INCIDENT NO 1: DROPPED DRILL PIPE

Background

2 x 30 ft lengths of 3½” heavy weight drill pipe [‘skinny pipe’]

4¾” accelerator

3½-4½” crossover sub

5 ft long 5½“ section of regular drill pipe [pup joint]

As the assembly was lifted up the Derrickman working near the top of the racks, passed a sling near its upper end. The sling was connected to a winch used for pulling stands toward their storage locations after they are released from the lifting machinery. The Derrickman was unable to reach the lifting release mechanism because the assembly was about 3.2 m longer than a normal stand. To overcome this problem the Assistant Derrickman was winched aloft in a harness [manriding]. He attached a rope to the lifting release mechanism and passed it to the Derrickman. The Assistant Derrickman was then lowered down to the drill floor.

Immediately after the Derrickman pulled the rope to release the assembly from the lifting machinery, its self weight caused it to bow away from its vertical stance. Some bending of this nature is not particularly unusual. However, in this case the bowing was aggravated by the reduced ability of the 3½“ skinny pipe in the assembly to resist bending under the weight of the heavier items above. The bowing continued. Having the effect of shortening the overall length of the assembly period. This caused it to slip free from the sling the Derrickman had placed near its upper end earlier.

Now completely unrestrained, and with its bending still progressing, the assembly fell against the drill pipe racked in the opposite [starboard] side of the derrick. It slipped between these pipes and fell against the derrick structure. As it fell the crew on the drill floor ran to safety, with the exception of the Assistant Derrickman who was unable to escape because his manriding harness restrained him. He took cover behind some steelwork nearby. The lower end of the falling assembly missed him by only a few feet. When the assembly hit the derrick a combination of its acquired momentum and the design of the derrick caused it to topple and fall toward deck of an adjacent supply vessel, striking a heli-fuel tank.

INCIDENT 1 - 2nd SHEET

Considerations

1. Equipment fell in an uncontrolled way.
2. Workers were exposed to unacceptable risks.
3. There was a MH risk created.
4. A work instruction was issued that did not support established procedures.
5. The work instruction was complied with, but the procedures were violated.
6. Relevant procedures were not reviewed when planning the task.
7. The task risk assessment for the operation did not reflect hazards detailed in the associated procedures.

Principal Causes

1. Weaknesses in the safe system of work operated on the rig as regards producing, reviewing and approving drilling work instructions that supported established procedures for specific tasks.

2. The task risk assessment for the operation did not identify the hazards of racking accelerators that are 4¾" outside diameter or less in the derrick.

3. The requirement to review relevant procedures for the operation prior to proceeding with the task was not followed.

4. There was no systemised method for planning the lifting and lowering of bottom hole assemblies.

Contributory Factors

1. The work instruction was treated with higher precedence than standing procedures for the operation.

2. There was a focus on reducing risk by minimising the time during which the well was left open.

3. The Driller perceived the supervisory workload as higher than usual. This may have reduced his attention to operational issues.

4. The Driller was regarded as competent and experienced by his superiors and was not supervised to the extent that might have prevented this incident. There was over reliance on his ability to detect and deal with the hazard that was present.

INCIDENT No 2: OVERPRESSURE OF RELIEF LINE TO FLARE

Background

A Pressure Safety Valve [PSV] had been intermittently lifting on a process gas line causing an increase to flare even when operation was steady-state. This was assumed to be due to a problem with the valve seating.

The Technicians decided to attempt to reduce the flaring and reseat the PSV by ‘cracking closed’ a block valve downstream of the PSV on the relief line to the flare. The increase in back pressure was found to be sufficient to reseat the PSV and reduce flaring. This process was carried out on a number of occasions.

On closing the block valve on an occasion as described above a flanged joint ruptured on the upstream side of the block valve. This caused minor injury to the Technician closing the valve. In addition a significant volume of process gas was released until the inventory in the line depressurised sufficiently for the PSV to reseat. Fortunately the hydrocarbons released did not ignite.

Pipework downstream of a PSV is not rated for the full process pressure on the upstream side, as it is open to atmosphere via the flare system. There is therefore a pipework specification change at the PSV. Any valves on the downstream relief pipework should therefore be locked open to prevent the line from seeing this full process pressure.

In this case the action of closing the valve was coincident with an overpressure of the PSV and significant back pressure was generated by closing the valve. The weak link in the system was the flanged joint on the downstream side which blew out.

INCIDENT No 2 : Sheet 2

Considerations

1. An unauthorised procedure was developed locally which did not involve any form of risk assessment. It was clearly an operation outwith normal operating procedures.

2. The downstream block valve was a locked open valve for which a controlled register and isolation procedure existed, requiring approval for issuing the key and permitting the closure. This procedure was bypassed.

3. No permit to work was issued for the task despite the fact that it involved change of status of a locked open valve.

INCIDENT 3: Release of hydrocarbons and fire

Incident – a fire occurred and 2 people received burns during a boroscopic examination to identify the reasons for persistent problems with the tripping of a hi hi level control valve [LCV] on a gas suction scrubber.

Background – a cold work permit was raised for the removal of the LCV actuator body and valve bonnet; this allowed access to inspect the valve body and the pipe work both up and down stream of the valve

The system was isolated, drained and purged with nitrogen; this was confirmed to the control room. No formal toolbox talk was held because this was a 'routine job'.

A small amount of fluid released when the LCV actuator and bonnet were removed. Fluid was clear with no smell. Portable gas meter read 4% of LEL, hence fluid assumed to be predominantly water. Inspection showed the valve was clear; however an M8 stainless steel bolt (15mm length) was found upstream the valve.

Following discussions with OIM and Ops Supervisor it was agreed to inspect the pipe work upstream LCV as far as emergency shutdown valve ESDV 3009 using a boroscope. This was done and no debris found.

Following further discussions with OIM/Ops Supervisor it was decided to inspect the pipework to the bottom of the scrubber drum. This would require ESDV 3009 to be opened. It was assumed that the bottom shell of the scrubber would contain about 90 litres of fluid when drained, but because of the low gas readings and the assumption that the fluid was predominantly water, it was considered safe to make a further change to the workscope. The introduction of non-intrinsically safe equipment (boroscope) was not risk assessed.

When ESDV 3009 was partially opened there was a rush of fluid. The valve was closed and the fluid washed down into the open drains. The valve was opened and closed several times until the fluid ceased to drain. Hand held gas detection was ongoing throughout – 4% LEL. Baroscopic examination through ESDV 3009 revealed no debris. Boroscope was withdrawn and was being coiled when flames flared up around both of the workers involved. The flames rose several feet in the air around the men; fortunately there were no serious injuries and the fire was extinguished by the platform fire team and deluge system.

INCIDENT 3 - Sheet 2
Considerations

- The initial workscope and system of work developed to carry out were satisfactory.
- The change of the workscope and the decision to introduce the boroscope without fully considering the implications of introducing a non intrinsically safe piece of equipment into any area where hydrocarbons are likely to be present.
- The change to the workscope with the opening of ESD 3009 and draining the contents of the bottom of train 'A' suction cover via the bonnet of LCV 3006 contrary to the company's safe operating practices, without fully evaluating the potential consequence of that change – that is a possibility of releasing hydrocarbons into an area where a non intrinsically safe piece of equipment was to be operated. Failure to recognise this potential, put hydrocarbons and a source of ignition together.
- The failure of both the fixed and portable gas detection equipment to detect the gas which was clearly present gave the people doing the work, a false sense of security. Their faith in the equipment and the readings it was giving was clearly misplaced.

Conclusions as to Causation
A fire occurred because 90 litres of fluid, containing hydrocarbons was drained onto the deck below train 'A' gas compressor scrubber. Hydrocarbons were released from this fluid and ignited. The source of ignition is not known, but there is a strong possibility of the non intrinsically safe boroscope was in the location at the time of the incident and provided the ignition source.

Preventative Measures
The main contributing factor to this incident occurring was the decision to drain the lower contents of the gas scrubber onto the deck contrary to the company safe operating practice, which calls for such fluid to be drained into a closed drained system, or a suitable closed container. A route was available to drain the fluid into the closed drain system, but was not used. Had the fluid been drained via valve G5274 with its spectacle blind swung to the closed drain system, it is unlikely that the incident would have occurred. Preventative measures that would have prevented the incident are:

System of work that provided the following:

1. Suitable and sufficient assessment of the risks to the personnel undertaking the task and implementation of risk control measure;
2. A system of work that facilitated the identification of the more suitable drain point that ensured the majority of the fluid was drained to a safe location;
3. Hydrocarbon freeing arrangements would have ensured the vessel was gas free; and
4. Audit and review arrangements for systems of work
5. Gas detection able to identify all the gases that had the potential to be released on the installation.

INCIDENT No 4: RELEASE OF CONDENSATE GAS

Incident - Well clean up and testing was taking place on an installation when a 'blowby' occurred leading to a 3,000 kg release of condensate and gas to atmosphere – a similar order of magnitude to the initiating event leading to the Piper Alpha disaster.

Background – following drilling completion, well clean up takes place through separator X – a separator that was neither designed for well clean up, nor to handle solids and carry over. The separator train incorporated sand filters. Upstream and downstream sand detectors were in place. Every 6 – 8 hours the duplex filters are switched for cleaning and flushing. Operators routinely use separator X in a 2-phase gas/liquid separation mode.

At some point prior to the incident the sand filters had collapsed causing a build up of proppant in the separator and ultimately into the condensate outlet. This was not detected by the installed pressure monitoring, the down stream sand detector or by the operators. The combination of sand and liquid increased the rate of erosion of the Level Control Valve; this valve has a history of poor performance; lasting only 6 - 9 months service. Level control became increasingly difficult due to damage.

When clean up of well A was complete, the operator's next task is to bleed down the wireline equipment; to do this he decided to drain the liquid from separator X. He inhibited the low liquid level trip to force the safety valve open, but did not seek authorisation, or log the inhibit. Liquid was drained off to downstream oil separator and the safety valve isolated manually to prevent backflow. Separator X was depressurised.

Later that same day a decision was made to test well B [known to produce a reasonable quantity of gas, little liquid and no sand; hence sand filters not required]. A different operator was involved; he was not aware that low liquid level inhibit had been left ON.

During the well test there was very little liquid in separator X; this resulted in a condensate and gas blowby to downstream equipment. This caused extremely high erosion rates and disintegration of the downstream valve internals, followed by rapid erosion, and gas leak at a piping reducer downstream. There had been frequent previous failures of this downstream valve, none of which had been investigated.

Gas detectors shut down the installations and Control Room Operator manually depressurised the system.

A few minutes after the initial release a much larger second release occured when condensate from the inlet pipework of the downstream separator flowed back to separator X causing rupture of the piping reducer.

INCIDENT No 4 - SHEET 2

Considerations

Causation

- Well clean up filter cartridges allowed sand to pass forward into separator 'x'.
- Well clean up filter pressure differential gauge set up was not adequate to detect filter failure.
- Well clean up filter sand detector did not pick up the low quantities of proppant passing the filters.
- Separator 'x' was not designed for well clean ups and hence handle solids and carry over. The original design philosophy was a dedicated well test separator.
- Wireline operation required depressurisation to flare via separator 'x'.
- Operator error to reinstate the separator 'x' low level trip – the inhibit meant that when the level was lost there was no protection to prevent gas blowby.
- Separator 'x' liquid outlet valve designed was susceptible to erosion due to small size of valve and small reduce diameter. Frequent valve failures not followed up.

Remedial Measures Identified

- Review design and operation of separator 'a' – identify solid flushing requirements, additional emergency shutdown, safety and non return valves. Also replacement of level control valve.
- Review design and operation of sand filters – calibration and sand management strategy.
- Review use of inhibits – create common procedure for control of inhibits across all company sites, and provide written confirmation that interim measures are in place for control of inhibits.
- Review competence and training – comprehensive competence training included but not limited to gas blowby awareness. Also develop a programme of risk awareness training.
- Review improved safety management system – issue guidance on management of change and use of formal safety reviews; review management of change and ensure control measures are in place; review and recommend improvements for recording analysis of maintenance data and implement changes to SAP.