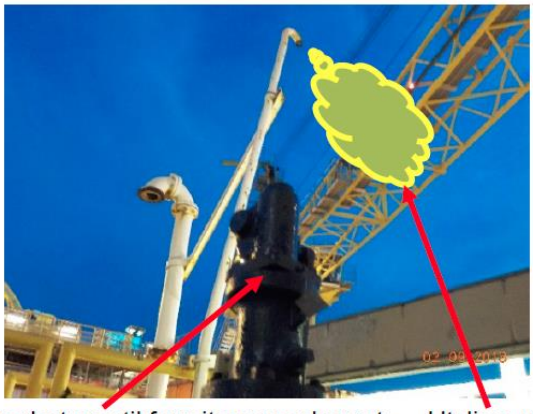
2018-B: Gas leak via nitrogen hose in connection with startup

The process plant had been shut down by a power cut. In connection with preparing to start up, the plant had to be pressurised to begin glycol circulation. A low-pressure hose was therefore connected from the nitrogen system to the glycol plant during the night shift. The hose had an approved working pressure of 16 bar. Weaknesses in the handover between the night and day shifts meant that the hose was not removed when the day shift started up production. As a result, hydrocarbon gas at a pressure of 40 bar flowed from the gas pipe in the glycol plant, via a defective permanent check valve at the nitrogen service station, into the nitrogen system. A safety valve in the nitrogen system opened at 16 bar and released hydrocarbon gas to the weatherdeck. This is an unclassified area – in other words, one where explosive hydrocarbon mixtures are not expected.

A chance observer, who was not involved in the startup work, reacted to an unusual noise, took a closer look and discovered the safety valve open to the air. This person also smelt gas. The control room was alerted, and a plant operator was dispatched to confirm the leak. Other plant operators on the cellar deck quickly located the hydrogen hose, closed two valves at the injection point and then began purging the nitrogen distribution plant.

The investigation team has calculated that hydrocarbon gas entered the nitrogen plant at a rate of 0.6 kilograms per second. Of this, 0.2 kg/s is calculated to have escaped to the weather deck via the safety valve. The remaining quantity went to the flare or was vented to other local safe locations.



Key to figures Left: connection point for nitrogen hose. Right: safety valve for the nitrogen plant HC gas emitted.

Causes

Direct causes

- No check valve was installed between the injection point and the temporary hose.
- A low-pressure system (nitrogen) was connected to a high-pressure system (gas outlet pipe from the glycol contactor) with a low-pressure hose.
- The temporary hose was not removed before starting up the gas plant.
- The check valve on the nitrogen station on the cellar deck did not remain closed.

Underlying causes

- System and operational documents for starting up a depressurised glycol plant were lacking.
- The platform was previously operated by a different company. Relevant documentation from the original operator was not carried over.
- The work process for using a temporary hose was not observed.
- Inadequate communication in the handover between the night and day shifts.
- The plant was not systematically reviewed and checked before start-up.
- The shift log was not updated before the handover meeting between the night and day shifts.
- Management of the post-blackout startup was inadequate. So was the use of established work processes.
- A weld bead in the check valve prevented the latter from closing completely.
- There was no way to function-test the check valve.
- No inspection programme had been prepared for the permanent check valve.
- No maintenance strategy for check valves was in place.

Lessons learnt and recommendations

- Update system and operational documents for gas dehydration and glycol circulation in order to include running down, starting up, special conditions and operating routines. A fixed template should be used to ensure a systematic approach.
- Measures to improve handover between shift and crew changes in order to ensure that important conditions are passed on, including the introduction of forms as well as training in conducting a handover.
- Improve the management of work related to operations, including the use of relevant work processes and the A standard. Managers must check the use of this standard.
- Training in running down and starting up the process plant, and to prevent oxygen intrusion in depressurised plants.
- Review of permanently installed check valves in stainless materials connected to distribution networks in carbon steel. Such valves give rise to galvanic corrosion, and cannot be function-tested. They should therefore be replaced with dismountable check valves installed at the closest injection point. This type of valve can be function-tested before use.