

Incident description: gas leak 2015

In connection with process shutdown of an oil train, a rupture disc burst downstream from primary gaskets on the drive end of the reinjection compressor. The disc was replaced, but problems were encountered in restarting the compressor. Production was restricted for three days, with considerable flaring, before the disc burst again and troubleshooting was initiated. During this work, the valve to the flare system downstream from the compressor was closed to prevent back-pressure from the flare to the rupture disc. Troubleshooting confirmed a failed gasket on the drive end, and this was to be replaced. A different work team from the one which had done the troubleshooting was assigned to the job.

During preparations to replace the gasket, it was discovered that the compressor itself could not be fully purged because of an internal leak in the valve between the first- and second-stage reinjection compressors. The work team decided to pressurise the system in order to move the valve so that was sealed, but was not aware that the flare valve had been closed. The valve between the reinjection compressors was opened, releasing a pressure of roughly 97.7 bar against a closed flare valve in a pipe segment with a design pressure of 19.6 bar. The segment was thereby overpressurised and the gasket in a three-inch flange blew out. This resulted in a gas leak into the compressor housing. An operator was standing nearby when the incident occurred, but was not exposed to the gas.

Two gas detectors in the compressor housing activated immediately, and ESD was initiated automatically with ignition source disconnection, deluge and general alarm. The emergency response organisation mustered in accordance with the alarm instructions.

The leak lasted for just under 17 minutes and emitted a total of 650kg of gas with an initial leak rate of 3.1kg/s. This created a gas cloud with an ignitable volume of 120m³ in outer parts of the main process deck.

The emergency lasted 47 minutes. Neither the gas leak nor the emergency response caused personal injuries.

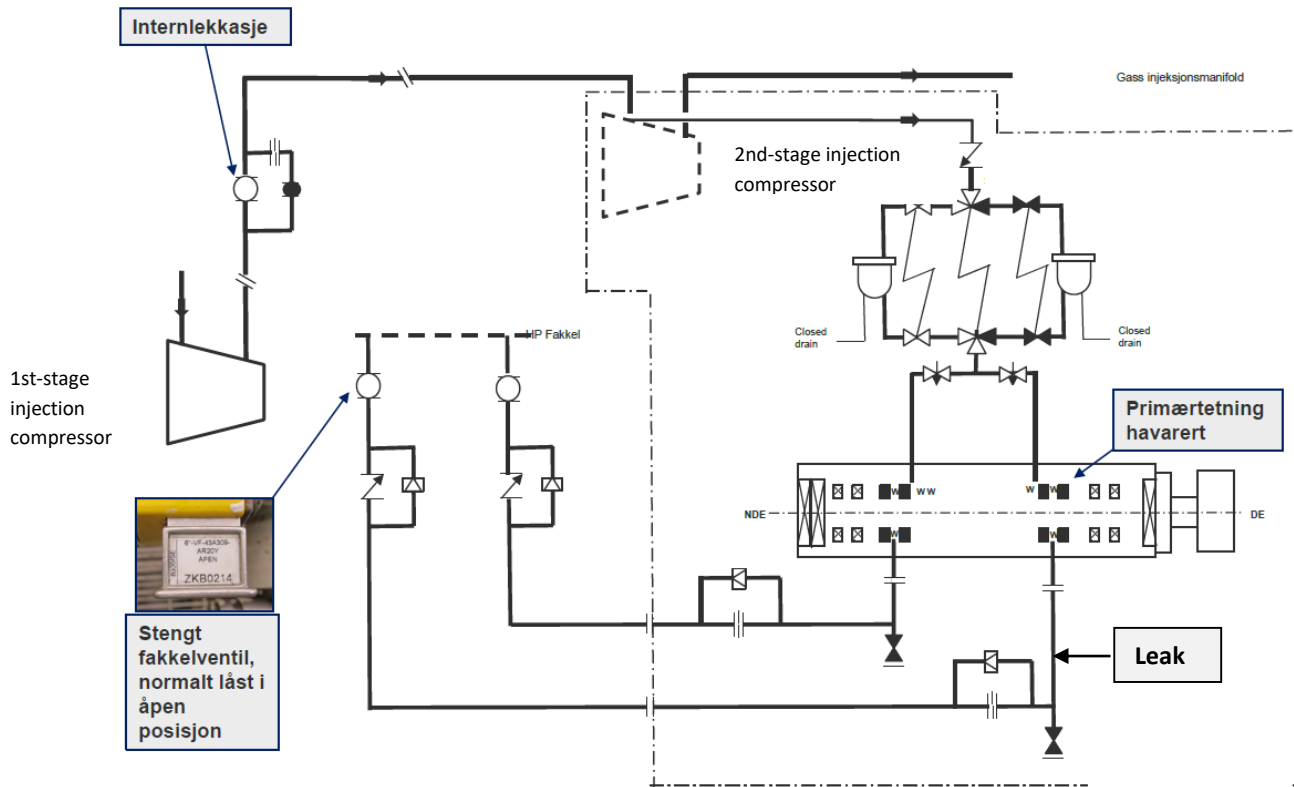


Figure: Simplified process diagram.



Figure: Red ring indicates where the gasket in the three-inch flange blew out.

Causes

Direct cause

A gasket in a three-inch flange downstream from the primary gaskets on the second-stage reinjection compressor failed as a result of overpressure.

Underlying causes

- The flare valve intended to prevent overpressure in the pipe segment, and normally locked in the open position, was closed because of troubleshooting.
- The decision to close the flare valve was not in accordance with the relevant work process, and compensatory measures were not implemented.
- A number of procedures relating to work permits and securing valves were not complied with.
- No routine for handover/change of jobs within the same shift.
- Change in pipe specification (spec break) was not entered on the P&ID for the second-stage reinjection compressor. Operator knowledge of the actual spec break was limited ahead of the incident.
- Level of activity on the platform was high because of activities ahead of the maintenance shutdown as well as ongoing operational disruptions. This created conditions where personnel felt they were under pressure of time.

Lessons and recommendations

- Kick-off and time-out meetings must be used to secure the barrier status with regard to unforeseen circumstances related to troubleshooting and maintenance.
- Review the safety strategy on the basis of the incident. Assess whether further measures are required.
- Assess whether solutions which involve securing valve positions included in safety barriers should be addressed in standardisation work.
- Introduce handover procedures for transfer of safety-critical information between work teams on the same shift. The dashboard showing safety-critical equipment which has been disabled should be updated continuously and a shift log should be kept.
- The P&ID for the compressor package should be reviewed and updated to accord with governing documentation.
- Pursue experience transfer with the supplier of compressor packages/project contractor (where the reasons why the spec break was not entered in the P&ID are clarified and where the requirements in governing documentation for marking spec breaks in the P&ID are emphasised).
- Implement a six-week topic on how to ensure that everyone always take the time to work safely, use of work permits also at times with an unplanned high level of activity, and inclusive handling of conditions which could cause people to feel they are under pressure of time.