

BLOWOUT IN A WORKOVER RIG WHILE SUBDUING THE WELL

Introduction:

An incident of uncontrolled flow occurred on a workover rig which was deployed for recompletion of well with packer. This has resulted in loss of hydrocarbon production and loss of property.

Well history:

The well was drilled up to 2665 mts. in 1988. Object-I, was tested and found to be mainly water producer with non-commercial quantity of gas. Object II was also water producer and was isolated by placing a 150 mt. cement plug with top at 2515 mts.

Object III, was tested and found to be commercial producer of gas. During bottom hole study leakage was observed in 5 1/2" casing between 410.29 - 416.46 mts. Leakage was repaired by squeezing cement in the 9 5/8 X 5 1/2 annulus. Well was activated with maximum FTHP-210 Kg/cm² and CHP-126.58 Kg/cm² through 6 mm bean with a maximum buildup pressure of 212 Kg/cm².

The well was currently producing about 45000 m³/day of gas. Static reservoir pressure was recorded to be 108.13 Kg/cm² at 2200 mts. in Feb.2011. On 12th of June 2011, STHP and SChP were recorded to be 80 Kg/cm².

Brief description:

- Rig building job was completed on 12th of June, 2011. Subduing of well with water was initiated.
- Well was bled to 60 Kg/cm² followed by pumping of 28 m³ of water through tubing and reverse circulation was carried out. Well could not be subdued as activity (water coming out with surges) was observed (STHP-45 Kg/cm² & SChP-38 Kg/cm²) at 1800 hrs. Well was shut-in.
- Revised/additional plan issued on 13th of June to subdue the well with mud of sp.gr 1.05 and mud preparation job at site was taken up.
- On 14th of June, STHP-78 Kg/cm² & SChP-78 Kg/cm² was recorded at 0800 hrs. Subduing of well with water was taken up through annulus with 6mm bean in the outlet line (flow arm). Water circulation was carried out for half an hour. THP and CHP were recorded to be zero. Circulation was continued for 2 1/2 hours.
- Water in the well was displaced with approx.20 m³ mud having sp.gr 1.05 and circulation was carried out for half an hour.
- Well was kept open and observed for half an hour. No activity was observed. Both side pressures (casing and tubing end) were recorded to be zero.
- While removing of X-mas tree observed a small kick (self flow) in the well at 1830 hrs. on 14.06.11.
- Christmas tree was repositioned and while attempting to tighten studs, well activity (flow of gas and mud) increased and tightening of studs could not be done. There was uncontrolled flow of dry gas through adapter flange and flow arm valve.
- Crisis management team reached at the site on 15.06.2011 afternoon. Equipment and materials were mobilized. Subduing the well was attempted on 16.6.2011 but could not succeed due to short circulation.

- Gas and water was flowing out from 7 1/16" X 5M adapter flange fitted with tubing hanger, flow arm valve and crown valve.
- On 17.6.2011, X-mas tree got completely damaged (cut) and fell off from the well head, resulting in the flow of gas and water in the vertically upward direction to about 15 mts.
- On 20.06.2011, well was capped with 7 1/16" BOP (Blow out preventer) and subdued well with mud of sp.gr.1.30 and kept under observation.

Root Cause of the incident:

Immediate cause of the incident

The immediate cause of accident could be:

- Inadequate monitoring and absence of documented procedure for gas well subduing.

Contributing factors

1. Lack of planning

No record of out-coming fluid (water/mud) parameters (that may have got gas cut due to gas ingress) and volume (there may have been loss) was available.

As no proper pumping rate and pressure profile was made and recorded it is possible that during well killing process gas continued to move up the well.

2. Deficient content in instructions/procedures

Activity was observed during well killing operation but it was found that no specific (written) instructions were conveyed to the rig crew about the procedure and consequences and handling the potential risk of the uncontrolled flow of gas.

Documented procedure for killing of gas well was not available.

3. Deficient personnel competence

In line with OISD-RP-174; Asstt. Shift Incharge / Asstt. Driller and above supervisory personnel should have valid accredited well control certificate (well intervention, for work over operations, of the appropriate level). At least one trained person should always be present to observe well for any activity even during shutdown period. During investigation it was found that present DIC and shift in charge did not have valid well control certificate.

Recommendations:

The recommendations as brought out below should be addressed, to prevent recurrence of such incidents and to improve the safety practices.

- 1) Documented procedure for killing of gas well should be available. Written instructions with clarity should be given for better understanding of the job.
- 2) In line with OISD-RP-174; Asstt. Shift In charge / Asstt. Driller and above supervisory personnel should have valid accredited well control certificate (well intervention, for work over operations, of the appropriate level).
- 3) Well plan should be checked for completeness of its contents (like tubing shoe depth, status of earlier remedial cement jobs) before issuing to rig. Incomplete information may lead to serious consequences.

- 4) Certain amount of time is required for the gas to migrate upward through falling kill fluid after the pumping ceases. Gas migrates upward app. at 1000 feet per hour, though in some cases it could be more or less as the migration rate depends on factors like density difference of well bore fluid and gas influx, viscosity of drilling fluid, degree of mixing of gas with well bore fluid etc. Therefore after stabilizing the well, it is important to wait/ observe well for sufficient period i.e. maximum anticipated time required to remove X-mas tree and installation of BOP plus adequate safety margin. Thereafter, one complete cycle circulation should be given before proceeding further for BOP installation.

It is also suggested to place high viscous pill at the bottom to minimize gas migration, in gas/high GLR wells.

- 5) JSA about the potential risk of uncontrolled well activity should be carried out before start of operation.
- 6) Monitoring of pumping rate and pressure during subduing to keep bottom hole pressure constant i.e. circulate out influx and not allow further influx entering in the well bore.
- 7) The parameters of return fluid during circulation, till well is subdued, conditioned & stabilized should be monitored & checked.