SAFETY ALERT

Failure of carbon steel piping due to methanol stress corrosion cracking

Description of Process:

Carbon steel is widely employed in offshore methanol systems and most commercially available methanol is supplied with a water content that can promote stress corrosion cracking. The level of residual or imposed tensile stress is the key variable that determines whether stress corrosion cracking is likely to occur.

Any carbon steel item exposed to methanol is susceptible to stress corrosion cracking if:

- it is under sufficient tensile stress (either imposed or residual stress) and;
- the methanol has a water content between 0.05% and 1% by volume

Description of Incident:

After approximately 18 months in service, a pinhole leak was observed on a carbon steel line from the methanol storage vessels to methanol transfer pumps. Further examination revealed multiple leaks and weeps at various locations throughout the low-pressure carbon steel bunkering, storage and transfer piping. All of the leaks and weeps were due to cracking associated with welds.

Although the welds were mechanically sound and had passed QC inspections, it is suspected that there may have been some deviation from the weld procedure, which resulted in individual welds having high residual stresses.

Good Practice Guidance:

Duty holders should:

- Identify whether they have carbon steel piping or equipment exposed to methanol that contains less than 1% water by volume

- Ensure that the risk-based inspection assessment for such piping or equipment addresses the threat of methanol stress corrosion cracking. The risk assessment should consider:
  - the water content of the methanol (specified and actual measured values)
  - imposed stresses (adequacy of supports, evidence of misalignment etc.)
  - residual stresses (confidence in compliance with welding procedures, measured values etc.)
  - time in service without failure
  - employ appropriate non-destructive evaluation (NDE) techniques to inspect for cracks at susceptible locations such as welds, i.e. where the risk-based inspection assessment identifies the requirement