

Fatal Incident at a Drilling Rig during production testing

-S/Shri Tarsem Singh & Anup Walia

1.0 Introduction:

A fire incident took place at drilling rig during production testing. The fire led to serious burn injury to one person; two other persons also received minor burn injuries. All the three injured persons were immediately rushed to hospital for treatment. The person with ~70% burn injury passed away on the 5th day.

2.0 Brief description:

The well (where the incident occurred) was drilled to target depth, 5 ½" production casing was lowered to bottom and cemented. After hermetical testing, the well was handed over for production testing.

The object interval was perforated and tubing string with BB shoe was lowered up to the top of perforation. Blow out Preventer stack was disconnected, removed and X-mas tree was installed. Well volume was displaced with water to activate the well.

Since the Well was not self-flowing in spite of maximum permissible drawdown, Bottom Hole Study (gradient survey) was carried out for quantitative analysis of hydrocarbon inflow at the bottom of the hole.

Based on the results of the gradient survey, it was decided to subdue the well and release the drilling rig for the next location. The well was to be subdued by displacing the hydrocarbon oil / gas, present in the well, by water with reverse circulation.

Pumping of water through annulus was started and the return through tubing (gas and oil) was being taken in crude oil tanks placed near waste pit. The return line consisted of 2 7/8" tubing connecting X-mas tree to two crude oil tanks with a T-manifold. This return line was not connected through mobile testing separator unit.

After five minutes of the reverse circulation, fire broke out near the oil tanks and one person with completely burning coverall was seen near the accumulator unit.

Two persons rushed to his rescue and received minor burn injury in this process. All the three were immediately shifted to hospital in the emergency vehicle of the rig.

Simultaneously, mud pump was stopped, X-mas tree valve was closed and the fire was put under control with the portable diesel engine operated fire pump.

The person with 70 – 80% burn injury passed away on the 5th day of the incident in the hospital.

3.0 Observations:

- i. It is evident from the IADC report of the rig dated 8th March, 2013 that there was continuous feeble flow of gas during the observation period. Gradient survey also showed presence of gas in the upper portion of the well bore. Still mobile production separator was not used to separate and discharge the gas at a safe distance from the rig. Though production

separator was available at the site at the time of this incident, as informed, the gas /oil were taken in the open roof crude oil tank.

- ii. SOP (Safe Operating Procedures) for 'Killing or subduing of well' is available in the 'ONGC – SOP Work over operations – onshore' but it was found to be deficient. It does not mention steps for separation and discharge of associated gas at safe distance from the rig, during this operation, when gas is present (in present case there was feeble flow of gas continuously).
- iii. Well killing job, requires continuous monitoring by testing team under a competent supervisor. It was informed that only one person (the deceased) from production side was present at the rig site during the well killing operation, instead of full testing team.
- iv. It transpired from the discussions with the site personnel that the deceased production engineer was not having portable gas detector with him during this operation.
- v. Accumulation of gas near the ground level is evident from the following:
 - The waste pit lining was found burnt starting from crude oil tank corner to 20 meters towards the rear of the drill site.
 - There was no indication of oil fire inside or outside the front crude oil tank. (Though both the tanks were receiving the well return fluid simultaneously).
- vi. It was informed that the deceased was a non-smoker and nobody had ever seen him smoking.
- vii. It was informed that there was no wind on the day of the incident and the weather was calm.
- viii. The crude oil tanks were not earthed.
- ix. There is no procedure in place to prohibit carrying cell phones in the operational area.
- x. The deceased person was not wearing fire retardant overall.

4.0. Root cause of the incident:

I. Explosive flammable environment due to not taking Oil/Gas separator system in line:

The root cause of the incident was not taking the oil/gas separator unit in line. Normal operating practice is to take the oil/gas separator system in line to prevent gas escape to open atmosphere. This is a serious violation of operating procedure. Gas cloud may have formed near the tanks in the absence of oil / gas separator unit due to the following reasons:

- (a) Feeble gas was flowing from the well to the crude oil tanks through return line during 'well under observations' period.
- (b) During reverse wash of the well, gas volume of upper portion of the well was displaced and released at the top of the crude oil tank.

In the absence of the flowing wind, gas released at the top of the crude oil tanks may have formed a cloud near the tanks.

II. Source of ignition:

There was no supervisor to control the well subduing operation. The only production engineer available may have gone to check the gas / oil leakage, if any, in the T-manifold hammer unions near crude oil tanks during reverse circulation.

As there was no mechanism in place to control the use of non-spark proof tools, it is quite likely that normal cast iron hammer was used during tightening of leaking hammer union joint of T-manifold resulting in spark which ignited the explosive/combustible atmosphere already existing in the area.

Role of inadvertent use of mobile phone acting as source of ignition cannot be ruled out.

- Source of ignition could be spark generated from use of non-flame proof tools or use of mobile phone.

5.0. Recommendations:

- I. The deficient SOP for 'Killing or subduing of well' should be modified. It should include the steps to be followed to ensure separation of associated gas from oil and its discharge at a safe distance from the rig. SOP should be followed diligently. (Had the adequate SOP been there and was being followed, oil / gas separator would have been lined up to receive well return).
- II. Carrying of Mobile phones inside the operational area shall be prohibited.
- III. Only non-sparking tools should be used where there is any chance of presence of hydrocarbon.
- IV. Work permit system should be enforced strictly. Gas % should be checked before carrying out any job in hydrocarbon bearing area.
- V. Persons working in hydrocarbon environment should wear coverall made of fire retardant cloths. Critical operations should be carried under the supervision of a competent supervisor.
- VI. Production crude oil tanks should be earthed (refer OISD – STD -216).