Safety Alert 016 - ANP/SSM

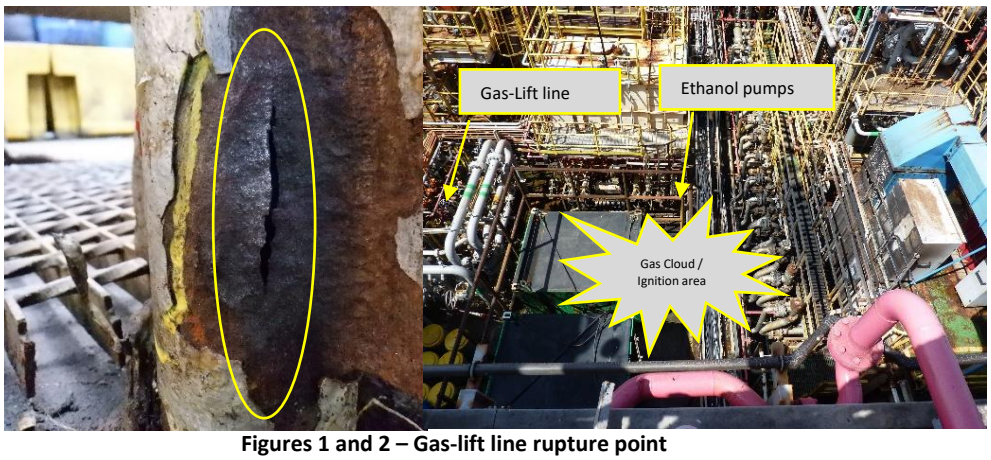
High pressure gas release and fire following gas-lift line loss of integrity

This Operational Safety and Environment Superintendence alerts the oil and gas industry and other stakeholders about high pressure gas release and fire after rupture in a gas-lift line.

What happened?

There was an emergency shutdown caused by the use of inadequate compressed air network – instead of the air supply line, the operator used the deluge instrumentation circuit to connect cleaning equipment. It is believed that, during the process plant ramp-up, the reopening of a SDV in the gas-lift line induced a sudden pressure rise in the line, which led to its rupture, generating loss of containment. A gas cloud was formed and then ignited, generating a fire that activated the platform's deluge system. The ignition source was not identified; however, the investigation points out as more likely the presence of a non-ATEX refrigerated container installed in a classified area. The initial event caused residual fire spots that were controlled by the Emergency Response Team. There were no injuries.

The unit is a mature asset that has recently had its operator changed.



Figures 1 and 2 – Gas-lift line rupture point

Potential consequences

If there were employees working in the area impacted by the fire, there could be injuries and eventual fatalities. In addition, the fire could have had a more significant impact on the company assets if it had not been controlled by the firefighting system and the platform emergency response team.

Identified causes

The investigation carried out by the Operator identified the following causes for the accident:

- Poor integrity of the high-pressure gas line, due to:
  - Inadequate inspection techniques and frequency, and
  - Inadequate management of RTI (Technical Inspection Recommendations) process, with loss of traceability and control of actions in occasion of the operator change.
- Hammer effect in the gas lift line due to pressure differential, caused by:
  - Lack of integrity of check-valves and maintenance plan for the air and gas check-valves, and
  - Start-up procedure that does not consider the pressure evaluation across SDV before realignment.
  - Inadequate design that allowed unnecessary opening of *blowdown valves* – BDVs – during the emergency stop, which led – along with the lack of tightness of the check-valves – to the depressurization of the gas-lift header, creating conditions for the occurrence of the hammer effect in the plant start-up;
- Delay in interrupting the leakage, due to:
  - Lack of training to close the SDV locally,
  - Supervisory system design that doesn't allow to actuate SDVs efficiently and quicky,
  - Inadequate emergency response, without manual and automatic activation of the ESD (emergency shutdown) system,
  - Failure of the fire and gas detection system, which presented non-conformities in maintenance execution, and
  - Inadequate location of fire and gas detectors;
- Existence of ignition source, caused by:
  - Unimplemented risk controls (existence of equipment unsuitable for use in classified areas), and
  - Overdue maintenance plans for ATEX equipment.

Lessons learned

- In case of transfer of operations to another company, ensure the traceability of information and actions derived from Technical Inspection Recommendations (RTI) and allocate adequate resources on and offshore to assess and continue RTI management.
- Establish specific requirements for quality, method and frequency in the training program for critical valve closure tasks.
- Design safety critical elements considering interactions with the control room operator, their physical and cognitive capabilities and characteristics.
- Ensure that all equipment in a hazardous area is approved, inspected and used in accordance with ATEx/Ex guidelines, ensuring its integrity. Establish quality assurance requirements and systematic for RTI management, ensuring approval, control and implementation on risk-compliant deadlines.
- Ensure minimum pipe thickness measurement procedures with clear instructions about the amount and locations of measurement points and risk criteria for operation.
- Establish plans and procedures for inspection, testing and maintenance that are compatible with the risks of the installation, including check-valves.
- Ensure routine inspection of location and positioning for fire and gas detectors.
- Establish pre-startup safety review procedures so that the start-up and resumption of operations occur safely.

Regulatory Framework

According to SGSO technical regulation annexed to ANP Resolution No 43/2007:

Item 1.5: Plan and provide necessary resources for the implementation and operation of the operational safety management system.

Item 3.3.1: Establish training requirements so that employees are able to perform the tasks determined to their functions.

Item 10.2.3: consider, during the acquisition of installation items and equipment, compliance with standards and good engineering practices related to operational safety matters.

Item 10.3: establish a system so that human and work environment factors are considered in the facility design phase and in its subsequent revisions.

Item 13.2.1: establish plans and procedures for inspection, testing and maintenance, to seek the mechanical integrity of systems, structures, equipment and critical safety systems. Such documentation should be aligned with manufacturers' recommendations, standards and good engineering practices.

Item 13.4: Monitor and evaluate inspection and test results.

Item 15.3: Establish and implement procedures for start-up and deactivation operations. Pre-operation information update mechanisms should be ensured, where applicable.

Contact

For additional information regarding this safety alert, please contact ANP Operational Safety and Environment Superintendence at incidentes@anp.gov.br.