



Vibration Assessment Capability

THE PROBLEM

The number of hydrocarbon releases due to corrosion and erosion have reduced over the past 10 years with corrosion management and inspection programmes being more effective, however releases due to vibration induced fatigue have not seen the same improvement.

A breakdown of the causes of loss of containment in process piping drawn from the UK HSE's Hydrocarbon Release Database (Figure 1), reveals that vibration induced fatigue accounts for over a fifth of hydrocarbon releases.

Source: UK Health & Safety Executive

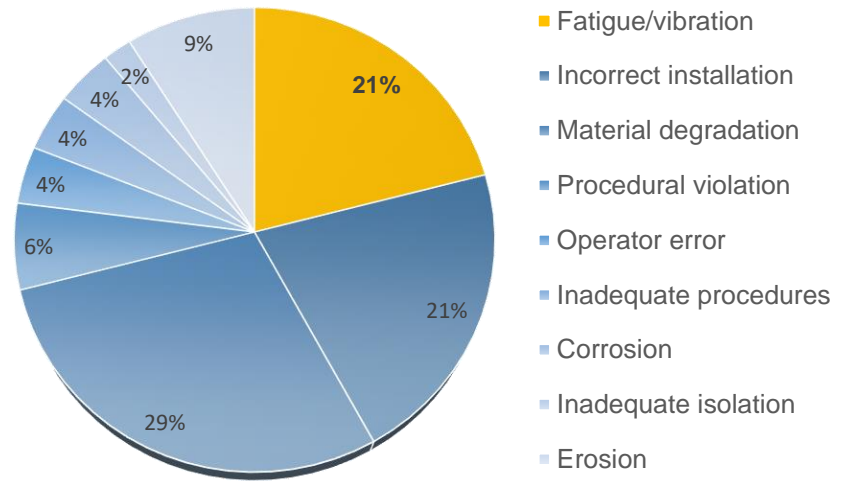


Figure 1:
Causes of Hydrocarbon Release from Process Pipework

Although the understanding of vibration induced fatigue has improved in the industry there are several factors that have resulted in the number of releases not reducing, including:

- Increasing flow rates beyond the original design
- Increasing use of duplex alloys for erosion and weight considerations
- Lighter weight and more flexible piping systems
- Stress concentrations at small bore connections

THE SOLUTION

SRJ Technologies have developed an approach to efficiently provide industry leading vibration expertise within the framework of an inspection scope.

This is enabled by providing the inspection teams with vibration awareness training, allowing the team to identify a vibration problem along with knowledge of how to take appropriate vibration measurements and what supporting information to gather. SRJ then provide remote support to diagnose the likely cause of the vibration and help define the optimum remedial solutions.

SRJ Technologies have a strong track record of solving vibration problems associated with process pipework, with personnel involved with developing the Energy Institute’s widely used “Guidelines for the Avoidance of Vibration Induced Fatigue Failure in Process Pipework”.

EXAMPLE SCOPES

1. High Vibration on Produced Water System

A produced water system using lobe pumps experienced high levels of piping vibration that resulted in the fatigue failure of two small bore instrument connections and damage to lobe pumps.

Vibration data was gathered by the inspection team and provided to SRJ. Following an assessment of the vibration data and with the support of an acoustic simulation model, the root cause was identified as the inappropriate locating of pulsation dampers, which was resulting in cavitation at the inlet to the lobe pumps



Figure 2: Damaged lobe on pump

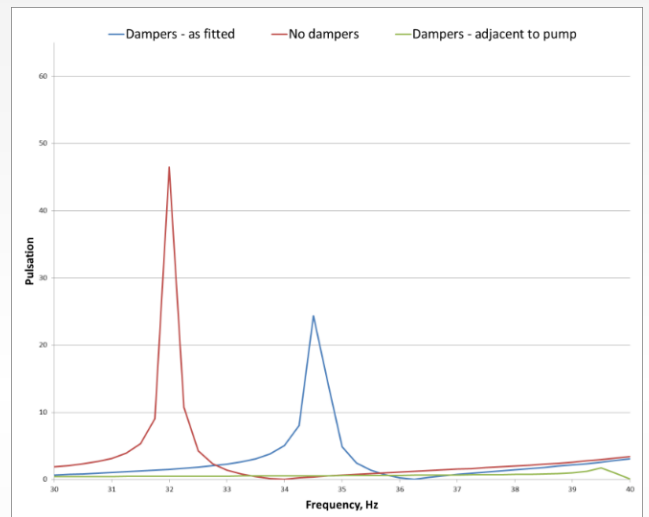
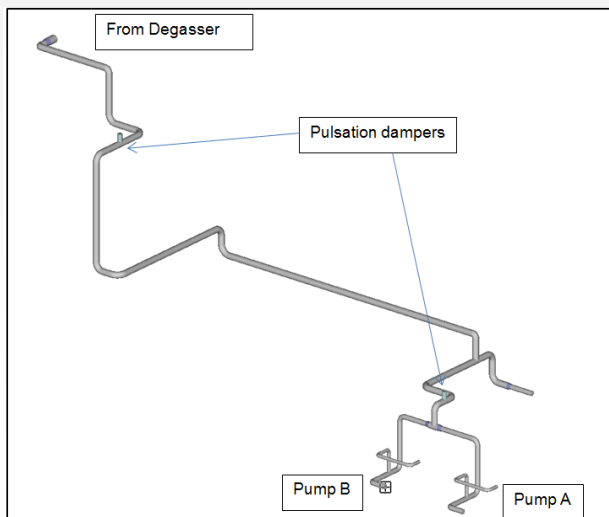


Figure 3: Acoustic model and predicted pressure pulsations

The acoustic simulation was used to determine the optimum locations for the pulsation dampers. The dampers were relocated as proposed and verification vibration survey results showed a ten-fold reduction in vibration levels, and no repeat damage occurred to the repaired lobe pumps.

EXAMPLE SCOPES (cont'd)

2. High Vibration of Filter Backwash Line

Operations team offshore identified vibration concerns on a backwash line for a seawater filter. A video capture of the problem was provided to SRJ.

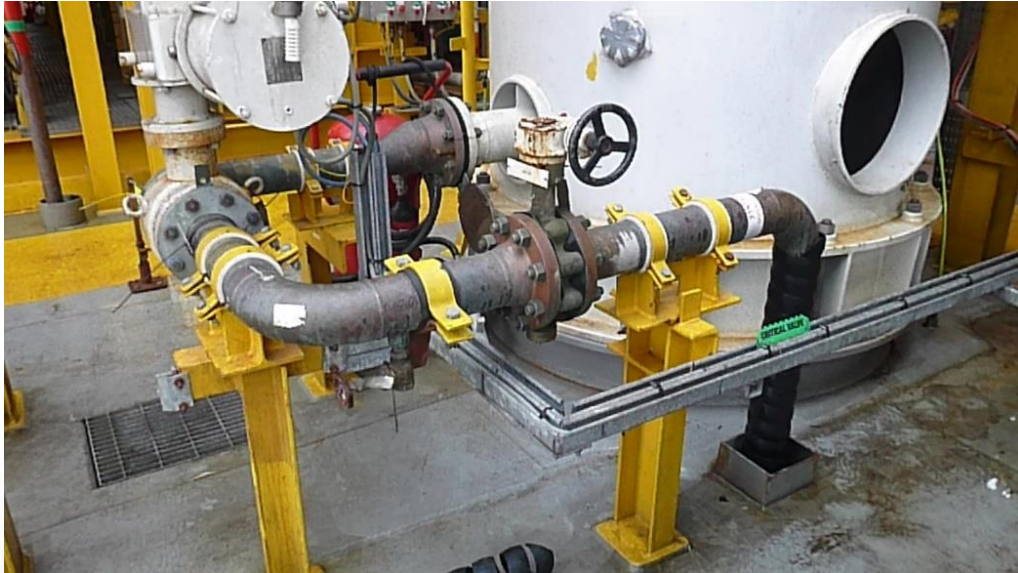


Figure 4: Backwash piping

A review of the video identified two separate problems:

- Continuous vibration during backwash
- A transient event resulting in significant pipework deflections as the end of the backwash cycle

The root causes were determined to be cavitation due to the pressure drop across a single restriction orifice resulting in the continuous vibration during backwash. The transient event occurred when the control valve closed, the cause was identified as the formation of a partial vacuum resulting in a vapour cavity, on collapse of the cavity a significant transient forces were generated resulting in the observed piping deflections.

The proposed remedial modifications were:

- Two restriction orifice plates were installed in series to stagger the pressure drop, minimising the cavitation
- The installation of a vacuum breaker/air release valve downstream of the control valve prevented the partial vacuum conditions being generated on control valve closure

Following their implementation, no further vibration concerns were evident on the backwash line.