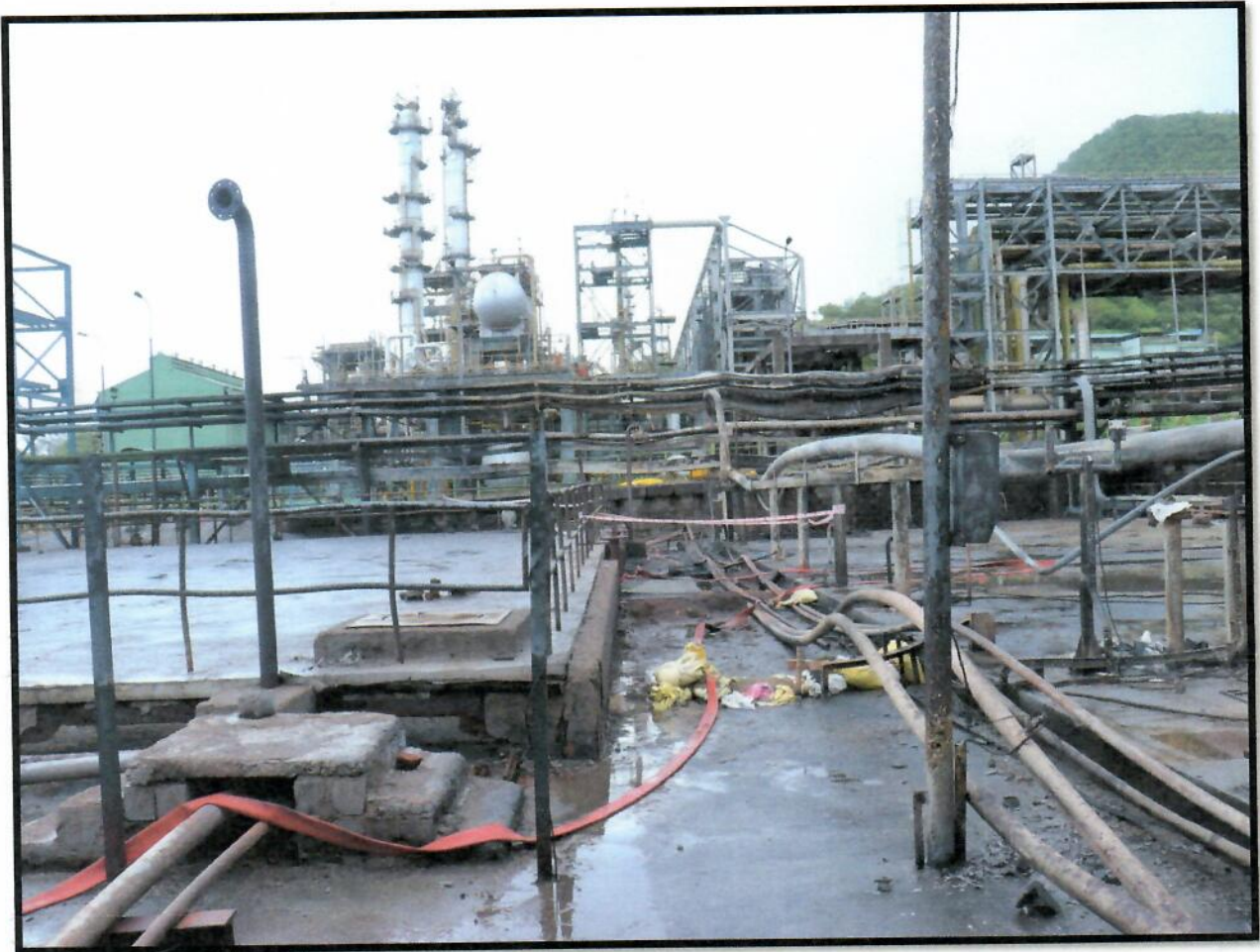

Enquiry Committee Report

**Major Fire at ONGC's Gas processing plant, Uran
On 03.09.2019**



PETROLEUM AND NATURAL GAS REGULATORY BOARD
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CONTENTS

Section	Description	Page No
1	Introduction	3
2	Constitution of Enquiry Committee by PNGRB	3
3	Methodology adopted by the Committee	4
4	Brief about the Plant and Process	4
5	Preliminary briefing of incident by ONGC	8
6	Inspection of accident site by Committee	11
7	Interaction with eyewitness and Inspection of CCTV footage	19
8	Inspection of Control room and review of process data:	24
9	Inspection of CCTV control room	25
10	Findings of the committee:	26
11	Terms of reference of committee	29

Detailed Report of Enquiry Committee constituted by PNGRB to investigate the major fire occurred at ONGC's Gas Processing Plant, Uran on 03.09.2019

1. Introduction

It was informed by ONGC that a major fire took place at its Uran Gas Processing Plant on 03.09.2019 at around 06:55 hrs. After detecting the strong smell of hydrocarbon, the same was reported by Fire Station to Control Room at 06:47 hrs. Immediately Resident Production Superintendent (RPS) rushed to the area in full safety gears. A fire tender also reached the site immediately with CISF Personnel in full safety gears. The location of the fire was near DM Water plant, Oily Water Sewage pit and CISF Security cabin, which is outside the main process area.

The fire was extinguished completely by 10:00 hrs with the help of Mutual Aid Resource Group. During the firefighting, Three CISF fire personnel and Resident Production Superintendent succumbed to injuries.

ONGC's initial incident report in the prescribed format of PNGRB is enclosed at **Annexure 1**.

2. Constitution of Enquiry Committee by PNGRB

Vide office Order dated 06.09.2019, a three member's enquiry committee of following persons was constituted by PNGRB to investigate the incident.

1. Shri J K Sarma, ED (Production Services), OIL India Ltd. - Chairman
2. Shri S P Garg, ED (HSE), GAIL (India) Limited
3. Md. Tanweer Akhter, Dy. Adviser, PNGRB – Convener

The terms of reference of the enquiry committee were as under: -

1. Identify lapses/shortcomings
2. Establish the root cause (s) of failure
3. Suggest improvements / remedial measures to prevent recurrence of such incidents
4. Fix responsibility

A copy of the Office Order No. PNGRB/Tech/12-Inci/ (1)/2019, dated 06.09.2019 is attached at **Annexure 2**.

3. Methodology adopted by the Committee

The committee visited the incident site on 10.09.2019 and carried out the investigation for three days. The committee inspected the site where massive fire occurred and interacted with a number of eyewitnesses including ONGC and CISF personals who were involved in the plant operations and firefighting activities.

Based on the available process data from Control Room, site visit to different plants and accident site and statement of concerned plant personnel including CISF-Fire personnel, the committee tried to find out the probable reasons for such a devastating fire, which resulted into multiple fatalities. In this regard, Internal Report of similar fire incident, which took place in 2004, was also referred.

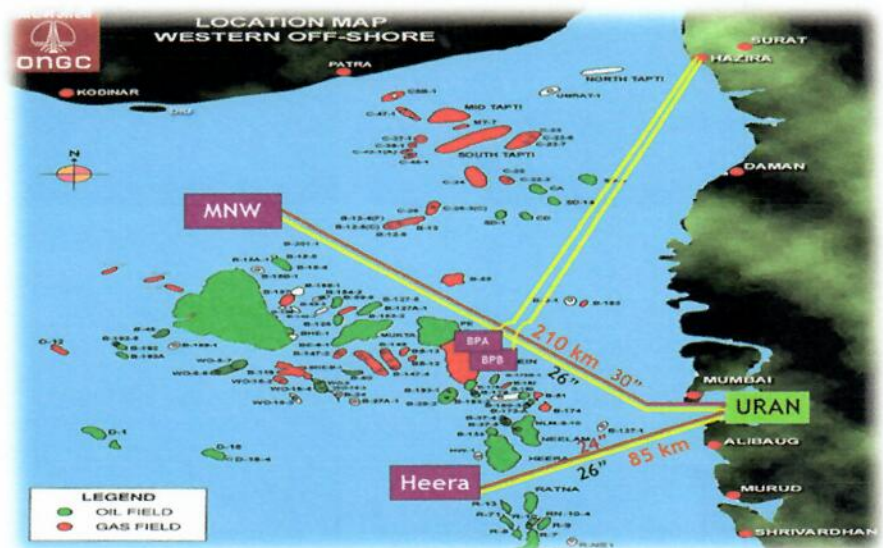
Following methodology was adopted for investigation.

1. Brief presentation on Plant and Process by ONGC
2. Preliminary briefing about the incident by ONGC
3. Inspection of accident site
4. Interaction with eye witnesses of the incident
5. Visit to Control room and collection of process data
6. Inspection of CCTV footage
7. Photographic evidence of accident site
8. Discussions and findings of the Committee
9. Final observations in line with the Terms of Reference

The Committee submitted its preliminary report on 26.09.2019. A copy of the preliminary report is attached at **Annexure 3**.

4. Brief about the Plant and Process:

ONGC's Uran Plant was set up during 1978 for Onshore Oil and Gas Processing as downstream facility to Western Offshore oil fields, and presently handles 20% of the total natural gas and 92% of the total oil produced by Western Offshore.



4.1 At Uran Plant, facilities are provided to stabilize the crude oil and extract LPG, Naphtha and C2-C3 from the gases received from Western Offshore. Crude oil produced in Mumbai High and other fields of Western Offshore in Arabian Sea is received at Uran Plant, through sub-sea pipelines, 30"Ø (MUT-Mumbai Uran Trunk Line) and 24"Ø (HUT-Heera Uran Trunk Line), respectively.

Associated gas produced in Mumbai High and satellite fields is received at Uran Onshore Processing Terminal, i.e. Uran Plant, through sub-sea pipelines, 26" Ø (BUT) / 28" Ø (MUT) and 26" Ø (HUT), respectively.

4.2 Role of Uran Plant:

(i) Feed Receives:

- 34,000 TPD of Crude Oil (~12.5 MMTA)
- 11.5 MMSCMD of Natural Gas & Condensate Eqv.

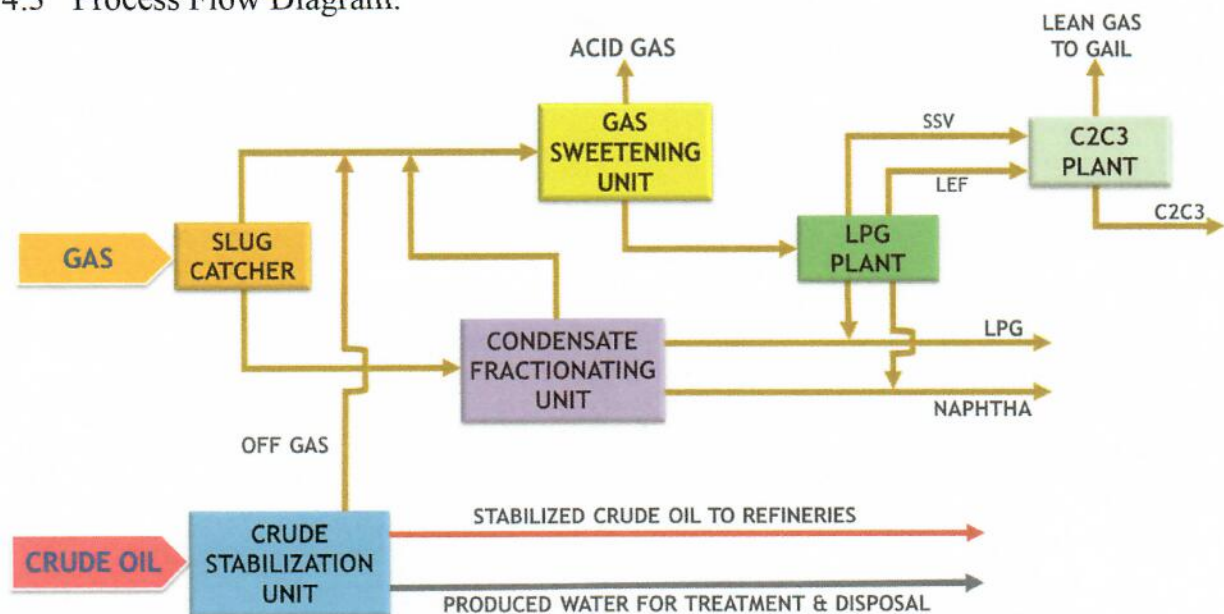
(ii) Extracts:

- 3400 TPD of Value Added Products (like LPG/C2C3 & Naphtha) from Natural Gas & Associated Condensate

(iii) Supplies:

- Stabilized Crude Oil to Refineries after Processing, Storage & Quality Assurance on 24x7 basis
- Natural Gas to Power, Fertilizer, Petro-chemical, Refineries, Steel & other Sector, Domestic (PNG) & Public Transport (CNG)

4.3 Process Flow Diagram:



4.4 Process Facilities:

At Uran Plant, facilities are provided to stabilize the crude oil and recover LPG, Naphtha and C2-C3 from the gases received from Offshore. Uran Plant consists of the following units to process oil and gas with associated utilities.

- Slug Catcher: Phase-II & III
- Crude Stabilisation Unit: CSU-I and II
- Condensate Handling Unit: CHU-IV
- Condensate Fractionating Unit: CFU-I, II and III
- Gas Sweetening Unit: GSU-I, II and III
- LPG Unit I, II and III
- Ethane Propane Recovery Unit – EPRU
- Crude Oil Storage Tanks
- C2-C3 Storage area
- LPG/Naphtha Storage area
- Flare Gas Recovery Unit (FGRU)
- Flare

Crude Stabilisation Unit: The Crude Stabilization Plant at Uran is designed to stabilize pressurized crude from the Mumbai off-shore oil fields. It is designed to process 20,000,000 Tons of stock tank crude oil per annum. Besides stabilization, the facility includes provision for dehydration and desalting crude oil whenever required. The unit includes separation dehydration, gas compression, storage and pumping facilities.

The crude oil received from offshore is stabilized in crude stabilization unit (CSU) through three stage separation with a view to optimize the liquid recovery. The liberated gas from CSU is compressed and mixed with offshore gas and fed to GSU of gas processing unit. The stabilized oil is stored in floating roof tanks and as per demand of refineries is sent to Trombay Terminal for onward transportation to refineries situated at Trombay and to various coastal refineries through Jawahar Deep or Jawaharlal Nehru Port Trust (JNPT) tanker loading terminal.

Slug Catcher: The gas from Mumbai High and Satellite fields is received in two separate slug catchers namely Ph-II (capacity 11.0 MMSCMD) and Ph-III (capacity 5.2 MMSCMD). Liquid condensate generated during sub-sea en-route is separated out in respective slug catchers. Separated gas is taken to Gas Sweetening Unit (GSU) for the purpose of sweetening i.e., removal of CO₂ & H₂S to the specified parameters. Condensate, separated in two slug catchers are sent to condensate fractionating unit (CFU) with fall back provision for stabilization and injection in crude oil.

Condensate Fractionating Unit : MUT & HUT slug catcher condensate along with CSU off gas compressor 2nd and 3rd stage condensate is received in CFU (I & II) for the extraction of LPG & Naphtha. Off gas from CFU is fed to GSU for further processing. The new CFU-III operates in parallel with CFU-I and II.

Gas Sweetening Unit: The GSU plants have been designed and constructed for the removal of acid gases i.e. H₂S & CO₂ from the sour feed gases consisting of Slug Catcher Gas, CFU off gas and CSU off gas. Two units of 5.75 MMSCMD capacity each are existing since 1989. An identical 3rd unit commissioned during 2014 under APU (Additional Processing Units). All three units receive the MUT and HUT gas mixture along with CSU off gas and CFU off gas. The combined sour gas is sweetened to contain less than 50ppm CO₂ and 4 ppm of H₂S.

LPG Unit: Three units of LPG of capacity 5.65 MMSCMD each and receives the sweet gas from GSU. LPG Recovery Units are designed to recover maximum LPG from sweetened gas coming from Gas Sweetening Units (GSU-I/II/III) and produce value added products viz. LPG and NGL. Remaining non-condensable gas i.e second stage vapour (SSV) and Light hydrocarbon gases from light ends fractionator (LEF) column are delivered as feedstock to C2C3 recovery unit.

Ethane Propane Recovery Unit: The EPRU is designed to recover a maximum of Ethane-Propane mixture from the residue gas from LPG-I, II, III units. The unit has two feed streams (1) the SSV feed which is high pressure vapor from the second stage flash in the LPG Units and (2) the LEF Feed which is lower pressure vapor from the Light End Fractionators in the LPG units.

After removal of LPG fraction 2nd stage vapors and LEF top vapors from LPG units are fed to the ethane-propane recovery unit where ethane-propane mixture is recovered and used as feed-stock for the RIL Petrochemical complex at Nagothane.

The lean gas after recovery of Ethane-Propane is supplied to M/s. GAIL for onward supply to various gas consumers like Usar LPG Plant, RCF, MSEB, TEC, MGL, etc.

Off Gas Compression: Five reciprocating compressors K-201 A/B/C and K-603 A/B are provided to compress and discharge the additional gases released from CSU into GSU for the main gas feed line of LPG unit.

4.5 There are two individual Oily Water Sewage (OWS) Pits each having capacity of around 900 M³ where the fire incident occurred. These pits are called as APU (Additional Processing Unit) and C2/C3 OWS pits. Both pits are provided with pumps, which discharge to ETP.

C2/C3 pit is provided with 03 Nos. of pumps (2+1) of discharge capacity of 15 m³/hr each and APU pit is provided with 02 Nos. of pumps (1+1) with discharge capacity of 150 M³/Hr each.

C2C3 OWS pit is connected with

- GSU-I & II
- CFU-I & II
- C2/C3 Recovery Unit (EPRU)

Similarly, APU OWS pit is connected with following units:

- Gas Sweetening Unit (GSU)-III
- Condensate Fractionation unit (CFU)-III
- LPG Plant-III
- Condensate Handling Unit (CHU)-IV
- Naphtha Tank of 5000 Cubic Meter capacity

Apart from the above, there are other OWS pits in LPG-1, LPG-2 and CSU plant also from where it discharges to ETP plant.

A copy of the Plot Plan of Uran plant is at **Annexure 4** and equipment layout for effluent sump (OWS pit) is placed at **Annexure 5**.

5. Preliminary briefing of incident by ONGC

Following sequence of events was informed by ONGC during their presentation given in the presence of Plant Head (ED-Uran) and other HoDs and preliminary briefing to the Committee.

5.1 At around 23:00 Hrs on 02.09.2019, the Shift In charge checked the level of APU OWS pit, which was around 1800 mm.

At around 01:00 hrs on 03.09.2019, there was a power dip, which lead to tripping of major electrical equipment like Feed pump and compressors of LPG plant and other plants. After getting clearance from Electrical substation, different units and equipment were started one by one.

Intensity of rainfall increased heavily at around 02:00 hrs and APU OWS pit level reached to 4000 mm. Accordingly, pit pumps were started for disposing the rain water to avoid any overflowing of the pit.

At around 06:40 hrs, Fire control station informed Process Control Room that there is intense smell at LPG Gate (near DM Plant area). Immediately, RPS rushed to the reported site from Control room at 06:49 hrs. In the meantime, Fire Tender and firefighting crew also reached at site keeping fire tender around 100 meters away from the leak reported area.

At around 06:50 Hrs, huge fire was reported near LPG Gate and nearby storm water channels. All the gas-processing plants were asked to shut down by Shift In charge except Crude Stabilisation Unit (CSU). Fire fighting started immediately and completely extinguished by 10:00 hrs.

Following personnel succumbed to their injuries during the fire incident:

1. Shri C N Rao, GM(P) & Resident Production Superintendent, ONGC

2. Shri Eraana Nayaka, CT/F, CISF
3. Shri S P Kushwaha, CT/F, CISF
4. Shri M K Paswan, CT/DCPO, CISF

5.2 Sequence of events between 02.09.2019 and 03.09.2019:

Following sequence of events were communicated to Committee by ONGC.

Time (hrs.)	Activities
22:20	The Shift In-charge with crew from Kharghar reached Uran Plant
22:30	Rain started and continued throughout.
22:45	Shift crew from Panvel also reached Uran Plant
	During handing over charge, plant was running normal with various units, e.g., GSU-13 & 14, CFU-III, LPG-I & III, CSU and various utilities.
23:00	Shift I/c checked level of APU OWS pit which was around 1800 mm.
01:00	There was a power dip causing tripping of various units., e.g. Dehydrator A & C, Feed Pumps, C2/C3 CT Fans & Pumps, LPG-I CT Fans (XM-302A/B), Service water Pump-P-619, Drinking water Pump-P-316A, Off gas compressor K-201A/B, Old FGRU Unit and LPG-I & III plants.
	After getting clearance from Electrical substation, different units & equipment, e.g. Fan XM-302A/B, Pump P-619, P-316A were started one by one.
	Shift I/c went to the field to see the status of plant and found there were no lights in propane compressor area and off-gas compressor area and the same was reported to the sub-station.
02:00	Intensity of rainfall increased heavily, Utility engineer found APU OWS pit level around 4000 mm and informed Shift I/c who was still in the field.
02:30	Shift I/c arrived at C2/C3 & APU OWS pit areas along with C2C3 CT operator and HT air compressor/APU OWS pit operator, who informed about filling of storm water channel with water and flow of water over floor of pits due to heavy rain. They immediately started C2C3 OWS pit pumps (03 nos.). Thereafter, Shift I/c along with OWS pit operator (Mr. Ramtekke) went along storm water channels towards LPG gate till the sluice gate of outgoing storm water of plant. There was heavy water flow from both side of channels (HT air compressor side and from OWS pit side). They found there was no severe smell of hydrocarbon in particular area at that time.
02:30	Shri S Wange, AEE (P) left C/R to LPG-III plant area along with LPG-III field personnel and Instrumentation team for unloading and starting of the compressor.
03:30	Shift I/c again went to C2C3 OWS pit (Pit-04) and observed all three pumps were running normal and he instructed operator to check level periodically and report to C/R. At that time, APU OWS pit was not overflowing and the team was there till 03:30 hrs.

Time (hrs.)	Activities
	Shift I/c returned to the C/R and found that the shift engineers were in the process of starting of various tripped units, eg LPG-I, evacuation compressor (K-101), etc. K-101 was finally started from field in presence of Shift I/c.
04:35	Shift I/c went to Off gas compressor and after getting Electrical clearance, started Off gas compressor K201B.
	Shift I/c went to Flare Gas Recovery Unit (FGRU) with Shift Instrumentation Maintenance. Since trouble shooting continued for long time. Shift I/c left for control room.
05:30	Shift I/c came back to C/R, found FGRU already started. He also found lean gas compressor, Propane compressor (KM-402C) of LPG-III have also been started.
05:45	Shri S, Wange, AEE (P) returns to C/R from LPG-III area and started preparing DPR.
06:40	C/R Fire Station (CISF), called C/R and Shift I/c picked up the call and was informed about gas leakage and intense smell near LPG gate (near DM plant area).
	By that time, RPS (Late C N Rao) and RE's (Mr. R M Borkar & Mr. Sheshnath) had reached C/R for their jobs. Since Shift I/c was preparing DPR, Late C N Rao who had also come to know about HC leakage told that he was going to see the matter and left for the site.
06:48	CISF Fire forwarded message to AC-Fire, DC-CISF, Process C/R, DGM(FS)-I/c Fire, RPS, Ambulance. Fire turn out with multi-purpose fire tender MH-43-G-5017 with crew members SI/F Shri Jai Bhagwan, HC/F Late Eraana Nayaka, CT/F Late S P Kushwaha, HC/DCPO Shri Lakhwinder Singh, CT/DCPO Late M K Paswan
06:49	Fire tender with crew parked their tender about 100 mts before leakage area. RPS and three fire crew members started search for leakage point.
06:50	Message received in C/R about huge fire near LPG gate and nearby storm water channels. Shift I/c left for the site and told others to shut down all plants except Crude Stabilization Units (CSU)
	Utility engineer at C/R informed GAIL to reduce gas off-take to zero and called VCR to stop gas throughput to Uran. He also checked fire water levels and started fire water make-up and left to CFU-I battery limit for firefighting.
07:00	HC vapour cloud explosion took place. 03 fire crew members along with RPS engulfed in fire.
	Shri S Biswas, AEE(P) finds huge fire outside, pressed ESD of GSU-14 and went to site.
07:02	Fire personnel from CISF started reaching site and firefighting operations were started.
07:25	First causality transferred from site to Hospital by ambulance
07:40	Second causality shifted to hospital
08:05	Third causality shifted to hospital

Time (hrs.)	Activities
08:30	Fourth causality shifted to hospital
08:55	Fire in CFU-IV area, LPG gate area extinguished. Fire in storm water drain around OWS pit was brought under control and fire fighting continued around OWS pit.
10:00	Fire extinguished, cooling off operation of the affected areas continued
10:30	Fire tenders of MARG were released from the site. Fire tenders of Uran Plant kept stand-by at site

5.3 List of Fire Tenders deployed during fire-fighting:

Time (hrs.)	Fire Tender Deployed
07:02	MPFT (Multipurpose Fire Tender) – 04 (Ist Turn out MH43G5017 with 05 Crew members), 03 others
07:02	DCP Fire tender – 01 No.
07:02	Foam Nurser – 02 Nos.
	Fire tender deputed from other locations
07:40	MPFT (Multipurpose Fire Tender) - JNPT
07:40	Foam Tender - JNPT
07:50	Water Tender - Mahagenco
08:25	Water Tender - CIDCO Dranagiri
08:25	Water Tender - CIDCO Ulwe
08:25	Water Tender - CIDCO Panvel
09:00	MPFT (Multipurpose Fire Tender) – ONGC Nhava
09:00	MPFT (Multipurpose Fire Tender) – ONGC Panvel
09:20	Fire Tender - NAD Karanja
10:00	MPFT (Multipurpose Fire Tender) – RIL Patalganga

6. Inspection of accident site by Committee

Enquiry committee visited following sites and made observations as below:

6.1 Road going towards CISF Security cabin near LPG plant Gate (Entry Checking Gate):

This area is marked as Area No. 850 in the plot plan (Annexure 4). Storm water channels from two sides merge here and crosses the road from where it goes outside the boundary of the plant after passing through a sluice gate.





Lot of HT Cables are running through overhead cable tray along and across the road.

The electrical power cable and instrumentation cables over the Storm Water Channel found in a totally burnt condition along with deformation of cable support trays made of MS material.

Maximum damage to the cables observed at exit point of Storm Water Channel near the boundary wall and burnt mark on the wall and sluice gate of the drain. However, the power cable passing through water inside the drain was intact.

Entire CISF Security cabin with roof was burnt due to fire. Shattered glass pieces of windows were spread on the floor. FLP Telephone along with electrical cable was totally burnt in fire.



CISF vehicle (Say: Car No. 01) was lying totally burnt in front of security cabin near LPG gate with its hand break in "Applied" position, but without the ignition key. The vehicle was having spark arrestor attached to it.

One number Air cylinder was also lying in totally burnt condition in the car. Dead body of one deceased was recovered from this car during rescue operation.



Another vehicle (Say: Car No. 02) was lying around 30 meters behind the car No. 1 in totally burnt condition.



In addition, all plant and trees along the road near LPG gate area were totally burnt. One breathing apparatus (BA) set was also lying in burnt condition on left side of the road.



6.2 DM Plant and its peripheral areas: This area is marked as Area No. 952 in the plot plan (Annexure 4). Most of the vessels, pumps, entire polymer shed of the plant, and all the control panels inside the Operator room were burnt. Entire operator room was blackened and covered with carbon soot powder from inside. All the electrical and instrumentation cables found to be 100% burnt.

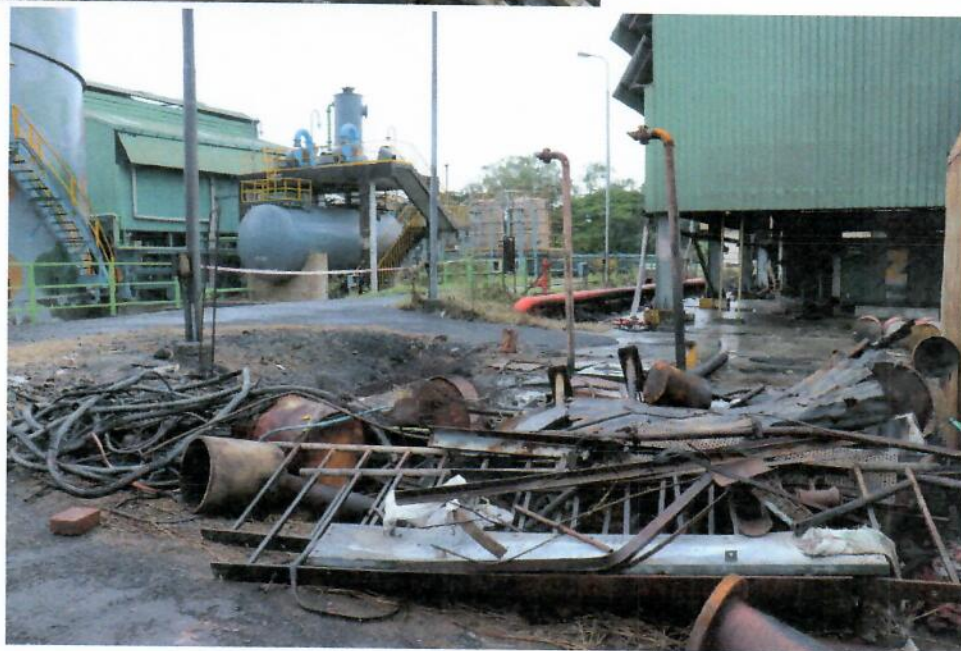




6.3 OWS Pit and pumps:
Both OWS pits of APU and C&C3 Plants were found totally burnt. Two Nos. Submersible pump of APU pit were found completely damaged along with its local control panel, accessory and cablings. Similarly, discharge pipeline was found to be in bend position due to excessive heat. Entire process cable network with its support cable trays were permanently damaged.



6.4 Condensate Handling Unit (CHU-IV): The fire burnt marks were observed on the support column of CHU and OWS drain pits of CHU. The storage bunkhouse in front of CHU also found burnt along with all the furniture.



7. Interaction with eyewitness and Inspection of CCTV footage:

Following persons working on the fateful day of fire incident were interviewed to get the possible scenario of the incident.

(1). **Mr. P J Rama Rao, Constable, CISF:** Mr. P J Rama Rao was posted at LPG Gate in the morning shift on 03.09.2019. He took over the post from Mr. Ashok at 5.00 am. According to him, everything was normal at the time of charge takeover except it was heavily raining. Both storm water channels from DM water plant and OWS pit sides were overflowing on roads. Around 6.30 hrs., he felt intense smell and breathing problem. When it became unbearable, he called the security control room to send his replacement, as he was not feeling well due to breathlessness.



LPG Gate Tripod : 03-09-2019 06:39:03.312
(GMT+05:30) Chennai, Kolkata, Mumbai, New Delhi

(2). **Mr. Digvijay Singh Baghela, Mr. Mohammad Akhlaque, Mr. Hari Om Yadav:** These three persons were part of CISF - STF team. After getting instruction from security control room, all the above three persons moved from NGL gate side in STF vehicle (Car No. 01) to see Mr. P J Rama Rao posted at LPG gate.



LPG Gate Tripod : 03-09-2019 06:39:52.117
(GMT+05:30) Chennai, Kolkata, Mumbai, New Delhi

Mr. Hari Om Yadav was driving the STF vehicle and they reached LPG gate at around 6:39 hrs. He

informed that their vehicle got auto accelerated while they reached at LPG gate and suddenly its engine got stopped with huge black smokes from the exhaust. He tried to

start the vehicle again, but it could not be started. Then, he left the vehicle there, in first gear with ignition key in the keyhole and without applying the hand break.

They observed intense smell in surrounding areas and started feeling acute breathlessness. Then, all of them along with Constable P J Rama Rao walked towards fire control room to inform the incident, suspecting hydrocarbons leakage. They also informed fire station that since there was hydrocarbon leakage, they should not take fire tender near the site.

(3). Mr. Prasad Damodar Mahatre, Lab person and Mr. Mahendra Prasad Mahto, Driver (Car No. -

02): Mr. Mahatre is a Lab Technical person who was returning by Car No. 02 after collecting muck samples at around 06:41 am. Mr. Mahendra Prasad Mahto was driving his vehicle. According to them, his vehicle also got auto acceleration and engine stopped with huge black smoke just behind the Car No. 01. Mr. Mahto tried three four times to



start his car but it did not start. He called another driver Mr. Amol Durugkar on mobile for his help. Both Mr. Mahatre and Mr. Mahto also felt intense smell there. At that moment, all the three STF persons and Constable P J Rama Rao were going towards the fire control room.

(4). Mr. Amol Durugkar, Driver (Say

Car No. 03): Mr. Amol received a call from Mr. Mahto about breakdown of his car at LPG gate and was requested to pick up Mr. Mahatre from there. Then, he reached at LPG gate and Mr. Mahatre was transferred in his car. Mr. Mahatre also advised Mr. Mahto not to start his car, as there might be



hydrocarbon leakage. Both Mr. Amol Durugkar and Mr. Mahto pushed the car no. 02 and parked the same around 30 - 40 meter away from the LPG Gate. Driver of this car, Mr. Mahto stayed back in his car, as it was raining heavily.

Subsequently, Mr. Amol Durugkar started his car and took a roundabout near LPG gate to return to control room. While taking roundabout, his vehicle also got auto accelerated leaving huge black smoke from the exhaust. However, the engine of the car did not stop this time.



While returning to control room, Mr. Amol Durugkar seen Late Shri C N Rao, GM (P), ONGC coming from control room in his vehicle (say car No. 04) which was driven by his driver, Mr. Kuleswar Yadav. He stopped him near OWS pit and informed about the intense smell near LPG gate. Shri C N Rao, GM (P) told him that he is going to see there.

(5). **Mr.Kuleswar Yadav, Driver (Car No. 04):** He brought Late Shri C N Rao, GM (P) from Control Room and dropped him near LPG gate. Thereafter, he left for Kharghar to bring the shift relievers as instructed by Mr. Rao.

Mr. Yadav also confirmed to Committee that while coming towards LPG gate, Late Shri C N Rao instructed him to stop the vehicle near OWS pit and talked to driver of Car No. 03. Subsequently, Late



Shri C N Rao also expressed his suspicion by saying him that “Yadav, it is too smelling here, it might be due to naphtha leakage”.

(6). Shri Jai Bhagawan, Sub Inspector (CISF-Fire) and Shift In charge:

After getting information of hydrocarbon leakage, he rushed towards site with fire tender along with his four fire staff, Shri Lakhwinder Singh, Late Shri Eraana Nayaka, Late Shri S P Kushwaha and Late Shri M K Paswan. But as advised by the CISF personal the fire tender was kept away almost 100 meters from the site and moved towards LPG gate on foot. When they reached the site, Late Shri C N Rao was present there and he told them that there is leakage of hydrocarbon, which has to be find out. Heavy rain was continued at that time and water was overflowing from storm water channels over the road. While Shri C N Rao was moving around in search of leakage, fire team decided to remove Car No. 01 from the gate so that the gate can be cleared for fire tender movement. Late Shri Eraana Nayaka opened the LPG gate.

While, Eraana Nayaka, S P Kushwaha and Shri M K Paswan were standing inside the pathway shed near LPG gate to save themselves from rain, Jai Bhagawan and Lakhwinder Singh moved backward to call more persons from the fire station so that the car can be removed from gate by pushing. While moving backward, he heard the voice



of Shri C N Rao saying that he had found the leakage and going to close the valve. At that time it is estimated that the distance between Jai Bhagawan and Lakhwinder Singh and the deceased Shri Rao could be nearly 50 meters or more. In the meantime, the Unconfined Vapor Cloud Explosion (UVCE) occurred triggered may be due to spark generated from DM plant area and all four persons Shri C N Shri Rao, Shri Eraana Nayaka, Shri S P Kushwaha and Shri M K Paswan caught in the fireball and succumbed to the injury.



(7). **Mr. Arvind Kumar, Shift In Charge, ONGC:** He was shift In charge and looking

after the entire processes of the plant during shift. At around 02.30 hrs on 03.09.2019, when he was on field round, got a message from control room that level of APU OWS pit had risen to 4000 mm which was 1800 mm at 23.00 hrs on the previous night. He went to C2C3 & APU OWS pits area along with C2C3 CT operator and HT air compressor/APU OWS pit operator, Mr. Deware and Mr. Ashish Ramtekke,



who informed him about filling of storm water channel with water and flowing of water over floor area due to heavy rain. They immediately started all three pumps of C2C3 OWS pit. Shift I/c then along with Mr. Ramtekke (OWS pit operator) went along storm water channels towards LPG gate till the sluice gate of outgoing storm water of plant. There was heavy water flow from both side channels (HT air compressor side and from OWS pit side). At that time, they didn't feel any smell of hydrocarbon in particular area.

Upon asking about the status of two pumps of APU OWS pit, Mr. Arvind Kumar confirmed that he started only one pump of APU OWS pit and another pump was under

maintenance. He also confirmed that valve of Storm Water Channel for diverting storm water in to APU OWS pit was opened and storm water was flowing in. This was the normal practice.

Just after the fire incident, he himself and Mr. R M Borkar, GM(Prod) operated the fire water monitors to contain the fire spreading from OWS pits to other surrounding areas. Later, Mr. R M Borkar also closed the valve of Storm Water Channel to stop storm water flowing in to the APU OWS pit.



8. Inspection of Control room and review of process data:

8.1 Following document/reports were made available by ONGC and those were reviewed by the committee at site:

- Plot plan of the plant
- Fire call list from Fire control station
- Previous Fire incident report occurred on 24.07.2004
- Post Mortem report of deceased
- ERDMP-Role of Incident Controller
- External Safety Audit report
- Drawing of OWS pit
- Risk assessment report
- Pigging Report
- Condensate Receipt in pigging

8.2 Following documents were also sought from ONGC to review, but the same were not made available by them:

- Shift In charge log book during the period from 01.09.2019 to 03.09.2019
- Process logs of OWS pit/pumps
- Process logs of CSU
- Online Gas detection report
- Detail of repairing job done before the fire incident, due to which plant was in shutdown (partially received)
- Process drain layout diagram
- P&ID of different plants
- OWS Level transmitter calibration report
- OISD Report on fire incident occurred on 03.09.2019

- Internal inquiry committee report constituted by ONGC management on fire incident occurred on 03.09.2019

8.3 After visiting the Process Control room, it was observed that:

- a) Process logs or events of the plant were not recorded by shift in charge in hardbound page book for the period from 01.09.2019 to 03.09.2019. Shift In charge informed that he had entered the events in his computer in excel sheet and handed over a print out of logs he had entered in the night shift of 02.09.2019. However, the panel engineers were recording the process parameters in the respective plant books. This was quite unusual.
- b) Level transmitter of APU OWS Pits were malfunctioning. C2C3 OWS pit did not have any level transmitter. There was no hydrocarbon detector near OWS pits and Storm Water Channel.
- b) Submersible pumps of OWS pits did not have Auto Start facility and it needed to be started manually after getting clearance from Process control room. However, Auto Shut off facility was available for the pumps.
- c) Display of CCTV was available in Security control room only and hence any physical movement could not be seen at Process control room.

9. Inspection of CCTV control room:

CCTV footage of various cameras available at the plant were made available to committee at Security control room. CCTV footage was clearly showing the movement of vehicles and working personnel before and after the fire incident.

Four vehicles approached LPG gate 30 to 40 minutes prior to the incident and all were emitting black smoke. Even two of them got stuck there and could not be started again. Probably due to rich hydrocarbon vapour atmosphere.

The origin of fire from an area near DM plant/LPG gate could be seen. The fire further spread towards OWS pits and remain concentrated there for long time. The heavy damage of DM plant area may be indicating that the origin of fire could be from the DM Plant.

Car No01 which was inside fire ball did not move an inch or was not blown off which indicates that the fire or explosion would not have originated from the vehicle itself.

These cameras are installed for Security purposes like entry/exit and any miscreant activities around the periphery of the plant. This system has not been installed for monitoring process activities.

10. Findings of the committee:

After thorough investigation, the committee identified the following,

a) **Past Process Event:** From the pigging report of MUT natural gas pipeline, it was observed that 26.5" poly pig was launched on 04.02.2019 which got stuck somewhere inside the pipeline. The management decided to launch another pig so that it may carry the stuck pig also. Therefore, a 26" bi-di pig was launched on 15.02.2019. This pig also got stuck in the pipeline and remained lying inside for a long time. Suddenly, high condensate/muck flow was observed inside the plant on 15.08.2019. This high condensate/muck flow also disrupted the gas-processing unit at Uran. This has also been confirmed from a letter of ONGC dated 04.09.2019, addressed to PNGRB regarding interruption in supply of gas to Mumbai consumers. On 31.08.2019, the bi-di pig was received at Uran plant with skin of poly pig and 200 kg of solid sludge/Black powder. A copy of pigging report and ONGC's letter to PNGRB regarding interruption in supply of gas are attached at **Annexure - 6**.

It is noteworthy to mention here that the shift In Charge, Mr. Arvind Kumar has mentioned in his observation in his typed log sheet of 02.09.2019 about presence of Floating Oil and debris in Storm Water Channel near NBPH (**Annexure 7**).

The committee vide its email dated 16.11.2019 asked ONGC to explain the mechanism of disposal of the condensate received from pigging, ONGC replied that on 15th august 2019 due to sudden arrival of stuck up pigs in 28" MUT gas trunk line, huge qty of condensate with muck and other contaminants entered CFU-III unit. Due to this plant had taken in s/d since 20.08.2019 to clean the muck and contaminants. The condensate was safely diverted to Crude Stabilisation Unit (CSU) via closed blow down system (CBD). The Muck and the associated condensate was rained safely to APU OWS pit.

b) From control room DCS trend, it was observed that 100% LEL was recorded in CFU-III at 0518 hrs on 03.09.2019 near pump no. 2601A/B and pump no.2604A. This could be due to hydrocarbon leakage in the plant, which later got carried away along with rainwater through Storm Water Channel.

It was also communicated during the discussions with working personnel that just before the fire incident; the deceased Mr. Rao had informed about the probability of leakage of naphtha and identified the source of leakage. He was going to arrest the leakage by closing the valve just before the fire incident occurred. However, exact location of the leakage was not communicated.

Fast spread of fire towards OWS pit also indicated presence of lighter hydrocarbon on the surface of storm water channel. Hence, there was every possibility of leakage of naphtha from one of the process units and accumulation in OWS pit. The situation might have further aggravated due to heavy rain carrying away huge condensate received from pigging in to the Storm Water Channel.

c) Storm Water Channel of respective units were lined up with OWS pits, which resulted in huge rainwater inflow in these two pits due to heavy rain. This also carried hydrocarbon condensate from the plants.

d) Proper monitoring of the level of OWS was not systematised and physical intervention was required to check the overflowing from OWS pit and storm water drain. Both C2C3 and APU pits were provided with pumps to evacuate fluid to effluent treatment plant. As informed by shift in charge, out of two pump installed in APU OWS pit, only one was running and another was under breakdown. However, operational trends of these pumps were not made available by control room.

From the DCS trends, it is evident that APU OWS sump level was 1410 mm at 21.00 hrs on 02.09.2019, which became 5058 mm at 03.30 hrs and 6068 mm at 06.28 hrs on 03.09.2019 after which alarm of bad process value was also received at 07.05 hrs. High Alarm level was set at 4750 mm which appeared at 02.30 hrs. However, as per as built drawing (Document No. 5015-LT-21-PD-01-EQ-0007), depth of sump is 4950 mm. Hence, there was every possibility of overflowing of hydrocarbons due to gravity.

The operation of disposal pumps of OWS pits were manual and after checking the level physically, the pumps used to be operated. It was observed that the pumping capacity was much less than the desired capacity. Hence, faster disposal of liquid from pit would require additional time so as to maintain the desired level.

Hence, inadequate evacuation through the pump resulted in overflow of hydrocarbon condensate from these pits, which later on formed dense hydrocarbon vapour cloud along the Storm Water Channel and entire area near LPG gate.

e) Two vehicles could not be started near LPG Gate due to rich mixture of gas & air, which was not suitable for complete combustion of vehicle IC engine. The same has been noted in CCTV footage; however, the same had not been identified /detected by the operation group/CISF personal as CCTV monitoring is meant only for the security purpose only. Nevertheless, as CISF is responsible for Fire- fighting of the entire plant, they should have the expertise to read such anomalies in the environment.

f) From CCTV footage, it appeared that the explosion took place in DM Plant and its roof was totally blown. It may also be possible that hydrocarbon vapour cloud got the ignition from electrical spark due to any cable fault or from electrical equipment in DM Plant.



LPG Gate Tripod : 03-09-2019 07:01:07.809
(GMT+05:30) Chennai, Kolkata, Mumbai, New Delhi



g) From CCTV footage it was observed that one of the crew member of fire tender entered several times in the stranded vehicle (car No. 01) while they were planning to shift that vehicle for clearing the road. It may also be presumed that the crew member would have also tried to restart the vehicle. Knowing fully well that they were inside the hydrocarbon vapour cloud, such action could have led to explosion.



h) In addition, record of regular check of spark arrestor of vehicles operating inside hazardous area was not available or practised. Breathing problem faced by CISF guard at the gate (Sri PJ Rama Rao at around 6-32AM) was another example of presence of rich

hydrocarbon mixture in the air at the vicinity of the security gate. Though he complained about breathlessness but that vital input was not considered in conjunction with the situation (over flooding of hydrocarbon etc in the drain) at the ground.

i) Cable passing through the Leader drain and galvanised water/air pipeline was intact. Hence, it is established that the drain was full with water and condensate was over flowing on the upper surface, which had reached on the road and other side of the drain. The same was evident from the fire marks available on the upper side of the drain and adjacent wall.

j) It was brought to the notice of committee that similar type of fire incident had occurred in OWS drain going outside the periphery of plant resulting into death of local person. That incident took place on 24.07.2004. As per the internal enquiry report which was made available to the committee, reason of fire was leakage of Naphtha due to partial closing of gate valve of GSU (Gas Sweetening Unit) which flew to the nearby storm water channel along the rain water. Limited capacity of OWS was also pointed out in this report. However, implementation status of the suggestions made by internal committee were not provided. A copy of the report is at **Annexure 08**.

k) This was the second time such incident had occurred at the same place i.e. Security cabin near LPG gate and hydrocarbon travelled towards storm water drain and towards boundary wall of the plant. The earlier incident also resulted in damage of High voltage power cables, communication cables & Instrumentation cables near the boundary wall (Storm water channel).

l) Although mobile phones were strictly prohibited inside the plant, however all communication with drivers and working personnel were done through mobile phone only.

11. Terms of reference of committee:

i. Identify the lapses/shortcomings:

- a) Overflowing of C2C3/APU OWS pit was not properly managed. One of the submersible pump was out of order since few days and Storm Water Chanel from various units were lined up to the OWS pit.
- b) There was no provision to see the level of C2C3 OWS pit from control room.
- c) This was repeated reportable similar fire incident, which had caused similar damage, and hence leakage of condensate/Naphtha could have taken place this time also. However, exact leakage point could not be ascertained due to limited process data made available to committee.
- d) Failure to notice the leakage even after reporting of 100% LEL from CFU-3.

- e) Provision of Gas detection system in storm water channel was suggested by internal committee who had investigated the fire incident occurred on 24.07.2004, which was not followed. Even there was no hydrocarbon detector in the OWS pit area.
 - f) The affected Area was not cordoned off immediately after getting the message from the CISF security about presence of hydrocarbon near LPG gate. Still there was vehicle movement and cell phones were in use.
 - g) The committee is of the opinion that hydrocarbon condensate/muck received from pigging previous day was not handled properly which would have also aggravated the situation.
- ii. Establish the root cause(s) of failure:
- a) Leakage of naphtha /condensate from LPG-III, CFU-III, CHU-IV or GSU-14.
 - b) Limited capacity of OWS for handling the hydrocarbons and limited capacity of disposal pumps.
 - c) Non-availability of gas detectors near OWS to check the gas concentration in case of leakage of hydrocarbon.
 - d) Interconnection between OWS pit and storm water channel created overflowing of hydrocarbon due to huge rainwater inflow in pits.
 - e) Probable source of ignition:
 - Short circuit or HT cable leakage near DM Water Plant
 - Non FLP motors in DM Water plant which were under operation
 - Spark generated due to use of mobile phone
- iii. Suggest improvements/remedial measures to prevent recurrence of such incidents:
- a) CCTV monitors were installed in the plant for security surveillance. It is suggested to provide the real time feed of these CCTV to Process control room also to check the movement of process personnel and any other abnormalities. So that such type of incidents could be averted much ahead of time.
 - b) Adequate care to be taken in rainy season to avoid the passing of liquid hydrocarbons from OWS pits, drains etc. as this may travel outside to nearby populated area which could turn into a disastrous situation in case of fire incident or gas leakage. This can be done by physical check of the liquid level transmitters of OWS pits.
 - c) It was observed that additional discharge line of OWS pit pump was directed into the open drain instead of ETP. This line might be used for discharging the

water into open drain going outside. But in case of overflowing of pit, this will aggravate the disposal of liquid hydrocarbon to open drain.

- d) Spark arrestors to the vehicle: its design, quality check to be done by authorised agency periodically (every 6 months).
- e) Frequent cleaning of the drain leading to sea during rainy season. Also outlet near the boundary wall to be widened. It was found out that the cleaning of OWS pit has not been done since its construction in 2014 and pit bottom could have accumulated sludge and dirt. Due to presence of sludge, the actual liquid handling capacity of the pit may have been reduced which was envisaged in the design. This will result in erroneous figure of the level transmitters. Hence, it is suggested for cleaning of the OWS pit on the regular basis.
- f) Firefighting job is entrusted to CISF. During interaction with them, the committee observed that CISF persons involved in hydrocarbon related firefighting did not have prior experience and adequate knowledge on the risk potential of such leakages. Hence Firefighting crew deputed for such jobs should be given sufficient knowledge about the process, hazards, do's, and don'ts in case of various scenarios as per risk analysis of the process plant.
- g) Although, online gas monitoring was being done centrally at the process control room, but additionally atleast audible local hooter system shall be made available at the critical points. This will help in life saving and avoid property damage by timely action of all concerned.
- h) Along with the monitoring of process parameter due diligence to be given to weather report and SOP for such scenario to be developed in Emergency Response Plan of the process plant.
- i) Hydrocarbon detectors should be installed around OWS pits and storm water channel approaching boundary wall.
- j) Although, portable gas detectors have been provided to plant personnel, same to be issued to CISF fire personnel, as they are available at stationery points whereas plant personnel are kept on moving. These detectors shall be calibrated as per OEM's requirement.
- k) Strict ban to be implemented on "Use of Mobile Phones" inside the process plant and serious action to be taken against the violators.
- l) All the vehicles running inside the plant area should have walkie-talkie system to avoid use of mobile phones.
- m) Existing location of CISF Security personnel to be shifted to safe location away from the drain to avoid any mishaps in the future.

iv. Fix responsibility:

The Committee has very clearly spelt out the lapses observed in the system which resulted into the generation of a risky situation which got converted into a serious accident, leading to death of four persons and huge loss of properties. The committee felt that this was avoidable situation had the local management maintained safe operating conditions and followed safe operating practices.

From above deliberations of the Enquiry Committee, it is proposed that decision of fixing of responsibility should be taken by the Management of ONGC appropriately, based on the findings.



J K Sarma



S P Garg



Md. Tanweer Akhter