NOPSEMA

Safety alert 65

July 2017

Well annulus leaks gas-lift inventory from failed instrument line

What happened?

Failure of an instrument tubing line connected to a wellhead gas lift line resulted in the release of a significant volume of hydrocarbon gas from the production annulus over a time period of 3.5 hours, elevating the risk on the facility during the release. Although initiation of the surface shutdown also closed the shutdown valve fitted to the gas lift line, this did not isolate the flow of hydrocarbon gas from the production annulus as the failed instrument line had been located on the gas lift line between the wellhead production annulus and gas lift line shutdown valve, see Figure 1.

Figure 2 provides an example P&ID that shows the instrument take-off point located downstream of the UV (Multivariable) shutdown valve.

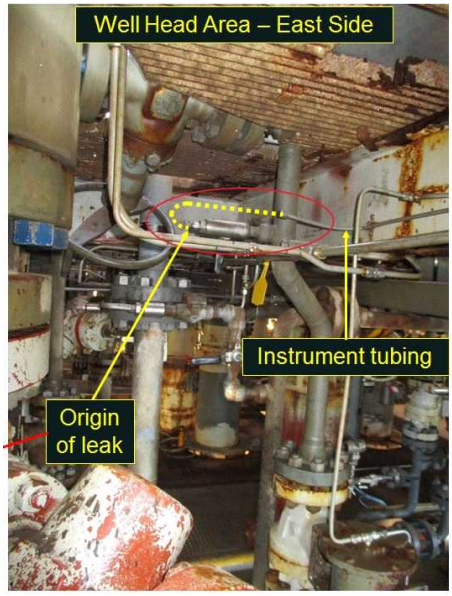

Figure 1 – Location of failed instrument line (dashed line) fitted to gas lift line between the production annulus wing valve and gas lift shutdown valve.

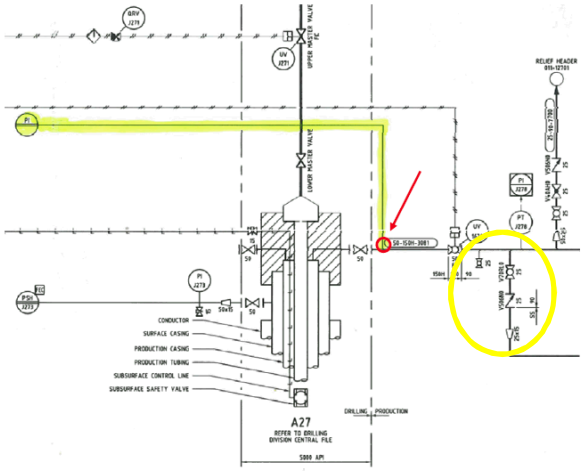

Figure 2 – Example P&ID drawing showing the instrument take-off point (arrow) incorrectly located downstream of the UV shutdown valve (circled).

Good design requires that the gas lift shutdown valve (SDV) should be as close as practicable to the wellhead with any fittings to the gas lift line on the upstream side of the gas lift SDV ensuring a barrier to gas in the production annulus in the event of any failure of fitting.

What could go wrong?

Locating the fitting for the instrument tubing line between the production annulus wing and gas lift shutdown valve created the potential for an unrestricted pathway from the failed instrument tubing line to the full volume of the production annulus. “This configuration is contrary to international guidelines and standards” (see References).

In this configuration, leaving the manually operated wing valve open to the production annulus to allow daily readings of the pressure in the production annulus resulted in an unrestricted pathway from the production annulus to the failed instrument tubing line as the shutdown valve was not able to safely isolate the gas inventory of the production annulus.

Key lessons

The following should be considered:

- The risk for an uncontrolled gas release of a significant volume of hydrocarbon gas from the production

annulus of gas lift production wells requires that effective barrier controls are in place.

- Valve fittings, instrumentation and small bore tubing fitted to wells that may be subject to movement due to thermal change from production or wave motion have the potential to be damaged or suffer an integrity failure which may lead to an unrestricted pathway for release of hydrocarbon gas.
- Damage or loss of integrity to valve fittings, instrumentation and small bore tubing fitted to wells may compromise the integrity of the secondary barrier envelope and could lead to a situation of relying on a single barrier envelope to control the well reservoir.
- Maintaining well integrity with a two barrier philosophy is considered good industry practice.
- Gas lift line shutdown valves (SDV) should be fitted as close as practicable to the wellhead and the SDV should be activated with the same signal as the surface safety valve to effect isolation of the gas lift line and any small bore take-offs.
- Keeping abreast of relevant industry literature: the risks of significant gas lift gas release had been identified previously. Refer to publications referenced below.

The legislation

Schedule 3 of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* places specific duties on the operator of a facility to take all reasonably practicable steps to ensure that any plant, equipment, materials and substances at the facility are safe and without risk to health.

Facility operators, employers, and persons in charge of work activities should review their wellhead configurations, with regard to the above information.

References

The following publications provide further information on the issue of gas lift well integrity:

2016, Oil & Gas UK, Well Life Cycle Integrity Guidelines *'Configuration should be such that a sidearm valve can be closed to effect isolation should the instrumentation or gauge assembly be knocked off the wellhead', 'If wells are gas lifted, the surface wellhead should be designed to reduce the risk of loss of 'A'-annulus containment to ALARP.'* Ref. Oil & Gas UK, Well Life Cycle Integrity Guidelines, Issue 3 March 2016, ISBN 1 903 004 71 6

2014, Zakum Development Company identified for gas lift production and injection wells '… the risk of venting significant lift gas volumes to atmosphere in a manned area through dropped objects or other failures.' Ref. 2014, Newton. D, Odom. W, Burchell, G, Kofoed. C, Surface Safety Systems Enhances Gas Lift Safety and Optimizes Surface Line Architecture on Island Wells, SPE 171748

2013, NORSOK standard D-010 Well integrity in drilling and well operations section 7.7.2 Gas lift wells "The large volume of pressurised hydrocarbon gas in both surface lines and in the A-annuli represents a substantial risk to a platform. The volume of release hydrocarbon gas due to accidental damage to the tree, wellhead or surface lines shall be minimized. 2013, NORSOK standard D-010 Rev 4. June 2013

2011, Offshore Magazine published an article *'…many major operating companies are looking to eliminate the well integrity compromises that have previously existed in their gas lift well designs, with particular regard to: the risk of high pressure gas venting from the annulus in the event that the HP lift gas flowline or wellhead fixture to the annulus is damaged.'* Ref. 2011, Brodie. A, Petroleum Technology Co. Gas-lift valve design addresses long-term well integrity needs, Offshore Magazine

2007, BP Clair Platform design review identified *'…integrity of the tree/wellhead assemblies and to include both annular safety valves and integral wellhead gas lift check valves. …gas in the annulus is isolated to the maximum possible extent should a failure of the gas lift line and / or connection at the wellhead occur.'* Ref. Tam. T, Coleman. S, 2007, The BP Clair Platform: A Case Study of Application of Layout in the Control of Explosion Hazards, IChemE Symposium Series No. 153.

Contact

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