

# Major fire incident at FCCU: Flare KOD draining to OWS

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## 1. THE INCIDENT:

FCC Unit flare KOD draining into open channel led to a Major fire incident in a Refinery recently.

In the beginning of night shift, the shift operators went for field round in Gas Concentration Unit (GCU) section of FCC. One of the operators started draining the liquid content from the unit flare Knock Out Drum (KOD) through a 2" dia. drain line. After 10 to 15 minutes time, suddenly at ~11:00 PM, fire erupted around the area of draining which subsequently engulfed the entire area including numbers of pumps, nearby OWS (Oily Water System) /Close Blow Down Catch Basin) as well as Instrumentation & electrical cables. Flame height was more than 10-15 meter from the grade level.

Considering the seriousness of the incident, disaster management plan was actuated immediately and fire was extinguished within 15 minutes. After ensuring no re-ignition, all clear siren was sounded after one hour and fifteen minutes from the fire incident time.

Electric power cables to the motors, instrumentation cables, pumps and instruments in the fire zone got burnt /

damaged due to fire. One employee received severe burn injury.

As a precautionary measure, FCCU unit was shut down immediately.

As per the subsequent communication the employee succumbed to the burn injury after 9 days. It was also gathered that unit was not fully stable on the date of incident, as the unit startup was in progress since a day prior to the fire incident date.

## 2. OBSERVATIONS

- As per the process, the uncondensed gases (comprising of lean gas, LPG and unstabilised naphtha) from the receiver drum, of main fractionator's overhead system is compressed by two stage WGC (wet gas compressors) and successively cooled in Air fin coolers and trim coolers. The condensed liquid (unstabilised gasoline) along with uncondensed gas is received in the High Pressure (HP) Receiver.
- The unstabilised gasoline from the HP receiver is transferred to the Stripper column, by the dedicated transfer pump, for further processing. The other stand-by transfer pump, is a common spare for transferring the liquid both from

HP receiver and Primary absorber column, which is having a separate dedicated pump.

- On the date of fire incident, in the evening shift, FCCU was in was unsteady in operation.
- At around 09:00 PM on that day, the pump, which was taking suction from HP receiver tripped. Operating people tried to start the other standby pump, but, it did not take start. As the standby pump did not take start, the earlier pump was restarted from Substation after resetting by electrical technician at around 09:25 PM.
- As a result of pump tripping, the level of HP receiver, whose operating pressure is 14.4 kg/sq.cm.g, started increasing from around 38% at 09:10 PM to 100% at 09:17 PM. To control the increase in level in the HP receiver, the throughput of the unit was temporarily reduced. However, the increasing in level had gone beyond 100 % resulting in popping up of Safety Valve. Of the HP separator.
- PSV popping got reflected in the in the DCS Panel; but since there was no Pressure Transmitter (PT) in the HP receiver, the fluctuation in HP separator pressure went un-noticed. The released material through PSV (which floats with flare K.O. vessel) of HP receiver is flared to flare K.O. drum of FCCU located inside the unit (operating pressure: 1.1 kg/sq.cm.g), from where lighter hydro carbon gases go to main flare header. Facilities exist to heat the

KOD condensate material by low pressure steam.

- As per the design provision KOD contents are to be routed to CBD but since lines to CBD for the last many years were defunct, liquid was drained to OWS; an unsafe act and not acceptable as per norms. Currently, provision exists to drain the accumulated liquid only to OWS instead of draining to CBD (Closed Blow Down system) as it is not maintained / defunct.
- At around 10:45 PM, the night shift field operator started draining from the KOD. Draining was kept continued, as liquid was coming continuously. The liquid drained from KOD comprise low boiling lean gas, LPG and unstabilised naphtha component etc., it started evaporating and formed vapour cloud around the area.
- The furnace (of FCCU) is located at a distance of only 5 meters from OWS drain against the OISD norm of 15 meter. Thus it (the source of ignition) is in very proximity to the area where the liquid from KOD is drained; vapour cloud formed due to draining of KOD material in OWS & resulted in explosion and flash fire.

### 3. ROOT CAUSE ANALYSIS OF THE INCIDENT:

- Facility has been provided in design for draining condensate/lighter material from the Flare KOD to CBD which is kept dis-functional since last few years. It is not permissible

to drain KOD material directly to OWS due to safety reasons.

- Draining of low boiling liquid containing LPG and naphtha component in the open drain connected with OWS manhole is the main cause of fire. The vapour cloud which formed from the drained liquid migrated towards the nearby Feed Preheater and caused fire. The liquid collected in the KOD should always be routed to closed blowdown system or slop system and not to open drain.
- The dedicated transfer pump, was having occasional starting problem particularly during change over schedule. The problem of any critical pumps/system should be analysed and corrective action taken promptly to prevent any unexpected failure of the system. In the extant case failure of pump led to high level in HP separator and consequential popping of PSV that led to high level in KOD.

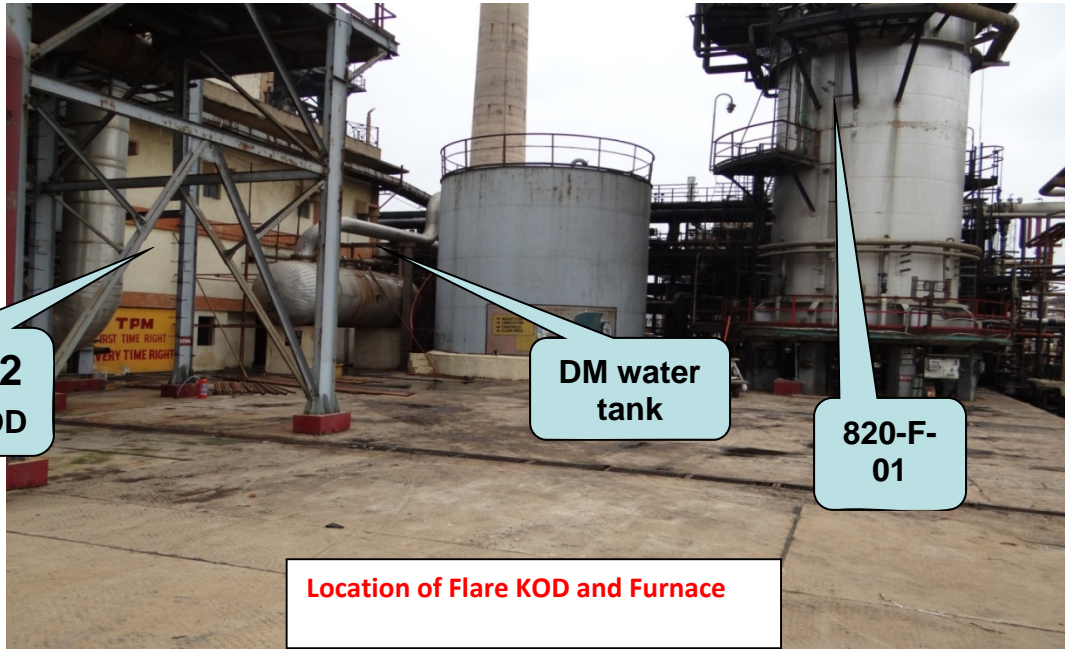
#### Lapses:

- Draining liquid from KOD into open channel instead to CBD system.
- Not rectifying defunct CBD lines from KOD since last few years.
- Non-rectification of electrical problem associated with spare pump which was identified two months back.
- Improper location of Hydrocarbon detector.
- Gap in communication.

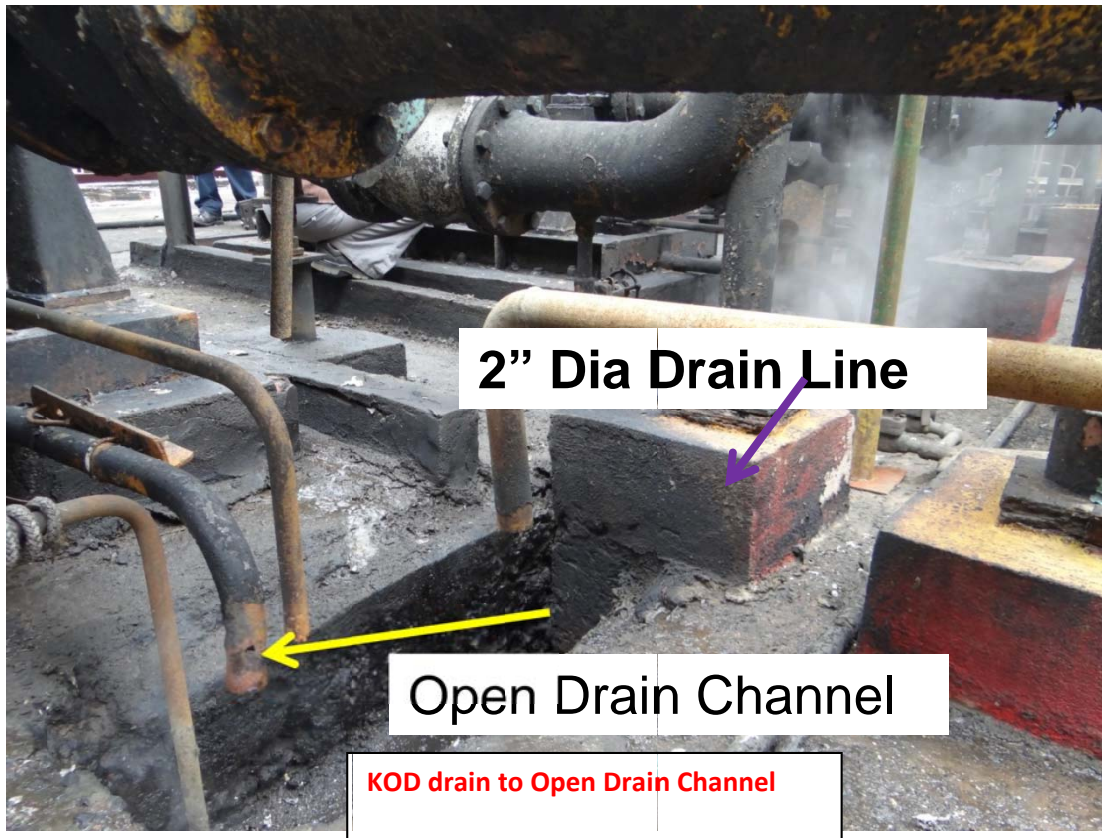
#### 4. LEARNINGS FROM THE INCIDENT:

1. Liquids from KOD should be routed to the Closed Blowdown system (CBD) as per OISD STD 106 and never to open drain / OWS.
2. Hazop study / MOC should be carried out for all Modification / critical Operations & implement the safety measures to prevent recurrence.
3. The transfer pump is a common spare for transferring the unstabilised gasoline from HP receiver, and rich gasoline from the bottom of Primary Absorber. Considering the criticality of the operation, providing independent pumps (one running + one standby) for both the system for continuous uninterrupted operation of the unit, may be looked into.
4. The present OWS manholes are very near to the process Feed Preheater. The separation distance is 5 M (approx.) as against the requirement of 15 M. The manholes should be immediately sealed in line with OISD STD 106 and 111. The displaced OWS vent lines should be repaired to prevent escape of vapour from the base of damaged portion of the pipe.
5. Immediate restoration of CBD facility must be taken up.

6. The HCD should be located close to the source of draining point for prompt early warning.
7. Decongestion of the area surrounding the KOD is required by removing the redundant facilities such as DM water tank and pumps along with allied facilities needs to be removed to provide more space around the furnace area.
8. Coordination between field operator, Panel and shift in charges must be strengthened for safe operation of the plant. Draining of KOD in night shift need to be carried out carefully in close coordination.
9. Provision of PT on the HP receiver with pressure indication and alarm in DCS panel should be available for taking quick action during any plant interruption.



**2" Dia drain Valve** Page 5 of 6



**2" Dia Drain Line**

**Open Drain Channel**

**KOD drain to Open Drain Channel**