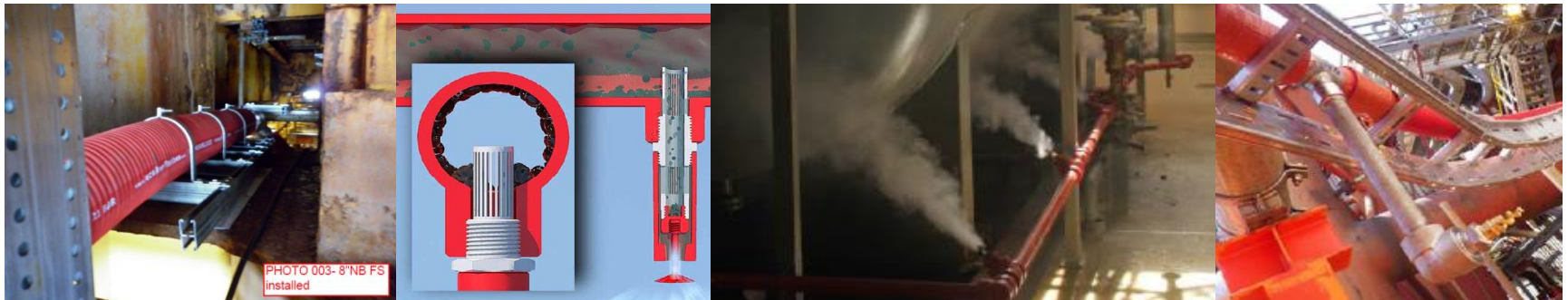


Safety Enhancements and OPEX Savings from Appropriate Installation of Flexible Deluge Pipework



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- Problem:

- Downward spiral of corrosion on North Cormorant with increasing wet test frequencies and the costs of response to testing failures

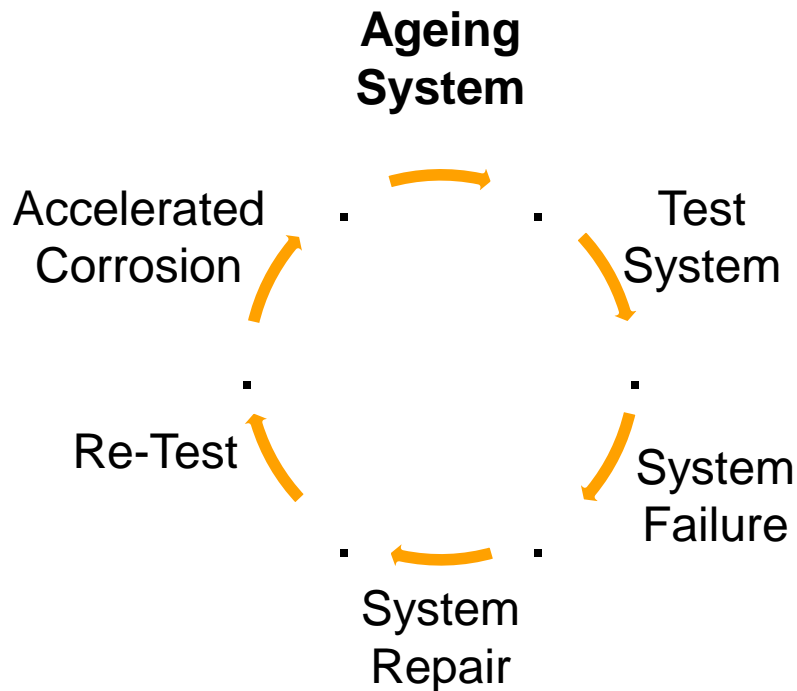
- Objective:

- To deliver an operational solution which delivers minimal platform input over the remaining field life (taken to be 10-15 years)

- Approach:

- The impact of the previous testing regime on the installation
- High level identification options, cost review and potential for success
- Design considerations overcome during replacement programme
- Delivery of success

An explanation of the problem with increasing wet test frequencies and the cost of response



- Ageing installation - carbon steel construction with significant corrosion products & galvanic coating breakdown
- Corrosion products sufficient to result in persistent failures thro nozzle blockage.
- Persistent failures resulted in:
 - re-work & increased wet testing frequency
 - significant rectification resourcing
 - no treatment for the corrosion

The impact of the previous testing regime on the installation



- A significant workload for Platform personnel and Maintenance Team:
 - for bagging equipment, inhibiting F&G, repairs, unblocking system and retesting
- More frequent Wet Testing impacts on Platform Operations - as low as 6 weekly testing
- Increased corrosion rate both internally and externally from near continuous introduction of fresh oxygenated sea water.
- Increased corrosion rate of surrounding platform structures and equipment



High level identification options, cost review and potential for success



Option	Title	10 year cost	Success Score (100%)
Option 1	Nozzle filtration installation	£900k per large module (2 visits)	65
Option 2	Chemical clean and inspect	£900k per large module (3 visits)	70
Option 3	Mechanical clean and inspect	£750k per large module (3 visits)	70
Option 4	Replace with Carbon Steel piping like for like	£650k per large module	85
Option 5	Replace with Corrosion Resistant Alloy piping	£1M per large module	95
Option 6	Replace with Flexible Corrosion Resistant piping	£1M per large module	95
Option 7	Vapour/Smoke Testing of Pipework	£750k per large module (3 visits)	65
Option 8	Boroscope inspection	£750k per large module (3 visits)	65

Design considerations overcome during replacement programme



- There are two (2) flexible piping options/systems available
- In design / technical terms both systems provide common benefits
- This commonality means cost is the most significant determining factor for option selection.
- Through previous TAQA experience of the installation of both available systems we had information available to inform the decision.

To meet the TAQA Assurance Process the following were assessed:

- Jet and Pool Fire Testing (at Spadeadam)
- Explosion Testing
- Smoke and toxicity
- Ageing (see next slide)
- Traceability
- Electrostatic
- Repair



Design considerations overcome during replacement programme



Hose Integrity

- From contact with other operators some experience showed concerns where the outer cover had started to split due to UV damage and has discoloured significantly though was not an integrity threat to pressure containment.
- This issue has since been resolved with a change to the outer cover from Chloroprene (CR) to CSM rubber which is now UV and Ozone stable.
- The hose range and every coil of hose is batch traceable and batch numbers which are embossed on the hose so old hose cannot be supplied

Hydraulic Calculations

- There were concerns raised as to the appropriateness of hydraulic coefficients used in calculations.
- TAQA reviewed available information and were satisfied that friction losses were well understood and is proven in our subsequent installations/commissioning.

Delivery of success



- Fully operational and available Deluge System
- Move testing to a minimum of 5 yearly frequency or possibly 10 years with inspection
- Significantly reduces resourcing overall for deluge maintenance activities
- Improved integrity of modules and equipment not having a frequent soaking from Sea Water.
- The installed costings have been bourn out by our experience.

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