Corrosion protection and the cost of failure

Navigating Deepwater – 26 February 2014, Houston

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Did you know?
5 metric tons of steel is degenerated every second World Wide
That 40% of all produced steel is used to replace corroded steel.
The estimated cost of corrosion is 1,8 trillion USD annually World Wide
How much is a trillion dollar?

100 USD
10,000 USD
1,000,000 USD
100,000,000 USD
1 BILLION USD
1 Trillion USD
Agenda

- Why things go wrong
- The cost of offshore maintenance
- Critical areas
Experience show

- 95% coating failures occur due to:
  - To incorrect specification choice
  - Poor surface preparation
  - Poor application
  - Climatic conditions

- 85% of coating failures appear within the first 1-3 years
Lessons learned - Norway

- All Norwegian FPSO’s have suffered from inadequate paintwork.
- The underlying problems are:
  - Lack of priority and time allocated to this activity
  - Quality control of preparation and finishing has been mixed
  - Painting in Singapore has been particularly poor due to humid conditions
- Painting of FPSOs is critical area to ensure low maintenance facility.
- Work often conducted late when the pressure for sail away is high.

Source: Norwegian oil and gas association
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CAPEX versus OPEX the balancing act

- Spend money up-front, save on maintenance
- Save money up-front, spend on maintenance
A large ageing offshore infrastructure

- 6000 fixed platforms
- 184 floating production units
- 650 offshore drilling rigs
- 2900 subsea wells operating
- 60% of the world offshore fleet are past their theoretical design age of 20 years
- Lifetime extension programs on-going and being planned

"More than 50% of the DNV classed mobile units is above 20 years of age"

Source: Douglas-Westwood
Offshore maintenance 15-20 times more costly compared to performing work at yard
Protective Coatings

Offshore Corrosion

DVN-RP-C302: Coatings are the only cost-effective means to control atmospheric corrosion

Corrosion can account for 60% of offshore maintenance cost

Maintenance Challenges

- Delay and backlogs on fabric maintenance work due to lack of bed capacity
- Scaffolding will provide best work efficiency and result
- Inspection program for integrity of passive fire protection often lacking
- Inspection program for corrosion under insulation often lacking
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The Water Ballast Tank challenge

- Ballast tanks pose a high corrosion risk due to contaminants in seawater and various water levels in tank.
- Complex geometry where application errors easily can occur
- CP only works when submerged
- Offshore units using ballast tanks for storage, risk SRB corrosion

SRB= Sulphate Reducing Bacteria
Crude oil tank environment

- Upper deck plate exposed to general corrosion due to sour environment

- Bottom plating exposed to pitting corrosion. Typical caused by a defect in the coating

- Double hull more exposed to pitting corrosion due to elevated temperature that will activate the Sulphate Reducing Bacteria (SRB)

- Sour crude and elevated temperatures will increase risk of pitting corrosion in bottom of tank
CUI a hidden time bomb?

- Potential major accident and a growing concern for an aging fleet
- Studies show over 60% of leaks on HC systems are caused by ageing processes such as fatigue, and corrosion
- Fire and explosions, usually a consequence of a HC leak
- Factors accelerating corrosion under insulation (CUI):
  - Availability of moisture
  - Availability of oxygen
  - High temperature
  - High concentration of dissolved aggressive species
The coating advisor a curtail role

- Good technical support is critical for a good result
- The coating advisor inspect, log and report
  - Surface preparation
  - Environmental monitoring
  - Paint application
- Coating advisor should have FROSIO or NACE certification
FPSo example – not including PFP

- FPSO cost 800 MUSD
- Cost of paint 1% of total investment = 8 MUSD
- Cost of surface preparation 4% = 32 MUSD
- Cost of scaffolding 3% = 24 MUSD

Total paint related cost: 64 MUSD
LCC example – FPSO conversion 13 year design life

• Same paint system different surface treatment

50% lower maintenance cost

- 2 maintenance cycles during lifetime
- 1 maintenance cycle during lifetime

Water jetting, corroded areas spot blasting
Full blast Sa 2,5
LCC example - Condition after 3 years
Remark: Blasting and painting at workshop good quality however, but after back to yard, a lot of mechanical damage and dirt.

Solution chosen by yard: one layer of topcoat
Summary

- Specify suitable coating systems for the design life on the asset.
- Take care during surface preparation and application stage, make sure you have qualified technical personnel to follow-up.
- Coating advisors from paint manufacturer often have a good relationship with the yard and can be helpful in getting the best possible result.
- It makes good economy to get it right during CAPEX stage.