



FUELS INDUSTRY
Association of South Africa

IOGP Process Safety Events – 2023 (SAPREF)

2024



INCIDENT – Production (Pg 8)

INCIDENT SUMMARY:

November 2023 a gas leak occurred on a HP separator at facility in Nigeria. The hydrocarbon leak resulted in a fire / Explosion causing asset damage to > \$100 000.

CAUSES / LEARNINGS:

1. MoC / Design:

- Leak occurred on a line connected to the HP system connecting the HP separator to the MP header. This line was not part of the original design, and was installed later to divert the gas to header on MP mode in anticipation of depletion of the HP wells in future. The configuration of the system allowed for this line to operate at higher pressure than design.
- ***Management of Change (MoC) process and related risk evaluation is crucial to ensure plant integrity.***

2. Training and Competence:

- Leading up to the incident electrical power and UPS was lost. 3 UV valves on the HP gas header outlet to flare failed closed. The UVs needed to be manually reset by the operator on site (to reopen). This action was not performed by any of the operators even though there was an alarm on the DCS alerting to the situation.
- ***Always monitor process parameters both from DCS and with on-field checks***
- ***Ensure that operators are properly trained on tasks to be performed and skilled according to their job position.***

3. Preventative Maintenance:

- There were 2 sets of PV valves connected to the HP flare, which were supposed to open for discharging the excess gas. However, only 1 out of 2 sets of PV valves partially intervened to discharge the excess gas. The other set of PV valves did not respond.
- ***Always ensure Safety Critical Equipment are well maintained, reliable and available.***



INCIDENT – Production (Pg 12)

INCIDENT SUMMARY:

January 2023 10m³ of oil was released to sea from a Floating Production Storage and Offloading (FPSO) facility in Angola due to an upset in the produced water (PW) treatment system. The release was above the threshold quantity in any 1-hour period.

CAUSES / LEARNINGS:

1. Key information not tracked:

- An inhibition was implemented on oil/water interface level in a PW decantation tank without proper tracking, and consequently inhibition was left in place for 7 days resulting in the oil/water interface level in the decantation tank reaching a critical level close to oily water booster pump suction. Oil was carried over to the downstream hydrocyclone and surge drum, and a part of it was routed to overboard, leading to a spill.
- Inhibition left in place was not captured or tracked through shift event log and at shift handover
- ***A list of alarms that are inhibited on DCS should be produced in the log detailing the alarm, reason for inhibition, existing mitigations and whether inhibition of this alarm has been covered by weekly alarm management review.***
- ***Quality of technician log required improvement. Key information must be clearly highlighted. This information must be discussed at shift handover.***

2. Preventative Maintenance & Design:

- Two level transmitters on PW decantation tank that should have triggered an alarm/shutdown but turned out to be not working at the time of the event.
- Two analyzers that should have detected out of spec water were also not working. It was also found that the analyzer's selected technology was not fit for purpose.
- ***Always ensure Safety Critical Equipment are well maintained, reliable and available.***
- ***Ensure equipment is fit for purpose at design stage.***



INCIDENT – Production (Pg 14)

INCIDENT SUMMARY:

September 2023, in an Angolan facility during a de-slopping operation, a valve spuriously opened, causing the slop tank pump discharge header to connect to the Crude Oil Tank transfer manifold. Oil from transfer manifold contaminated the discharged slop water (to sea) resulting in a release above the threshold quantity in any 1-hour period.

CAUSES / LEARNINGS:

1. LOTO:
 - System card was found in short circuit. Valve activated and opened several times.
 - ***Standing instruction was issued to allow Slop discharge only if the valve was confirmed to be Locked closed.***
2. Proactive Monitoring:
 - Oil Discharge Monitoring System (ODME) was not functional.
 - ***Improve reliability of ODME: Review operating conditions, perform tests in different conditions (with and without slop water treatment package online), review adequacy of technology.***



INCIDENT – Planned Shutdown (Pg 14)

INCIDENT SUMMARY:

December 2023, in an Angolan facility a bleed valve located on a high-pressure compressor discharge shut down valve (SDV) to the gas injection system leaked, resulting in gas release to the process area activating alarms and a process shutdown.

CAUSES / LEARNINGS:

1. Valve Installation:

- Installation procedures do not include requirements for checks on valve fittings..
- ***Update installation procedures to check all valve fittings, including bleed valves.***

2. Maintenance:

- Blow down valve was not maintained in accordance with company guidance issued.
- ***Non conformance to processes and procedures. (Behavioral)***

3. Emergency Response:

- Emergency response training did not address best practices to manage and eliminate hazardous atmospheres.
- ***Develop response plan to manage responding to hydrocarbon releases and establish clear learning objectives for emergency response drill scenarios.***



INCIDENT – Planned Shutdown (Pg 15)

INCIDENT SUMMARY:

May 2023, facility in Congo, a gas recycling line from a compressor to an exchanger had burst open during a voluntary shutdown. Due to shock wave, there was much damage to nearby lines and supports. No one was injured.

CAUSES / LEARNINGS:

1. Inadequate Risk Assessment:

- Inadequate routing and criticality of the discharge valve not recognized.
- No process expertise was assigned to operational support during this activity hence there was low visibility of critical exposures.
- The Equipment overpressure detection design problem was not considered, and the hazard was not analyzed.
- ***Pressurized Stop mode requires process review. Knowledge based decision making on complex systems are crucial for recognition of critical exposures. Risk Assessment should be multidisciplinary team.***

2. Procedures:

- Gas Compressor start and stop methodology was not standardized across shifts and Operating instructions was lacking in detail.
- Operating Instructions were also lacking in detail.
- ***Procedures in place must be Standardized to ensure consistent understanding across shifts.***



INCIDENT – Routine Maintenance (Pg 16)

INCIDENT SUMMARY:

August 2023, facility in Congo, during the preventive maintenance of an injection skid (hypochlorite), an accumulator was filled with Nitrogen. An overpressure led the accumulator to burst, and debris was projected around injuring two operators involved in the work.

CAUSES / LEARNINGS:

1. Non-compliance to Procedure:

- A manifold was used to inject Nitrogen without a pressure regulator connected to the cylinder. This was in contravention to the procedure.
- ***Raise staff awareness of the need to comply with procedures attached to work permits.***

2. Inadequate Risk Assessment: (Risk Recognition)

- Poor risk assessment done by stakeholders and lack of supervision on the work
- ***Hydraulics team was recommended be trained again in the basics of pressurized systems.***
- ***Raise staff awareness of the importance of good communication and supervision during task execution.***



INCIDENT – Production (Pg 18)

INCIDENT SUMMARY:

February 2023, facility in Nigeria, a leak point with a 12mm diameter due to corrosion was identified on the bulkhead (a liquid-tight transverse wall between adjacent compartments of a tank) between a Water Ballast Tank (WBT) & Crude Oil Tank. The WBT was undergoing repairs at the time. The release was above the threshold quantity in any 1-hour period.

CAUSES / LEARNINGS:

1. MoC:

- Management of Change of repair strategy from use of insert plates to painting and blasting of corroded sections was done but not approved by Technical Authority.
- Manual override (inhibition) of gas detection safety system inside the WBT was done without following procedure leading to late detection of hydrocarbon in the WBT.
- ***Reinforce change management procedure where there is a change of scope, with proper technical approvals attained for these changes.***

2. Inspection:

- Inadequate inspection of bulkhead, as further Non-Destructive Test (NDT) were required for corroded sections was not done after previous repair.
- ***Asset Integrity Management system review required.***



INCIDENT – Production (Pg 20)

INCIDENT SUMMARY:

July 2023, facility in Nigeria, increased volumes were detected discharging to flare. It was determined that a PSV pilot sensing line separated from PSV and 3/4-inch bleed valve nipple separated from weldolet (butt-weld branch connection) downstream of the PSV. The release was above the threshold quantity in any 1-hour period.

<https://www.youtube.com/watch?v=VI3IIEV1GV4>

CAUSES / LEARNINGS:

1. Procedures:

- Overtightening of sensing line tubing connector led to crack which propagated over time.
- ***Update applicable procedures to capture correct method for installing threaded fittings and train personnel.***

2. Asset Design:

- Small bore connection downstream of PSV was not braced in accordance procedure updated after initial design and start up.
- ***Implement bracing of small-bore piping in vibrating service.***



INCIDENT – Turnaround (Pg 21)

INCIDENT SUMMARY:

May 2023, facility in Australia, during a planned shutdown an internal combustion event occurred inside the air assist system of the Stage 1 warm wet flare which resulted in damage > \$100 000.

As part of shutdown work scopes, the main flare air blowers were taken offline leading to no positive pressure within the air annulus of the flare warm wet (FWW) and spare first stage flares. These two air assist flares were communicating through common air ducting and open dampers. A venturi effect (created by a low-pressure point at the spare first stage tip) drew hydrocarbon from the flare warm wet gas riser/pilots into the air annulus towards the spare flare. A flammable atmosphere was then created and ignited at the flare warm wet tip, leading to a deflagration (causing flare warm wet tip damage) followed by a detonation which caused the flare warm wet bellows to rupture.

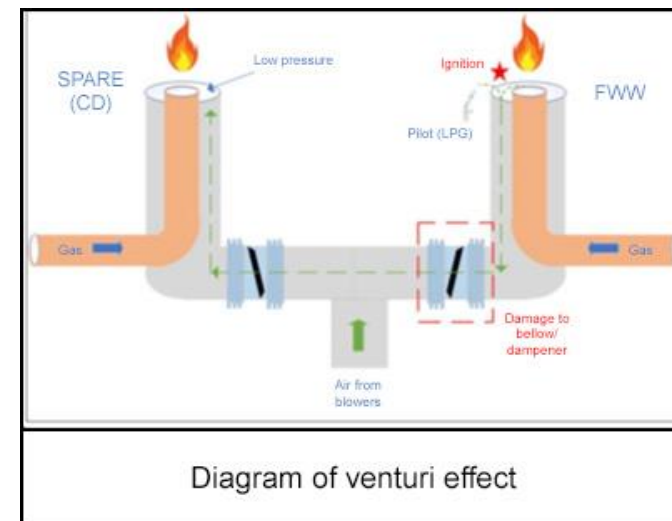
CAUSES / LEARNINGS:

1. Design Review:

- The air assist system design was modified, and operating mode changed at different times before facility startup.
- The risk of hydrocarbon ingress into the air assist system was not identified during design reviews.
- ***Vendor engagement during front-end design and safety reviews/HAZOP specifically for novel or complex systems is important.***

2. Communication:

- Risk of hydrocarbon ingress into a flare air assist annulus was identified in a prior event with lessons potentially not clearly articulated.
- ***Operating procedures to provide key vendor parameters and a clear line of sight to operational risks.***





INCIDENT – Pipeline Operation (Pg 25)

INCIDENT SUMMARY:

September 2023, facility in Malaysia, Hydrocarbon was observed released on a subsea pipeline through a small opening on flexible riser close to the flange connection to Pipeline End Manifold (PLEM) elbow.. The release was above the threshold quantity in any 1-hour period.

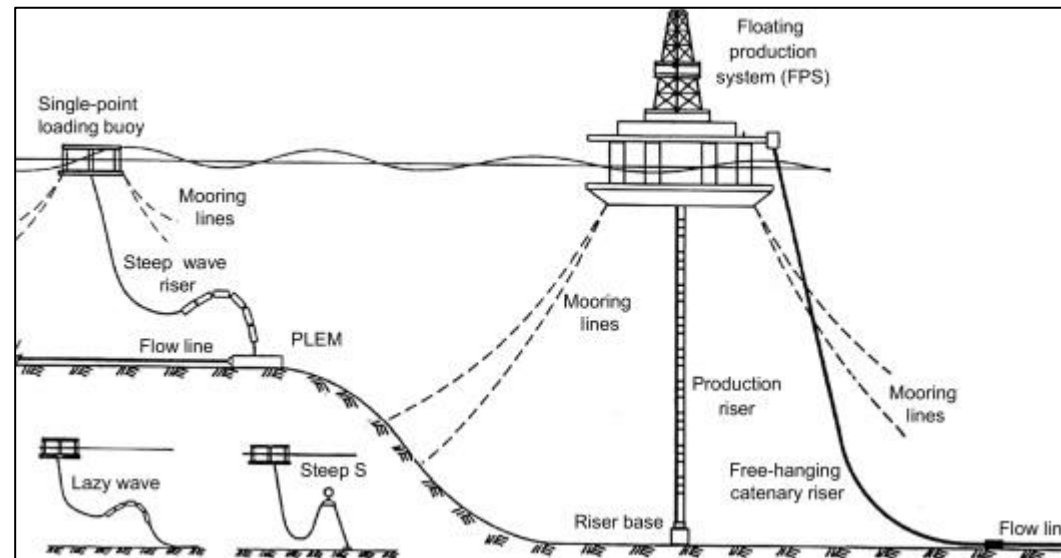
CAUSES / LEARNINGS:

1. Lack of Awareness:

- Leak was due to fatigue on the flexible riser.
- Investigation concluded surrounding changes arising from operational activities contributed to the failure of the riser.
- ***Be more vigilant and alert on the surrounding changes and to immediately report any abnormalities..***

2. Preventative Maintenance:

- ***Review the adequacy and frequency of inspections, testing and preventive maintenance in ensuring equipment integrity.***





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Thank You

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