NOPSEMA

Safety alert 58

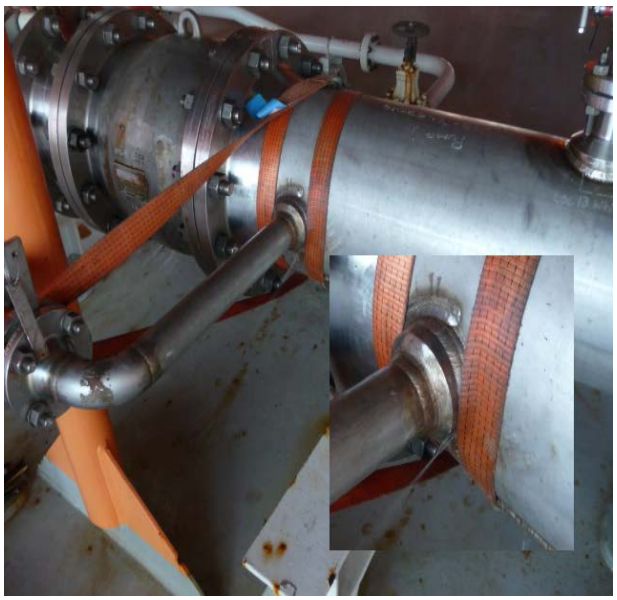
January 2014

Vibration-induced fatigue on process pipework

What happened?

During a recent inspection at a facility, a NOPSEMA inspector observed vibration-induced fatigue cracking and evidence of rectification work carried out on several small bore connections on seawater cooling pipes. On further investigation, it was discovered that there had also been a recent fatigue failure on the hydrocarbon test separator header. Fortunately, the operator had detected hydrocarbon leaking out of the crack and the line was repaired without any major release of hydrocarbons.

The operator of the facility initially did not report the incident as a dangerous occurrence (damage to safety critical equipment), as it was considered only a "minor weep".



Seawater line with fatigue cracking

Failed hydrocarbon test header with engineered temporary clamp

What could go wrong?

In certain situations, vibration-induced fatigue could lead to a loss of containment of a significant quantity of hydrocarbons, which if ignited could result in a major accident event involving multiple fatalities.

Key lessons:

- The risk of vibration-induced fatigue on hydrocarbon facilities must be thoroughly assessed. All types of excitation should be considered, including:
  - flow induced turbulence
  - mechanical excitation
  - pulsation from reciprocating and positive displacement pumps and compressors, rotational stall and flow induced excitation
  - high frequency acoustic fatigue
  - surge/momentum changes due to valve operations
  - cavitation and flashing.

- The Energy Institute, based in the United Kingdom, has developed guidelines for the avoidance of vibration-induced fatigue failure in process pipework. The guidelines can be used from the design stage through to the operational stage in the life of a facility to identify and address pipework at risk of vibration-induced fatigue.
- It is a requirement to report any dangerous occurrence on a facility to NOPSEMA under Clause 82 of Schedule 3 to the *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. Regulation 2.41 of the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009, defines a dangerous occurrence as:
    - *An occurrence that did not cause, but could reasonably have caused:*
        a. *the death of, or serious personal injury to, a person; or*
        b. *a member of the workforce to be incapacitated from performing work for a period of at least 3 days.*
    - *A fire or explosion*
    - *A collision of a marine vessel with the facility*
    - *An uncontrolled release of hydrocarbon vapour exceeding 1 kilogram*
    - *An uncontrolled release of petroleum liquids exceeding 80 litres*
    - *A well kick exceeding 8 cubic metres (or 50 barrels)*
    - *An unplanned event that required the emergency response plan to be implemented*
    - *Damage to safety-critical equipment*

Contact

For further information email alerts@nopsema.gov.au and quote Alert 58.