDU # 1 Trim Heater	60	1.402	1.6	7.2	3.8	0.0	0.2	0.2
3	CDU # 2	53.8	1.968	4.4	45.9	11.1	0.0	0.4	0.3
4	CDU # 2 Trim Heater	60	1.402	1.0	13.1	2.9	0.0	0.1	0.1
5	VDU # 1	47.8	2.4	5.3	23.8	11.2	0.0	0.3	0.3
6	VDU # 1 Trim Heater	60	1.8	1.5	9.5	4.1	0.0	0.1	0.1
7	FEU	35.2	1.1	0.0	18.5	0.0	0.0	0.0	0.0
8	FPU	60	1.1	1.5	1.2	0.0	0.0	0.0	0.0
9	GAS TURBINE(GT#I)	60	3	4.5	7.6	6.3	0.0	0.2	0.2
10	GAS TURBINE(GT#2)	60	3	5.3	10.1	7.9	0.0	0.2	0.2
11	GAS TURBINE(GT#3)	60	3	3.8	6.7	5.8	0.0	0.2	0.2
12	VBU	39	1.3	2.3	29.2	5.2	0.0	0.2	0.2
13	HGU-1 (PDS)	60	0.35	0.0	0.1	0.0	0.0	0.0	0.0
14	HGU # 1 Reformer	60	1.15	1.3	3.9	0.0	0.0	0.1	0.2
15	HGU # 2 Reformer	60	2.65	1.6	5.1	0.0	0.0	0.2	0.2
16	HGU # 2 PDS	60	0.55	0.0	0.1	0.0	0.0	0.0	0.0
17	FCCU (Heater)	60	1.48	0.3	1.3	1.0	0.0	0.0	0.0
18	FCCU (Regenarator)	100	2	5.9	83.9	13.2	0.0	0.8	0.7
19	SRU - II	63	0.8	0.8	11.4	1.8	0.0	0.1	0.1
20	SRU - III	63	0.8	0.8	43.3	2.2	0.0	0.1	0.1
21	SRU - IV(NEW)	60	1.06	1.4	72.5	3.9	0.0	0.2	0.2
22	TPS (Boiler-I)	80	2.5	16.1	0.0	42.6	0.0	1.5	1.7
23	TPS (Boiler-II)	80	2.5	13.5	46.5	36.1	0.0	1.6	1.7
24	TPS (Boiler-III)	80	2.5	17.7	51.5	42.2	0.0	1.8	2.0
25	TPS (Boiler-IV)	80	2.5	17.5	147.0	46.3	0.0	1.9	2.1
26	CRU	40.5	1.77	0.4	1.7	1.4	0.0	0.0	0.0
27	KHDS	30.3	1.55	0.3	1.2	0.9	0.0	0.0	0.0
28	HFU	21.5	0.65	0.1	0.2	0.1	0.0	0.0	0.0
29	VDU # 2	60	2.38	3.8	64.5	15.5	0.0	0.5	0.6
30	MSQU	65	1.4	0.3	5.8	0.9	0.0	0.0	0.0
31	DHDS	60	1.35	0.2	1.0	0.8	0.0	0.0	0.0
32	CIDW	60	1.5	0.3	0.8	0.9	0.0	0.0	0.0
33	PDA	35.7	1.25	1.1	12.2	3.2	0.0	0.1	0.1
34	OHCU	60	2.65	2.5	16.1	7.3	0.0	0.3	0.3
	AVG			**122.5**	**766.6**	**289.6**	**0.0**	**11.5**	**12.3**
				ANNUAL AVG VALUE OF EACH PARAMETER					

STACK EMISSION PARAMETERS OF HALDIA REFINERY

Sl. No.	Source Name	Height	Diameter	ANNUAL AVG (207-18) Pollutants' Concentration (kg/hr)					
		(M)	(M)	PM	SO_2	NO_x	H_2S	CO	HC
1	CDU # I	53.8	1.94	5.5	26.8	10.8	0.0	0.4	0.4
2	CDU # 1 Trim Heater	60	1.402	1.6	8.5	3.3	0.0	0.2	0.2
3	CDU # 2	53.8	1.968	5.0	46.8	11.1	0.0	0.4	0.4
4	CDU # 2 Trim Heater	60	1.402	1.1	14.3	2.9	0.0	0.1	0.2
5	VDU # 1	47.8	2.4	5.8	25.4	11.3	0.0	0.4	0.4
6	VDU # 1 Trim Heater	60	1.8	1.7	14.6	3.7	0.0	0.1	0.2
7	FEU	35.2	1.1	0.0	38.6	0.0	0.0	0.0	0.0
8	FPU	60	1.1	1.5	2.3	0.0	0.0	0.1	0.1
9	GAS TURBINE(GT#I)	60	3	6.0	9.5	6.1	0.0	0.4	0.6
10	GAS TURBINE(GT#2)	60	3	7.9	12.0	9.0	0.0	0.6	0.6
11	GAS TURBINE(GT#3)	60	3	4.9	8.8	6.3	0.0	0.4	0.4
12	VBU	39	1.3	1.8	27.0	5.2	0.0	0.2	0.2
13	HGU-1 (PDS)	60	0.35	0.0	0.0	0.0	0.0	0.0	0.0
14	HGU # 1 Reformer	60	1.15	0.0	0.0	0.0	0.0	0.0	0.0
15	HGU # 2 Reformer	60	2.65	1.5	6.1	0.0	0.0	0.2	0.2
16	HGU # 2 PDS	60	0.55	0.0	0.1	0.0	0.0	0.0	0.0
17	FCCU (Heater)	60	1.48	0.4	1.5	1.0	0.0	0.0	0.0
18	FCCU (Regenarator)	100	2	6.0	74.3	12.2	0.0	0.8	0.7
19	SRU - II	63	0.8	0.8	34.0	1.9	0.0	0.1	0.1
20	SRU - III	63	0.8	0.7	36.1	1.6	0.0	0.1	0.1
21	SRU - IV(NEW)	60	1.06	1.6	75.1	3.9	0.0	0.2	0.2
22	TPS (Boiler-I)	80	2.5	0.0	0.0	0.0	0.0	0.0	0.0
23	TPS (Boiler-II)	80	2.5	0.0	0.0	0.0	0.0	0.0	0.0
24	TPS (Boiler-III)	80	2.5	15.2	128.8	34.7	0.0	1.8	1.8
25	TPS (Boiler-IV)	80	2.5	16.8	169.6	44.2	0.0	1.9	2.0
26	CRU	40.5	1.77	0.4	1.2	1.0	0.0	0.0	0.0
27	KHDS	30.3	1.55	0.2	1.1	0.9	0.0	0.0	0.0
28	HFU	21.5	0.65	0.0	0.2	0.2	0.0	0.0	0.0
29	VDU # 2	60	2.38	4.2	69.1	15.5	0.0	0.6	0.8
30	MSQU	65	1.4	0.2	0.9	0.6	0.0	0.0	0.0
31	DHDS	60	1.35	0.2	0.8	0.6	0.0	0.0	0.0
32	CIDW	60	1.5	0.2	1.0	0.7	0.0	0.0	0.0
33	PDA	35.7	1.25	1.2	12.3	3.3	0.0	0.1	0.1
34	OHCU	60	2.65	2.4	19.9	7.3	0.0	0.3	0.3
	AVG			**94.8**	**866.7**	**199.0**	**0.0**	**9.4**	**10.0**
				ANNUAL AVG VALUE OF EACH PARAMETER					

STACK EMISSION PARAMETERS OF HALDIA REFINERY

Sl. No.	Source Name	Height	Diameter	ANNUAL AVG (2015-16)					
				Pollutants' Concentration (kg/hr)					
		(M)	(M)	PM	SO_2	NO_x	H_2S	CO	HC
1	CDU # 1	53.8	1.94	4.7	34.7	7.6	0.0	0.4	0.5
2	CDU # 1 Trim Heater	60	1.402	1.2	10.1	2.0	0.0	0.1	0.1
3	CDU # 2	53.8	1.968	4.4	49.6	9.5	0.0	0.4	0.5
4	CDU # 2 Trim Heater	60	1.402	1.2	20.5	3.3	0.0	0.2	0.2
5	VDU # 1	47.8	2.4	4.8	37.0	10.2	0.0	0.4	0.5
6	VDU # 1 Trim Heater	60	1.8	2.3	15.6	3.2	0.0	0.1	0.2
7	FEU	35.2	1.1	1.3	18.4	2.4	0.0	0.1	0.1
8	FPU	60	1.1	0.0	0.0	0.0	0.0	0.0	0.0
9	GAS TURBINE(GT#I)	60	3	9.8	17.2	14.4	0.0	0 7	0.9
10	GAS TURBINE(GT#2)	60	3	12.5	13.9	9 8	0.0	0.6	0.8
11	GAS TURBINE(GT#3)	60	3	8.5	10.4	8.0	0.0	0.4	0.5
12	VBU	39	1.3	1.8	14.3	3.8	0.0	0.1	0.1
13	HGU-1 (PDS)	60	0.35	0.0	0.0	0.0	0.0	0.0	0.0
14	HGU # 1 Reformer	60	1 15	0.0	0.0	0.0	0.0	0.0	0.0
15	HGU # 2 Reformer	60	2.65	3.9	8.5	0.0	0.0	0.2	0.3
16	HGU # 2 PDS	60	0.55	0.1	0.2	0.0	0.0	0.0	0.0
17	FCCU (Heater)	60	1.48	1.3	4.2	3.3	0.0	0.1	0.1
18	FCCU (Regenarator)	100	2	6.8	75.1	12.1	0.0	0.9	1.0
19	SRU - II	63	0.8	0.8	2.3	1.5	0.0	0.1	0.1
20	SRU - III	63	0.8	0.9	3.4	1.7	0.0	0.1	0.1
21	SRU - IV(NEW)	60	1.06	1.7	5.1	2.7	0.0	0.1	0.1
22	TPS (Boiler-I)	80	2.5	0.0	0.0	0.0	0.0	0.0	0.0
23	TPS (Boiler-II)	80	2.5	0.0	0.0	0.0	0.0	0.0	0.0
24	TPS (Boiler-III)	80	2.5	13.1	148.7	19.7	0.0	1.4	1.6
25	TPS (Boiler-IV)	80	2.5	14.4	174.6	41.7	0.0	1.6	1.7
26	CRU	40.5	1.77	1.4	3.0	3.3	0.0	0.2	0.2
27	KHDS	30.3	1.55	2.3	6.1	4.4	0.0	0.1	0.2
28	HFU	21.5	0.65	0.3	1.5	0.8	0.0	0.0	0.0
29	VDU # 2	60	2.38	5.9	82.5	14.9	0.0	0.6	0.7
30	MSQU	65	1.4	1.1	1.9	1.9	0.0	0.0	0.0
31	DHDS	60	1.35	1.1	5.5	2.6	0.0	0.0	0.0
32	CIDW	60	1.5	1.4	1.9	2.0	0.0	0.0	0.1
33	PDA	35.7	1.25	1.2	19.6	3.7	0.0	0.1	0.1
34	OHCU	60	2.65	6.5	39.0	14.9	0.0	0.5	0.6
	AVG			**116.9**	**824.8**	**205.3**	**0.0**	**9.5**	**11.4**
				ANNUAL AVG VALUE OF EACH PARAMETER					

Stack emission parameters of Haldia Refinery

Sl. No.	Source Name	Height	Diameter	ANNUAL AVG (2013-14)				
				Pollutants Concentration (kg/hr)				
	Stack Attached to	(M)	(M)	PM	SO_2	NO_x	H_2S	CO
1	CRU	40.5	1.77	1.4	2.9	1.9	0.0	0.2
2	CDU-II	54.9	1.97	3.7	62.3	14.2	0.0	0.6
3	CDU-II Trim Heater	65.5	1.40	2.0	26.2	5.5	0.0	0.3
4	CDU-I Trim heater	60	1.40	1.9	11.9	3.1	0.0	0.2
5	CDU-I	60	1.40	2.0	11.3	3.0	0.0	0.1
6	KHDS.	30.3	1.55	2.3	15.9	4.5	0.0	0.2
7	FCCU (Heater)	60	1.48	1.5	3.8	3.8	0.0	0.2
8	FCCU (Regenarator)	100	2.00	6.6	77.4	14.7	0.0	1.4
9	MSQU	65	1.40	1.3	0.9	1.1	0.0	0.0
10	DHDS	60	1.35	1.2	1.9	1.4	0.0	0.1
11	HGU-I Reformer	60	1.15	0.0	0.0	0.0	0.0	0.0
12	HGU-I PDS	60	0.35	0.0	0.0	0.0	0.0	0.0
13	OHCU	60	2.65	8.4	52.9	13.7	0.0	0.9
14	HGU-II Reformer	60	2.65	5.3	6.4	4.0	0.0	0.2
15	HGU-II PDS	60	0.55	0.2	0.3	0.0	0.0	0.0
16	PDA	35.7	1.25	0.9	20.4	4.1	0.0	0.2
17	VBU (South)	39	1.30	1.4	37.3	4.2	0.0	0.3
18	VDU-I Main	47.8	2.40	3.7	34.8	8.7	0.0	0.6
19	VDU-I Trim Heater	60	1.80	2.6	16.1	4.5	0.0	0.3
20	CIDW	60	1.50	1.1	1.7	1.5	0.0	0.1
21	TPS (Boiler-I)	80	2.50	0.0	0.0	0.0	0.0	0.0
22	TPS (Boiler-II)	80	2.50	15.8	144.4	22.6	0.0	2.6
23	TPS (Boiler-III)	80	2.50	15.4	162.0	22.4	0.0	3.0
24	TPS (Boiler-IV)	80	2.50	11.9	174.4	22.3	0.0	2.1
25	GAS TURBINE(GT#1)	60	3.00	13.0	24.5	16.6	0.0	2.9
26	GAS TURBINE(GT#2)	60	3.00	13.0	19.8	12.4	0.0	0.9
27	GAS TURBINE(GT#3)	60	3.00	13.1	22.7	15.1	0.0	1.0
28	VDU-II	60	2.38	5.4	65.9	10.9	0.0	0.7
29	INCINERATOR	30	0.60	0.0	0.0	0.0	0.0	0.0
31	FEU	35.2	1.10	1.5	43.6	2.8	0.0	0.1
32	HFU	21.5	0.70	0.3	1.5	0.9	0.0	0.0
33	SRU-II	63	0.80	0.9	35.8	1.7	0.0	0.1
30	SRU - III	63	0.80	0.7	43.4	1.5	0.0	0.1
34	SRU-IV	60	2.65	1.2	70.4	2.1	0.0	0.1
			Total	139.7	1192.6	225.2	0.0	19.5
				ANNUAL AVG VALUE OF EACH PARAMETER				

Stack emission parameters of Haldia Refinery

Sl. No.	Source Name	Height	Diameter	ANNUAL AVG (2012-13)				
				Pollutants' Concentration (kg/hr)				
	Stack Attached to	(M)	(M)	PM	SO_2	NO_x	H_2S	CO
1	CRU	40.5	1.77	1.8	7.9	2.3	0.0	0.2
2	CDU-II	54.9	1.968	4.9	55.3	11.2	0.0	0.8
3	CDU-II Trim Heater	65.5	1.402	1.9	20.9	4.7	0.0	0.3
4	CDU-I	53.8	1.94	7.1	62.6	13.3	0.0	0.9
5	CDU-I Trim Heater	60	1.402	2.2	16.4	2.7	0.0	0.2
6	KHDS	30.3	1.55	1.9	10.8	2.5	0.0	0.2
7	FCCU (Heater)	60	1.48	1.6	3.5	2.8	0.0	0.6
8	FCCU (Regenarator)	100	2	6.9	74.5	13.1	0.0	1.2
9	MSQU	65	1.4	1.9	2.9	2.5	0.0	0.0
10	DHDS	60	1.35	1.7	8.9	4.3	0.0	0.2
11	HGU-I Reformer	60	1.15	0.6	2.3	1.1	0.0	0.1
12	HGU-I PDS	60	0.35	0.1	0.2	0.5	0.0	0.0
13	OHCU	60	2.65	7.9	48.4	14.2	0.0	1.1
14	HGU-II Reformer	60	2.65	5.1	16.7	4.0	0.0	0.5
15	HGU-II PDS	60	0.55	0.2	0.8	0.1	0.0	0.0
16	PDA	35.7	1.25	1.0	18.0	3.3	0.0	0.1
17	VBU	39	1.3	1.2	26.4	3.9	0.0	0.2
18	VDU-I	47.8	2.4	4.7	31.7	9.4	0.0	0.6
19	VDU-I Trim Heater	60	1.8	2.4	18.0	4.6	0.0	0.2
20	CIDW	60	1.5	2.3	15.8	4.6	0.0	0.3
21	TPS (Boiler-I)	80	2.5	0.0	0.0	0.0	0.0	0.0
22	TPS (Boiler-II)	80	2.5	0.0	0.0	0.0	0.0	0.0
23	TPS (Boiler-III)	80	2.5	9.2	139.3	31.1	0.0	2.2
24	TPS (Boiler-IV)	80	2.5	11.2	107.9	28.4	0.0	2.1
25	GAS TURBINE(GT#1)	60	3	13.0	26.7	15.2	0.0	3.4
26	GAS TURBINE(GT#2)	60	3	22.2	33.3	20.4	0.0	0.9
27	GAS TURBINE(GT#3)	60	3	15.0	23.4	18.3	0.0	1.0
28	VDU-II	60	2.38	6.0	59.6	9.8	0.0	0.8
29	INCINERATOR	30	0.6	0.0	0.0	0.0	0.0	0.0
30	FEU	35.2	1.1	1.4	46.1	2.9	0.0	0.1
31	HFU	21.5	0.7	0.4	1.5	0.8	0.0	0.1
32	SRU-II	63	0.8	0.9	37.3	1.7	0.0	0.1
33	SRU - III	63	0.8	0.9	44.8	1.6	0.0	0.1
34	SRU-IV	60	2.65	1.3	68.1	2.5	0.0	0.1
			Total	**138.9**	**1029.7**	**236.0**	**0.0**	**18.6**
				ANNUAL AVG VALUE OF EACH PARAMETER				

Stack emission parameters of Haldia Refinery

Sl. No.	Source Name / Stack Attached to	Height (M)	Diameter (M)	ANNUAL AVG (2011-12) Pollutants' Concentration (kg/hr) PM	SO_2	NO_x	H_2S	CO
1	CRU	40.5	1.8	1.9	12.5	2.9	0.0	0.3
2	CDU-II	54.9	2.0	3.3	48.4	11.5	0.0	0.9
3	CDU-II Trim	65.5	1.4	1.6	18.3	4.5	0.0	0.3
4	CDU-I	53.8	1.94	5.7	52.6	10.8	0.0	0.9
5	CDU-II Trim	60	1.40	1.6	14.4	2.2	0.0	0.2
6	KHDS	30.3	1.55	1.9	15.7	3.2	0.0	0.2
7	FCCU (Heater)	60	1.48	1.3	3.4	3.1	0.0	0.5
8	FCCU (Regenarator)	100	2.00	8.2	91.3	13.8	0.0	1.4
9	MSQU	65	1.40	1.1	1.6	2.5	0.0	0.0
10	DHDS	60	1.35	1.2	7.4	3.7	0.0	0.2
11	HGU-I Reformer	60	1.15	0.0	0.0	0.0	0.0	0.0
12	HGU-I PDS	60	0.35	0.0	0.0	0.0	0.0	0.0
13	OHCU	60	2.65	7.0	46.0	12.8	0.0	1.4
14	HGU-II Reformer	60	2.65	4.0	16.7	0.0	0.0	0.6
15	HGU-II PDS	60	0.55	0.6	2.6	0.0	0.0	0.1
16	PDA	35.7	1.25	1.0	18.9	2.4	0.0	0.2
17	VBU	39	1.30	1.5	10.0	7.2	0.0	0.3
18	VDU-I	47.8	2.40	5.1	31.5	9.1	0.0	0.6
19	VDU-I Trim	60	1.48	2.6	12.7	3.1	0.0	0.2
20	CIDW	60	1.50	1.6	15.6	3.8	0.0	0.3
21	TPS (Boiler-I)	80	2.50	12.6	145.6	34.9	0.0	1.8
22	TPS (Boiler-II)	80	2.50	13.1	134.3	40.5	0.0	2.1
23	TPS (Boiler-III)	80	2.50	13.7	146.4	41.1	0.0	2.2
24	TPS (Boiler-IV)	80	2.50	16.2	167.6	42.4	0.0	2.5
25	GAS TURBINE(GT#1)	60	3.00	11.0	24.6	17.8	0.0	2.3
26	GAS TURBINE(GT#2)	60	3.00	11.5	17.9	14.3	0.0	1.0
27	GAS TURBINE(GT#3)	60	3.00	11.2	21.1	17.6	0.0	1.2
28	VDU-II	60	2.38	4.5	56.5	8.7	0.0	0.8
29	INCINERATOR	30	0.60	0.4	0.2	0.6	0.0	0.1
30	SRU - III	63	0.80	0.8	37.6	1.0	0.0	0.1
31	FEU	35.2	1.10	1.2	42.3	2.7	0.0	0.1
32	HFU	21.5	0.70	0.3	1.0	0.7	0.0	0.1
33	SRU-II	63	0.80	0.8	34.8	1.3	0.0	0.1
34	SRU-IV	60	1.06	1.3	67.2	2.2	0.0	0.1
			Total	**149.6**	**1316.7**	**322.2**	**0.0**	**23.0**
				ANNUAL AVG VALUE OF EACH PARAMETER				

Stack emission parameters of Haldia Refinery

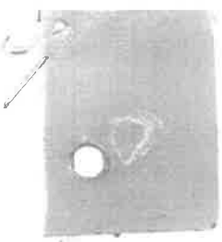
Sl. No.	Source Name / Stack Attached to	Height (M)	Diameter (M)	ANNUAL AVG (2010-11) Pollutants' Concentration (kg/hr) PM	SO_2	NO_x	H_2S	CO
1	CRU	40.5	1.77	1.3	9.7	3.1	0.0	0.2
2	CDU- II Main	54.9	2.0	4.1	53.6	12.5	0.0	0.8
3	CDU - I Main	54.9	2.0	4.5	54.5	12.6	0.0	0.8
4	CDU-II Trim Heater	65.5	1.4	1.3	20.9	5.4	0.0	0.3
5	CDU-I Trim Heater	65.5	1.4	1.6	22.8	6.0	0.0	0.3
6	KHDS.	30.3	1.6	1.7	14.6	2.8	0.0	0.2
7	FCCU (Heater)	60	1.5	1.0	3.0	3.9	0.0	0.4
8	FCCU (Regenarator)	100	2.4	7.3	69.4	11.6	0.0	1.2
9	MSQU	65	1.4	0.8	1.1	1.5	0.0	0.0
10	DHDS	60	1.4	0.8	5.2	3.5	0.0	0.2
11	HGU-I Reformer	60	1.2	0.5	2.4	0.0	0.0	0.1
12	HGU-I PDS	60	0.4	0.1	0.2	0.0	0.0	0.0
13	OHCU	60	2.7	7.4	46.2	13.8	0.0	1.2
14	HGU-II Reformer	60	2.6	3.9	18.2	2.1	0.0	0.6
15	HGU-II PDS	60	0.6	0.2	0.7	0.8	0.0	0.0
16	PDA	35.7	1.3	1.0	19.6	1.8	0.0	0.2
17	VBU	39	1.3	1.5	24.9	2.4	0.0	0.3
18	VDU (Old)	47.8	2.4	5.1	29.9	9.3	0.0	0.6
19	VDU (Old) Trim Heate	60	1.5	2.5	11.9	3.4	0.0	0.3
20	NMP	63	1.2	1.4	19.1	1.6	0.0	0.2
21	CIDW	60	1.5	1.0	12.1	3.0	0.0	0.2
22	TPS (Boiler-I)	80	2.5	11.9	133.6	35.1	0.0	1.7
23	TPS (Boiler-II)	80	2.5	11.9	126.8	40.1	0.0	2.1
24	TPS (Boiler-III)	80	2.5	0.0	0.0	0.0	0.0	0.0
25	TPS (Boiler-IV)	80	2.5	16.5	163.7	42.7	0.0	2.8
26	GAS TURBINE(GT#1)	60	3	6.8	9.9	11.3	0.0	1.1
27	GAS TURBINE(GT#2)	60	3	7.8	9.1	10.0	0.0	0.9
28	GAS TURBINE(GT#3)	60	3	9.1	11.7	12.0	0.0	1.2
29	VDU-II	60	2.4	4.1	43.4	6.1	0.0	0.7
30	INCINERATOR	30	0.6	0.5	0.2	0.6	0.0	0.1
31	FEU	35.2	1.1	1.0	13.6	3.4	0.0	0.1
32	HFU	21.5	0.7	0.2	0.6	0.6	0.0	0.0
33	SRU-II	63	0.8	0.9	28.9	1.3	0.0	0.1
34	SRU - III	63	0.8	0.8	41.3	1.1	0.0	0.1
35	SRU-IV	63	1.1	1.5	75.5	2.0	0.0	0.2
			TOTAL	121.8	1098.4	264.3	0.0	19.3
				ANNUAL AVG VALUE OF EACH PARAMETER				

OIL INDUSTRY SAFETY DIRECTORATE STANDARDS AND GUIDELINES FOR PETROLUEM REFINERY

Sr. No.	OISD Standard/GDN/ RP No	Standard Name	Current edition in vogue
1	OISD-STD-105	Work Permit System	Sep, 2004
2	OISD-STD-106	Pressure Relief & Disposal System	Oct, 2010
3	OISD-RP-108	Recommended Practices on Oil Storage and Handling	Jul, 1997
4	OISD-STD-109	Process Design and Operating Philosophies on Blow Down & sewer system	Jan, 2015
5	OISD-RP-110	Recommended Practices on Static Electricity	Oct, 2018
6	OISD-STD-111	Process Design & Operating Philosophies on Fired Process Furnace	Apr, 2016
7	OISD-STD-112	Safe Handling of Air Hydrocarbon Mixtures & Pyrophoric Substances	Aug, 2019
8	OISD-STD-113	Classification of Area for Electrical Installations at Hydrocarbon Processing & Handling Facilities	Oct, 2013
9	OISD-STD-114	Safe Handling of Hazardous Chemicals	Oct, 2010
10	OISD-GDN-115	Guidelines on Fire Fighting Equipment and Appliances in Petroleum Industry	Jul, 2000
11	OISD-STD-116	Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants	Oct, 2017
12	OISD-STD-118	Layouts for Oil and Gas Installations	Jul, 2008
13	OISD-STD-119	Selection, Operation and Maintenance of Pumps	Jul, 2008
14	OISD-STD-120	Selection, Operation and Maintenance of Compressors	Jul, 2008
15	OISD-STD-121	Selection, Operation Inspection & Maintenance of Steam & Gas Turbines	Oct, 2010
16	OISD-RP-122	Selection, Operation and Maintenance of Fans, Blowers, Gear Boxes, Agitators & Mixers	Jul, 2008
17	OISD-RP-123	Selection, Operation and Maintenance of Rotary Equipment Components	Jul, 2008
18	OISD-RP-124	Predictive Maintenance Practices	Aug, 2007
19	OISD-STD-125	Inspection & Maintenance of Mechanical Seals	Aug, 2007
20	OISD-RP-126	Specific practices for installations and maintenance of Rotating Equipment	Aug, 2007
21	OISD-STD-127	Selection, Operation, Inspection & Maintenance of Diesel Engines	Oct, 2010
22	OISD-STD-128	Inspection of Unfired Pressure Vessels	Oct, 2010
23	OISD-STD-129	Inspection of Storage Tanks	Nov, 2006
24	OISD-STD-130	Inspection of Piping Systems	Jul, 2008
25	OISD-STD-131	Inspection of Boilers	Aug, 2019
26	OISD-STD-132	Inspection of Pressure Relieving devices	Jul, 2012
27	OISD-STD-133	Inspection of Fired Heaters	Apr, 2016
28	OISD-STD-134	Inspection of Heat Exchangers	Oct, 2010
29	OISD-STD-135	Inspection of Loading & Unloading hoses for Petroleum Products	Sep, 2021
30	OISD-STD-137	Inspection of Electrical Equipment	Apr, 2016
31	OISD-STD-138	Inspection of cross country pipeline - onshore : Withdrawn in June , 2012	Jun, 2012
32	OISD-STD-140	Inspection of jetty pipelines	Aug, 2019
33	OISD-STD-141	Design and Construction requirements for cross country liquid hydrocarbon pipelines	Jul, 2012
34	OISD-STD-142	Inspection of fire fighting equipments and systems	Feb, 1996
35	OISD-STD-144	Liquefied Petroleum Gas (LPG) Installations	Oct, 2017
36	OISD-STD-145	Internal Safety Audits	Sep, 2021
37	OISD-RP-146	Preservation of idle electrical equipment	Aug, 2000
38	OISD-RP-147	Inspection & safe practices during electrical installations	Oct, 2002
39	OISD-RP-148	Inspection & safe practices during overhauling electrical equipment	Aug, 2000
40	OISD-RP-149	Design aspects for safety in electrical systems	Oct, 2013
41	OISD-STD-150	Design and Safety Requirements for Liquefied Petroleum Gas Mounded Storage Facility	Sep, 2021
42	OISD-STD-151	Safety in Design, Fabrication and Fittings Propane Tank Trucks	Oct, 2018
43	OISD-STD-152	Safety Instrumentation for Process System in Hydrocarbon Industry	Oct, 2010
44	OISD-STD-153	Maintenance & inspection of safety instrumentation in hydrocarbon industry	Jan, 2015
45	OISD-STD-154	Safety aspects in Functional Training	Sep, 2001
46	OISD-STD-155	Personal Protective Equipment	Sep, 2021
47	OISD-STD-156	Fire Protection Facilities for Ports Handling Hydrocarbons	Oct, 2017

48	OISD-RP-157	Safety in Transportation of Bulk Petroleum Products (Rail and Road)	Aug, 2019
49	OISD-RP-158	Recommended Practices on Storage and Handling of Bulk Liquefied Petroleum Gas	Aug, 2000
50	OISD-STD-159	LPG Tank Trucks - Requirements of Safety on Design/Fabrication & Fittings	Oct, 2018
51	OISD-STD-160	Protection to fittings mounted on existing LPG tank trucks : Withdrawn in Oct, 2018	Mar, 2003
52	OISD-GDN-161	LPG Tank Truck Incidents Rescue & Relief Operations	Oct, 2018
53	OISD-STD-162	Safety in installation and maintenance of LPG Cylinders Manifold	Oct, 2018
54	OISD-STD-163	Safety of Control Room in Hydrocarbon industry	Sep, 2004
55	OISD-STD-164	Fire Proofing of Steel Supporting Structures in Oil & Gas Industry	Jul, 2012
56	OISD-GDN-165	Guidelines for Rescue & Relief Operations for POL Tank Truck Accident	Jul, 1999
57	OISD-GDN-166	Guidelines for Occupational Health Monitoring in Oil and Gas Industry	Jul, 2012
58	OISD-STD-170	Inspection, Maintenance, Repairs & Rehabilitation of Foundations & Structures	Jul, 1997
59	OISD-STD-171	Preservation of Idle Static & Rotary Mechanical Equipment	Jul, 1998
60	OISD-STD-173	Fire Prevention and Protection System for Electrical Installations	Oct, 2017
61	OISD-STD-175	Cementing Operations	Jan, 2015
62	OISD-STD-176	Safety Health & Environment Training for Exploration & Production (Upstream) Personnel	Sep, 2003
63	OISD-STD-177	Inspection and Maintenance of Insulation System	Sep, 2021
64	OISD-GDN-178	Guidelines on Management of Change	Jul, 1999
65	OISD-GDN-180	Lightning Protection	Oct, 2018
66	OISD-STD-184	Standard on Life Saving Appliances	Sep, 2021
67	OISD-GDN-186	Simultaneous Operations in E&P Industry	Aug, 2008
68	OISD-STD-187	Care and Use of Wire Rope	Aug, 2000
69	OISD-STD-191	Oil Field Explosive Safety	Oct, 2017
70	OISD-GDN-192	Safety Practices during Construction	Apr, 2016
71	OISD-STD-195	Safety in Design, Operation, Inspection and Maintenance of Hydrocarbon Gas Compressor Stations and Terminals	Sep, 2001
72	OISD-GDN-196	Guidelines for Seeking Environmental Clearance of Development Projects in Petroleum Industry	Sep, 2001
73	OISD-GDN-197	Guidelines for Environmental Impact Assessment	Sep, 2001
74	OISD-GDN-199	Guidelines For Conducting Environmental Audit In Upstream Petroleum Sector (Onland) - Withdrawn in Sep, 2021	Sep, 2021
75	OISD-GDN-200	Guidelines For Preparation Of Oil Spill Response Contingency Plan	Oct, 2002
76	OISD-RP-201	Environment Management in E&P Sector	Jul, 2008

77	OISD-GDN-203	Operation, Maintenance & Inspection of Hoisting Equipment	Sep, 2003
78	OISD-GDN-204	Medical Requirements, Emergency Evacuation and Facilities (for Upstream)	Sep, 2001
79	OISD-RP-205	Recommended Practices for Crane Operation, Maintenance & Testing (for Upstream)	Aug, 2019
80	OISD-GDN-206	Guidelines on Safety Management System in Petroleum Industry	Sep, 2001
81	OISD-GDN-207	Contractor Safety	Apr, 2016
82	OISD-GDN-211	Safety in Petroleum Laboratories	Aug, 2019
83	OISD-GDN-212	Guidelines on Environmental Audit (Internal) in Downstream Petroleum Sector : Withdrawn in Sep, 2021	Sep, 2021
84	OISD-GDN-224	Monitoring & Control of Volatile Organic Compounds Emission	Nov, 2006
85	OISD-GDN-227	Emergency Response and Preparedness in E&P Industry	Aug, 2007
86	OISD-GDN-228	Selection, Training & Placement of Fire Operators in Hydrocarbon & Petrochemical Industry	Jul, 2008
87	OISD-GDN-232	Identification of hazards and control measures in E&P industry	Oct, 2013
88	OISD-GDN-233	Guidelines on inspection of non-piggable pipelines.	Oct, 2013
89	OISD-STD-234	Electrical Safety in Onshore Production Installations in E&P Sector	Jan, 2015
90	OISD-STD-237	Layout, Design consideration, Safety, Operation and Maintenance of Lube/ Grease manufacturing and filling plants	Jan, 2015



SCHEDULE-VI

(Refer Regulation 23.0)

Incident Reporting Format

1. Organization	IOCL	**2. Division**	Refinery Division
3. Location	Haldia Refinery	**4. Incident Sr. No**	
5. Date of Incident	21-12-2021	**6. Time of Incident**	1450 hrs
7. Major / Minor / Other Reportable / Nearmiss	Major	**8. Report - Preliminary / Final**	Report-Preliminary
9. Fire / Accident	Fire	**10. Duration of fire – hrs / min**	Less than 15 Minutes
11. Type of incident with loss of life/ injury; Fire, Explosion, Blowout, Electrocution, Fall from Height, Inhalation of Gas, Driving, Slip/Trip, Others,			Fire
12. Location of the Incident (Name of the Plant / Unit / Area / Facility / Tank farm / Gantry / Road / parking area etc)			Motor Spirit Quality (MSQ) Upgradation Unit
13. Whether plant shutdown / caused outage of the facility? Yes / No.			Yes, Plant was under M&I shutdown

14. Fatalities nos.	**a) Employee = Nil**	**b) Contractor = 03**	**c) Others =Nil**
15. Injuries nos.	**a) Employee = Nil**	**b) Contractor =38**	**c) Others = Nil**
16. Man-hours Lost	**a) Employee = Nil**	**b) Contractor = 9600**	**c) Others =Nil**

17. Direct Loss due the incident (Rs in Lacs). Loss to equipment / Machinery as per Insurance claim etc.	Nil
18. Indirect Losses: Throughput / Production Loss	Nil as Unit was under M&I shutdown
19 Status of the Facility: Construction / Commissioning / Operation / Shutting down / Turn around, Maintenance / Start up / Any other.	Under Maintenance
20 Brief Description of the Incident including post incident measures. (Attach details in separate sheet)	Grating cutting job at first platform was being Carried out, fire at 14:50 Hrs occurred in MSQ unit.
21. Whether Similar Incident has occurred in past at the same location, If yes, give brief description of the incident and attach details in separate sheet.	No
22. Whether Internal Investigation has been completed. If no, likely date by which it will be completed.	No, 27/12/2021
23. Whether internal investigation report (Major Incident) has been submitted to OISD / PNGRB. If no, likely date by which it will be submitted.	No, 27/12/2021

24. Cause of the Incident (Tick the most relevant cause preferably one, maximum two) – Detail Incident investigation is being done.			
a) Deviation from Procedures	Under investigation	i) Not using the PPE	Under investigation
b) Lack of Job knowledge		j) Equipment failure	
c) Lack of supervision		k) Poor design /Layout etc	
d) Improper Inspection /checking		l) Inadequate facility	
e) Improper Maint (Mech./El./Inst.)		m) Poor house keeping	
f) Improper material handling		n) Natural Calamity	
g) Negligent Driving		o) Pilferage / Sabotage	
h) Careless walking/climbing etc		p) Any other (give details)	
25. Cause of leakage - Oil, Gas or Chemical (Tick one only)			
a) Weld leak from equip / lines	Under investigation	e) Leakage due to improper operation	Under investigation
b) Leak from flange, gland etc		f) Leak due to improper maintenance	
c) Leak from rotary equipment		g) Normal operation: Venting/draining	
d) Metallurgical failure		h) Any other	
26. Cause of Ignition leading to fire (Tick only one cause):			
a) Near to hot work	Under investigation	f) Static Electricity	Under investigation
b) Near to furnace / flare etc		g) Hammering / Fall of object	
c) Auto-ignition		h) Heat due to friction	
d) Loose electrical Connection		i) Lightning	
e) Near to hot surface		j) Any other (pyrophoric etc)	
27. Was the incident Avoidable? : Under Investigation			
28. The incident could have been avoided by the use of/or by; (Tick the most relevant point preferably one, maximum two)			
a) Better supervision	Under investigation	f) Personal Protective Equipment	Under investigation
b) Adhering to specified operating		g) Better equipment	
c) Imparting Training		h) Management Control	
d) Giving adequate time to do the activity through proper planning.		i) Adhering to specified maintenance procedure	
e) Adhering to the work permit system		j) Adhering to specified Inspection / Testing procedures.	
k) Any other:			Nil

Signature: 21/12/2021

Designation of Occupier: Executive Director & Refinery Head
Location: Haldia Refinery, Indian Oil Corporation Ltd,
Date: 21/12/2021

O/c – Exgratia

Indian Oil Corporation Limited

Haldia Refinery

PO Haldia Oil Refinery

Dist Purba Medinipur West Bengal 721606

To

Dated: 30.12.2021

Branch Manager

State Bank of India

Haldia Refinery Campus Branch

Purba Medinipur-721606

Sub-Payment Exgratia

Sir,

Please Pay Rs. 10,00,000/- (Rupees Ten lacs only) as mentioned in attached list and debit the same according to individual payment to our OD Account 10521992237.

BENEFICIARY_A/C NO	IFSC CODE	BENEFICIARY_NAME	TRAN_AMOUNT
50100483970084	HDFC0003320	Ms. Neetu	10,00,000

Please do the needful.

UTR NO – SBIN321365187224

STATE BANK OF INDIA HALDIA REFINERY CAMPUS BR.

31 DEC 2021

Thanking You,

Yours faithfully

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

सतपाल वर्मा, सहायक निदेशक

Satpal Verma, Assistant Manager

इंडियन ऑयल कॉर्पोरेशन

INDIAN OIL CORPORATION LIMITED

To
The Branch Manager
State Bank of India
Haldia Refinery Campus Brach
Purba Medinipur - 721606

Dated-21/01/2022

Sub – Payment to ExGratia.

Sir,

Please pay Rs.10,00,000/- (Rupees Ten Lacs only) as mentioned in attached sheet and debit the same according to individual payment to our OD account 10521992237.

BENEFICIARY_A/C NO	IFSC CODE	BENEFICIARY_NAME	TRAN_AMOUNT
921010056787626	UTIB0001003	Ms. Navneet Kaur	10,00,000

Please do the needful.

Thanking you,

Yours faithfully

For and on behalf of
Indian Oil Corporation Ltd
Haldia Refinery

सौरव गुप्ता, वित्त अधिकारी
Saurav Gupta, Finance Officer

For and on behalf of
Indian Oil Corporation Ltd
Haldia Refinery
कल्याण आर, वरिष्ठ लेखा अधिकारी
Kalyan R. Senior Accounts Officer

UTR No:- SBIN122021164938

21 JAN 2022

C/c - Ex-Gratia

Indian Oil Corporation Limited

Haldia Refinery

PO Haldia Oil Refinery

Dist Purba Medinipur West Bengal 721606

To

Dated: 17.01.2022

Branch Manager

State Bank of India

Haldia Refinery Campus Branch

Purba Medinipur-721606

Sub-Payment ExGratia

Sir,

Please Pay Rs. 10,00,000/- (Rupees Ten lacs only) as mentioned in attached list and debit the same according to individual payment to our OD Account 10521992237.

BENEFICIARY_A/C NO	IFSC CODE	BENEFICIARY_NAME	TRAN_AMOUNT
50100488187041	HDFC0002894	Ms. Manjinder Kaur	10,00,000

Please do the needful.

UTR - SBIN222017160403 J-211467494

Thanking You,

Yours faithfully

17 JAN 2022

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

कल्याण आर. वरिष्ठ लेखा अधिकारी

Kalyan R. Senior Accounts Officer

EX-GRATIA

Indian Oil Corporation Limited

Haldia Refinery

PO Haldia Oil Refinery

Dist Purba Medinipur West Bengal 721606

O/C.

To

Dated: 31.12.2021

Branch Manager

State Bank of India

Haldia Refinery Campus Branch

Purba Medinipur-721606

Sub-Payment ExGratia

Sir,

Please Pay Rs. 10,00,000/- (Rupees Ten lacs only) as mentioned in attached list and debit the same according to individual payment to our OD Account 10521992237.

BENEFICIARY_A/C NO	IFSC CODE	BENEFICIARY_NAME	TRAN_AMOUNT
4951108002633	CNRB0004951	Ms. Sushila Devi	10,00,000

Please do the needful. UTR NO :- SBIN321365962929

Thanking You,

Yours faithfully

31 DEC 2021

Rakesh Agarwal

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

R. Kalyan

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

कल्याण आर, वरिष्ठ लेखा अधिकारी

Kalyan R, Senior Accounts Officer

इंडियन ऑयल कॉर्पोरेशन लिमिटेड, हल्दिया रिफाइनरी

INDIAN OIL CORPORATION LIMITED, Haldia Refinery

Ex-Gratia

Indian Oil Corporation Limited

Haldia Refinery

PO Haldia Oil Refinery

Dist Purba Medinipur West Bengal 721606

To

Dated: 24.12.2021

Branch Manager

State Bank of India

Haldia Refinery Campus Branch

Purba Medinipur-721606

Sub-Payment to Sub Vendor

Sir,

Please Pay Rs. 30,00,000/- (Rupees Thirty lacs only) as mentioned in attached list and debit the same according to individual payment to our OD Account 10521992237.

UTR / JN NO	BENEFICIARY_A/C NO	IFSC CODE	BENEFICIARY_NAME	TRAN_AMOUNT
SBIN1213587 87471	52788100001133	BARB0JANDIA	Ms. Neetu	10,00,000
SBIN1213587 89660	0226001700007281	PUNB0022600	Ms. Bholi	10,00,000
147784716	36108434678	SBIN0002963	Ms. Tajmun Nesha	10,00,000
			TOTAL	30,00,000

Please do the needful.

Thanking You,

Yours faithfully

24 DEC 2021

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

For and on behalf of

Indian Oil Corporation Limited

Haldia Refinery

सतपाल वर्मा, सहायक वित्त प्रबंधक
Satpal Verma, Assistant Finance Manager
INDIAN OIL CORPORATION LIMITED, Haldia Refinery

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 23.12.2021**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

The Ex-gratia amount to be paid by Indian Oil Corporation Limited, for the family members of the deceased Contract workers, due to the unfortunate incident occurred on 21.12.2021, may be paid to the beneficiaries as under :-

Sl. No.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Pargat Singh	Ms. Neetu W/o Late Pargat Singh Aadhar No. 4483 0575 6614	Bank Account No. 52788100001133 IFSC Code BARB0JANDIA
2.	Late Sarabjit Singh	Ms. Bholi M/o Late Sarabjit Singh Aadhar No. 9723 2546 8263	Bank Account No. 0226001700007281 IFSC Code PUNB0022600
3.	Late Shamshad Ali	Ms. Tajmun Nesha W/o Late Shamshad Ali Aadhar No. 2694 3868 4425	Bank Account No. 36108434678 IFSC Code: SBIN0002963

Thanking you.

Yours faithfully,

(Jayakumar T S)
Chief Manager
Shilpi Engineering Pvt. Ltd.

SHILPI ENGINEERING PVT. LTD. NAVI MUMBAI

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Centre, Cooptex, Plot No. 1 & 3, Sector - 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 30.12.2021**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

Sl. No.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Shamshad Ali Amount received	Ms. Tajmun Nesha W/o Late Shamshad Ali Aadhar No. 2694 3868 4425	Bank Account No. 36108434678 IFSC Code SBIN0002963

We confirm that Ms. Tajmun Nesha, W/o Late Shamshad Ali has received Rs.10,00,000/- (Rupees Ten Lakhs only) in her bank account no. 36108434678 as tabulated above.

Thanking you.

Yours faithfully,

(Koushik Gole)
Project Manager
Shilpi Engineering Pvt Ltd.

SHILPI ENGINEERING PVT. LTD. NAVI MUMBAI

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sector - 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 Date: 30.12.2021

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

The Ex-gratia amount to be paid by Indian Oil Corporation Limited, for the family members of the deceased Contract workers, due to the unfortunate incident occurred on 21.12.2021, may be paid to the beneficiaries as under :-

Sl. No.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Pargat Singh	Ms. Neetu W/o Late Pargat Singh Aadhar No. 4483 0575 6614	Bank Account No. 50100483970084 IFSC Code HDFC0003320
2.	Late Sarabjit Singh	Being obtained. Will be provided shortly.	Being obtained. Will be provided shortly.

Thanking you.

Yours faithfully,

(Koushik Gola)
Project Manager
Shilpi Engineering Pvt Ltd.

SHILPI ENGINEERING PVT. LTD. NAVI MUMBAI

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sector - 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 14.02.2022**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

We confirm that Ms. Navneet Kaur, W/o Late Sarabjit Singh has received Rs.10,00,000/- (Rupees Ten Lakhs only) in her bank account no. 921010056787626 as tabulated above.

Sl. No.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Sarabjit Singh	Ms. Navneet Kaur W/o Late Sarabjit Singh Aadhar No. 3915 3994 8852	Bank Account No. 921010056787626 IFSC Code UTIB0001003

This is for your kind information and record.

Thanking you.

Yours faithfully,

(Koushik Gole)
Project Manager
Shilpi Engineering Pvt Ltd.

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sector - 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No: SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 24.01.2022**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

We confirm that Ms. Neetu, W/o Late Pargat Singh has received Rs.10,00,000/- (Rupees Ten Lakhs only) in her bank account no. 50100483970084 as tabulated above.

Sl. No.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Pargat Singh	Ms. Neetu W/o Late Pargat Singh Aadhar No. 4483 0575 6614	Bank Account No. 50100483970084 IFSC Code HDFC0003320

This is for your kind information and record.

Thanking you.

Yours faithfully,

(Koushik Gole)
Project Manager
Shilpi Engineering Pvt Ltd.

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sector - 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 30.12.2021**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

The Ex-gratia amount to be paid by Indian Oil Corporation Limited, for the family member of the deceased Contract workers, due to the unfortunate incident occurred on 21.12.2021, may be paid to the beneficiaries as under :-

SL No.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Lal Babu Mahto	Ms. Sushila Devi W/o Late Lal Babu Mahto Aadhar No. 3528 1203 2714	Bank Account No. 4951108002633 IFSC Code CNRB0004951

Thanking you.

Yours faithfully,

(Koushik Gose)
Project Manager
Shilpi Engineering Pvt Ltd

SHILPI ENGINEERING PVT. LTD. NAVI MUMBAI

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sector - 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 24.01.2022**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

We confirm that Ms. Sushila Devi, W/o Late Lal Babu Mahto has received Rs.10,00,000/- (Rupees Ten Lakhs only) in her bank account no. 50100483970084 as tabulated above.

Sl. No.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Lal Babu Mahto	Ms. Sushila Devi W/o Late Lal Babu Mahto Aadhar No. 3528 1203 2714	Bank Account No. 4951108002633 IFSC Code CNRB0004951

This is for your kind information and record.

Thanking you.

Yours faithfully,

(Koushik Gole)
Project Manager
Shilpi Engineering Pvt Ltd.

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sec19F- 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136833
ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 14.01.2022**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

The Ex-gratia amount to be paid by Indian Oil Corporation Limited, for the family members of the deceased Contract worker viz., Late Kuldeep Singh due to the unfortunate incident occurred on 21.12.2021, may be paid to the following beneficiary:-

Sl.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Kuldeep Singh	Ms. Manjinder Kaur W/o Late Kuldeep Singh Aadhar No. 4381 8650 5312	Bank Account No. 50100488187041 IFSC Code HDFC0002894

Thanking you.

Yours faithfully.

(Koushik Gole)
Project Manager
Shilpi Engineering Pvt Ltd.

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sector - 11, Near Parsvnath(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

SHILPI ENGINEERING PVT LTD
CIN:U45200MH2002PTC136830

ISO-9001:2015
ISO-45001:2018

No. SEPL/TNH/IOCL-Haldia/Fire Incident/2021 **Date: 14.02.2022**

To

The Engineering-in-Charge / GM I/c (HR)
Haldia Refinery
Indian Oil Corporation Limited
Haldia

We confirm that Ms. Manjinder Kaur, W/o Late Kuldeep Singh has received Rs.10,00,000/- (Rupees Ten Lakhs only) in her bank account no. 50100488187041 as tabulated above.

Sl.	Name of the Deceased	Particulars of Beneficiaries.	Bank Details
1.	Late Kuldeep Singh	Ms. Manjinder Kaur W/o Late Kuldeep Singh Aadhar No. 4381 8650 5312	Bank Account No. 50100488187041 IFSC Code HDFC0002894

Thanking you.

Yours faithfully,

(Koushik Gole)
Project Manager
Shilpi Engineering Pvt Ltd.

Corporate
D505, 5th Level, Tower 2, Seawoods Grand Central, Sector 40, Nerul(E), Navi Mumbai, Maharashtra (INDIA)-400 706.

Registered
213, 2nd Floor, Shubham Comm. Complex, Plot No. 1 & 3, Sector - 11, New Panvel(E), Navi Mumbai, Maharashtra (INDIA)-410 206.

+91 22 62715077
+91 22 62715088

info@shilpiengg.com
shilpiengg@rediffmail.com

www.shilpiengg.com

268

INDIAN OIL CORPORATION LTD.

FIRE & SAFETY DEPARTMENT

HALDIA REFINERY

Indian Oil

Safety Induction Training For Contractor Employees

Date : **Venue : Fire Station**

Topic Discussed : General Safety Tips, Work at height, Hot Work, Emergency Preparedness, Confined Space Entry, Electrical Safety, Traffic Safety, Material Handling

Sl. No.	Name	Agency Name	CISF Gate Pass	Safety Pass No.	Valid Till
62	Tagmeetsingh	Sepl	22872		
63	Malkit Singh	"	22871		
64	Sarwan Singh	"	21609		
65	Suman Dhara	R.M works	22389		
66	Sudip Das	"	22375		
67	Milan Berg	"	22380		
68	Sanjit Tanej	"	22397		
69	Bijoy reihng	Power mech	22165		
70	Milan Das	"	22165		
71	Santanu k	R.M works	22377		
72	Upendra kr.	Sepl	22843		
73	Dasharath kr	"	2284		
74	Amar Nath	R.M works	22400		
75	Kanakinath	Power mech	22164		
76	Praenjit	"	22162		
77	Ranganath	"	22163		
78	sanjay kr	R.M work	22360		
79	sahadeb Das	R.M work	22382		
80	Tapar kr	"	22386		
81	Buddadeb	"	22384		
82	Sugamundas	"	22388		
83	Ravinder Singh	Sepl	22911		
84	Akash Singh	"	22909		
85	Varinder	"	22912		
86	Kulvarth Singh	"	22240		

267

INDIAN OIL CORPORATION LTD.

FIRE & SAFETY DEPARTMENT

HALDIA REFINERY

Indian Oil

Safety Induction Training For Contractor Employees

Venue : Fire Station

Date :

Topic Discussed : General Safety Tips, Work at height, Hot Work, Emergency Preparedness, Confined Space Entry, Electrical Safety, Traffic Safety, Material Handling

Sl. No.	Name	Agency Name	CISF Gate Pass	Safety Pass No.	Valid Till
32	Chandan Kr	Power mech	22467		
33	Ravi Chandhary	Sepl	22797		
34	Munna	"	22795		
35	Kashinath Kr.	"	21388		
36	Mantu yadav	"	21391		
37	Deresh	"	21389		
38	Raj Bulakhar	"	21387		
39	Abhishek	"	21386		
40	Kamlesh yadav	"	21390		
41	Mohammad	Emeresm Prosse	22340		
42	Subham	Hubert Enviro	79271		
43	Swapan kumar	R.M works	88327		
44	Samiran Patra	AB enter.	88634		
45	Rajiv V. M	Hubert Enviro	85484		
46	Premchand	Test Metal	91179		
47	Dipak Roy	Santra enter	89974		
48	Shambhu	Nayak Const.	90664		
49	Rajib Barik	"	90464		
50	Amrit Ghorai	"	90657		
51	Sayan	"	90663		
52	Dinesh Das	Sudipto Mokhopa	85692		
53	Raj kumar Das	City Const.	90489		
54	Shamsher Singh	Sepl	21289		
55	Dalbir Singh	"	22792		
56	Lovepreet	"	22868		
57	Sarabjit singh	"	22870		
58	Harpreet	"	21176		
59	Chand singh	"	22687		
60	Sukhdev	"	22869		
61	Rahul	"	21177		

Company Pass issued for six months

INDIAN OIL CORPORATION LTD.

263

FIRE & SAFETY DEPARTMENT

HALDIA REFINERY

Indian Oil

Safety Induction Training For Contractor Employees

Date : 23/11/21

Venue : Fire Station

Topic Discussed : General Safety Tips, Work at height, Hot Work, Emergency Preparedness, Confined Space Entry, Electrical Safety, Traffic Safety, Material Handling

Sl. No.	Name	Agency Name	CISF Gate Pass	Safety Pass No.	Valid Till
63	Sk Ohab Ali	Radiant	22992		
64	Prasanta Tung	PMPL	21574		
65	Sayan Jana	RM Works	22109	Temporary	
66	Praskrijet Hembram	SEPL	22713	Pass issued	
67	Santosh Kr. Agrawal	"	14148	for Six months	
68	S. Jana	KCC	87173		
69.	Debabrata Maji	MCB	91982		
70.	Manas Dhara	"	87555		
71.	Amit Nandi	Radiant	1278		

260

INDIAN OIL CORPORATION LTD.

FIRE & SAFETY DEPARTMENT

HALDIA REFINERY

Indian Oil

Safety Induction Training For Contractor Employees

Date : 22/11/21

Venue : Fire Station

Topic Discussed : General Safety Tips, Work at height, Hot Work, Emergency Preparedness, Confined Space Entry, Electrical Safety, Traffic Safety, Material Handling

Sl. No.	Name	Agency Name	CISF Gate Pass	Safety Pass No.	Valid Till
63.	Gopal Bag	J & B Entr.	90695		
64.	Raju Samanta	"	90406		
65.	Srimanta Das	"	90724		
66	Joyanta Mishra	"	90236		
67.	Arun Das	Cooling Point	87886		
68.	Basistha Gayen	Santra Entr.	83982		
69.	Ramesh Bishra	Friends NDT	82418		
70.	Kuntal Karmakar	"	82417		
71.	Animesh Kar	"	82413		
72.	Buddhadeb Bari	J & B Entr.	90890		
73.	Sk Mobasar Ali	SEPL	20184		
74.	Satnam Singh	SEPL	356		

257

INDIAN OIL CORPORATION LTD.

FIRE & SAFETY DEPARTMENT

HALDIA REFINERY

Indian Oil

Safety Induction Training For Contractor Employees

Date : 20.11.21.

Venue : Fire Station

Topic Discussed : General Safety Tips, Work at height, Hot Work, Emergency Preparedness, Confined Space Entry, Electrical Safety, Traffic Safety, Material Handling

Sl. No.	Name	Agency Name	CISF Gate Pass	Safety Pass No.	Valid Till
32.	Surajit Paul	Test Metal	90776		
33.	Sabir Ali	VBrothers	90188		
34.	Somoresh Dhara	"	90189		
35.	Purnendu Das	"	90190		
36	SK Mushair Rahman	"	90445		
37.	Jaynal Abedin	PMPL	21523	Temporary Pass	
38.	Bikram Das	"	21563	Issued for	
39.	Rabindranath Patra	RMworks	3430	Sir Mantu	
40.	Prasanta Pramanik	Mitra Sntr	90012		
41.	Bidesh Pal	"	90007		
42.	Amit Kumar	SEPL	166		
43.	Tatan Barman	BNP Engg.	90322		
44	Manoj kr Prajapati	SEPL	14160		
45	Raja Kumar	"	14131		
46	Goutam Maity	RMW	14629		
47	Narayan Deb	"	14520		
48	Pranab Patra	"	16292		
49	Sanjit Pati	Radiant	2289		
50	Dinesh Yadav	"	25629		
51	Rakesh Singh	SEPL	21023		

INDIAN OIL CORPORATION LTD.

FIRE & SAFETY DEPARTMENT

HALDIA REFINERY

Indian Oil

Safety Induction Training For Contractor Employees

+255

Date : 19/4/21

Venue : Fire Station

Topic Discussed : General Safety Tips, Work at height, Hot Work, Emergency Preparedness, Confined Space Entry, Electrical Safety, Traffic Safety, Material Handling

Sl. No.	Name	Agency Name	CISF Gate Pass	Safety Pass No.	Valid Till
33	Purna ch. Maji	PMPL	21562	Temporary Pass issued for Six Month	
34.	Ram ch. Mahapatra	"	21561		
35.	Sanoj Kumar	SEPL	20111		
36.	SK. Mahabub Rahman	MK Roy & Bros.	79949		
37.	Sudip kr. Ghatak	Vasu Chemical	85528		
38.	Sasanka Samanta	Santra Entr.	75335		
39.	Rabindranath Maji	"	88260		
40.	Nag N. Sal	SEPL	146		
41	Abhijit Maity	PNP	81838		
42	Santu SOME	SEPL	15558		

IndianOil

Indian Oil Corporation Ltd.

Refineries Division

Incident Investigation Report

Ref. No.– RHQ/ACC/HR/01/2019 Date – 12.02.2019

Name of Location– Haldia Refinery	Incident No.- 01/2018-19

1.0 Executive Summary :

1.1	Sequence wise description of incident	MS Tank-440 was under M&I since 24.07.2018 as per the inspection recommendations. - At about 11:19 Hrs there was a flash fire in the pontoon in which spray painting job was in progress. - This was seen by the standby painter as well the helper. - The painter who was doing the painting job sustained severe burn injuries throughout the body and rescued by the above two persons present there. - After first-aid as per the medical advice the injured person was shifted to Kolkata with necessary medical precautions for further treatment. - On 12.02.2019 as per information provided the injured person expired at Kolkata at about 06:00 Hrs
1.2	Property loss / injury / fatality	One contractor person of M/S Expo Gas Containers Limited.
1.3	Cause	Burn injury due to fire / explosion
1.4	**Recommendations**	1. Sufficient exhaust ventilation must be provided in places where spray painting is being done to keep the concentration of solvent vapour below explosive limit. 2. Monitoring of concentration of explosive / flammable mixture should be carried out on Regular intervals and record to be maintained. Corrective action to be defined and implementation to be ensured. 3. All electrical equipment (including lighting) being

		used in area (where spray painting is being done) to be explosion proof. 4. PPEs and clothing of painting crew (doing spray painting with solvent having flashpoint less than 80 deg F) must not produce static electrical sparks. 5. In such type of jobs, clothing should be fire resistive type. 6. All metallic parts of paint spraying equipment using a solvent having flashpoint less than 80 deg F must be grounded and bonded to the vessel/tank being painted. 7. Job safety analysis for tank M&I jobs should be done separately for each sub-activity. 8. Work permit systems to ensure that other work will not create an ignition source in adjacent spaces where painting is being carried out. 9. Suitability of spray painting in confined areas (with limited means of providing ventilation/ escape routes) to be reviewed and other painting techniques such as brush painting/ airless painting to be explored. 10. Tool box talk should include the safety information / precaution related to specific jobs plan to carry out.

2.0 Brief description of incident

2.1	Category (Major Reportable / Minor Reportable / Other Reportable Incident	Major Reportable – Fatal Accident
2.2	Date & time	08-02-2019 at 11:19 Hrs.
2.3	Location	MS Tank No.-440 (Under M&I)
2.4	Brief Description	MS Tank-440 was under M&I since 24.07.2018 as per the inspection recommendations. On 08.02.2019 the following jobs were planned: - Painting of balance pontoons (12 nos.) out of total 24 nos. - Fixing of foam seal - Painting of ladder / external annular plate Particularly on that time (about 11:19 Hrs) 4 pontoons were completed and job was in progress in the seventeenth pontoon. Simultaneous jobs as mentioned above were also in progress. - At about 11:19 Hrs there was a flash fire in the pontoon in which spray painting job was in progress. - This was seen by the standby painter as well the helper.

		- The painter who was doing the painting job sustained severe burn injuries throughout the body and rescued by the above two persons present there. - After first-aid as per the medical advice the injured person was shifted to Kolkata with necessary medical precautions for further treatment. - On 12.02.2019 as per information provided the injured person expired at Kolkata at about 06:00 Hrs.
2.3	Reported by	MCP-449 & 453 to F&S Control Room

3. Constitution of Investigation Committee

3.1	Date & Time of formation of Committee	08.02.2019, 17:30 Hrs
3.2	Constituted / Approved by	Shri Kaushik Bora, ED(HSE), RHQ
3.3	Investigation Team Convener	Shri PK Agarwal DGM (HSE), RHQ - Convener
3.4	Details of Members (Name , Designation)	1. Shri, Kumar Ojaswi, CMNMEL(M&I),RHQ, Member 2. Shri Amit Kumar Mishra, IPM, PDR, Member

3. Terms of Reference -

4.1	Terms of Reference of the Investigation	1. Detail Investigation to establish the root causes of the incident. 2. To suggest the remedial measures to avoid such type of incident in future. 3. To identify the technical and procedural lapses. 4. To identify Person (s) responsible for the incidents, if any.
4.2	Methodology adopted for Investigation	• Committee Meetings • Site Visits • Review of Documents • Review of CCTV Footage – not available • Laboratory analysis of related electrical equipment – Not required • Photographs - enclosed • Interviews of concerned personnel • Consultation with experts – Committee has referred OSHAS standard relevant to this. • Analysis of Process trends – Not applicable

5.0 Brief Description of Unit / Area / Location of Incident

5.1	**Brief Description**	MS Tank-440 was under M&I since 24.07.2018 as per the inspection recommendations. On 08.02.2019 the following jobs were planned:

		- Painting of balance pontoons (12 nos.) out of total 24 nos. - Fixing of foam seal - Painting of ladder / external annular plate Particularly on that time (about 11:19 Hrs) 4 pontoons were completed and job was in progress in the seventeenth pontoon. Simultaneous jobs as mentioned above were also in progress. - At about 11:19 Hrs there was a flash fire in the pontoon in which spray painting job was in progress. - This was seen by the standby painter as well the helper. - The painter who was doing the painting job sustained severe burn injuries throughout the body and rescued by the above two persons present there. - After first-aid as per the medical advice the injured person was shifted to Kolkata with necessary medical precautions for further treatment. - On 12.02.2019 as per information provided the injured person expired at Kolkata at about 06:00 Hrs

6.0 Details of Description of the Incident:

6.1	Situation Before Incident	MS Tank-440 was under M&I since 24.07.2018 as per the inspection recommendations. Scheduled M&I completion for the tank was 30.01.2019 as per original bar chart. Around 20.01.2019, the timeline for completion of the tank was revised to 10.02.2019. In this tank 7 nos. of pontoons were replaced at different locations. The painting of all pontoons was recommended by Inspection Dept. On 08.02.2019 the following jobs were planned: - Painting of balance pontoons (12 nos.) out of total 24 nos. - Fixing of foam seal - Painting of ladder / external annular plate Particularly on that time (about 11:19 Hrs) 4 pontoons were completed and job was in progress in the seventeenth pontoon. Simultaneous jobs as mentioned above were also in progress.
6.2	Chronology of events leading to the incident	1. Job at this location was started at about 09.00 hrs. on 08.02.2019. 2. Job of spray painting of pontoons was started and four pontoons were completed. 3. Job of spray painting of fifth pontoon was in

		progress. 4. Previous day total twelve (12) pontoons were spray painted. None of the pontoons was offered for inspection as it was planned to offer all the 24 nos. together for inspection. 5. Composite Hot work / working at height permit was taken (assuming all jobs). 6. As per procedure a mixture of 10 ltrs of paint, 1 ltr of thinner and 1.45 Ltrs of hardener was prepared by a contractor person assigned for this job. 7. A procedure was also available to carry out the painting job inside the pontoon by two painters alternatively to avoid fatigue/ adverse conditions. 8. At about 11:18 Hrs approximately 70% painting job of that pontoon had been completed and remaining job was being done by the painter Sh. Alok Bhunia while other painter Sh. Shankar Baroi was standing nearby (as stated by witness). 9. Helper was also available near the man-hole and just before the incident he inquired the status of painting from the painter and as per him the painting job was expected to be completed soon. 10. At about 11:19 Hrs the job was nearing completion and the painter was working near to the manhole. 11. All of a sudden a minor explosion / flash fire occurred in the pontoon as stated by both of the witnesses (alternate painter & helper). 12. Due to the flash fire the painter Sh Alok Bhunia sustained burn injuries and immediately taken out from the pontoon through the manhole with the assistance of the two persons. 13. Immediately injured person was shifted to Haldia Refinery First-Aid center then Refinery Hospital. 14. The first aid was provided and as per the medical observation injured was shifted to Dessun Hospital, Kolkata for further treatment. 15. As per the information provided injured person succumbed to his injuries on 12.02.2019. 16. As per the site observation and statement of witnesses Sh. Alok Bhunia was using the following PPEs at the time of incident: - Complete hood with front and back flappers - Safety shoe - Leather gloves

6.3	Situation after the Incident	Job at this site was suspended and electrical equipment were taken into custody by F&S.
6.4	Emergency Handling / Fire Fighting Methodology adopted (In case of Fire)	It was a momentary flash fire hence got extinguished by itself.

7.0 Details of Fatality / Injury (s):

S. No.	Item Description	Fatality	Injury
7.1	Name of Persons (s) a. Shri Alok Bhunia	Fatal	
7.2	Any Major Disruption / Damage	NA	
7.3	Cost of Fire Fighting (In Rs.)	Nil	

8.0 Details of Damages / Losses:

8.1	App. Loss in case of Fire (in Rs.)	Nil
8.2	Loss of Petroleum product due to leakage / burst (Qty.) and (In Rs.)	Nil
8.3	Any measure Disruption /Damge	Nil
8.4	Cost of Repair / Restoration / Maintenance (In Rs.)	Nil
8.5	Indirect Cost (Rs.)	Nil
8.6	Total Cost (Rs.)	Nil

9.0 Methodology of Investigation -

9.1	Committee Meetings Done on	From 10.02.2019 to 12.02.2019 at Haldia Refinery
9.2	Site Visits	During 10.02.2019 to 12.02.2019
9.3	List of Documents referred to find the facts including Police FIR / Fire Brigade Reports. (Pl. enclose signed copies of all documents referred during investigation.)	1. Copy of FIR 2. Tool Box Talk record- Painting job missing 3. Photographs of site 4. Fire permit with clearance 5. Copy of statements of witnesses
9.4	Name of witnesses including eye witnesses. (Please enclose signed copies of statements.)	A. Haldia Refinery-Production Dept. 1. Sh. R. N Verma, PNE 2. Sh. P Sengupta, AMPN 3. Sh. N L Biruli, SPNM

		B. Haldia Refinery- Mechanical Dept. 1. Supratik Ray, AMML 2. H S Das, MLE 3. B Mishra, DGM(MN) C. M/s Expo Gas Containers Limited 1. Anup Ghanti, Electrician 2. Shankar Baroi, Alternate Painter 3. Tapas Goswami, Helper 4. Azad Kumar, Overall Supervisor 5. Anupam Panda, Supervisor 6. M T Hussain, Safety Supervisor Discussion with HR inspection group was also done to understand the system.
9.5	Review of CCTV footage, if applicable	NA
9.6	Photographs of the site / Incident	Enclosed
9.7	Laboratory analysis of related Materials	Not Applicable

10.0 Adequacy of Safety System

10.1	Adequacy of Safety Systems	Inadequate

11.0 Analysis of Incident:

11.1	Probable causes based on the above inform (list out all the causes)	1. Static electricity 2. Electric spark 3. Hot job in the vicinity of the pontoon 4. Smoking 5. Spark due to falling of metallic object 6. Hot surface of the hand lamp bulb
11.2	In case of Fire, probable source of fuel	Vapours / fume of paint & thinner
11.3	In case of fire, probable source of ignition	1. Static electricity 2. Electric spark 3. Hot job in the vicinity of the pontoon 4. Smoking 5. Spark due to falling of metallic object 6. Hot surface of the hand lamp bulb
11.4	Operating conditions : a. Power Supply b. Illumination c. Operating Parameters d. SOPs e. Remark	a. Power Supply-Non standard- 220V, 100W non flame proof hand lamp without protective glass cover over the bulb was being used for illumination in confined space of pontoon. b. Illumination-Satisfactory c. Operating Parameters-Normal

		d. Specific SOP for pontoon painting- Not available e. Remarks-Nil
11.5	Working Conditions a. Work area Temperature b. Work area Illumination c. Working Conditions d. Inspection and Maintenance e. SOP of inspection & Maintenance f. Remarks	a. Ambient b. Satisfactory c. Confined space full of atomised paint & thinner vapours without adequate ventilation d. Job as per inspection & maintenance recommendations e. Specific SOP for pontoon painting not available. However painting specifications for this job is available. f. Nil
11.6	Weather Conditions a. Temperature b. Rain c. Storm d. Fog e. Poor Visibility f. Adequate Day Light	a. Ambient b. No c. No d. No e. No f. Yes
11.7	Analysis of all above probable causes.	1. Smoking: Entire area as well as the inside of pontoon area was checked thoroughly and no evidence of smoking was found. In addition of this the entire dyke area was also checked and no evidence of smoking was found. The witnesses were also questioned regarding smoking and all confirmed that nobody was smoking in this area. Based on the evidence and statement of witnesses the Committee rules out smoking as cause of accident. 2. Spark due to falling/rubbing of metallic object: Pontoon area was checked and no evidence was found against sparking due to falling of metallic object. The spray gun used for the job (as shown to the committee) was non-sparking type. Based on the evidence and statement of witnesses the Committee rules out sparking due to falling of metallic object as cause of accident. 3. Hot job in the vicinity of the pontoon: The entire pontoon and its vicinity was checked and no evidence of hot job was found. No equipment for hot job like cutter, grinder, welding electrode /torch etc. was found. Based on the evidence and statement of witnesses the Committee rules out hot job in vicinity of pontoon as cause of accident. 4. Hot surface of the hand lamp bulb: The

		committee checked the light bulb and observed that the bulb was fused but its glass cover was not damaged. Committee feels that if temperature of the bulb was the cause of fire then the bulb would have bursted. On the basis of facts committee concluded that this was not the cause of fire. 5. Static electricity: The spray painting setup shown to the committee included the spray gun, paint pot and PVC tubing connecting the spray gun to the paint pot. The PVC tubing was re-inforced with non metallic braiding and was clamped at the gun. Spray painting activity has hazard of generation of static charges due to rubbing of high velocity paint and air with the metallic components of the set up. The same has also been mentioned in the product data sheet of M/s Berger. Berger has also advised the users to take suitable protection against static electricity. As per the statement of the helper Sh. Tapas Goswami, the painter had kept the spray gun on the pontoon floor in order to signal to him regarding the status of job. The accident took place after the painter picked up the spray gun (made of non sparking material) from the floor and re-started the job. The committee is of the opinion that if any static charge build-up was there in the spray gun the accident would have taken place immediately on placing the spray gun on the tank floor. Hence possibility of fire due to static charge build-up in spray gun has been ruled out by the committee. 6. Electric spark : The hand lamp along with cable and industrial top used in the job as per witnesses was seen by the committee. Committee observed that the hand-lamp was non flame proof type, the bulb used was rated for 220V and 100W, the glass cage for protection of the bulb was missing. Pin type bulb was used and the holder was spring loaded type which is found loose. The hand lamp grip and connecting cable upto 2m from the bulb was damaged due to heat. A temporary joint in the cable at around 10m from the bulb side and around 3 m from the industrial plug side was also observed. However no damage due to heating of the cable was observed near to the joint. As no damage to cable was observed at joint the committee ruled

		out sparking from cable joint as cause of the accident. As per the witness, Sh. Tapas Goswami, present at site the incident took place just after he enquired about the status of the painting job (after around 10 minutes of spray painting inside the pontoon) from the painter. Hence it is suspected that spark got initiated in the bulb holder due to sudden jerking of the hand lamp (the hand lamp was in the hand of the painter as per the same witness). Inflammable vapours from paint thinner and oxygen in sufficient quantity was present near the pontoon manhole. Committee is of the opinion that initiation of spark from bulb holder in presence of inflammable vapours leading to explosion and fire appears to be the most possible reason of explosion and fire.
11.8	Inspection record in case of equipment failure	NA
11.9	Work Instruction / Supervision	Not Evident.

12.0 Vehicle and Driver Details (In case of Road Accidents during transportation of petroleum products) –

Not Applicable

13.0 Conclusion and Recommendations –

13.1	Basic Cause of Incident	Electric spark from hand lamp
13.2	Root cause of Incident	Use of sub standard equipment and inadequate SOPs.
13.3	Gaps and Lapses if any	From the evidences and interrogation it is emerged that – **A. M/s- Expo Gas Containers Limited** The above party was responsible to carry out the M&I jobs of tank-440 as well as the safety of his personnel. Though party having the sufficient experience still following lapses were noted during the investigation- 1. Though in the permit it was clearly mentioned that all lightings should be limited to 24 volts but contractor had used 230 volts lamps. This violation was detected by site engineer (as per the statement) still contractor have removed the transformer and used 230 volts hand lamps. 2. The job was being done in the confined space which is full of paint/ thinner vapours, still provision of ventilation was not ensured. From

		the statement of site Engineer it was evident that instruction was issued and air pipe was provided for ventilation which was later on removed by the contractor personnel. 3. Though job was being done in highly flammable atmosphere still cotton clothing for the workers was not ensured as the deceased person was wearing polyester shirt. 4. In the past, Safety violation of same contractor was also observed by site engineers in other tanks and subsequently contractor was penalized. 5. Party had failed to provide the standard electrical equipments, like hand lamps used for this job was substandard without protective glass, cable was having joint and non FLP fittings were used. **B. Production Dept- Haldia Refinery** The permit for this job was requested by Mr. H S Das, MLE, released by Mr. R N Verma, PNE and fire permit signatory was Mr. N L Biruli, SPNM. Clearance was issued by Mr. P Sengupta, AM(PN). 1. It was also evident that production department issued the permit after verifying the site condition and took necessary actions to rectify the unsafe conditions, if any. Like removal of empty paint drums from site, ensuring the electrical clearances, etc. In the past, clearance was also denied due to prevailing unsafe condition. 2. Production department issued the Composite hot work permit without mentioning the specific painting jobs. It indicates the painting job is not considered as critical activity. 3. Since, production department had not given due importance to painting jobs especially pontoon painting. This lapses also one of the contributing factors for the accident. **C. Mechanical Maintenance Dept- Haldia Refinery** For this job site Engineer was Mr. Supratik Ray, AMML and Engineering In-charge was Mr. B Mishra, DGM(ML). The permit related activity was being carried out by Mr. H S Das, MLE. The observations are 1. It was evident that maintenance department taking actions time to time to ensure the safety

		compliance. 2. In the past, Safety violation of same contractor was also observed by site engineers in other tanks and subsequently contractor was penalized (copy enclosed). 3. Mechanical department requested the Composite hot work permit without mentioning the specific painting jobs. It indicates the painting job is not considered as critical activity. 4. The mechanical department had not visualized the criticality of pontoon painting. Hence couldn't ensure the required safety precaution as mention below- a) Provision of adequate ventilation b) Use flame proof electrical fitting/ standard electrical fittings c) Use of fire resistive clothing by the workmen engaged in painting d) Required precautions against static electricity. If above points might have taken care the incident could be avoided.
13.4	Recommendations to avoid such types of incidents in future	1. Sufficient exhaust ventilation must be provided in places where spray painting is being done to keep the concentration of solvent vapour below explosive limit. 2. Monitoring of concentration of explosive / flammable mixture should be carried out on Regular intervals and record to be maintained. Corrective action to be defined and implementation to be ensured. 3. All electrical equipment (including lighting) being used in area (where spray painting is being done) to be explosion proof. 4. PPEs and clothing of painting crew (doing spray painting with solvent having flashpoint less than 80 deg F) must not produce static electrical sparks. 5. In such type of jobs, clothing should be fire resistive type. 6. All metallic parts of paint spraying equipment using a solvent having flashpoint less than 80 deg F must be grounded and bonded to the vessel/tank being painted. 7. Job safety analysis for tank M&I jobs should be done separately for each sub-activity.

		8. Work permit systems to ensure that other work will not create an ignition source in adjacent spaces where painting is being carried out. 9. Suitability of spray painting in confined areas (with limited means of providing ventilation/ escape routes) to be reviewed and other painting techniques such as brush painting/ airless painting to be explored. 10. Tool box talk should include the safety information / precaution related to specific jobs plan to carry out.
13.5	Specific Recommendations / Remarks if any.	Such type of jobs should be considered as "critical Jobs" and accordingly details SOP should be made. The SOP should include various situations, associated hazards and necessary corrective actions.

Enclosures –

1. Copy of office order of constitution of Investigation Committee.
2. Photographs
3. Statements of witnesses
4. Copy of Fire & Safety permits

(CA·K·MISHRA)
IPM, PDR
12/02/2019

(K. Khanna Ojaswi)
CMNM(MKT).
12.02.2019

12/02/2019
(P.K. AGARWA)
DGM(CHSE)
RHQ.

Annexure-I

Indian Oil Corporation Limited
HSE Department
Refinery HQ
New Delhi

Ref No: RHQ/HSE/Gen./01 **February 08, 2019**

OFFICE ORDER

Sub: Formation of Committee for Investigation of Flash Fire Incident at Haldia Refinery

It has been reported that flash fire has occurred in tank no. 440 of Haldia Refinery today at about 11.19 hrs. when one of the contractor workers Mr. Alok Bhunia, of M/s. EXPO Gas Containers received severe burn injury.

1.0 To investigate the incident, a committee consisting of the following officers is hereby constituted:

1. Mr. P.K. Agarwal, DGM (HSE), RHQ - Convenor
2. Mr. Ojaswi Kumar, CMNM (M&I), RHQ - Member
3. Mr. Amit Kumar Mishra, IPM, Paradip Refinery - Member

2.0 The terms of reference of the Committee will be as under:

1. Detailed investigation to establish the root cause of the incident;
2. To suggest the remedial measures to avoid such type of incident in future;
3. To identify the technical and procedural lapses;
4. To identify person(s) responsible for the incident, if any.

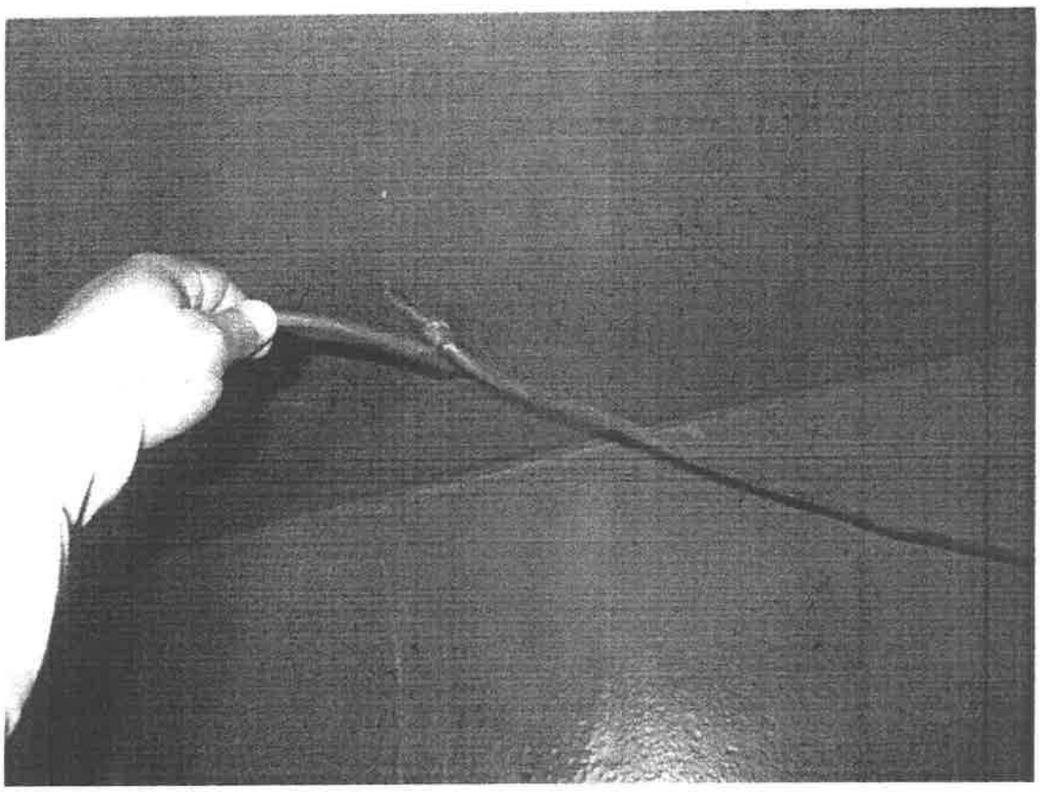
The Committee will submit its report to the undersigned by February 12th, 2019.

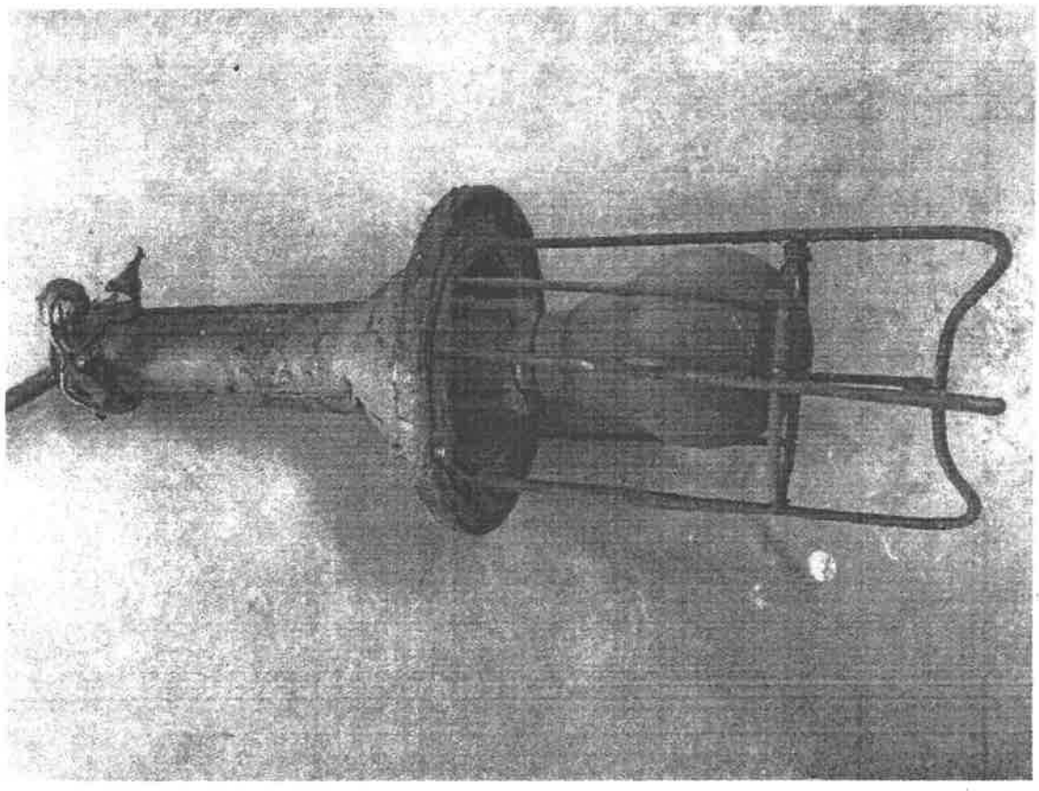
(Kaushik Bora)
Executive Director (HSE)

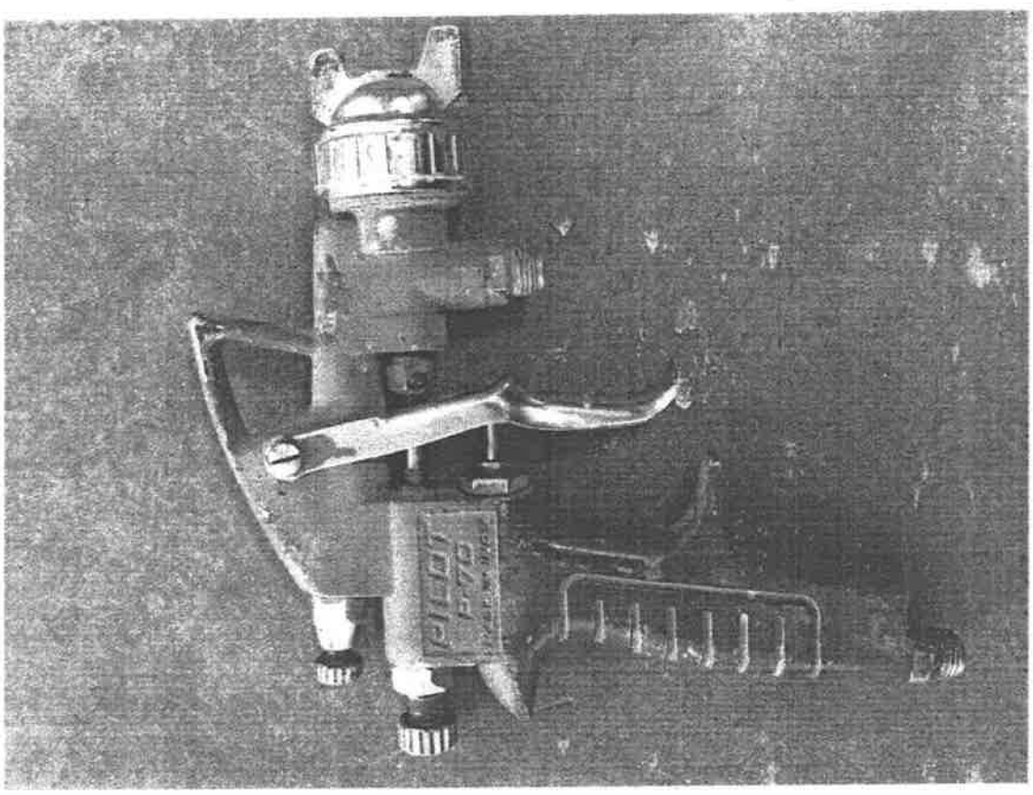
CC : - All Committee Members

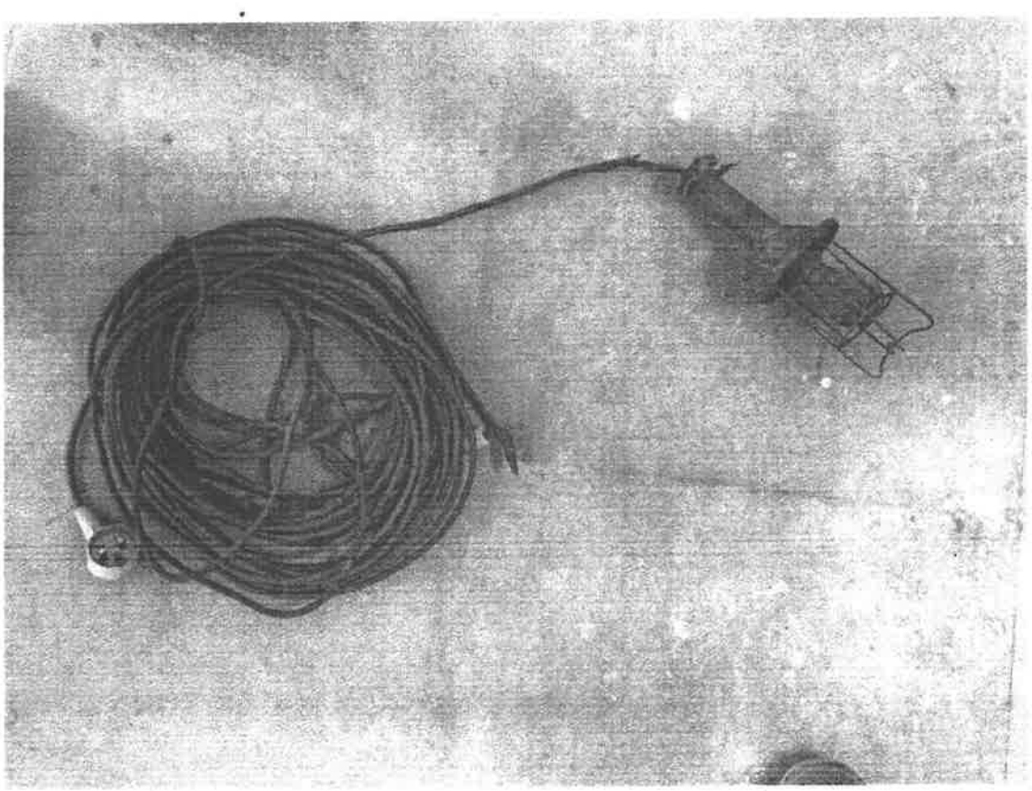
- ED(O) - RHQ/ED(M&I) - RHQ/ED-HR/ED-PDR
- Director (R) - For information please.

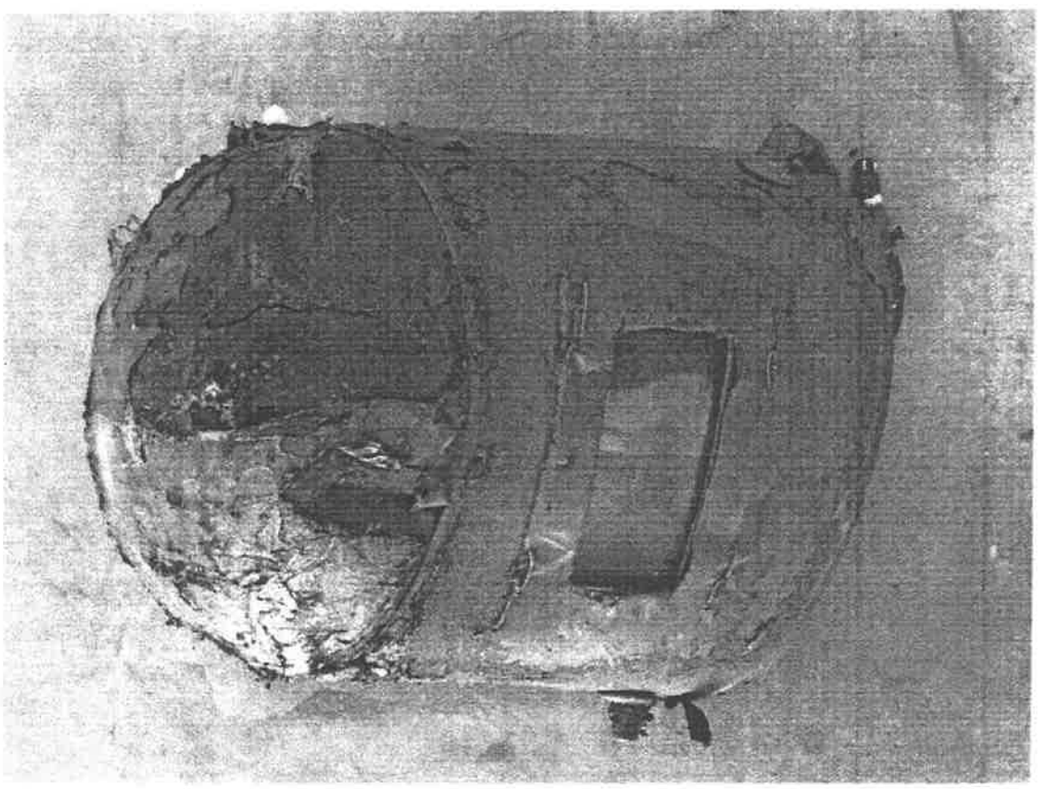
Annexure-II

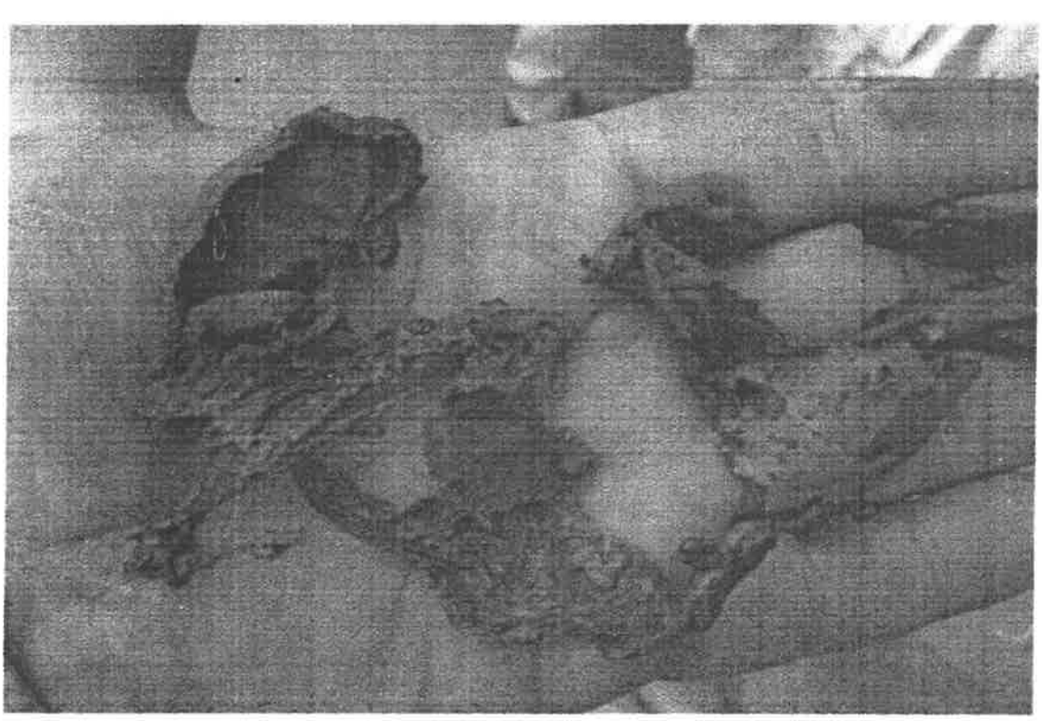


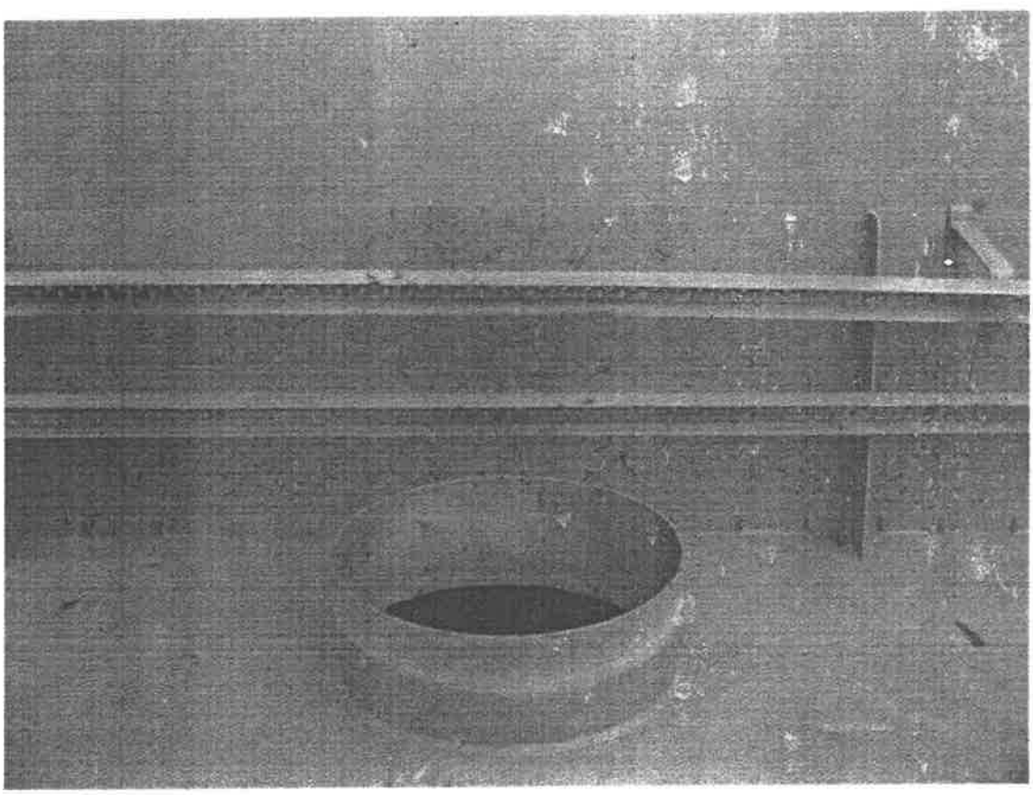










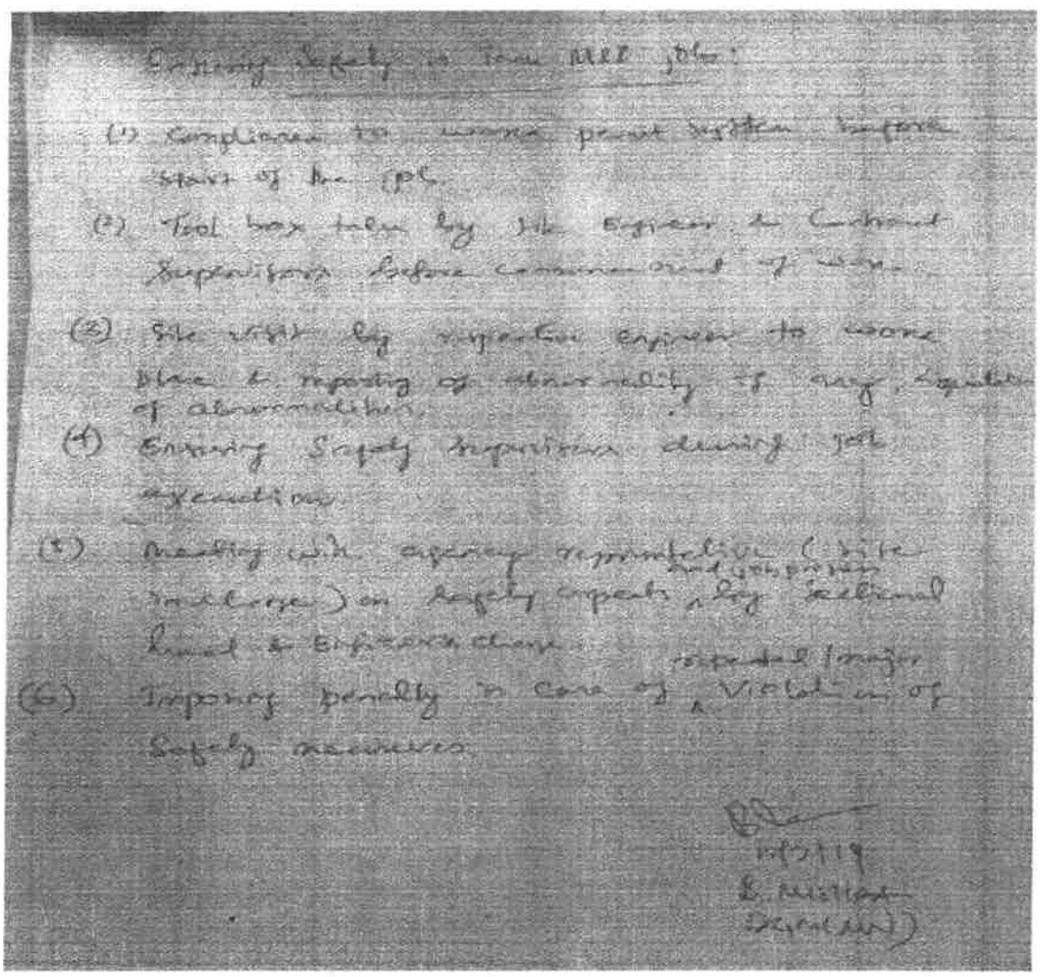


Annexure-III

As the incident happened in the night shift, it was noticed that the electrician person engaged on painting job is using 220 V illumination. During morning time at [redacted] the worker, the job with 24 V illumination, but later he replaced it with 220 V bulb.

The spark may generated from bulb holder connecting pin, which may loose contact & spark may occure during shifting.

As per blasting permit it was meant to painting job, and painting as the casting after of blasting job, so separate permit was not issued for painting job in that area.



Ensuring Safety in Tank Well job:

(1) Compliance to permit written before start of the job.

(2) Tool box talk by the Engineer in Charge/Supervisor before commencement of work.

(3) Site visit by respective Engineer to ensure place & reporting of abnormality if any, Equipment of abnormalities.

(4) Ensuring Safety supervision during job execution.

(5) Meeting with agency responsible (site In charge) on safety aspects by external Level & Engineers Cleared.

(6) Imposing penalty in case of violation of Safety measures.

m/s HJ
& Mistry
Engg(Civil)

Akanksha Kalyan

1) Paint mixing: ...20Ltr ...1 Ltr ...
10 ... Base ...., ... Hardener ... 10% Thinner ... mixing ... 2 ... Paint ...

2) Alok Bhunia ... Air hose ... ... Manhole ... 2 ... Manhole ...

3) ... Switch Board, Deck Manhole ...

11/02/19

1) Paint mixing: We take 10Ltr base by using a 1 Ltr mug and add required hardener with that base into a 20Ltr. empty drum and add with it 10% thinner we have done this type mixing two times on that day.

2) I asked Alok Bhunia, what amount of painting is balance? He said to me a small amount is balance. After this, I saw, Alok stood at pontoon manhole. Then he sat down inside. After this, he was coming from manhole inside himself.

3) The switch Board was at near to deck Manhole.

1) I am a painter of that job. I was painting at pontoon box 2 to 3 minute, before Alok Bhunia with same paint and same spray gun. After I was outside, Alok Bhunia went for painting to box inside with same paint and same spray gun.
Suddenly, there was a sound. Then I saw Alok Bhunia stood at pontoon manhole.
Then he sat down inside and after that he was outing from manhole himself. We then burn out himself by leather handglove.

2) We have nose mask, Air hood with us. We had also leather handglove with us. We were painting with a hand lamp set inside pontoon box.

১) যদি কোনো কারণে বাল্ব fuse হয়ে যায়, তখন সেইটা ঐ
Handlamp set টা ঠিক করার জন্য দিয়ে দিই। আমাদের Electrician
Check করে নতুন বাল্ব লাগিয়ে Ok বললে আমরা সেই
lamp set ব্যবহার করি।

2) Paint mixing: আমরা একটা 20Ltr এর খালি ড্রামে
1Ltr মগ দিয়ে 10 লিটার করে 10লি. Base নিয়ে দিই, এরপর
পরিমাণ মতো Hardener ও 10% Thinner দিয়ে ঐ drum এ
mixing করি, এইভাবে সেদিন দুবার Paint তৈরি
করেছিলাম।

3) আমি সেদিন ঐ সময় ঘটনাস্থলে ছিলাম Deck এর উপরে দাঁড়িয়ে ছিলাম।
হঠাৎ করে দেখতে পেলাম, আমাদের Chargehand Alok Bhuia
Pontoon Manhole এর উপরে দাঁড়িয়ে ছিল, তারপর উনি নিজে
নিচে নেমে গেলেন Manhole দিয়ে নিজে বেরিয়ে আসে।
তখন আমরা [illegible] আগুন [illegible], তখন আমরা
আমাদের Leather H/gloves দিয়ে নিভিয়ে দিই।

1) If a bulb is fused, then we transfer that handlamp to our electrician. After this, when our electrician take that handlamp as ok condition, we use that handlamp set at our job.

Arun Kum. Sinda
11/12/17

2) Paint mixing: We take 10 Ltr base by using a 1Ltr mug and ~~add~~ required hardener with that base into a 20Ltr. empty drum and add with it 10% Thinner. We have done this type mixing two times on that day.

3) I was at the spot on deck. I saw suddenly, Alok Bhunia stood at pontoon manhole. Then he sat down inside after that he was outing from manhole himself. We, by leather gloves, ~~[illegible]~~ burn out him.

[illegible] K. Ojha [illegible]

Annexure-IV

Indian Oil Corporation Limited [illegible]
Plant: [illegible]
Company: [illegible]
Functional Loc: [illegible]
Work Permit Request: [illegible]
Desc: [illegible]

Exact Location of work: [illegible]
[illegible]
[illegible]
Notification: [illegible] Old permit Reference
Issued to: [illegible] Work Centre: [illegible]

Q no	Question	Answer/Details
A	General Points	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]
5	[illegible]	[illegible]
Detail	[illegible]	
6	EQUIPMENT PROPERLY DRAINED AND DEPRESSURISED	[illegible]
7	EQUIPMENT PROPERLY STEAMED/PURGED	N.A
8	EQUIPMENT WATER FLUSHED	[illegible]
9	[illegible]	[illegible]
10	[illegible]	N.A
Detail	[illegible]	
11	[illegible]	N.A
Detail	[illegible]	
12	GAS TEST	[illegible]
[illegible]	[illegible]	[illegible]
Detail	[illegible]	
[illegible]	[illegible]	[illegible]
Detail		
[illegible]	OXYGEN [illegible]	Yes
Detail	[illegible]	
[illegible]	GAS TEST DONE BY [illegible]	[illegible]
Detail	[illegible]	
13	RUNNING WATER HOSE/FIRE EXTINGUISHER PROVIDED/FIRE WATER SYSTEM AVAILABLE	Yes
14	AREA CORDONED OFF AND PRECAUTIONARY TAGS/BOARDS PROVIDED	Yes
B		
1	PROPER VENTILATION & LIGHTING PROVIDED	Yes
2	PROPER MEANS OF EXIT/ESCAPE PROVIDED	Yes
3	STANDBY PERSONNEL PROVIDED FROM PROCESS/MAINT/CONTRACTOR/FIRE AND SAFETY DEPT	Yes
4	CHECKED FOR OIL AND GAS TRAPPED BEHIND THE LINING IN EQUIPMENT	N.A
5	SHIELD PROVIDED AGAINST SPARK	Yes
6	PORTABLE EQUIPMENT/NOZZLES PROPERLY GROUNDED	Yes
7	ATTENDANT AT MANWAY PROVIDED FOR ENTRY INTO CONFINED SPACE (TANK)	Yes
8	ADEQUATE COMMUNICATION PROVIDED TO STANDBY PERSON	Yes
9	TRAINED ATTENDANT PROVIDED WITH RESCUE EQUIPMENT/SCBA	N.A
10	SPACE ADEQUATELY COOLED FOR SAFE ENTRY OF PERSON	Yes
11	CONTINUOUS INERT GAS FLOW ARRANGED	N.A
12	CHECK FOR EARTHING/ELCB OF ALL TEMPORARY ELECTRICAL	Yes

Indian Oil Corporation Limited
Company: [illegible]
Functional Loc: [illegible]
Work Permit Request: [illegible]
Desc: [illegible]

Q no.	Question	Answer Details
[illegible]	[illegible]	[illegible]
	Detail	[illegible]
[illegible]	[illegible]	[illegible]
	Detail	[illegible]

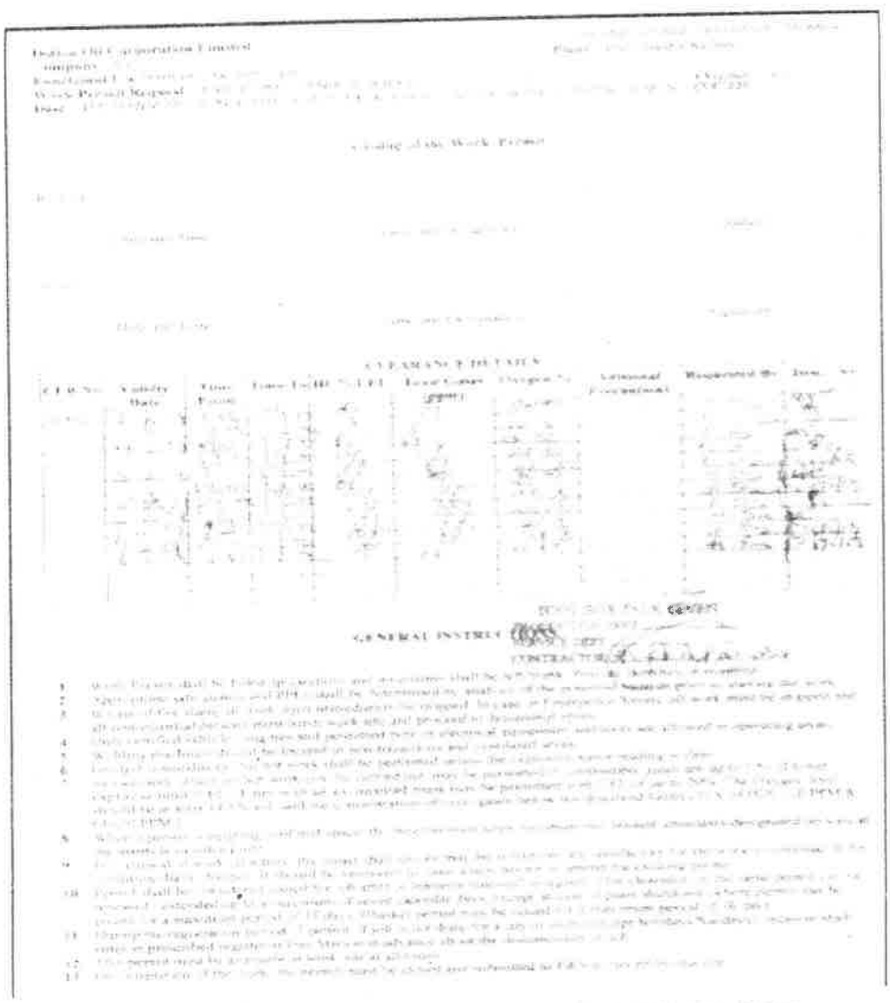
Remarks: [illegible]

4) Additional Activity / Precaution, if any (Ist : On case to case basis)

01	PRE USE CHECK OF PORTABLE MULTI GAS METER DONE??	YES	
02	PRE USE CHECK OF H2S DETECTOR DONE??	YES	
03	JOB SAFETY ANALYSIS IF REQD. DONE	NA	
04	NEAREST SAFETY SHOWER / EYE WASH FOUNTAIN LOCATION	YES	
05	NON SPARKING TOOLS REQUIRED?	NA	
06	NEAREST HYDRANT / FIRE WATER POINT	YES	
07	NEAREST EXTINGUISHER POINT	YES	
08	NEAREST ASSEMBLY POINT & SOP LOCATION	YES	
09	ANY OTHER PRECAUTION	YES	ENSURE ALL SAFETY PRECAUTION
10	CHECKED BY AREA IN-CHARGE (NAME & SIGNATURE)	YES	

	User ID	Name	Desg	Date	Time	Sign
Requested By	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Executing HOD	[illegible]	[illegible] Kumar Mazumdar	[illegible]	[illegible]	[illegible]	
Released By	[illegible]	[illegible] Verma	[illegible]	[illegible]	[illegible]	

[illegible] K. [illegible] [illegible]



इंडियन ऑयल कॉर्पोरेशन लिमिटेड
हल्दिया रिफ़ाइनरी, डाकघर : हल्दिया ऑयल रिफ़ाइनरी - 721606
जिला : पूर्व मेदिनीपुर (प० बं०)
Indian Oil Corporation Limited
Haldia Refinery, P.O.: Haldia Oil Refinery-721606
District : Purba Medinipur, West Bengal
Website : www.iocl.com; Email : HaldiaRefinery@indianoil.in
Fax : 91-3224-252141; Phone : 91-3224-223270

ISO 9001 / ISO 14001/OHSAS 18001

रिफाइनरीज़ प्रभाग
Refineries Divison

Date: 23-05-2019

To
Sh. Harshil kathiriya
Assistant Consultant, Technical Division,
Petroleum and Natural gas Regulatory Board,
First floor, World Trade Center, Babar Road,
New delhi-110001

Our reference No: HR/HSE/PNGRB/May19

Sir,

With reference to your email dated 16/05/2019, investigation report of the incident dated 08/02/2019 of tank 61-TK-440 at IOCL Haldia refinery is enclosed as Annexure-1.

The compliance status of the recommendations mentioned in detail investigation report is given below:

Sl. No.	Recommendations of Multi–Disciplinary Investigation Committee	Compliance Status
1	24 Volt flame proof lighting to be used in confined space painting as per OISD-RP-149 and OISD-GDN-207. A mechanism to be established so that non FLP electrical fittings are not allowed during execution of painting jobs.	24 V flame proof light in use for Tank M&I illumination. This is mentioned in general condition of contract. Mentioned in work permit. **Complied**
2	SAP Permit format "Dos and Don'ts" to include and mention use of 24 Volts flameproof light fittings during confined space painting.	Flame proof 24 Volt lighting shall be used The SAP permit shall be revised. **Matter taken up at Corporate level.**
3	Painting is a hazardous activity emitting flammable vapors. This job must not be executed in conjunction of HOT jobs at vicinity. Clearance for both the hot jobs and painting shall not be given at the same time.	Separate permit obtained and no simultaneous jobs in practice. **Complied**
4	Separate permit for paint application job to be issued.	Separate work permit for paint application job is being followed. **Complied**
5	SOP for tank M&I including the standard JSA (job safety analysis) requirement to be prepared and followed.	HIRA (hazard identification & risk assessment) for each sub activities prepared and strictly being followed (in addition to Tank M&I manual). **Complied**
6	Job safety analysis (JSA) by a team of multidisciplinary personnel shall be ensured as per tank M& I SOP.	HIRA for each sub activities prepared and strictly being followed (in addition to Tank M&I manual). **Complied**

Sl. No.	Recommendations of Multi–Disciplinary Investigation Committee	Compliance Status
7	Spray painting is intrinsically unsafe in confined space in particular as it generates inflammable hydrocarbon vapour and static electricity together. Brush painting as an alternative for spray painting of pontoon box (confined space) to be reviewed for its preferential use over spray painting reducing the hazard in small confined space.	Spray painting in pontoon boxes is stopped. Manual (Brush) painting has been carried out after receipt of corporate guidelines.
8	Regular safety briefing to the workforce must be carried out prior to start of the jobs on each day both by Contractor and Owner.	Safety briefing regularly done by F&S department. **Tool box talks imparted by executor / agency safety supervisors.**
9	The agency for the tank M& I jobs, M/s Expo should be penalized for violation of GCC and safety norms as per the terms of the contract.	Agency penalized for an amount INR 7,45,620.42 as per provisions of contract. Also Committee report under review and approval for Holiday listing of the executing agency.
10	Safety aspect related to static electricity generation during high pressure fluid transfer thru spray painting equipment or painting apron/dress to be further studied for possible source of ignition and its mitigation measures.	Fire retarded and chemical resistance apron in use for paining jobs as per corporate HSE guidelines. Earthing of spray gun ensured. **Complied**
11	The gun used for the painting had a ferrous trigger which could lead to spark upon impact. Suitable material for spray gun to avoid spark to be studied.	Verified the metallurgy of spray gun. The trigger of the spray nozzle is brass (nonferrous) material. **Complied.**
12	Training material for hazards associated with painting process to be prepared and training to be provided to concerned persons.	Training imparted. **Complied**

Thanking You,

Yours faithfully.

23/05/19

P N K Mohanty
CGM (TS &HSE) I/C
Haldia refinery
Indian Oil Corporation Limited
Dist: Purba Medinipur (WB)
Pin 721606

Encl: 1) Investigation Report

2) Email communication dated 16/5/2019 from PNGRB

OISD Investigation Report
ATR OF RECOMMENDATIONS (PDA unit -32 incident DT. 07.01.18)

SL.NO.	Recommendation	Action taken	Target/ Remarks
1.	The railing height of the elevated platform of the water monitor must be increased from the existing 0.60 M to a suitable height (at least 1.00 M as per standard practice) to prevent fall from the platform while normal working/ particularly while fighting emergency situations.	List of elevated monitor whose railing heights are less than 1.0 m are listed. 1. Railing height less than 700mm = 13 nos 2. Railing height 700mm to 900mm = 51 nos 3. Railing height 900mm to 1000mm = 78 nos.	Action by : DGM(MN) All Complied
2.	The structural support of all the equipment must always be properly maintained. In the instant case, the improper support of the control valve resulted in additional stress in the bottom piping network of 32-C01 C and contributed to asphalt mix leakage.	System to be developed for periodic checking.	Action by : DGM(MN) The system is there, covered under walkthrough audits by Inspection department. Abnormality if any is liquidated in running after PN Clearance or shutdowns by ML. (Complied)

OISD Investigation Report
ATR OF RECOMMENDATIONS (PDA unit -32 incident DT. 07.01.18)

SL.NO.	Recommendation	Action taken	Target/ Remarks
3.	Integrity of all gaskets & flange joints & fittings must be ensured and maintained at all times.	Action: Integrity checks of gaskets and flange joints and fitting are checked during shutdown or in available opportunities. Leak check done in during start by PN and abnormality if any is liquidated by ML.	Action by: DGM(MN) Complied
4.	Prior to commissioning of any unit/ unit idling for some time – integrity of all allied facilities like flange joints its gaskets etc. must be checked and its integrity authenticated by IOCL.	In case of any process units are idle for long duration, its integrity check and leak checks shall be ensured before start up.	Action by: DGM(PN) Target: To be checked at next startup of PDA units. Complied
5.	All the railing height of technological platform to be checked and rectified accordingly.	Railing height of technological platform is being checked in respective units. Shortcoming if any to be taken up during shutdown job lists.	Action by: DGM(PN) Target: Checking completed.

OISD Investigation Report

ATR OF RECOMMENDATIONS (PDA unit -32 incident DT. 07.01.18)

SL.NO.	Recommendation	Action taken	Target/ Remarks
6.	All the elevated Water Monitors/ HVLRs should be provided with remote operation from ground level as best engineering practices.	Remote monitors have been installed based on criticality. All other elevated monitors/ HVLRs the isolation valve have been placed at safe location.	Action by: CMFS Status: Reviewed and existing system found adequate. Complied
7.	Hydrocarbon detector should be provided at all potential leak sources.	HC detectors are already provided in the process units.	Action by: DGM(EL&IT) Status: Complied

Start-up SOP for ISOM (U86)

1.1 SUMMARY OF START UP

The unit status prior to its first start-up is as follows:

- Each section has been thoroughly drained free of water and lines have been blown with air to remove any pockets.
- All adsorbent have been loaded in the dryers.
- Pall and Raschig rings have been loaded, respectively, into the top of the LPG side stripper, LPG separator drum and scrubber packed section.
- The bottom insert balls have been loaded into the reactors.
- The chloride guard beds have been loaded.
- Each section has been satisfactorily leak tested.
- The unit has not been inerted but is isolated with blinds:
  - on the feed and product lines
  - on the flare and fuel gas headers
- The compressor is isolated

1.2 FINAL PREPARATION / CHRONOLOGY OF START UP OPERATIONS

The start-up sequence is as follows:

Complete inerting of:
- the dryers section, reactors section and regeneration facilities,
- the stabilizer, deisohexanizer and LPG recovery sections.

- Hydrogen Sweep
- Oil circulation and stabilizer/Deisohexanizer /LPG recovery section start-up
- Reactor Oil in.

} initial dry-out

- Acidizing and final dryout.
- Hydrogenation/Isomerization catalysts loading.
- Isomerization unit start-up
- Lining out of Isomerization unit at design conditions.

- LPG recovery start-up
- Lining out of LPG recovery section at design conditions.

1.3 Complete Inerting / PURGING

The purpose is to reduce the O_2 content in all of the sections below 0.2 volume % prior to hydrogen or hydrocarbons introduction.

Evacuation using steam ejector followed by vacuum breaking with nitrogen is preferable for the unit section where water is not desirable, like the dryer and reaction sections. The inerting of these sections could also be carried out with repeated pressurization / depressurization cycles using nitrogen. For the rest of the unit where water is not a problem, the steam out procedure could be used.

1.3.1 Prerequisites

- The pre-commissioning has been properly performed. It includes in particular the complete and satisfactory inspection of the unit and the calibration of all the instruments.
- The units are isolated according with the P&ID drawing sent by Axens with blinds from adjacent sections containing hydrocarbons (liquid or gaseous) and from adjacent sections, equipments and utilities systems. Blind list must be elaborated and daily checked.
- All Axens punch lists must be returned properly completed and signed by the IOCL representative.
- No hydrocarbon, H_2, fuel gas or other flammable product can be introduced in the unit without the Axens agreement (ready for Start-up Certificate should be received by IOCL).
- The initial leak tests were performed according to the unit owner and engineering contractor normal practices. These tests can be carried out using air or nitrogen depending upon local facilities.
- Each section has been thoroughly drained free of water and lines have been blown with air to remove any pockets.
- All adsorbent have been loaded in the dryers.
- Pall and Raschig rings have been loaded, respectively, into the top of the LPG side stripper, LPG separator drum and scrubber packed section.
- The inert balls have been loaded into the reactors.
- The chloride guard beds have been loaded.

1.3.2 Steam-out procedure

Steam out operation is a general refinery practice and only some points are raised in these instructions.

The start-up steam hoses for LP steam should be connected to the maximum number of points, usually on vessel bottoms. All vents on columns, reflux drums and other high points of lines should be opened. The air coolers should be shut-down and cooling water circulation through coolers and condensers stopped. Pumps to be kept isolated during steaming operation.

Steam should be introduced slowly to heat up all parts of equipment and lines. The condensate should be drained at low points of piping and drums.

The steam out operation can be used for tightness test. This can be done by pressuring the system with steam and observing the flange connections to determine possible leaks.

IN UNIT 86, THERE ARE NO PROVISIONS FOR FUEL GAS INJECTION. FOR THIS REASON, AFTER STEAM-OUT NITROGEN MUST BE USED.

The steam out operation for a period of 24-48 hours is usually sufficient to eliminate air from the system. The steam out is followed by filling with nitrogen. The steam flow must be reduced gradually and vent valve throttled following the pressure decrease. The N_2 is introduced at all reflux drums and surge drum. The cooling of equipment will suck the N_2. Thus the N_2 is acting as vacuum breaker.

However, ensure that N_2 is flowing without interruption and positive pressure is maintained in all sections of the piping and equipment.

DO NOT ALLOW ANY PART OF THE SYSTEM TO DEVELOP VACUUM. THIS WILL RESULT IN INTRODUCTION OF AIR AND FURTHER DANGER OF EXPLOSION.

The steam out operation can be done simultaneously in the splitter and the stabilizer sections or separately in each section depending on the availability of steam and N_2.

The feed section, splitter and stabilizer once filled with N_2 must be left at positive pressure (0.5 to 0.8 kg/cm^2g). But ensure that all equipment are filled with N_2 and not isolated from other parts ("boxed in").

1.3.3 Sections

The Isomerization unit is split into the following sections for inerting.

1) Dryers Section including Regeneration Facilities and Reactor Section.
2) Stabilizer Section.

3) Deisohexanizer Section.
4) LPG recovery Section.
5) Additional Equipments.

1.3.3.1 Dryers Section including Regeneration Facilities and Reactor Section

This section should be evacuated using a steam ejector 86-J-01, breaking the vacuum with nitrogen. Vacuum test should be done.

The following equipments are included.

- Feed Surge Drum 86-B-01
- Feed Dryers 86-B-02 A/B
- H_2 Dryers 86-B-03 A/B
- H_2 Make-up Cooler 86-E-01
- H_2 Make-up KO. Drum 86-B-04
- Reforming Stabilizer Off Gas Dryers 86-B-14 A/B
- Regenerant Vaporizer
- Regenerant Superheater
- Regenerant Condenser
- Regenerant Trim Condenser
- Regerant Degasser
- Deisohexanizer Recycle / Reactor Feed Exchanger (shell side)
- Reactor Feed Heater shell side
- Hydrogenation Reactor
- Isomerization Reactors
- Feed / Effluent exchangers
- Hydrogenation Reactor Feed Heater (shell side)
- Deisohexanizer Recycle / Reactor Feed Exchanger (tube side)
- 86-E-22.

Procedure to be followed is explained stepwise in section below:

◊ Isolate from other sections.
◊ Open all the valve between equipments with-in the reaction section (including bypasses, instrument tapping, lines, etc.).
◊ Isolate the equipments and instruments not suitable for vacuum service (such as compressors, pumps).
◊ Install at least two vacuum gauges to monitor the vacuum level.
◊ Test the ejector to make sure that it is operational.
◊ Remove the blinds to the steam ejector 86-J-01.
◊ Pressurization and depressurization must follow the normal reactor flow direction, to avoid any disturbance in catalyst beds.
◊ Pull a vacuum in the reaction section to 0.2 kg/cm^2 abs by starting the ejector 86-J-01. MP steam is to be fed to the ejector by manually throttling the valve on MP steam line.

- ◊ **Vacuum Test** : Stop the ejector and hold the vacuum for one hour to check for leaks, in particular the flanges opened during catalyst loading. **The pressure must not rise more than 0.07 kg/cm² per hour.**
- ◊ Pressure the unit upto 1.0 kg/cm² g with nitrogen. Nitrogen can be fed from the nitrogen supply line available at the inlet of reactor 86-R-01. Open the blind on this nitrogen supply line and feed nitrogen by throttling the globe valve in the nitrogen line. The nitrogen pressure can be noted on 86-PI-0501.
- ◊ Depressurize through low points, dead legs, vents, etc.
- ◊ Repeat until the oxygen level in the reaction section is less than 0.2% volume.
- ◊ Typically the required O_2 content (0.2% volume) is achieved with 3 cycles of vacuuming / pressurizing.
- ◊ If the O_2 content is not lower than 0.2% volume at all locations, repeat the vacuum / pressurizations steps until reach less than 0.2% volume of O_2 in each point.
- ◊ When the O_2 contents is lower than 0.2% volume, the reaction sections is considered "air free". Put all instruments on line and replace the vacuum Pi with the normal PI.
- ◊ Isolate 86-B-01 closing UV-102. Pressurize with N_2 the isomerizaation feed drum upto 2.5 kg/cm². **The pressure must not decrease more than 0.05 kg/cm² per hour.**
- ◊ Pressurize with N_2 the reaction section upto 6 bar g. The pressure must not decrease more than 0.05 kg/cm² per hour.
- ◊ After air purge, the system is kept with nitrogen under positive pressure of 0.5 to 0.8 bar g until start-up and introduction of hydrogen.

1.3.3.2 Stabilizer Section

This section should be inerted with LP steam, as any water accumulation in the system due to steam condensation during the start-up will be removed during oil circulation.

The chloride guard bed 86-B-06 and reforming stabilizer off gas dryers 86-B-14 A/B should be isolated and bypassed. Their inerting are independently realized with nitrogen.

The following equipments are included.

- Stabilizer 86-C-01
- Stabilizer Air Condenser 86-EA-01
- Stabilizer Reflux Drum 86-B-07
- Stabiliser Reboiler 86-E-06
- 86-E-23
- 86-E-09 tube side.

Procedure to be followed is explained stepwise in section below:

- ◊ Isolate the stabilizer section. Fuel gas and flare connections to remain isolated. Pumps to be kept isolated during steaming operation.
- ◊ Carefully check that the vessels design pressure and temperatures are not exceeded.

◊ LP steam shall be fed to stabilizer by dedicated LP steam line on nozzle UC. LP steam to be fed to the drum 87-B-07 through the utility connections UC.
◊ Exchangers tubes or / and shell sides could be steamed out by the process inlet / outlet lines or connecting independent steam supply, if needed (for ex. : reforming stabilizer off gas exchanger 86-E-22).
◊ Open all high point vents and start the steaming within all the above mentioned equipments of the stabilizer section simultaneously. Allow steam to purge the line upto product B/L valve. Remove the blinds on the
- Safety valves to flare
- Flare header, fuel gas header
- Products to battery limits
- Remaining blinds on utilities.

◊ Slowly warm up with steam and allow steam to come out through vent. Drain condensate periodically in all low points.
◊ Continue steaming for 2-hours minimum after steam appears at all the vents.
◊ After steam-out, N_2 will be introduced, follow the general procedure described in section 7.3.2

1.3.3.3 Deisohexanizer Section

This section should be inerted with LP steam, as any water accumulation in the system due to steam condensation during the start-up will be removed during oil circulation.

The following equipments are included.

- Deisohexanizer 86-C-03
- Deisohexanizer Air Condenser 86-EA-02
- Deisohexanizer Trim Condenser 86-E-11
- Deisohexanizer Reflux Drum 86-B-09
- Deisohexanizer Reboiler 86-E-10
- Deisohexanizer Recycle Drum 86-B-08
- Deisohexanizer Feed / Recycle Exchanger 86-E-09 shell side
- Deisohexanizer Recycle / Reactor feed / exchanger (86-E-02 tube side)
- Recycle Trim Cooler 86-E-08
- Off-spec Isomerate Trim Cooler 86-E-18.

Procedure to be followed is explained stepwise in section below:

◊ Isolate the Deisohexanizer section. Fuel gas and flare connections to remain isolated. Pumps to be kept isolated during steaming operation.
◊ Carefully check that the vessels design pressure and temperatures are not exceeded.
◊ LP steam shall be fed to deisohexanizer by dedicated LP steam line on nozzle UC. LP steam to be fed to the drum 86-B-09 and 86-B-08 through the utility connections UC on each drum.
◊ Exchangers tubes or / and shell sides could be steamed out by the process inlet / outlet lines or connecting independent steam supply, if needed.

◊ Open all high point vents and start the steaming within all the above mentioned equipments of the stabilizer section simultaneously. Allow steam to purge the line upto product B/L valve. Remove the blinds on the
- Safety valves to flare
- Flare header, fuel gas header
- Products to battery limits
- Remaining blinds on utilities.

◊ Slowly warm up with steam and allow steam to come out through vent. Drain condensate periodically in all low points.
◊ Continue steaming for 2-hours minimum after steam appears at all the vents.
◊ After steam-out, N_2 will be introduced, follow the general procedure described in section 7.3.2.

1.3.3.4 LPG Recovery Section

This section should be inerted with LP steam, as any water accumulation in the system due to steam condensation during the start-up will be removed during oil circulation.

The chloride guard bed 86-B-13 and 86-B-15 should be isolated and bypassed. Their inerting are independently realized with nitrogen.

LPG refrigeration system 86-E-14 must be inertized and commissioned according to the vendor instruction.

The following equipments are included.

- LPG Refrigeration System (tubes side) 86-E-14
- LPG Separator Drum 86-B-11
- Separator Drum Bottom / Lean Oil Exchanger 86-E-15
- LPG Stripper Feed / Bottom Exchanger 86-E-16
- Lean Oil Trim Cooler (shell side) 86-e-17
- LPG Stripper 86-C-04
- LPG Stripper Condenser 86-E-20
- LPG Stripper Reflux Drum 86-B-12
- LPG Stripper Reboiler 86-E-21
- LPG Side Stripper 86-B-17
- LPG Trim Cooler 86-E-19
- Scrubber 86-C-02
- Caustic Recycle Heater 86-E-07.

Procedure to be followed is explained stepwise in section below:
◊ Isolate the LPG section. Fuel gas and flare connections to remain isolated. Pumps to be kept isolated during steaming operation.
◊ Carefully check that the vessels design pressure and temperatures are not exceeded.

◊ LP steam shall be fed to LPG stripper and scrubber by dedicated LP steam line on nozzle UC. LP steam to be fed to the drum 87-B-11, 87-B-12 and 87-B-17 through the utility connections UC on each drum.
◊ Exchangers tubes or / and shell sides could be steamed out by the process inlet / outlet lines or connecting independent steam supply, if needed.
◊ Open all high point vents and start the steaming within all the above mentioned equipments of the stabilizer section simultaneously. Allow steam to purge the line upto product B/L valve. Remove the blinds on the
- Safety valves to flare
- Flare header, fuel gas header
- Products to battery limits
- Remaining blinds on utilities.

◊ Slowly warm up with steam and allow steam to come out through vent. Drain condensate periodically in all low points.
◊ Continue steaming for 2-hours minimum after steam appears at all the vents.
◊ After steam-out, N_2 will be introduced, follow the general procedure described in section 7.3.2.

1.3.3.5 Additional Equipments

This section includes:

- Chloride guard beds 86-B-06, 86-B-13 and 86-B-15
- Chlorine agent drum 86-B-05.

All of these systems (including pumps, drum) are inertized with Nitrogen.

1.4 HYDROCARBON CIRCULATION, HEATING UP AND INITIAL DRYDOWN

The unit is now considered oxygen free and leak tested. The following procedure introduces hydrogen and then hydrocarbon circulation at design operating pressure in order to begin dry out. During this period it will be necessary to change the flow pattern through the reactors and associated piping to ensure that all lines are used. In addition any "dead" legs such as control valve bypasses should have flow established through them for a short time and all instrument lead lines must be adequately purged. This is to ensure that no water pockets remain in the system. These flow patterns are repeated during the subsequent acidizing steps. Initially line up the isomerization reactors for series flow operation. Then every six hours after hydrocarbon circulation has been established switch the flow patter is as follows:

- Reactor 86-R-02 single operation
- Reactor 86-R-03 single operation
- Reactor 86-R-03 to Reactor 86-R-02 series operation

- Reactor 86-R-03 to Reactor 86-R-02 series operation

1.4.1 Hydrogen Sweep

This step starts with admitting hydrogen to the reaction section and pressurising to operating pressure.

Reaction section includes 86-R-01, 86-R-02, 86-R-03, 86-B-03 A/B.

- Hydrogen comes from hydrogen unit. Check hydrogen availability and purity
- With the feed dryers isolated from reaction section (KV-0214 A/B, KV-0211 A/B closed and UV-0413 closed) and the distillation section blocked off from the reaction section, line-up the circuit before introducing hydrogen
- LPG recovery section is isolated (86-UV-1002 at LPG separator drum inlet , 86-PV-1001 at LPG separator drum vapour outlet ,86-FV-1102 at LPG rundown line , 86-FV-0802 at DIH bottom outlet and 86-FV-1003 at LPG stripper bottom outlet line are closed.)
- Introduce hydrogen through hydrogen drivers in series at a filling rate that will not upset the other hydrogen users.
- Pressurise reaction section to operating pressure (38 kg/cm^2)
- Survey the reaction section for leaks at each step ,in particular, check those locations which were leaking during initial leak test. (Soap solution or explosimeter can be used)
- With the reactors holding at operating pressure (38 kg/cm2 g), slowly open the H2 pressurisation line 1½-P-86-04-014 (to the stabilizer reflux drum) and pressurize the stabilizer column to normal operating pressure (13.7 kg/cm^2 g in PIC-0604)
- Check that LPG recovery section is isolated.
- Crack open the bypass valve of the stabiliser overhead pressure control valve PV 0604 and pressurise the scrubber to operating pressure (8 kg/cm2 g in PIC 1201). This must be carried out very carefully so as not to bump or dislodge the packed sections. Avoid pressure surge while doing so; otherwise the packings may be damaged / dislodged. The DIH section is not included in this system (UV 1001 close)
- Using LPG dedicated hydrogen pressurisation line 1½-P-86-04-016, pressurise LPG stripper and LPG separator drum to operating pressure 14.4 kg/cm2 g in PIC 1102 and 11 k/cm2 g in PIC 1201.
- Add sufficient hydrogen to the reaction section to maintain operating pressure and close the H2 pressurisation line

- Set in service the pressure controlleers on the stabilizer feed and overhead, the scrubber, the LPG stripper and the LPG separator drum. Route any excess gas first to flare and then to fuel gas
- Survay the unit for leak. Set the hydrogen makeup flow at 40 % of normal rate.(86-FIC-0301 at 65 kg/hr).
- Switch the flow pattern arround the dryesr and ensure all dead legs are purged.

1.4.2 Oil Circulation, and Stabilizer / Deisohexanizer

Refer Oil circulation loops on P&IDs in Annexure T in volume 2 of this manual.

This sequence allows the C_5/C_6 feed introduction in the system through the Feed Dryers, to the Stabilizer, the Deisohexanizer and the LPG recovery section by utilizing the start-up line by passing the dryers (feed and hydrogen) and the reactors and the other one only by-passing the reactors.

The dryers regeneration circuit is also flushed with oil and the oil is finally routed to storage through the product lines. This performs a thorough flushing of foreign material from the equipment and the liquid lines.

- Check the C_5/C_6 feed availability and quality. It must be on-spec with regard to contaminant content.
- Check that the Feed Dryers are blocked off from the reaction section.
- Check that the C_5/C_6 feed is by-passing the Feed Dryers. Line called "start-up line" i.e. 3"-P-86-02-011 should be used.

Before establishing the complete loop it is necessary to draw off the C_5/C_6 to off-spec storage to remove the equipment oil coating and not to contaminate the dryers molecular sieves. **A period of 8 hours** is necessary before closing the loop. During this step, the chloride guard bed 86-B-06 will be by passed.

- Establish a level in the stabilizer bottoms. Stabilizer is already at its operating pressure(LIC-0601 / FIC-0604)
- When the level in the stabilizer reaches 40%, commission the level controller and route the bottoms to the Deisohexanizer. **The chloride guard bed 86-B-06 is still by-passed.** (The block valve at FV-0604 to be opened) Guard against possible breakthrough to DIH; Check proper indication and functioning of LIC-0601.
- Commission Deisohexanizer overhead air condenser 86-EA-02, then the reboiler. Remove in a first step, the isomerate product to off-spec storage (sidedraw control valve LV-0701 closed). In a second step, after all the equipment are cleaned, commission the sidedraw and begin recycling the sidedraw. Keep removing the isomerate to the off-spec storage. Set the pressure controller at the DIH overhead at (2.4 kg/cm2 PIC 0801).

After the 8-hour period, the complete loop including dryers can be established.

- Slowly fill each Feed dryer separately using globe valves on KV-0209 A/B bypass lines and venting the nitrogen to flare through the pressure safety valves bypass. Dryers filling and nitrogen displacement to be monitored by the level glasses on the PSV bypasses.
- Once both the dryers are full, the start-up line bypassing dryers is closed and the oil circulation is continued to the stabilizer through the reactor bypass line 3"-P-86-04-013 (UV 0415 open)
- Commission the stabilizer overheads air condenser
- Slowly bring the stabilizer up to operating temperature, 170 °C in TI-0604 at a rate of 30 °C/hr. As the level appears in the reflux drum start the reflux pumps and reflux back to the column.
- Adjust the flow on the reactors by-pass line to reach a circulation rate of 60% of design throughput (25 m^3/hr in FIC 0101).
- Commission the chloride adsorber on stabilizer bottoms.

- Once th circulation is ready, line-up the regeneration circuit to bypass the dryers line 3"-P-86-02-009. Valves KV-0208, KV-0205 are open and valves KV-0213 A/B and KV-0203 A/B are closed.
- Crack open the flow controller FIC-1302 on the regeneration loop and flush the loop free of foreign material back to rundown to storage using Off-spec isomerate line 3"-P-86-09-016.
- Adjust the flow to design rate (3000 kg/hr on FIC 1302), hold for 4 hours and then stop the circulation through the regeneration loop. Close the by-pass line (across both dryer and reactor) and direct flow through feed dryers.
- Calibrate the moisture analyzers on the feed, hydrogen and reforming stabilizer off gas dryers. Commission them to monitor dryer performance.
- During the circulation, switch the flow pattern around the dryers and ensure all possible dead legs are adequately purged.

1.4.3 LPG recovery section start-up

1.4.3.1 Section status

- Leak test has been performed and LPG section is pressurised
- Raschig rings are installed on top of the scrubber and pall rings in the LPG side stripper and LPG separator drum.
- Absorbent is loaded in the chloride guard beds. LPG and heavy products absorbed to be blocked off. Both chloride guard beds are bypassed.
- All utilities are available including chilling package
- Section is isolated as follows
  - Off gas from stabilizer reflux drum: UV 1002 + block valves closed

- Off gas from reforming: block valves closed (at the outlet of dryers 86-B-14)
- Lean gas from LPG separator drum to caustic scrubber: PV 1001 + block valves closed.
- FV 1102 + block valves closed (LPG product rundown at the outlet of chloride guard bed 86-B-15)
- Lean oil inlet from Deisohexanizer bottoms: FV 0802 + block valves closed
- Heavy Product Outlet: FV 1003 + block valves closed (downstream side of Chloride guard bed 86-B-15, DIH bottom.)

Close the UV 1103 at LPG Stripper bottoms, the PV 1102 at the LPG stripper reflux drum and the FV 1105 on the LPG side stripper.

1.4.3.2 LPG recovery section is by passed

- 86-B-14 reformer off gas dryers on stand by. Isomerization off gases are sent directly to the scrubber, ie. UV 1001 is open and UV 1002 is closed.
- Scrubber caustic and water circulation are in service. PIC-1201 is set at 8 kg/cm^2 g and offgas is directed to fuel gas

Caustic Receipt and dilution facility

Caustic Receipt and dilution facility will need to be commissioned. Tanks are cleaned and pumps tried.

- Receive 20 % in any of the tanks (85-T-21/22) to a level sufficient to make dilution to 10 % strenghth, check caustic strenght as received .(The second tank is for preparing caustic of 5 % strength.
- Circulate the tank content by pump 85-P-28 A/B to homogenise the solution.Check Caustic solution strenght for proper dilution.
- Operate caustic pump 85-P-28 A/B to supply caustic solution to consumers.Minimum flow control of the pump should be commissioned. Piping consideration allows simulteneous supply of cautic of different strenght by running both pumps, if required.

  Caustic supply system is now operational. Caustic of 10 % solution will be now be charged to lower section of caustic scrubber 86-C-02.
- Slowly receive Caustic solution (10 %) at the bottom of Caustic scrubber.
- When adequate level (86-LI-1202) builds up, establish caustic circulation by pump 86-P-04 A/B.through heater 86-E-07.
- Ensure normal flow to the top of packing (86-FI-1205) and under the packing (86-FI-1206). The former is required to neutralize acid gas while the latter is sprayed on column wall to protect against corrosion in the bottom section.

- Introduce LP steam to heater 86-E-07 and bring up circulating caustic temperature to normal value. This to avoid possible hydrocarbon condensation in the scrubber.Commission temperature control system 86-TIC-1201 / 86-FIC-1201.
- Check fuel gas quantity to ensure proper neutralization. Also monitor caustic strength periodically. Discard the solution if strength goes below 2 %. Makeup with fresh solution.
- PIC 1201 is set at operating pressure and off gas is directed to fuel gas.

Remark for reformer off gas:

LPG recovery unit can operate on isomerization off gas only. Reformer off gases will only be routed to the LPG recovery unit after LPG recovery unit after LPG recovery line out and CRU line out.

Procedure

- Line-up the internal circuit between 86-B-11 (LPG separator drum) and 86-C-04 (LPG stripper)
- Slowly direct heavy product from DIH bottom through FV-0802 at 86-P-07 discharge to 86-B-11 up to 100% at LG 1004 (LPG separator drum).Confirm with 86-LIC-1003 indication . The flow will take place through chiller 86-E-14.
- Start then 86-P-10 and through FV 1002, introduce liquid to 86C-04 (LPG stripper) until LG 1107 reaches 100% while maintaining make up to 86-B-11. Stop make-up when LIC 1003 at 86-B-11 bottom is 60%. Ensure pump minimum flow protection is on line whenever pump is in operation.
- Commission SHM steam to 86-E-21 (LPG stripper reboiler) and bring 86-C-04 at total reflux conditions. C-04 reboiler outlet design temperature is 177 at TI-1103. Make-up heavy product to 86-B-11 and restart 86-P-10 as necessary to maintain LPG stripper levels. Reboiler commissioning procedure is same as mentioned earlier.
- Open fully UV 1001 by-pass (UV 1001 is open). Commission the PIC 1001 at the LPG separator drum overhead (PIC-1001 set point is 11 kg/cm^2)
- Using HS 1001 A/B, close UV 1001 and open UV 1002. As pressure is lower in the scrubber most of the rich off gas will still flow to the scrubber.
- Very slowly start to close UV 1001 by-pass, say in 20 minutes for initial start-up. Rich off-gas will then pass through the separator and leave it through PV 1001 to scrubber. LPG separator drum will be at its operating pressure by the action of 86-PIC-1001 at LPG separator drum overhead.
- Commission chilling medium to 86-E-14 chilling exchangers. Follow vendor's instructions for taking the chiller online attached in Annexure Q in volume 2 of thus manual and extracted in section 11.2.1.
- UV 1103 (LPG stripper bottoms) to be forced open.

- Start recycling heavy product through FV 1001, restart 86-P-10 as required.
- PV 1102 (LPG stripper reflux drum), in auto mode, will start to open to maintain 86-C-04 pressure, recycling the lean off-gas to the separator.
- Open FV 1105 (LPG side stripper) and start filling LPG in 86-B-17. As level reaches 40%, commission steam to the bottom coil.
- Commission LPG trim cooler 86-E-19.
- When level reaches 50% at LIC 1106 start 86-P-12 on minimum flow line, and then open FV 1102. **The chloride guard bed 85-B-15 is still bypassed**. The LPG product is sent to the off spec storage via the start-up/drying line during 8 hours.

To remove the equipment oil coating and not contaminate the chloride guard beds, a period of 8 hours is necessary before putting them in service.

- Commission then LIC 1106/FIC 1102 at the LPG side stripper.

- Open the FV 1003 and commission in auto/cascade the FIC 1003/LIC 1102 at the LPG stripper bottoms. **The chloride guard bed 85-B-13 is still bypassed** for 8 hours for the same reasons as before.

- After at least 8 hours, start opening 86-B-13 and 86-B-15 inlet valves to fill both chloride guard beds. Open the outlet lines and close the bypass lines.

1.4.4 Reaction Circuit Oil-in

1.4.4.1 Status

- Hydrogen is flowing at 40% of design capacity through the H_2 dryers and the reaction circuit at operating pressure, through the stabilizer, the deisohexanizer, the LPG recovery section, to the scrubber and out to fuel gas.
- C_5/C_6 feed is flowing through the Feed Dryers by passing the reactor section to the stabilizer.
- The stabilizer, the Deisohexanizer and the LPG recovery section are operating under total reflux at 60% capacity.
- The dryer regeneration loop has been flushed and is full of liquid naphtha.
- Following pressure controllers are in service and are at their respective set points.
  - the stabilizer feed and overhead
  - the deisohexanizer overhead
  - the scrubber overhead
  - the LPG separator drum overhead
  - the LPG stripper overhead
- The caustic and water washes are in service.

- The isomerization reactors are loaded with bottom inert balls only and are lined up for series flow.

For 86-R-01/02/03 start up:

- Drain lines to CBD/ CBD-CL/ flare to be blinded.
- Evacuation lines from 86-R-01 / 02/ 03 to 86-J-01 are blinded.
- 86-E-05 shell side bypass to be blinded.

1.4.4.2 Procedure

- Establish normal hydrogen make-up flow.
- Commission the reactor feed hater 86-E-05 and slowly raise the hydrogenation reactor inlet temperature to 110°C at 40°C/h. Place the reactor inlet temperature controller in cascade service 86-TIC-0503 /86-FIC-0503. 86-UV-0501 in steam line to 86-E-05 may need to be forced open.This will be restored to normal position once the diversion is over.
- Survey the unit for leaks.
- With all conditions steady slowly diver feed Naphtha to reaction section . The block valves operation in the diversion should be in steps and gradual. At the end all of 60 % normal flow will flow through reactor.
- Reactor bypass flow should be stopped.
- Slowly increase the hydrogenation reactor inlet temperature to 160° C at 20° C/hr. Test the reactor inter-coolers temperature control and alarms. Set in auto mode the isomerization reactor TIC at 160°C.
- The liquid flowing through the reaction section will remove the oil film on the vessel inside walls and internals placed there after sand blasting. This oil will contaminate the dryer adsorbent if regeneration is taking place.

  During this period, it is recommended that the deisohexanizer side-draw product is not used to avoid contaminating the dryer adsorbent. The oil will flow out the deisohexanizer bottoms and be routed to off-spec storage. **The stabilizer chloride guard bed is by-passed** for the same reasons.

  Dryer regeneration and/or cooling should be completed and discontinued before reactor oil-in See separate dryer regeneration section for procedure. Regeneration of either dryer must not take place until 8 hours after reactor oil in.
- 8 hours after reactor oil in, open the side-draw control valve 86-LV-0701, and increase slowly the recycle flow rate to the reactors(86-FIC-0702). Recycle pump 86-P-06 A/B will be in service with minimum flow control. Establish pump around flow through 86-FIC-0703.
- During the hydrogen and hydrocarbons circulation, it will be necessary to switch the flows through the different reactors circuits as discussed previously. It is imperative

that all piping sections are exposed to this "dry out" step. Also line-up the sulfur stripping line.

- Continue drying until the water content is below 10 ppm at the reaction section outlet. The water content in the heavy product to storage must also be lower than 10 ppm.
- Regenerate the dryers (feed, hydrogen and reforming stabilizer off gas) on a regular basis.

Note 1:
During this step all efforts should be made to get all moisture analysers working properly and most specially those down stream reactors, which will be used during acidizing.
Note 2:
The moisture analyser installed downstream the reactor, which will be used during acidizing should have its sampling system equipped with separator liquid / gas . The liquid sample only will be sent to the moisture analyser cell.

The analyzer measure repeatability should be checked carefully at this stage as the acidizing step follow-up will rely only on the good operation of this analyzer.

1.5 ACIDIZING AND FINAL DRYDOWN

As previously mentioned iron oxide on contact with HCl will liberate H_2O which is an irreversible poison to the isomerization catalyst. In this step, the final dry down occurs and anhydrous HCl is added to remove all traces of iron oxide. These steps could take up to 3-4 weeks to satisfactorily complete depending upon the equipment conditions, the sandblasting efficiency and the previous initial dry down steps. The unit chemical cleaning during pre-commissioning can significantly reduce the length of the dry out period.

1.5.1 Preparation

- The caustic and water circulation in scrubber are already in circulation as described above.
- Drain any liquid water which may have been accumulated in the stabilizer reflux drum and LPG stripper reflux drum. During the acidizing period with HCl, it will be necessary to check and drain these points on a frequent basis as highly acidic liquid could be present.
- Connect up the anhydrous HCl. The HCl cylinder should be mounted on an accurate scale to determine and control the injection rate.
- Block in the reactor effluent moisture sample point to the dryer moisture analyser as the highly acidic effluent could damage the analyzer cells. After HCl has been injected it is necessary to wait for atleast one hour before reconnecting the analyzer.
- Swing the blinds on the HCl injection facilities to feed / H2 line to reactor.

- Perform a leak test on the injection piping system.
- DIH side draw product shall not be used.

1.5.2 Acidizing Step

With hydrogen flow at design rate, C_5/C_6 feed at 60% of design, and the unit steady with the reactors inlet temperature set at 160° C:

- Inject 5 kg of HCl into the reactor feed at a steady rate over a 10 minute period.

Note: the first injection should take into account the volume of the injection line (the quantity injected to be adjusted)

- Wait for one hour or until the reactor effluent sample pot vapor contains less than 10 ppm HCl.
- Reconnect the moisture analyzer and obtain a reading on the sample pot liquid, then disconnect. Record the moisture level, HCl addition and sample time (see typical injection table data report attached).
- Continue HCl injecting in the same manner until the moisture level peaks start to decline. During this period continue draining all low points, purging instrument lead lines, flushing bypasses around control valves and switching the reactors flow pattern.
- Continue HCl injection until no further response is noted by the moisture analyzer.
- Check that the moisture analyser is operating correctly and that the readings are correct.
- Add another 10 kg of HCl over a 30 minute period. When the HCl content has decreased below 10 ppm, recheck the moisture content. If a response is note return to regular injections of 5 kg of HCl over a 10 minute period. If no response is noted, discontinue HCl injection.
- H_2S stripping line and the superheater are lined up and acidified (160° C at the superheater). Crack closed the isolation block valve at the hydrogenation reactor inlet.
- Continue unit circulation until the moisture content is 1 ppm for both the reactor effluent and the heavy product to storage.
- Throughout the HCl injection period, monitor the caustic strength in the scrubber bottoms. Replenish as necessary.
- Do not allow NaOH concentration decreases below 3% wt.
- Check HCl content in the scrubber off-gas with DRAGER tubes – (HCl < 1 ppm vol.).
- Reduce the reactor inlet temperature to 100°C over a one hour period.
- When the reactors have cooled to 100°C, slowly open the reactor bypass and route the naphtha around the reactors to the stabilizer.(86-UV-0415 in reactor bypass line may need to be forced open and block valve operated to effect gradual change over)

- Reduce the steam flow to the Reactor Feed Heater until closed.
- The naphtha feed flow to the stabilizer can be stopped at this stage. Normal mode of operation of 86-UV-0413 (in Naphtha feed line to reactor) and 86-UV-0415 (in reactor bypass line) may be restored along with the normal position of block valves.Shut-off steam to the reboiler and shutdown the reflux pump. Reduce the stabilizer bottoms level to 30% and block in the stabilizer on standby mode until ready for restart. The deisohexaniser is also in standby mode.
- The LPG recovery section is isolated on the standby mode and the stabilizer off gases are sent to the scrubber.
- Shutdown the caustic circulation and water wash pumps. Maintain stabilizer, LPG recovery section and scrubber pressure with hydrogen.
- Continue H_2 make up at design flowrate to cool and to sweep the reactor circuit of liquid hydrocarbons to the stabilizer, by switching normal hydrogen make-up line to dedicated start-up line.(upstream of makeup compressor)
- Switch the reactor flow pattern to sweep out all liquid hydrocarbons.
- Cool the reactor circuit to 40°C then shut-off the H_2 make-up but maintain pressure in the reaction section, stabilizer, LPG recovery section and scrubber.
- Block in and blind reactors.
- Depressurize and purge each reactor with nitrogen. Use only nitrogen containing less than 1 ppm of water. If necessary route this nitrogen through a regenerated H_2 Dryer which has been properly purged.
- Pressure and depressurize with nitrogen until the hydrocarbon content is less tan 0.2 vol%.
- Maintain a slightly positive nitrogen pressure of 0.5 bar g. The isomerization reactors are now ready for loading.

ACIDIZING INJECTION TABLE DATA REPORT 1

No.	Date	Time	Cylinder Number	Weight Before Injection	Weight after Injection	HCl Injected Kg/h.	Total HCl Injected
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

ACIDIZING INJECTION TABLE DATA REPORT 2

No.	Moisture Analyser		Reactors	Reactor A	Reactor B	Scrubber	
	Value	Base line	Arrangement			NaOH	Water
	Wt. ppm	Wt. ppm	AB BA			% wt.	pH
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

1.6 HYDROGENATION AND ISOMERIZATION CATALYSTS LOADING UNDER N2

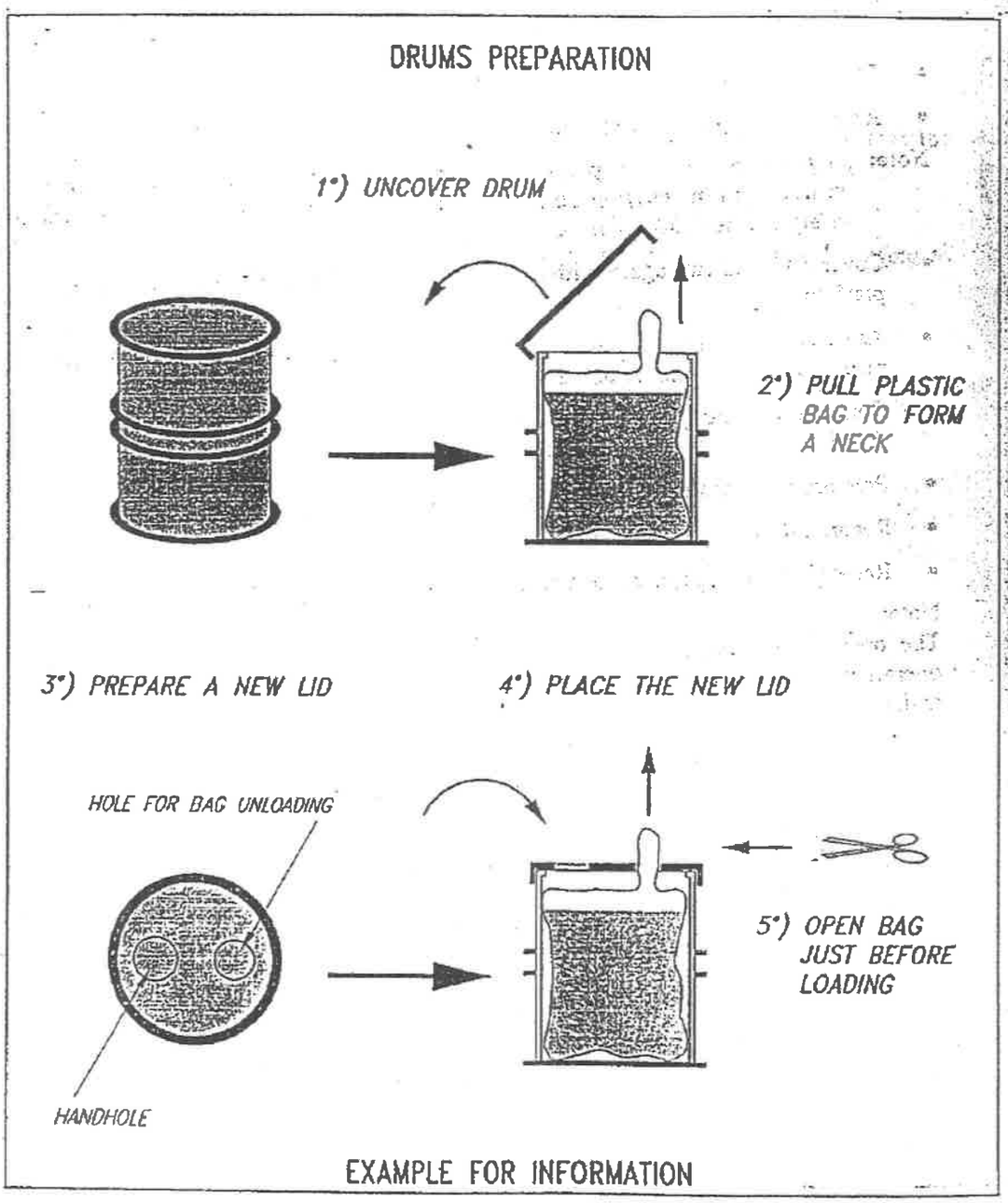
1.6.1 General

The following procedure describes in detail the loading steps recommended by Axens. As the reaction section has undergone a special drying procedure, care must be taken to ensure that no air or moisture enters the reactors during the catalyst loading period. It is recommended that the reactors be loaded using Axens dense loading apparatus "CATAPAC".

The benzene hydrogenation catalyst LD-412 R and the isomerization catalyst IS-614 A manufactured by Axens are shipped in sealed drums (120 kg for LD-412R and 130 Kg for IS-614A) that have a special protective lining (see Figure 5).

FIGURE 5

PREPARATION OF THE DRUMS



The catalyst is contained in a heavy plastic bag with an unloading neck. This bag is inside another heat-sealed plastic bag. Care should be taken in the drums handling so as not to break or puncture the plastic bags.

Before, during and after catalyst loading the catalyst must be protected from moisture at all times.

Any contact with water or air will result in permanent deactivation of the catalyst.

The empty drums and bags should be kept to return the spent catalyst for platinum recovery.

1.6.2 Preparation

Prior to the loading, preliminary checking:

- The LD-412 R and the IS – 614 A catalysts for loading, are stored by sealed plastic bags in drums.
- The inert balls for top of the catalyst bed, it is recommended that these balls be oven dried and stored in sealed plastic bags in drums similar to the catalyst.
- The CATAPAC dense loader device (see Figures 7, 8, 9 and 10).
- Special unloading lids with quick release retainer rings (4 required fitted at ground level – see Figure 5).
- Sufficient dry nitrogen (less than 1 ppm wt. H_2O) if not available provide temporary piping to route nitrogen through the hydrogen dryers.
- Provide emergency nitrogen storage in case of refinery nitrogen failure.
- Make available several nitrogen flexible hoses. They must be specified for nitrogen service, must be new and perfectly dry.
- One telescopic crane capable of lifting a drum 3 m above the reactor upper flange (see Figure 6).
- One standing hopper (see Figure 9)
- One forklift to handle the drum pallets.
- Tarpaulins should be available in case of rain or interruption during loading.
- One structure (scaffolding) disposed on the top of the reactor adapted to receive the drums and to fill them into the reactor through the special device (see Figure 7)
- One safety harness, portable oxygen analyser, air packs and dust masks.
- The oxygen analyser will be used when reactors are open for catalyst loading to make sure that no air is entering.

FIGURE 6

DRUM LIFTING CATALYST DENSE LOADING

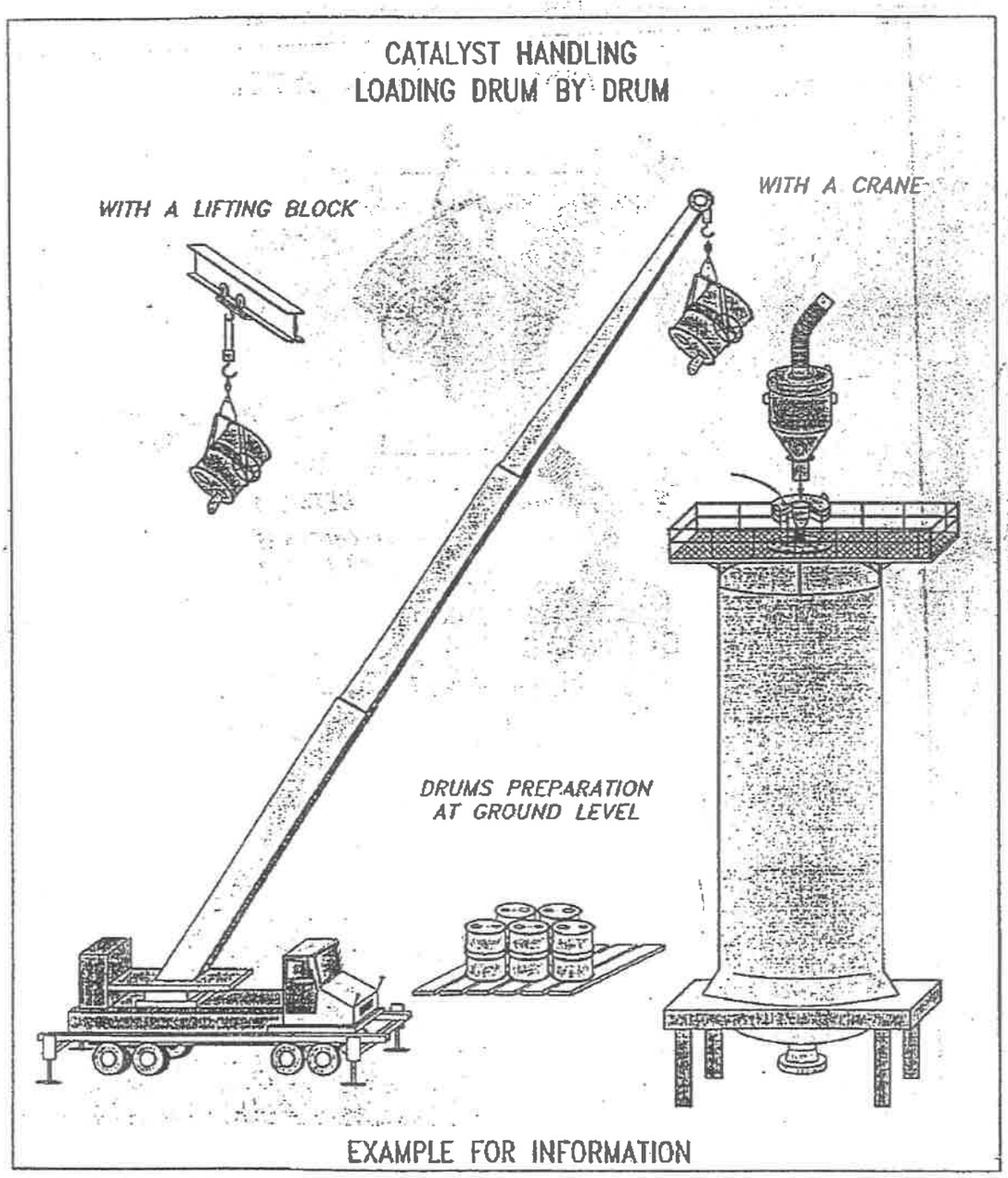


FIGURE 7

CATALYST HANDLING WITH CATAPAC

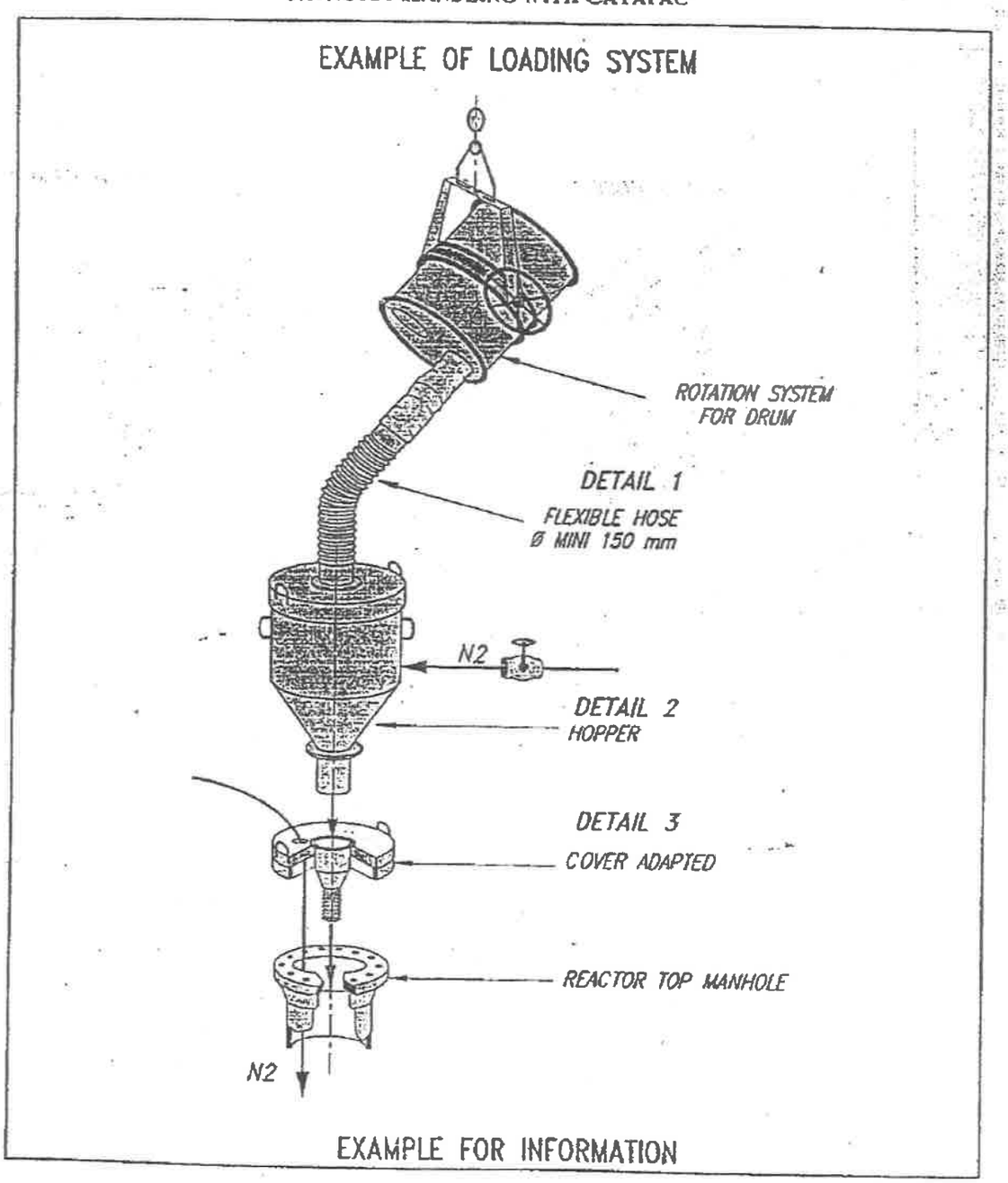


FIGURE 8
CATALYST DENSE LOADING (PART 1)

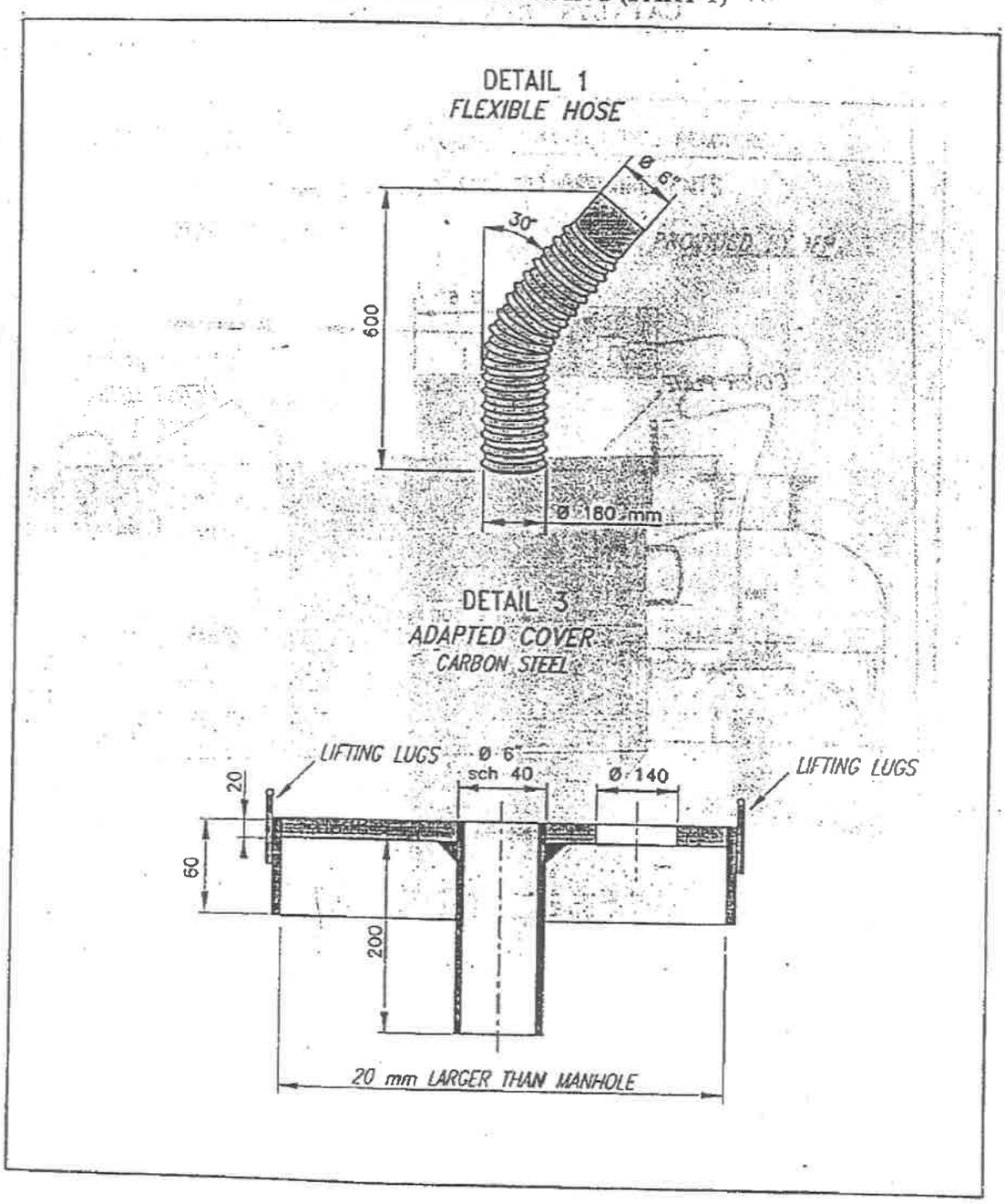


FIGURE 9
CATALYST DENSE LOADING (PART 2)

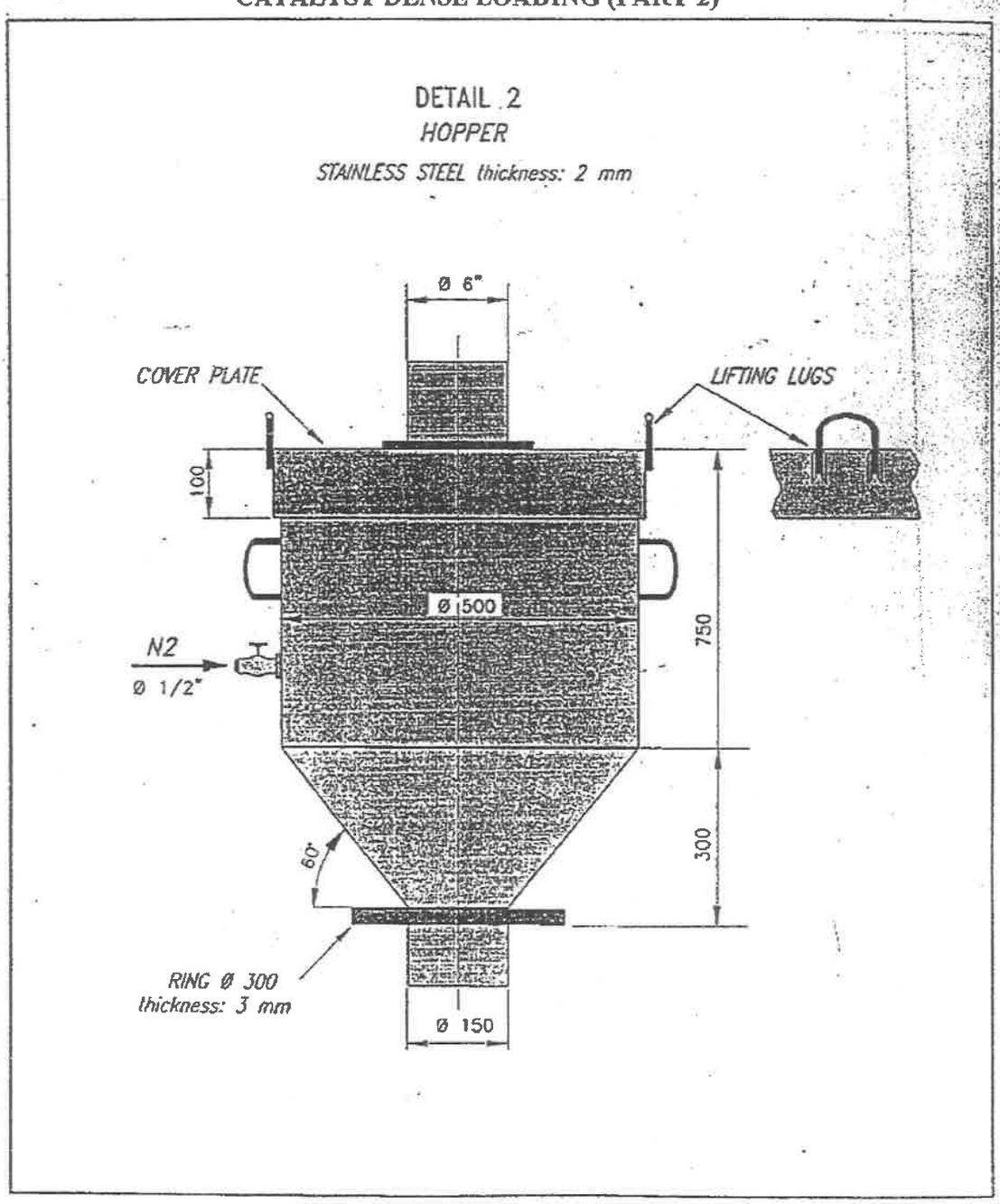
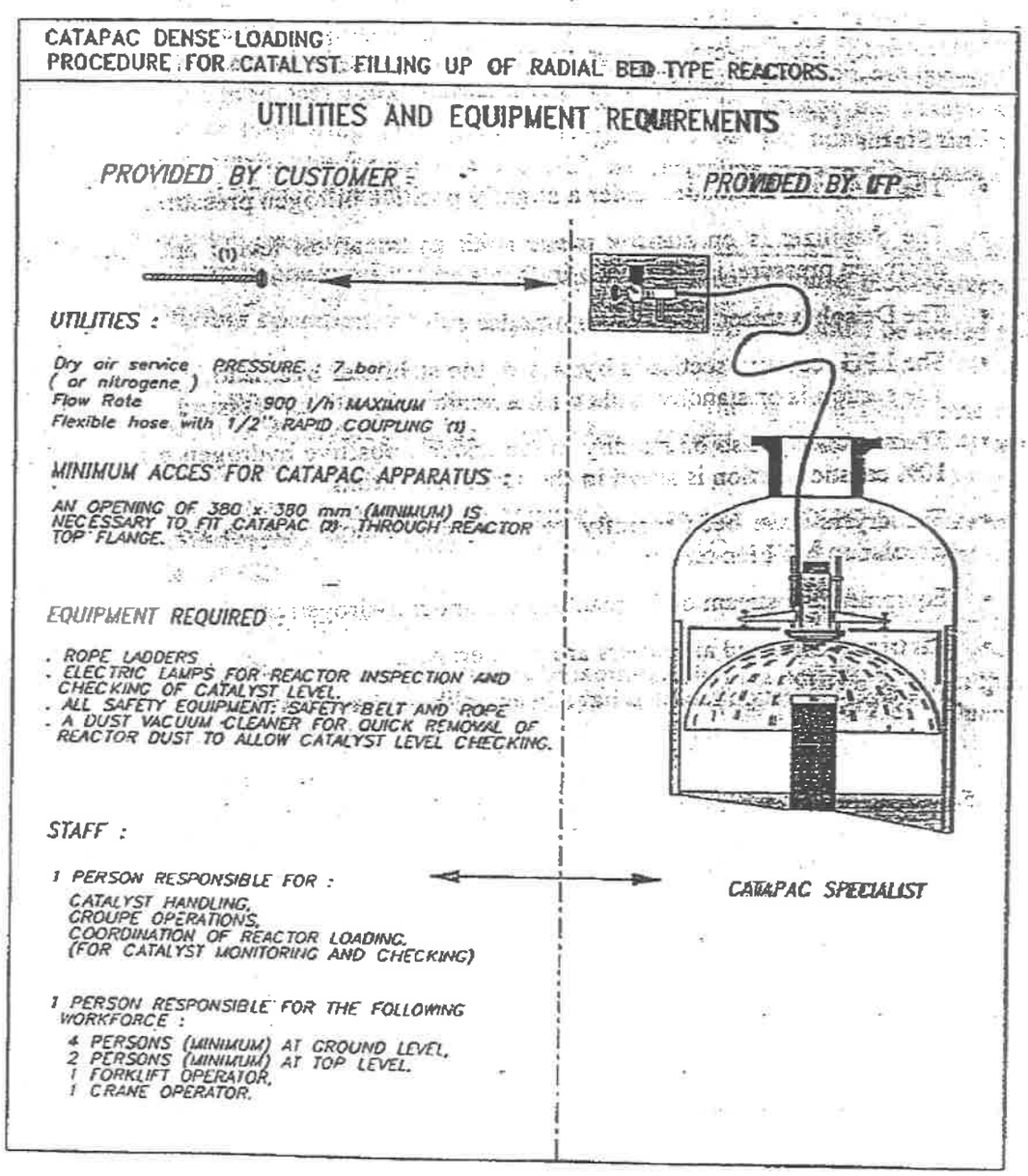


FIGURE 10
UTILITIES AND EQUIPMENT REQUIREMENTS



Personnel (minimum)

- Foreman
- Crane Operator
- Forklift Operator

- 2 riggers on the top of the reactor for drum handling
- 4 riggers on the ground from drum handling
- 2 fitters for attaching the dense loader and opening/closing manholes.
- Safety supervisor

1.6.3 Catalyst Loading Procedure

The following instructions must be strictly adhered to throughout the entire catalyst loading for the 3 reactors. An Axens loading specialist will be present during the loading to advise and monitor the loading method. It is imperative that no air or moisture enters the reactors or comes in contact with the catalyst at any time.

- Connect the nitrogen flexible hoses from nitrogen header to drain point at reactor bottom and to inlet pressure gauge tapping at reactor inlet line.
- Start a small purge of nitrogen into the reactor bottom and out the reactor inlet PI connection.
- Unbolt and remove the reactor inlet elbow and top head. As the reactor is opened, tightly cover the open flanges with plastic until the bottom inert balls entry.
- To install the dense loading device (CATAPAC) on the top distributor of the reactor, attach the nitrogen connection and then attach the loading sock from the stationary pipe above.
- Set down on the top man hole the stationary steel cover, the standing hopper and pipe catalyst loading.
- At the same time, care must be taken to ensure that the sock penetrates in the center of CATAPAC device. Look it through the little hole drilled on the steel cover (figure 7).
- Then load drum by drum the required quantity of catalyst.
- After the catalyst has been loaded install the top bed inert alumina balls layer.

Note: At no time should a person enter a reactor having a nitrogen purge on it without full instruction and experience with a fresh air mask, safety harness, safety clothes and life line.

- Cover the manway again with plastic. Remove all the loading devices off the top platform.
- As quickly as possible after the loading is complete, install the inlet distributor tray, reactor cover and inlet removable elbow.
- Continue the nitrogen purge at the bottom of the reactor out through the inlet PI. Check that the purge out through the PI is oxygen free.

- Pressure the reactor back up to 0.5 bar g. Check for flange leaks.
- Record all loading data, number of catalyst drums, inert balls, etc.
- Repeat loading procedure for the second then third reactor.

Note:

The opening, loading and closing procedure of the reactors should be a continuous operation without break. During this operation a positive nitrogen pressure should be maintained in the reactor at all times.

1.7 ISOMERIZATION UNIT START-UP

When C_5/C_6 feed is first introduced to a reactor, particularly when the catalyst is fresh, it is important to minimize the operation severity to prevent hydrocracking and consequently high reactor temperatures. Minimizing hydrocracking means minimum temperature, adequate feed rate and only starting-up one reactor at a time.

1.7.1 Unit Status

- The 3 reactors are loaded under a slightly positive nitrogen pressure.
- The Stabilizer is on standby mode with hydrocarbon levels and under a positive hydrogen pressure, isolated by blinds.
- The Deisohexanizer is on standby mode.
- The LPG recovery section is by passed, the stabilizer overhead is sent to the scrubber. The section is on standby mode with a positive hydrogen pressure.
- The scrubber is also on standby mode under a positive hydrogen pressure. Sufficient 10% caustic solution is stored in the scrubber bottom.
- The dryers have been recently regenerated. If not, plan to do this once naphtha circulation has been restored.
- Equipment upstream of the reactors are under hydrogen pressure.
- All trim coolers and air coolers are in operation.
- UV-413, UV-414 and UV-415 are in close position

1.7.1.1 Chloriding agent injection facility testing

The C_2Cl_4 injection facilities should be calibrated and tested. For this following steps may be adopted.

- Place C2Cl4 drum at the unloading bay. Use suitable personnel protective appliances.

- Hook up nitrogen connection to the drum through flexible hose .Ensure that drum is not subjected to excessive pressure. A nominal positive pressure will suffice. Adjust 86-PCV-0103 accordingly.
- Install unloading pump 86-P-15 on the drum. Take care to avoid exposure to chemical or nitrogen. Hook up plant air supply to pump and discharge connection to Chloriding agent drum.
- Ensure that Chloriding agent drum and associated piping are clean and dry.Purge the drum with Nitrogen and maintain nominal positive pressure.
- Run unloading pump and slowly transfer the chemical into Chloriding agent drum (86-B-05). Vent to realease displaced vapours; watch drum pressure while venting. Stop unloading pump after transfer.
- Try out injection pumps 86-P-02 A/B using the recirculation line.
- For calibration of the dosing pump, install a blind in the chemical inlet line (1 ½ inch) of chloriding agent drum. Connect pump recirculation line chemical drum (200 lit) using flexible hose. Care should be taken to avoid exposure to Nitrogen while doing these activities.
- Try out pump (86-P-02 A/B) and calibrate the dose control system.Use graduated scale on 86-B-05 while collecting pump discharge into chemical drum (200 lit).
- Restore the normal connections.
- Empty out content of chemical drum into chloriding agent drum 86-B-05.
- Dispose of chemical drum as per suppliers recommendation.
- For details on dosing rate, refer section 5.3.1.

1.7.2 Hydrogen Pressurization and Isomerization Catalyst Heating up

This treatment is required only for a new catalyst and during the first start-up. It is done by circulating hot hydrogen.

- Check the system for leaks, in particular the flanges which were open.
- Pressure up the system using hydrogen and set the flowrate to design rate. Verify the operation of the dryers on the hydrogen feed. All the pressure controllers should be in operation.
- Depressurize the nitrogen out of reactors. Ensure the reactor isolation valves are tightly closed and swing the isolation blinds.
- Close other isolation valves which were open to maintain reaction section pressure.
- Line up the three reactors in series: the hydrogenation reactor, the 86-R-02 in lead position and the 86-R-03 in lag position.
- Line up the Reaction section, the Stabilizer and the scrubber (Deisohexanizer excluded).

- Run makeup Hydrogen compressor and slowly send H2 to hydrogen dryers. With the UV-0414 close, route the H2 to flare through the H2 catalyst stripping line 1½"-P-86-04-014, 1½"-P-86-04-015 line and 1½"-FLP-85-17-060 line. Check the moisture content is lower than 1 ppm with AE-401 A/B and AE-402.
- When the moisture content is okay, route the H2 to the normal operating line by opening the UV-414 (UV-413 remains close). Slowly pressurize the hydrogenation reactor with hydrogen. This must be carried out carefully so as not to damage the catalyst or internals by over pressuring very quickly. Target for 5 bar per minute maximum. Repeat the same operation for the 1st and the 2nd isomerization reactors. This must be carefully realized reactor by reactor using the ¾" equalizing valve in the reactor outlet block valves. Check the reactor pressure versus the reactor downstream pressure before slowly opening the reactor outlet block valves.
- Check the scrubber operation. At this stage, the scrubber off gas should be routed to flare.
- By-pass the 2nd stage isomerization reactor (86-R-03) through the single reactor bypass line. Bypass the hydrogenation reactor feed/effluent exchanger (86-E-04) on the effluent side.
- The temperature of the hydrogenation reactor is increased to 100°C at a rat of 10°C/h (using the reactor feed heater) to obtain about 90°C at the fist isomerization reactor inlet (86-R-02).
- Maintain the conditions for 2 hours.
- This operation is carried out on the 2nd stage isomerization reactor (86-R-03) in the same way: 1st isomerization reactor (86-R-02) and 1st stage reactor feed/effluent exchanger (86-E-03) by passed.
- Both reactors are lined up and cooled down to 65°C.

Total catalyst activation is foreseen to last 6 hours. A T of 15 to 20°C will be observed in the catalyst beds.

1.7.3 Naphtha Feeding

Feed quality according to Process Book specification must be checked prior to charging the unit. It is recommended that this naphtha be as low as possible in Benzene content.

Re-establish naphtha at 60% of design rate through the reactors bypass (UV-415 open, UV-413 close), to the Stabilizer and the Deisohexanizer section. Commission the Stabilizer and the Deisohexanizer on total reflux as outlined in Section 7.4. Line-out the isomerate product lines to off-spec storage. The LPG recovery section is isolated and the stabilizer off gases overhead is sent to the scrubber.

- On start-up will be introduced cold into the benzene saturation reactor at a minimum of 75% (FT 0101) of reactor design feed rate. **Remark: Reactor feed rate includes recycle + unit fresh feed. 75% of reactor design feed rate, corresponds to 50"% of unit**

design fresh feed. The reactors should never be operated at less than 75% of design feed rate (FT0101) and no part of the reactors should be over 65°C. The 2nd isomerization reactor (86-R-03) in lad position is bypassed.

- **Check the dryers operation, the moisture analyzer on the tail dryer must be reading under 0.1 ppm wt H_2O.**
- With all the conditions steady, open the naphtha feed control valve to introduce naphtha into the benzene saturation reactor. Increase the flow up to 75% of design as quickly as possible cutting back on the reaction section bypass valve until closed.
- When the naphtha feed first contacts the fresh catalyst, there will be an immediate exothermic reaction; this phenomenon will be short in duration, the magnitude of the temperature increase will depend very much on the feed quality. If possible, it is recommended that this naphtha be as low as possible in benzene content until the reactors are up and running.
- The temperature rise, although rapid, should not be a problem if the initial reactor temperature is less than 65°C. Under no circumstance this temperature should be above 200°C. If it occurs, follow the emergency procedure for high reactor temperature.
- Once a steady operation is reached, commission the reactor feed heater and slowly increase the hydrogenation reactor inlet temperature to 120°C at a rate of 10°C per hour, while monitoring the exotherm and catalyst bed temperatures. Then set n auto mode TIC's at 86 R02 (inlet a 130°C).
- When the temperature reaches 108 °C in the isomerization reactor, start C2Cl4 injection at 400 ppm wt. based on the C5/C6 feedrate to the reactors (Refer section 5.3.1 for dosing rate)
- Monitor the chloride in the stabilizer off-gas. When the first isomerization reactor stops consuming chloride, reduce the C2Cl4 injection to operating value of 150 ppm.
- Check the stabilizer bottoms quality, adjust the reactor temperature to achieve the optimum product quality when operating on one reactor at 75% of design feed rate (FT 0101).
- Switch to isomerate rundown storage if desirable.
- Commission the scrubber off-gas H2 analyser AE-1201. Check the H2/HC ration to be sure of the procedure.
- Allow the operation to stabilizer, adjust conditions where necessary, ensure all instrumentation is working and in the proper range. The first isomerization reactor should operate alone for at least two days in steady state operation before the second isomerization reactor is brought on-line.

Series Flow Operation

When the second stage isomerization reactor is ready to be brought on-line, check the reactor pressure versus the system pressure to ensure there is no significant differential. If there is a pressure differential, depending on the magnitude, the Axens start-up representative will advise on the best method to equilibrate the pressure before bringing the second reactor on line. Naphtha feed rate should be at least 75% (FT 0101) of design prior to this step.

- Reduce the first isomerization reactor outlet temperature to 110°C and establish flow through the Cold Feed / Effluent Exchanger (86-E-03) to cool the second reactor inlet temperature as much as possible.

- Open the second reactor inlet and outlet block valves (inlet first) very slowly as to maintain always flow to the stabilizer while filling the reactor.

- Establish flow through the second reactor by closing very slowly the single reactor bypass line. The TIC should be on manual with all of the first reactor effluent passing through the tube side of the Cold Feed/Effluent Exchanger

- Increase the C_2Cl_4 injection back to 400 ppm to compensate for the chloride consumption in the second reactor.

- Again monitor the stabilizer off-gas and reduce the chloride injection once the consumption levels off.

- As before, there will be an increase of temperature in the second reactor, but this will not be dramatic.

- Allow the operation to stabilize. As the second reactor is brought on-line, there could be some flow perturbation to the stabilizer

- Commission the second reactor inlet temperature controller and slowly increase the second reactor inlet temperature to 115°C at 10°C/hour

- Adjust all operating conditions for optimum operation.

1.8 NORMAL OPERATION

1.8.1 Isomerization Unit Line-Out at Design Capacity

1.8.1.1 Status

- The unit is operating at 75% of reactor (FT0101) design capacity (is equivalent to 50% unit design fresh feed) at design hydrogen make-up.

- Inlet temperatures to reactors have been adjusted for optimum isomerate quality

- The Stabilizer and the Deisohexanizer are operating at design reflux rates and the scrubber is in operation with both water wash and caustic circulation at design rates. Isomerate product is routed to rundown product storage and scrubber off-gas to fuel gas.

- The dryer analyzers are in operation and the dryers have been recently regenerated.

- The LPG recovery section is bypassed and the stabilizer off gases are sent to the scrubber (UV 1002 closed, UV 1001 and bypass open)

1.8.1.2 Procedure

- Slowly increase the C_5/C_6 isomerization unit feed rate (86-FIC-0101) to design in increments of 10% per hour. Monitor the catalyst bed temperatures for higher than normal exotherms. Allow the unit to stabilize after each change.

- Record all operating data at each 10% increment, i.e. flow, temperatures, conversion levels out of each reactor.

- At design capacity and steady temperatures, sample the isomerate product for analysis

- Adjust temperatures as necessary to improve the conversion ratios of the isomers. The first reactor temperature should be adjusted to maximize isomerization in the first reactor and the second reactor temperature adjusted to take the advantage of the higher equilibrium isomer content at lower temperatures. A sample point is located at the first reactor outlet to allow an analysis of the conversion in the first reactor.

- Check the scrubber off-gas H2 analyzer to ensure that H_2/HC ratio is above 0.06

- Adjust the temperature and reflux on the stabilizer to meet the product RVP requirements and to minimize the loss of C_5 in the overheads. Also, the stabilizer should completely strip-out HCl from the reactor effluent.

REMARK: Isomerization unit may be operated for a long period of time without LPG recovery section.

1.8.2 LPG Recovery Section Line-Out

The LPG recovery section operation is very sensitive to any upset in reflux or reboiling duty at the LPG stripper, in which case chloride content in LPG product will not be acceptable. For this reason, the gas feed to the LPG recovery section is only permitted when LPG recovery has been lined up on lean oil side, LPG stripper being on total reflux and lean oil at design flowrate.

For any upset in the stabilizer or in the LPG recovery section (loss of reboiler or reflux), LPG recovery section will be bypassed on off gas side (UV 1002 closed – UV 1001 open).

The isomerization unit is operating at design capacity. The stabilizer off gases are sent to the scrubber.

The LPG recovery section is isolated on isomerization off gas side (UV 1002 closed, UV 1001 and bypass open) and on reformer offgas side.

- Line –up the LPG recovery section on the lean oil side only, i.e. UV 1002 closed UV 1001 and bypass open.
- Stop the standby mode but maintain the bypass of the isomerization off gas inlet coming from the stabilizer overhead (UV 1002, UV 1001 and bypass open).
- Slowly increase the lean oil upto 60% of the design flowrate.
- Commission LPG refrigeration system, LPG separator drum and LPG stripper.
- LPG side draw is routed to the isomerate off spec product.
- Only when the design flowrate of lean oil is reached and LPG stripper operates at design conditions (design reboiler duty and design reflux), isomerization off gas feed to LPG recovery section is permitted. Open UV 1002, close UV 1001 and close slowly UV 1001 bypass valve.
- Chloride control to be monitored on LPG and heavy product very frequently during the sequence.
- Check the scrubber off-gas H_2 analyser to ensure that H_2/HC ratio is above 0.06.

TURN AROUND-WORK PROCEDURE

COLUMNS & VESSELS

1.0 General:
1.1 We will supply besides supervision, all types of tools & tackles, lifting arrangements like chain pulley blocks, all consumables, machineries & equipments and labour to complete the job in all respects.

2.0 Material Collection & Return:
We will prepare a material request list covering all the materials requirements for the work including gaskets as per scope, ollect all the materials from owner's storage point, inter-cart between the point of issue of materials & work spot / contractor's fabrication shed etc return back the unused materials back to owner's storage point with a return note.

3.0 Preparatory Jobs / Blinding / De-blinding:
We will carry out all preparatory works & blinding for regeneration, isolation, entry of an equipment, chemical washing, testing as per the Operations blind list and as required at site. We will also provide necessary rigging facilities for lifting & lowering the materials to the respective structural platforms near the equipment man ways. We will carry out deblinding on completion of all maintenance.

4.0 Shutting down assistance:
We will provide necessary assistance to Operations & Maintenance departments in de-commissioning / shutting down & isolating the equipment. The assistance will include jobs such as wedge opening of flanges, connecting necessary hoses for steaming, venting, placing of AC units wherever required, draining, water washing, etc.

5.0 Opening & Boxing up of Man ways / Covers:
5.1We will open the equipment man ways after obtaining necessary work permits. The job involves opening of man ways by de-bolting (cold / gas cutting if required), fixing air / steam eductors / exhaust fans, connecting hoses to the eductors, cleaning the man ways, servicing of fasteners, replacing defective fasteners and finally boxing up with proper gasket / packing to ensure zero leak of joints including hot bolting during start up.

6.0 Removal / re-fixing of Safety Valves / Relief Valves:

6.1 We will remove the flanged safety valves / Relief valves of all ratings connected to the equipment at all grades & elevations by de-bolting / cold cutting / gas cutting, provide emporary blind flange at the inlet & outlet of safety valve mating flanges, provide identification mark on the safety valve with a tag and transport the valve to the maintenance valve shop for servicing / testing.
6.2 We will service fasteners & replace the defective fasteners, wherever required.
6.3 We will transport the safety valves from maintenance shop after servicing & testing and install the safety valve at all heights & grades using proper gaskets & studs (Valves will be kept in upright position during shifting).

7.0 Confined space entry to the Columns / Vessels:
We will enter the equipment only after obtaining specific permit for entry. Standby personnel will be kept always near the equipment man way (outside) during men at work inside the equipment.
8.0 Dismantling & re-fixing of internals:

8.1 We will dismantle & remove the equipment internals wherever required. The equipment internals will include Distributors, grids, and all structural items used for supporting the internals.
8.2 We will check all the removed distributor piping by assembling them on the ground level after repairs and prior to re-installation.
8.3 In case of replacement, we will collect the required materials from the owner's storage point, shift the same to the work site, assemble the segments on the ground for Process Engg. / Inspection clearance, mark the segments prior to installation to eliminate mix up of components.

8.4 We. will re-fix either with repaired internals or with replacement materials after obtaining necessary clearance from Process Engg. / Inspection.

9.0 Scaffolding / Staging:
We will provide necessary scaffolding or Ladder inside the equipment at the required locations to access trays / internals / internal surface of the top/bottom dome or any other location as per EIC instructions. We will also provide scaffolding externally over the equipment as required. Erection and dismantling of scaffolding will be done as per CLIENT guidelines as stipulated under SHE guidelines. We will dismantle & remove the scaffolding or ladder after completion of all the maintenance work.

10.0 Cleaning:
10.1 We. will clean the internal surface of the equipment and internals including distributors, support grids, etc.; thoroughly free from scales, rust, coke, deposits using cold work cleaning methods (viz.,) scrapers, wire brush, etc.
10.2 We will clean the internal surface of the equipment in such a way as to prevent debris falling on any of the troughs.
10.3 We will buff the weld seams & HAZ to carry out Wet fluorescent magnetic particle testing (WFMPT) and spot buff the parent metal surface of the equipment for thickness gauging.
We will arrange dye penetrant chemicals for testing and offer assistance during Inspection.

11.0 Vessel internal repairs:
We will carry out minor repairs to equipment internals and the equipment parent surface as required. All these repairs / replacements will be done using cold work or hot work, removal of cracks by grinding & welding, repairing of equipment internal lining as required.

12.0 Inspection stages:
We will offer for Inspection at various stages of work to CLIENT as detailed below.
1 Initial Inspection after opening Equipment shell & tray man ways PE / Inspection
2 Repairs in an equipment including internals Inspection
3 Hydro testing of Equipment if required Inspection
4 Equipment cleaning Operations
5 Boxing up of tray man ways Operations
6 Nozzles proving & boxing up of Equipment man ways Operations

13.0 Hydro testing:
We will provide necessary hose connections from the source of supply including pipe fittings, pressure gauges, etc., pressurize to the stipulated hydro test pressures, offer hydro testing of equipment / steam coil, drain the water and flush the system as per EIC instructions.

14.0 Equipment Nozzles:
We will flush & clean all the equipment nozzles using water hoses, prove the nozzle clear from all deposition up to the spool pipe near pump / instrument / other equipment to which the nozzle is connected and obtains clearance from Operations department.

15.0 Equipment Box-up:
We will box up all the dismantled internals / tray man-ways / shell man-ways / top covers, etc., with proper gaskets / packing after obtaining necessary clearances from Operations & Tech. Services department.

16.0 Multiple work fronts:
We will plan the resources properly & execute in such a way that work can proceed simultaneously at different locations without impeding into each other so as to complete the work as per the schedule.

HEAT EXCHANGERS:

1.0 General:
We will supply besides supervision, all types of tools & tackles, Mobile Air compressors, lifting arrangements like tube bundle pullers, chain pulley blocks, all consumables, machineries & equipments and labour to complete the job in all respects

2.0 Shutting down assistance:
We will provide necessary assistance to Operations & Maintenance departments in de-commissioning / shutting down & isolating the equipment. The assistance will include jobs such as wedge opening of flanges and connecting necessary hoses for steaming / venting / draining / water washing, etc.

3.0 Material Collection & Return:
We will prepare a material request list covering all the materials requirements for the work including gaskets collect all the materials from owner's storage point, inter-cart between the point of issue of materials & work spot / contractor's fabrication shed etc, return back the unused materials back to owner's storage point with a return note.

Gaskets: *We* will collect the gaskets well in advance and offer the gaskets for inspection prior to installation. We will check for dimensional accuracies and inform EIC for rectification, if defects are noticed. Damaged gaskets will not be used for the work.

4.0 Preparatory Jobs / Blinding / De-blinding:
4.1 We will carry out all preparatory works & blinding for isolation, testing as per the Operations blind list and as required at site.
4.2 We will erect necessary scaffolding with Gratings, wherever required to facilitate removal of covers, etc., and will dismantle / remove on completion of all activities.
4.3 We will also provide necessary rigging facilities for lifting & lowering the materials to the respective structural platforms near the equipment.
4.4 We will service the test rings intended for the equipment including all fasteners before starting the exchanger maintenance work, clean on completion of testing activities and secure it in the test ring stand firmly.
4.5 We will ensure that all dismantled parts of heat exchangers are segregated & painted with proper identification marks including the fasteners in order to eliminate mix up of parts.
4.6 We will carry out de-blinding on completion of all maintenance activities, box up the flanges with new gaskets and tightening of studs (replace the defective studs / nuts) to ensure zero leak of joints including hot bolting.

5.0 Removal of Covers, plugs & Tube Bundles:
5.1 We will open the exchanger channel cover, channel head, shell cover, floating head cover, etc., by de-bolting (cold / gas cutting if required), and place the covers at the grade level.
5.2 We will pull out the tube bundle from the shell, wherever required, by using tested chain pulley blocks / monorail,tube bundle pullers in the safest manner and place the tube bundle at the grade level or to the ground level as per the instructions of EIC.
5.3 We will use only tested nylon belts / slings for handling the exchangers while pulling out and care will be taken to protect the tubes & tube sheet surfaces.
5.4 We *will provide necessary Crane, tube bundle pullers, to remove the covers / pull out the bundles wherever required.*

6.0 Cleaning of Exchanger Tube bundle and Components:
We will carry out cleaning of exchanger tube bundle, components tubes as detailed below.

6.1.1 ***Cleaning of Pulled out Tube Bundles:***
We will clean the tube bundle, which had to be removed from the exchanger shell using one or more of the following options as detailed below.

7.1.2 Tube internal cleaning:
a) Hydro lancing: The exchanger tube internal surfaces are to be cleaned by high-pressure water jet using a lance with nozzles.

7.1.3 Tube external cleaning:
a) Hydro blasting: The exchanger tube external surfaces will be cleaned by high-pressure water jet blasting.

7.1.4 *Cleaning of Exchanger Components:*

We will carry out cleaning of exchanger components (viz.) Shell, shell cover, floating head cover, channel head, channel head cover and other components, by one or more of the following methods.
a) Manual Scraping: The component internal surfaces will be completely cleaned manually using hand tools like wire brush, scrappers, emery sheet, etc.
b) Hydro blasting: The component internal surfaces will be cleaned by high-pressure water jet blasting.The sacrificial zinc / magnesium anodes welded / fastened to the channel head, floating head & covers will be removed & cleaned manually. Hydro blast machines will be arranged as per scope for cleaning.
c) Fin fan coolers tubes will be cleaned externally using Foam method as per the procedur and scope of work

9.0 Cold & Weld Repairs:
9.1 We will rectify the transverse baffle edges, tie rods, spacers, impingement plates, longitudinal baffles, sacrificial anodes, etc., by grinding / bend removal / weld repairs, etc.as per scope of work.
9.2 We will carry out weld repairs on shell, tube bundle & components like channel head, channel cover, floating head cover, shell cover, sacrificial anodes, etc., as recommended.
9.3 We will carry out weld reinforcement to the eroded / corroded portions on tube sheet, gasket seating surfaces of components & on tube seal welds, etc., wherever required.
9.4 We. will replace the channel head pass partition plate wherever required.
9.5 We. will replace consumed / damaged sacrificial anodes as per recommendations.

10.0 Retubing:
We will do in-situ re tubing of identified leaky tubes of Fixed tube exchangers and Fin fan coolers.
We will remove all covers, channel boxes of fixed tube exchangers and fin fan coolers
We will remove seal welding of identified tubes by grinding and pull it out
We will clean the tube holes on both tube sheets and insert new tubes and expand it
We will seal weld the tubes/plugs with approved welding electrodes
After hydro test if any tubes are found leaky it will be rolled and rectified

Reinstallation of, Tube bundles & Components:
11.1 We will re-install the components after cleaning, glass flake coating/painting as the case may be and after obtaining clearance from Maintenance, Inspection and Operations Departments in a stage wise manner to facilitate hydro testing.
11.2 We will use only tested nylon belts / slings for handling the exchangers while re-installing the components and care will be taken to protect the tubes & tube sheet surfaces.
11.3 We will renew all the asbestos / metallic gaskets pertaining to the exchanger omponents and disturbed flanges while re-assembly.

12.0 Hydro test:
We will carry out hydrostatic testing of the exchanger to the specified test pressures after re-installing the tube bundles & components as detailed below.

12.1 ***SHELL TEST:***
Shell test is applicable for all types of exchangers as detailed below.
12.1.1 We will conduct shell test by installing channel head on the stationary end side & a test ring between the floating head tube sheet and shell. In "U" tube bundles, shell test will be done with shell cover in position.
12.1.2 We will fill up water in shell & pressurize the shell side of exchanger gradually.
We. will clean the entire visible weld joints and the flanges between fixed tube sheet and shell flange and offer for inspection at the specified test pressure.
We will remove the water accumulated inside the tubes by pressurized air before offering the test for Inspection.
12.1.3 We will attend roll leaks from tube mouths, if any by re-rolling of the tube ends.

12.1.4 We will rectify the seal weld leaks by suitable weld repairs after draining the water in the shell.
12.1.5 We will plug both the tube ends in case of a tube leak with tapered plugs of material conforming to tube material in the presence of CLIENT Inspection.
12.1.6 Shell test will be deemed completed till satisfactory results are observed without any tube or roll leaks.

13.0 ***TUBE TEST:***
Tube test is applicable for all types of exchangers as detailed below.
13.1.1 We will conduct tube test by removing the test ring on floating head side and fixing floating head in position. We will also fix channel head cover in position with proper tightening.
13.1.2 We will fill up water in tube side through the channel section & pressurize the tube side of exchanger gradually to the specified tube test pressure. We will air blow the floating head & channel cover flanges and look for any leaks.
We will tighten all the fasteners uniformly in order to eliminate all leaks and offer for inspection.
13.1.3 In case of pressure drop observed through the pressure gauges and there is no leak through the floating head & channel cover flange gaskets, we will open the shell side drain valve for water accumulation in shell.
13.1.4 In case of a failure of tube test, we will re-do the shell test to identify the leaky tube as per EIC instructions.
13.1.5 Tube test will be deemed completed till satisfactory results are observed without any leaks through floating head & channel cover gaskets and water accumulation through shell drain connection.

14.0 Job completion & Startup Coverage:
14.1 We will carryout boxing up of all flanges, covers, nozzles, etc., with proper gaskets / packing after obtaining necessary clearances from Operations & Tech. Services department.
14.2 We will do hot bolting during startup & commissioning of the equipment and will provide start up coverage.

15.0 House Keeping :
15.1 The work area will be kept clean and tidy always during the course of work.
15.2 Cleaning of debris will be done as and when such scrap / debris is generated and the same will be disposed at areas designated.
15.3 The House Keeping of the work spot and surrounding areas will be done on a day-to-day basis.

16.0 Multiple work fronts:
We will plan the resources properly & execute in such a way that work can proceed simultaneously at different locations without impeding into each other so as to complete the work as per the schedule.

PIPING JOBS

1.0 Piping:
The scope of work will include all types of work as covered in SOR pertaining to Piping / Structural work in plant as per the list and also any other works cropped up during the shutdown as per the EIC instructions.
3.0 Material Collection & Return:
We will prepare a material request list covering all the materials requirements for the work, collect all the materials from owner's storage point, inter-cart between the point of issue of materials & work spot / contractor's fabrication shed etc, return back the unused materials back to owner's storage point with a return note and dump the generated scrap material to scrap yard.

4.0 Fabrication and Welding:
4.1 The fabrication & welding of piping & structural will be as per the relevant drawings, Inspection recommendations, specifications, codes & procedures.
4.2 We will obtain necessary clearance from CLIENT Inspection / General Engg. for any deviations required at site with reference to the existing drawings.
4.3 We will offer welder performance qualification test for their welders with necessary test pieces / test bench under each category of material & obtain welder identity card for the qualified welders.
4.4 We will deploy the qualified welders for a work with respect to the qualified range permitted.

4.3 We will use CLIENT approved welding consumables such as coated electrodes, filler wires etc. (CLIENT approved Electrode manufacturer – Advani Oerlikon (ADOR), Esab India Ltd. and D&H)
4.6 We. will pre-fabricate the shop portion of work at his fabrication yard and execute the field portion of work alone at work site.
4.7 We will make all necessary arrangements such as blinding / deblinding, flushing, draining, plugging / covering of sewers & open drains and prepare the work area suitable for carrying out hot work by taking all precautionary measures for executing the work in the safest manner.
4.8 We will cut and remove the existing old pipelines / structure / chequered plate / Gratings, which are recommended for replacement.
4.9 We will erect scaffolding wherever required for the execution of work and dismantle on completion of all activities.
4.10 We will remove the existing hot Insulation over the existing piping wherever required to facilitate inspection, executing piping modification work / replacement.
We will segregate and shift the removed insulation materials like LRB mattress, aluminum sheets etc., to the designated place and dump as per the instruction of EIC.

5.0 Radiography:
All weld joints are subjected to radiography quality as per standards / specifications / Inspection recommendation and We. will arrange for the radiography and offer the films to Inspection for clearance.
Carbon steel Material - 10% minimum or as specified.
Alloy steel Material - 100% (Twice - Before and after Stress relieving)
Stainless steel Material - 100%.

***6.0* Inspection Stages:**
6.1 We.'s work will be subject to CLIENT inspection at various stages of work such as positive material identification, joint fit up, root dye penetrant testing, final weld dye penetrant testing, radiography, hydro test, etc., and the extent of inspection will be as decided by CLIENT Inspection.
6.2 We will maintain a quality verification charts for each work taking clearances from CLIENT Maintenance & Inspection during various stages of work as per the format recommended by Inspection.

7.0 Hydraulic / Pneumatic Testing:
7.1 We will carry out hydro testing / pneumatic testing of the newly fabricated pipelines to the specified test pressures.
7.2 We will carry out blinding up to the first break up flange from the portions intended for hydro testing including the existing old pipelines, if any, flushing, filling up water on the piping circuit, vent entrapped air, pressurize to the required hydro test pressure with necessary test pumps, and offer for inspection including access & assistance to CLIENT Inspection team during the checking.
7.3 We will also carry out de-blinding, draining & drying of the piping circuit Up to the first breakup flange.

8.0 **House Keeping :**
8.1 The work area will be kept clean and tidy always during the course of work.
8.2 Cleaning of debris will be done as and when such scrap / debris is generated and the same will be disposed at areas designated for the same and cleaning will be done on a day-to-day basis.

9.0 Job completion & Startup Coverage:
9.1 We will carryout boxing up of all flanges with proper gaskets after obtaining necessary clearances.
9.2 We will do hot bolting during startup & commissioning of the pipe lines and will provide start up coverage.

HEATERS

2.0 General:
We will supply besides supervision, all types of tools & tackles, lifting arrangements like chain pulley blocks, all consumables, machineries & equipments and labour to complete the job in all respects.

3.0 Material Collection & Return:

We will prepare a material request list covering all the materials requirements for the work including gaskets, collect all the materials from owner's storage point, inter-cart between the point of issue of materials & work spot / contractor's fabrication shed etc, return back the unused materials back to owner's storage point with a return note.

4.0 Blinding / De-blinding:

a) We will carry out all preparatory works & blinding for Passivation of the furnace tubes , isolation, entry of the equipment, testing as per the Operations blind list.
b) We will do deblinding / blinding after completion of passivation as per the manufacturing requirement.

5.0 : Mechanical decoking

a) We will carryout mechanical decoking of heater coils as per scope of work
b) We will assess, fabricate and lay necessary temperory pipe lines required for decoking
c) We will mobilize necessary decoking equipment and manpower required for this job
d) Decoking will be carried out in stages as per standard procedure

6.0 Arch Roof Replacement :

We. will cut and remove the jacketing boxes and carry out replacement of arch roof casing plate along with Refractory lining as per Inspection and as per the detailed work Package.

7.0 Panels/Covers/Doors/Man ways:

7.1 We will dismantle removable panels, covers, doors, man ways, etc., as required and position at the respective grade level or to ground level as per EIC instructions, rectify / repair including welding of refractory anchors and re-install on completion of work.
7.2 We will ease out the furnace explosion doors, keep in open condition during execution of work inside the furnace and re-fix back on completion of all activities.
7.3 We will weld refractory / Insultwist anchors wherever required.
7.4 We will carry out patch repair or fabricate panels, covers, door, man ways, etc., wherever required.

8.0 Burners:

8.1 Oil guns of the burners will be removed and marked with identification marks and stored safely in We. Shed.
8.2 We will disconnect the Oil, Gas, Steam lines / metallic hoses with match identification marks and remove all the burners with proper identification marks by mentioning the number.
8.3 We will service the burners by dis-assembling with match marks, cleaning, removal of any coke deposits on the furnace, proving all the nozzles, and servicing of Air registers. Minor repairs to throat / regent tile / muffle blocks will be carried out by us.
8.4 We will blow out & prove the burner piping, hoses, etc., usingsteam or air and obtain clearances from PE & Operations.
8.3 We will take necessary precautions to protect the burner muffle blocks by covering with wooden covers whenever work is executed inside the heater.
8.6 We will re-fix the serviced burners or with new ones, obtain clearance from Mfg. and box up on completion of all activities.

9.0 Soot blowers:

All the soot blower electrical terminals will be removed by the CLIENT Electrical personnel. These soot blowers will be marked with match identification marks and to be removed using crane / chain pulley block as the case may be and brought down to the ground level using crane. The steam line connected to the Soot blower will be closed / blinded properly. These soot blowers are to be transported to Maintenance-shop for servicing. We will shift back the soot blowers to work site on completion of servicing and fix back in position. All the fasteners to be kept at a safe location and to be serviced for reuse.

10.0 Scaffolding / Staging:

10.1 We will provide necessary staging using scaffolding pipes, base plate, clamps & steel gratings up to a maximum height inside the radiant section as required. Steel gratings will be laid fixed properly

with the scaffolding pipes at every 2 meters height interval with two grating widths along the radius of heater tubes and the arrangement will be made in such a
way that cleaning & inspection of all the radiant tubes & bottom row convection screen tubes are comfortable. We. will also provide aluminum ladders at two locations for the full height of the staging for easy climbing.
10.2We will also provide scaffolding inside the stack up to the damper level or as required.
10.3 We will also provide scaffolding externally over the heater radiant & convection casing for attending repairs and painting work.
10.4 We will carry out scaffolding as per the procedure stipulated
under SHE guidelines.

11.0 Tube Cleaning:
11.1 We will clean the radiant tubes including return bends thoroughly using wire brush, scrappers, etc. and light chisels to remove hard deposits / scales.
11.2 We will also carry out spot cleaning in the tubes and return bends at locations as per Inspection using emery sheets, chisels, wire brush, etc. for thickness measurement.
11.3 We will buff the weld seams & HAZ to carry out Dye penetrant testing (DPT) and spot buff the parent metal tube surface for thickness gauging.
11.4 We will clean the convection tubes with scrapers, wire brush, etc and finally with compressed air / Water washing as required as per the Instruction of the EIC / ES-Inspection. We. will assist CLIENT Inspection team for thickness measurement / creep measurement of tubes.
11.3 Necessary quantity of water proof tarpaulins to be provided by us, and fixed properly while water washing the convection tubes to avoid any damage to the refractory.

12.0 Inspection assistance:
We will assist CLIENT Inspection / Maintenance team for the inspection of furnace tubes including thickness measurement / Creep measurement.
We will arrange dye penetrant chemicals and arrange all the cleaning tools, etc. and clean the surface & offer assistance for testing and thickness gauging and creep measurement.

13.0 Replacement Tubes :
13.1 Tubes replacement will be carried out by We. as indicated in the work details. Replacement includes cold cutting and dismantling of tubes; cutting and edge preparation, erection and fit up of new tubes, welding, post weld heat treatment and radiography.
13.2 We will have the necessary rigging resources to cut &remove the existing tubes and repositioning the new tubes in position for replacement. Cutting of tubes will be based on the tube metallurgy and will be made in such a way that all the other tubes are duly anchored with proper supporting before cutting operations.
13.3 Welding of tubes will be done by using the right electrodes as recommended and the electrodes will be from the CLIENT approved manufacturer's list.
13.4 Radiography will be taken on the weld joints as required and offer the films for Inspection interpretation.
13.3 We will repair / replace the tube bottom guides as required.
13.6 We will follow the welding procedures as attached

14.0 Casing plate replacement / repairs:
14.1 We. will carry out replacement of furnace casing sheet as recommended by cutting, removal of the existing casing sheet along with stiffeners / supports, fabricate & erect the casing sheet along with required stiffeners in position, weld to the adjoining casing or structural member and grind flush all the welds.
14.2 We. will gouge out the box provided in the arch roof, and renew the area as per Inspection .We. will provide patch plate on the holed casing sheet locations as recommended by fabricating a new casing sheet to the required size, erects in position, weld over the existing casing and grind flush all the fillet welds.
14.3 We. will weld refractory anchors / Insultwist anchors wherever
required.

13.0 Skin Points:

13.1 We. will heat the skin point leads on the tubes using flame torchto check the healthiness as per the requirements of Maint. – Instruments.
13.2 We. will rectify / replace the skin points by bending the thermocouple leads / coils to the contour as required, fabricating & welding the support pads at the ear marked locations on the tubes, welding the thermocouple leads to the heater tube, offering DPT of weld joints and providing assistance to Maint. Instruments for lining up, testing and commissioning of thermocouple skin points.

16.0 Snuffing steam lines:

16.1 We will replace the snuffing steam lines as required and as mentioned in the work package and as per the Instructions of the Inspection.

17.0 Hydro test:

17.1 We. will carry out hydro testing of heater radiant, convection coils, to the specified test pressure for the furnaces.
17.2 We. will fabricate necessary manifolds, laying temporary piping, providing hose connections from the source of water supply to the heater coil, etc., for preparing hydro test.
17.3 We. will fill up the water on the heater coils, vent entrapped air, pressurize to the required hydro test pressure with necessary test pumps, and offer the coils for inspection including assistance to CLIENT Inspection team during the checking.
17.4 We. will drain the filled water on completion of hydro test and displace the entrapped water using compressed air / nitrogen.

18.0 IBR Cordination

We will coordinate with the Directorate of Steam Boilers for the submission of reports,arranging their visits and obtaining inspection reports and settling of fees etc

18.0 Damper servicing:

We. will carry out overhauling of the stack damper by cold / weld repairs, replace the wire ropes, if required, check / prove the operability of the damper and obtain clearance from Operations.
We wil lcarry out Refractory jobs as required in the work details and as per Inspection. Refractory jobs will include replacement / repairs to radiant / floor / convection / stack / convection ducting / brick lining / castable / ceramic fiber as applicable. Castable refractory renewal will be done by Hand application as required and patch repair by trowel application as per recommended application procedures. Refractory repairs include welding of anchor hooks and supports and all such related mechanical work.

20.0 Packing of Expansion gaps:

We. will pack the expansion gaps on the brick wall & and on the header box between plain tubes & tube sheet holes using ceramic fiber blankets.

21.0 Painting:

We will carry out painting of Heater radiant shell casing, convection and stack as per the CLIENT painting system specified in the furnaces work package. We will carry out surface preparation by means of mechanical hand tool cleaning / supply and application of required paint including consumables. We will erect suitable staging of the subject work. We will offer stage wise inspection for CLIENT inspection authority. Contractor will strictly adhere to the CLIENT color-coding system. The paint manufacturer batch Number and expiry dates for each batch of inward material will be submitted to CLIENT for approval and record.

22.0 General Cleaning:

We. will remove the fallen refractory, insulation materials, debris & other materials inside the heaters & ducts on completion of all activities and maintain the area in & around the furnace with better house keeping.

23.0 House Keeping:

23.1 The work area will be kept clean and tidy always during the course of work.
23.2 Cleaning of debris will be done as and when such scrap / debris is generated and the same will be disposed at areas designated for the same

23.3 The House Keeping of the work spot and surrounding areas will be our responsibility and cleaning will be done on a day-today basis.
23.4 Transportation of scrap / debris generated during the execution of work and disposal at designated areas / scrap yard will be within the contractor's scope of work.

24.0 Job completion & Startup Coverage:
24.1 We will carryout boxing up of all flanges with proper gaskets after obtaining necessary clearances from Mfg. & EIC.
24.2 We. will do hot bolting during startup & commissioning of the pipelines and will provide start up coverage for a max of 7 Days.

25.0 Multiple work fronts:
We. will plan the resources properly & execute in such a way that work can proceed simultaneously at different locations without impeding into each other so as to complete the work as per schedule

	SHILPI ENGINEERING . LTD.	
	WORK INSTRUCTION	REV001

WORK INSTRUCTION FOR AIR FIN COOLER [GENERAL]:

1. Award of Contract.
2. Submit documents for commencing the work as per SOW. And completing the legal formalities.
3. Submission of list of equipment, execution plan, Lifting Plan and other required details as per CLIENT.
4. Mobilization of equipment, machineries, tools tackles, all necessary consumables etc. from SEPL warehouse to CLIENT job location.
5. Unloading the arrived items to designated locations as per the instruction of CLIENT EIC.
6. Conduct the Safety inspection and tagging of machines, tool tackles & Equipment.
7. Obtain work permit to start preparation activities.
8. Line up of equipments at site.
9. Arrange scaffolding for working access.
10. Remove insulation wherever req. (Blind location).
11. Obtain work permit.
12. Blind as per blind list.
13. Cover opening of tube side in cover type AFC
14. Mark the header plugs for open (As per scope).
15. Unbolt & open the header plugs which are marked by CLIENT.
16. Pre inspection by CLIENT.
17. Clean the internal tubes by hydro jetting.
18. Clean the header plugs by manually.
19. Post cleaning inspection by CLIENT.
20. Repair works if any by SEPL.
21. Obtain box up certificate.
22. Re-install the header plugs with new gaskets.
23. Hydrotest of the tubes.
24. If any tubes leak and do the necessary as per inspection recommendation.
25. Repair if any by SEPL.

Prepared by: SEPL (Engineering Dept.)

26. Final inspection by Client.
27. De-blinding as per blind list
28. Housekeeping.
29. Close all permits.
30. Handover of equipment to plant.

	SHILPI ENGINEERING . LTD.	
	WORK INSTRUCTION REV001	

WORK INSTRUCTION FOR DE-SUPERHEATER [GENERAL]:

1. Award of Contract.
2. Submit documents for commencing the work as per SOW. and completing the legal formalities.
3. Submission of list of equipment, execution plan, Lifting Plan and other required details as per CLIENT.
4. Mobilization of equipment, machineries, tools tackles, all necessary consumables etc. from SEPL warehouse to CLIENT job location.
5. Unloading the arrived items to designated locations as per the instruction of CLIENT EIC.
6. Conduct the Safety inspection and tagging of machines, tool tackles & Equipment.
7. Obtain work permit to start preparation activities.
8. Erection of scaffolding if required.
9. Installation of Blinds as per blind list.
10. Insulation removal wherever required.
11. Drop/lift the De-superheater for the inspection and associated line for the flushing.
12. Dismantling of actuator and send to CLIENT workshop for overhauling as per CLIENT AI.
13. Pre-Cleaning Inspection by CLIENT
14. Internal cleaning or flushing, nozzle inspection.
15. Servicing/repair if any & Carrying out NDT by SEPL
16. Spray test to be done as per CLIENT.
17. Post Inspection of internals by CLIENT.
18. Install back the de-superheater with the actuator and associated piping.
19. Final inspection by CLIENT.
20. Box-up of de-superheater
21. De-blinding as per blind list.
22. Housekeeping.
23. Close all permits.
24. Handover of equipment to plant.

	SHILPI ENGINEERING . LTD.	
	WORK INSTRUCTION	REV001

WORK INSTRUCTION FOR EXCHANGER [GENERAL]:

Cover opening, Bundle Cleaning & other related Activities:

1. Award of Contract.
2. Submit documents for commencing the work as per SOW. And completing the legal formalities.
3. Submission of list of equipment, execution plan, Lifting Plan and other required details as per CLIENT.
4. Mobilization of equipment, machineries, tools tackles, all necessary consumables etc. from SEPL warehouse to CLIENT job location.
5. Unloading the arrived items to designated locations as per the instruction of CLIENT EIC.
6. Conduct the Safety inspection and tagging of machines, tool tackles & Equipment.
7. Obtain work permit to start preparation activities.
8. Line up of equipments at site.
9. Arrange scaffolding for working access (This may be done as pre-TA activity, only modification can arise during the job time).
10. Remove insulation wherever required
11. Obtain work permit for the respective equipment.
12. Blind the exchanger as per blind list.
13. Unbolt & remove the channel covers & channel head as per scope.
14. Pre inspection by CLIENT.
15. Preparation for bundle pullout if required.
16. Pull out bundle by using bundle puller & crane if required.
17. Preliminary inspection of the shell & bundle.
18. Shifting the pulled out bundle to the hydro-jetting yard.
19. Clean the bundle by high pressure water jetting.
20. Clean the cover and channel head.
21. Cleaning inspection by CLIENT.
22. If any bundle, Shell, Channel head & cover etc. repair works found by CLIENT AI, rectification by SEPL

23. Support for ECT, RFET, WFMPT etc. if required by CLIENT agency.
24. Assistance for re-tubing activities of CLIENT hired agency.
25. Assistance for refractory works for CLIENT hired agency.
26. Replacement of impingement plate as per SOW.
27. Inspection by CLIENT after the repair works.
28. Shift the bundle after CLIENT clearance for insertion from Hydro jetting yard.
29. Insert the bundle after CLIENT clearance for pulled out exchangers and proceed HT.
30. Install the Test ring and channel head for the shell side hydrotest.
31. Preparation for the shell side Hydro test.
32. Shell side Hydro test.
33. Inspection by CLIENT.
34. Remove Test ring.
35. Install floating head & channel cover with new gasket.
36. Tube side Hydro test.
37. Inspection by CLIENT
38. Install the remaining components and preparations for combined hydrotest.
39. Combined hydrotest.
40. Final inspection by CLIENT.
41. De-blinding as per blind list
42. Housekeeping.
43. Close all permits.
44. Handover of equipment to plant.

	SHILPI ENGINEERING . LTD.	
	WORK INSTRUCTION REV001	

WORK INSTRUCTION FOR INCIENERATOR FURNANCE WITH STACK [GENERAL]:

1. Award of Contract.
2. Submit documents for commencing the work as per SOW. and completing the legal formalities.
3. Submission of list of equipment, execution plan, Lifting Plan and other required details as per CLIENT.
4. Mobilization of equipment, machineries, tools tackles, all necessary consumables etc. from SEPL warehouse to CLIENT job location.
5. Unloading the arrived items to designated locations as per the instruction of CLIENT EIC.
6. Conduct the Safety inspection and tagging of machines, tool tackles & Equipment.
7. Obtain work permit to start preparation activities.
8. Blinding of piping & Disconnection and LOTO of fuel lines.
9. Manhole / Explosion doors opening of furnace and vessel.
10. Removal of burner assembly.
11. Vessel Entry preparation as per CLIENT Procedure.
12. Safety inspection, Gas monitoring, O2 check (Each 2 hrs intervals)
13. Erection of internal scaffolding in incinerator furnace.
14. Erection of external and internal scaffolding where ever required for stack
15. Pre-Cleaning Inspection.
16. Drop the burners for servicing.
17. Burner tip and ignitor Inspection.
18. Burner tip, ignitor, soot blower etc. repair/replace if any.
19. Furnace coils inspection and repairs if any.
20. Incinerator dome cover removal and assistance for burner tiles removal and fixing.
21. Anchors cutting job for furnace and stack if any as per CLIENT AI.
22. Anchors welding for furnace and stack as per AI requirement.
23. Maintenance of dampers, chock rings, thermocouples removal in installation.
24. Inspection assistance for non-metallic bellow and repairs if any recommended by CLIENT AI.

25. Stack nozzle MOC: Metallurgy upgradation job as per SOW.
26. Cutting, Grinding and welding of nozzles as per CLIENT AI and NDT test where ever required.
27. Assistance for application of refractory by CLIENT agency for both furnace and stack.
28. Refractory Curing. Inspection by CLIENT AI.
29. Re-install of Burner assembly.
30. Heat Exchanger Screen Tube & Evaporator inspection if required.
31. Welding of thermocouples if required.
32. Incinerator Internal inspection.
33. Internal Cleaning after repairs.
34. Post Cleaning Inspection by CLIENT.
35. NDT Inspection by AI after weld repairs.
36. Removal of internal scaffolding from furnace and stack.
37. Final Inspection by AI and clearance for box-up.
38. Box-up of manways of furnace and incinerator vessel.
39. Water filling for IBR hydrotest of steam drum.
40. IBR hydrotest of steam drum & waste heat boiler.
41. Inspections by AI & IBR Inspector.
42. De-blinding as per blind list.
43. Housekeeping.
44. Close all permits.
45. Handover of equipment to plant.

Mitra S. K. Private Limited

MSK TESTING • INSPECTION

TEST REPORT

Name & Address of the Customer :
INDIAN OIL CORPORATION LIMITED
P.O.- Haldia Oil Refinery,
Pin - 721606

Report No. : WB/ED-2588A
Date :30.09.2021
Sample No. :MSKGL/ED/2021-22/09/00860
Sample Description : VOC Monitoring

Ref. No. & Date : 26525063, dtd - 12.08.2020

Date - 22/07/2021
Area - DHDS BLOCK
Location - MSQU AREA
Unit No - 85,86 & 87

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
87 PM-01A	Suction	0	0	0	0
	Discharge	0	0	0	
87 PM-01B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-51A	Suction	2	0	0	0
	Discharge	0	0	0	
87 PM-51B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-52A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-52B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-53A	Suction	0	0	0	0
	Discharge	0	0	0	
87 PM-53B	Suction	0	0	0	0
	Discharge	0	0	0	

Contd to Page-2

Head Office: Shrachi Centre (5th floor), 74B, A.J.C. Bose Road, Kolkata - 700 016, West Bengal, India.
Tel. : 91 33 40143000 / 22650006 / 22650007 Fax : 91 33 22650008
Email : info@mitrask.com, Website: www.mitrask.com

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
87 PM-02A	Suction	0	0	0	0
	Discharge	0	0	0	
87 PM-02B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-08A	Suction	0	0	0	0
	Discharge	0	0	0	
86 PM-08B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-12A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-12B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-11A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-11B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-01A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-01B	Suction	0	0	0	0
	Discharge	0	2	0	
85 PM-03A	Suction	0	0	0	0
	Discharge	0	0	0	
86 PM-03B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-85B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-85A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	

Contd to Page-3

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
85 PM-82A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-82B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-04B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-04A	Suction	0	0	0	0
	Discharge	0	0	0	
86 PM-05B	Suction	0	0	0	0
	Discharge	0	0	0	
86 PM-05A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-56B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-56A	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-26A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-106A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-02A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
86 PM-02B	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-27A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-27B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	

Contd to Page-4

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
87 PM-55A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-55B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-13B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-13A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-87A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
87 PM-104	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-28A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-28B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-23A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-23B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-25B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-25A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-24A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	

Contd to Page-5

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
85 PM-24B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-21A	Suction	0	1	0	0
	Discharge	0	0	0	
85 PM-21B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-22A	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-22B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-81A	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-81B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-01B	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-01A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-02B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-02A	Suction	0	0	0	0
	Discharge	0	1	0	
85 PM-03B	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-03A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	

Contd to Page-6

WB/ED-2588A

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
87 PM-101A	Suction	0	0	0	0
	Discharge	0	0	0	
87 PM-101B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 E-22C	Suction	0	0	0	0
	Discharge	0	0	0	
85 E-27	Suction	0	0	0	0
	Discharge	0	0	1	
85 E-25A	Suction	0	0	0	0
	Discharge	0	0	0	
85 E-25B	Suction	0	0	0	0
	Discharge	0	0	0	
87 E-51A	Suction	0	0	0	0
	Discharge	0	0	0	
87 E-51B	Suction	0	0	0	0
	Discharge	0	0	0	
87 E-51C	Suction	0	0	0	0
	Discharge	0	0	0	
87 E-51D	Suction	0	0	0	0
	Discharge	0	0	0	
87 E-51E	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-29B	Suction	0	1	0	0
	Discharge	0	0	0	

Contd to Page-7

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
85 PM-29A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-80B	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-80A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-04B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-04A	Suction	0	0	0	0
	Discharge	4	0	0	
85 PM-106B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-106A	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-101A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-101B	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-102A	Suction	0	0	0	0
	Discharge	0	0	0	

Contd to Page-8

Equipment No	Description	Valves (PPM)	Flange (PPM)	Prassure Gauge (PPM)	Seal (PPM)
85 PM-102B	Suction	0	0	0	0
	Discharge	2	0	0	
85 PM-105B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-105A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-104A	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-104B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-103A	Suction	0	0	0	0
	Discharge	0	0	0	
85 PM-103B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-93B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-93A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-92B	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	
85 PM-92A	Suction	Not Running	Not Running	Not Running	Not Running
	Discharge	Not Running	Not Running	Not Running	

Report Prepared By

for Mitra S. K. Private Limited

Authorised Signatory

Vendor No.: 11922892 SHILPI ENGINEERING PVT LTD 212, 2nd Floor,Shubham Comm Complex Plot No. 1 & 3, Sector-11 New Panvel,Navi Mumbai MUMBAI-410206 India **Tel No. 1** 912227467735 **Tel No. 2** 919324403514 **Fax** 912227468772	**Tender No. 600C-001** **Work Order No.: 26699602** **Work Order Dt.: 07.12.2020** **Work Order Value: INR** 340,547,432.20 Rs.THIRTY-FOUR CRORE FIVE LAC FORTY-SEVEN THOUSAND FOUR HUNDRED THIRTY-TWO & PAISE TWENTY ONLY

, Vendor Email: SHILPIENGG@REDIFFMAIL.COM

Expecting supplies from : SHILPI ENGINEERING PVT LTD (11922892)
NOTE: ANY CHANGE IN SUPPLYING LOCATIONS SHALL BE IMMEDIATLEY INTIMATED TO EIC.
EIC Email: SHRESTHS@INDIANOIL.IN
Subject:
Composite Works for Revamp of Linear Alkyl Benzene (LAB), Project Gujarat Refinery, India.

DETAILED LETTER OF ACCEPTANCE (DLOA)

Kind Attn: SHILPI ENGINEERING PVT. LTD
E-mail: SHILPIENGG@REDIFFMAIL.COM

Dear Sir,
In continuation of our Fax of Acceptance No.- **RHQCC/2020-21/FOA/093 dated 06.11.2020**, we are pleased to issue this Detailed Letter of Acceptance (DLOA).

Vendor No. 11922892 W.O. No.: 26699602
Contractor Name:SHILPI ENGINEERING PVT LTD Date:07.12.2020

O.Lev. Sr.No.	Item No Item Description	Quantity	Unit	Rate	Amount
00430	1.3.2.3	60.000	IM	205.00	12,300.00
NB 16.0 INCH TO NB 24.0 INCH -			Rs.TWO HUNDRED FIVE ONLY		Rs.TWELVE THOUSAND THREE HUNDRED ONLY
00440	2				
"CARBON STEEL PIPING (IBR) (ABOVE GROUND)Transportation of all piping items from OWNER'S storage point to worksite/work shop, supply of all consumables, all tool&tackels,construction equipment (cranes, farana etc.) labors etc., Establishmentof PQR, WPS & welder qualification test for similar/dissimilar material,fabrication including cutting, edge preparation (inclusive of grindingthe edges of pipe, pipe spools, fittings, flanges etc. to match with themating edges of uneven/different thickness wherever required), fit-up,bending, preheating wherever required, welding for similar/dissimilarmaterial, threading and laying of pipes and pipe spools over sleepers,overhead racks and at all elevations, including all related scaffolding,hook-ups with existing piping, connecting with equipment nozzles,installation of strainers, steam traps, orifice assemblies, spraynozzles, rotameters, sample connections, sample coolers, closed samplesystem cabinets etc., tappings for pressure gauges, thermowells, fixingof gaskets, bolts, nuts including application of torque whereverrequired & all other inline instruments and fittings, like elbows,reducers, tees, flanges, spectacle blinds and spacer & blinds, pipingspecials such as miters and fabricated fittings, vents, drains (butexcluding reinforcing pads), welded valves up to 40 NB, Steam Supply/Condensate Recovery stations (Cast/Fabricated), Sight glass, Quick fixcoupling, Supply & welding of					

इंडियन ऑयल कॉर्पोरेशन लिमिटेड
हल्दिया रिफाइनरी, डाकघर : हल्दिया ऑयल रिफाइनरी -721606
जिला : पूर्व मेदिनीपुर (प० बंo)
Indian Oil Corporation Limited
Haldia Refinery, P.O.: Haldia Oil Refinery-721606
District : Purba Medinipur, West Bengal
Website : www.iocl.com, E-mail : haldiarefinery@indianoil.in
Fax : 91-3224-252141, Phone : 91-3224-223270

ISO 9001/ ISO 14001/ OHSAS 18001

रिफाइनरीज प्रभाग
Refineries Division

01st Dec, 2021

To
Asst. Environmental Engineer (I/C)
West Bengal Pollution Control Board
Haldia Regional Office, Super Market Building (3rd Floor),
Durgachak, Haldia, Purba Medinipur, Pin-721602

Kind Attention: Shri Prasoon Mondal, Asst. Environmental Engineer (I/C)

Subject: Declaration letter for shutdown of some process units due to M&I job in IOCL Haldia Refinery

Sir,

Indian Oil Corporation Ltd, Haldia Refinery has been planned for partial shutdown of following process units for maintenance and inspection related activities from 1st Dec'2021 to 21st Jan'2022:

(1) Crude Distillation Unit-II (CDU-II)
(2) Vacuum Distillation Unit-I (VDU-I)
(3) Resid Fluidized Catalytic Cracking Unit (RFCCU)
(4) Hydrogen Generation Unit-1 (HGU-I)
(5) Motor Spirit (MS), Naphtha Hydro-treater Unit (NHDT) & Prime Gasoline Units (Prime G)
(6) Diesel Hydro-Desulphurization Unit (DHDS)
(7) Catalytic Reforming Unit (CRU)
(8) Sulphur Recovery Unit-II, Sour Water Stripping Unit & Amine Regeneration Unit

Some process units like Once Through Hydro Cracker Unit (OHCU), Diesel Hydro-treater unit (DHDT) and Kero Hydro-Desulphurization unit (KHDS) will also be taken into shutdown for one week period.

This is for your kind information please.

Thanking you.

Yours Sincerely

01/12/21

I Daniel Raj
Dy. General Manager (HSE)
IOCL Haldia Refinery,
Haldia, Dist: Purba Medinipur
Pin-721606
Tel. – 03224 223607, 252445

इंडियन ऑयल कॉर्पोरेशन लिमिटेड
हल्दिया रिफाइनरी, डाकघर : हल्दिया ऑयल रिफाइनरी -721606
जिला : पूर्व मेदिनीपुर (प० बंo)
Indian Oil Corporation Limited
Haldia Refinery, P.O.: Haldia Oil Refinery-721606
District : Purba Medinipur, West Bengal
Website : www.iocl.com, E-mail : haldiarefinery@indianoil.in
Fax : 91-3224-252141, Phone : 91-3224-223270

रिफाइनरीज प्रभाग
Refineries Division

Haldia
02.12.2021

To,

Shri. B. Vinod Babu

Scientist E & DH, IT Division,

Central Pollution Control Board,

Parivesh Bhawan, East Arjun Nagar, Delhi – 110032

Subject: Declaration letter for shutdown of some process units due to M&I job in IOCL Haldia Refinery

Sir/Madam,

This is to inform that IOCL Haldia Refiner has undergone planned shutdown from 1st Dec'21 21st Jan'22.

In view of the above, following process units in Haldia refinery in connection to stacks configured in OCEAMS portal are scheduled to be under M&I shutdown/idling as per plan during below mentioned period :

S.No.	Unit Name under shutdown	Station (Station Name) as in OCEAMS /CEMS portal	Planned shutdown/idling duration	Stack analysers (SO2,NOX,CO,PM) offline in OCEAMS
1	CDU-I	a) STACK_8_CDU1MAIN b) STACK_9_CDU1_TRIM	13th Dec'21- 16th Dec'21	
2	VDU-II	STACK_19_VDU_2	13th Dec'21- 16th Dec'21	
3	OHCU	STACK_24_OHCU	13th Dec'21- 20th Dec'21	
4	HGU-II	a) STACK_22_HGU2_PDS b) STACK_23_HGU2_REFORMER	13th Dec'21- 19th Dec'21	
5	HGU-I	STACK_21_HGU_1_REFORMER	27th Nov'21 - 17th Jan'22 (Ongoing)	SO2,NOX, CO,PM : since 09:15 hrs on 01.12.2021
6	RFCCU	STACK_20_FCC	01st Dec'21- 21st Jan'22 (Ongoing)	SO2,NOX,CO,PM : since 11:15 hrs on 01.12.2021

S.No.	Unit Name under shutdown	Station (Station Name) as in OCEAMS /CEMS portal	Planned shutdown/idling duration	Stack analysers (SO2,NOX,CO,PM) offline in OCEAMS
7	CDU-II	a) STACK_10_CDU2MAIN b) STACK_11_CDU2TRIM	06th Dec'21- 13th Jan'22	
8	VDU-I	a) STACK_12_VDU1 b) STACK_13_VDU1TRIM	06th Dec'21- 13th Jan'22	
9	SRU-II (U-28)	STACK_16_SRU_2	13th Dec'21- 02nd Jan'22	
10	DYIP Block (DCU, CGO-HDT & MHC)	a) STACK_25_DCU b) STACK_26_CGO_HDT	12th Dec'21- 27th Dec'21	
11	ETP	a) ETP-1 COD, BOD, TSS, pH analyser b) ETP-2 COD, BOD, TSS, pH analyser c) ETP-3 COD, BOD, TSS, pH analyser	13th Dec'21- 16th Dec'21	
12	TPS Boiler-4	STACK_4_TPSBOILER_4	17th Nov'21 - 17th Dec'21 (Ongoing)	SO2,NOX,CO,PM : since 14:15 hrs on 17.11.2021
13	GT-2/ HRSG-2	STACK_6_GT2	13th Dec'21 -28th Dec'21	

Hence, the stack emission analysers (SO2,NOX,CO & PM) corresponding to above stations in OCEAMS portal are being taken in offline mode from CPCB data connectivity leading to non-availability of its data in online CPCB server, as the units are going under S/D or idling subsequently .

Any abnormal reading/ exceedances/ alarms generated in CPCB server during below mentioned period from the abovementioned stacks may please be ignored.

The online data connectivity of these stacks to CPCB server will be made operational/online on start-up of these units and the same shall be intimated accordingly.

This is for your kind information please.

Thanking you

Yours Faithfully

02/12/'21

I Daniel Raj
Dy General Manager-HSE
IOCL-Haldia Refinery

आई. डेनियल राज, उप महाप्रबंधक (एच, एस एवं ई)
I. Daniel Raj, Dy. Gen. Manager (H, S&E)
इंडियन ऑयल कॉर्पोरेशन लि०, हल्दिया रिफाइनरी
Indian Oil Corporation Ltd., Haldia Refinery