

Corrosion Management Considerations for Assets Approaching CoP and Decommissioning

by

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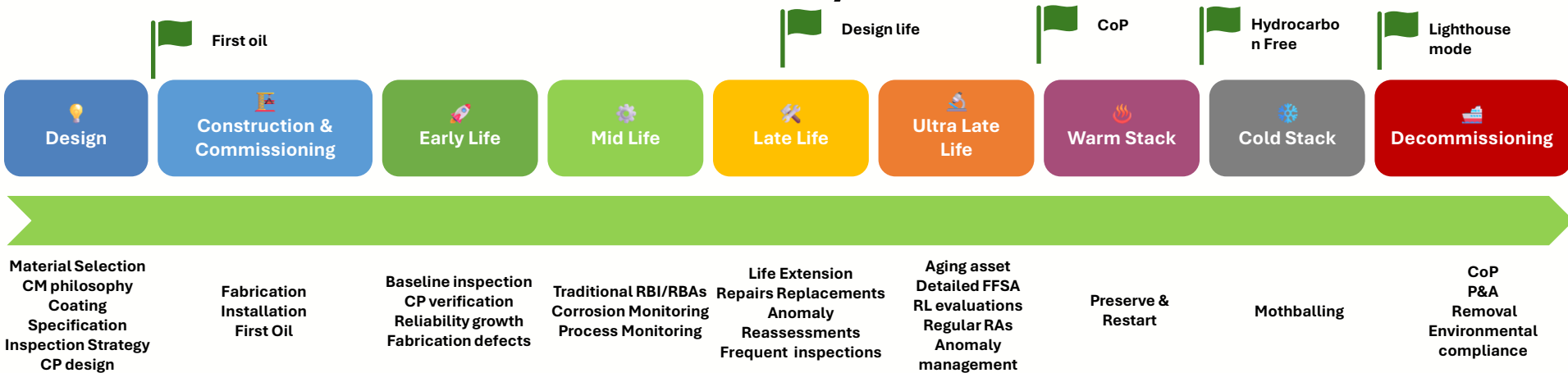
**Materials and Corrosion Advisor
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OUTLINE

-  Asset life cycle
-  Uncertainty in CoP planning
-  Context and challenges
-  Corrosion management - Late life assets
-  Regular review of risks
-  Corrosion assessments & RBIs
-  Corrosion influencing parameters
-  Anomaly management
-  Case Study 1 – Unexpected flow effects
-  Case Study 2 – Cathodic protection retrofit



Offshore Oil and Gas Asset - Life Cycle



Considerations for asset in late life/ultra late life



Develop late life strategy & review CM strategy



Identify items critical for decommissioning



Review existing anomalies



Update Inspection, CM and FM plans



Air-gapping & mothballing strategy

Uncertainty in CoP planning



Decision based economics

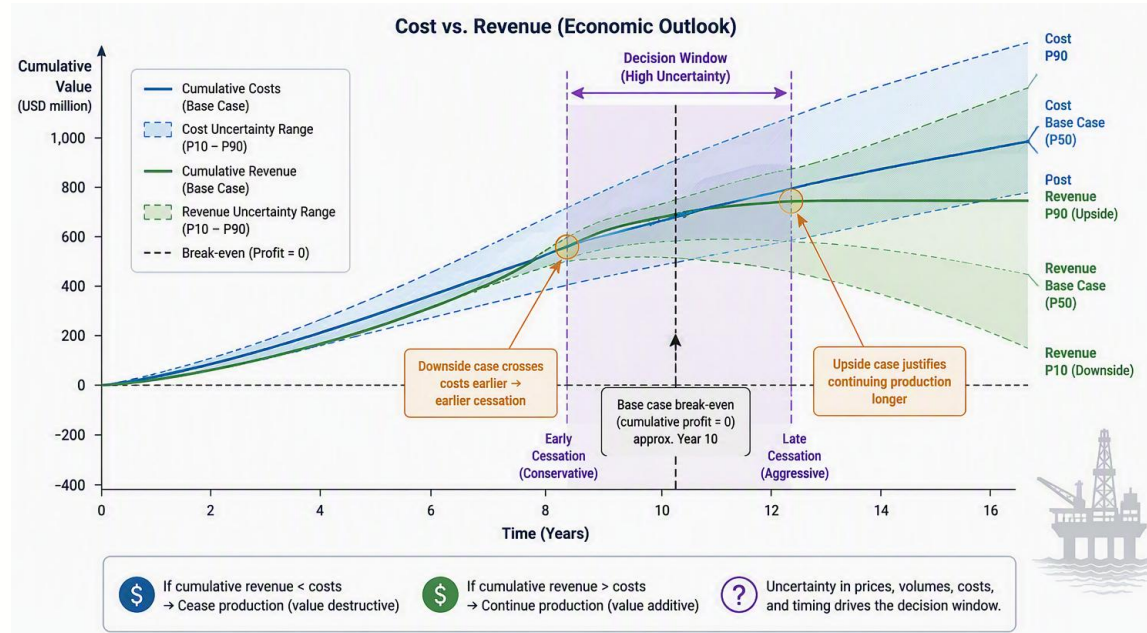


Cost vs. Revenue



CoP date is not fixed

- ✓ Asset integrity
- ✓ Equipment reliability
- ✓ Reservoir performance
- ✓ Oil and gas prices
- ✓ Fiscal and regulatory
- ✓ Decommissioning cost
- ✓ Stakeholder and commercial
- ✓ Technology



Example CoP planning – Cost vs. Revenue

Context and Challenges



Safety Risks



Major accident hazards must be prevented



Environmental Risks



Responsible stewardship of environment



Business Risks



Unplanned failures



Interrupted production



Unplanned outage



Hydrocarbon releases



Cost of up to £50MM + per annum



Aging offshore oil and gas platform

Corrosion Management - Late Life Assets

-  Ageing infrastructure
-  Reduced production and limited budget
-  Changing operational conditions
-  Redundant equipment
-  Increased dropped object threat
-  Obsolescence and out-dated technologies
-  Decommission focus increases
-  Change in Strategy is necessary



Out-dated equipment



Focused inspection

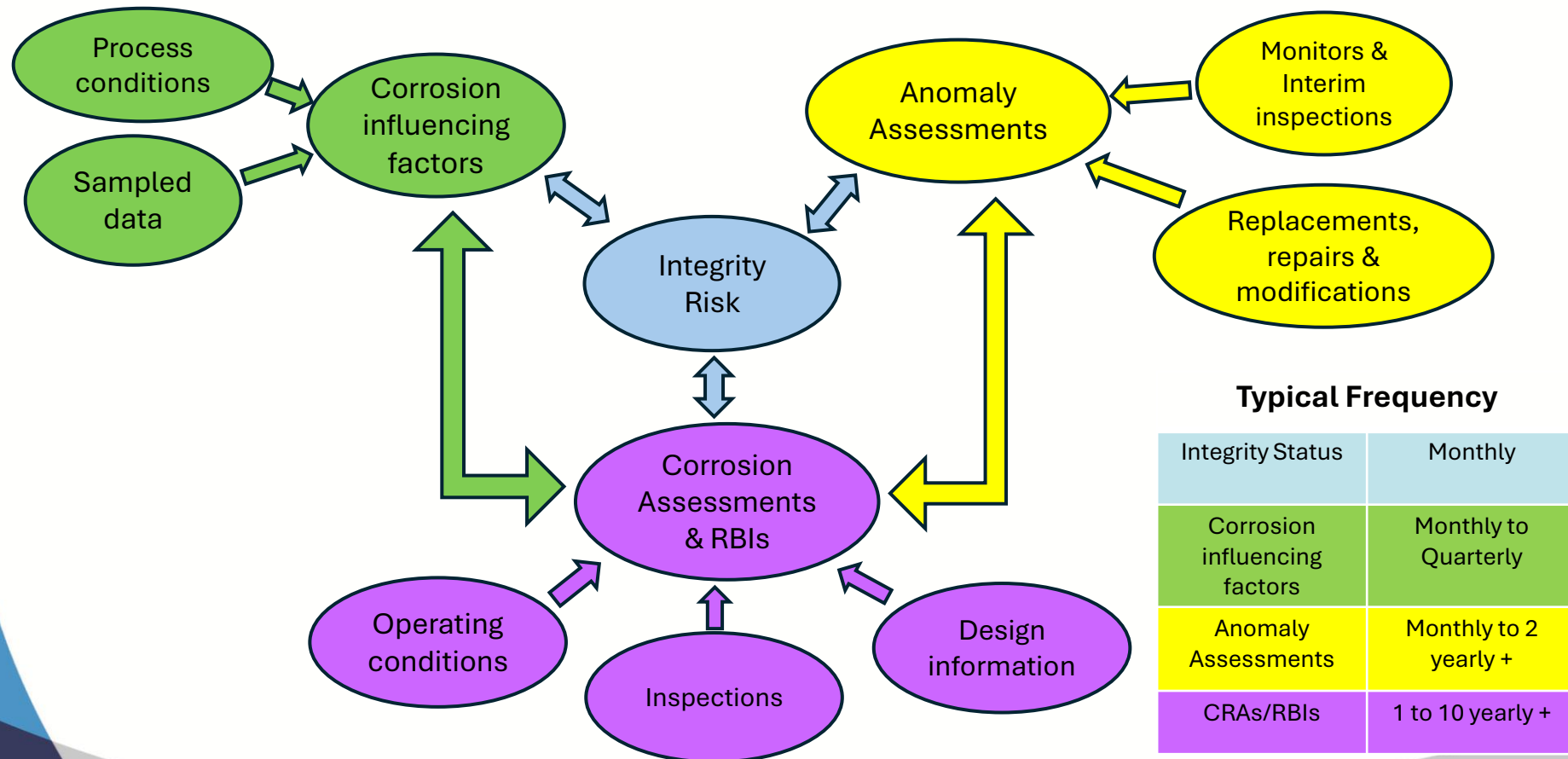


Internal corrosion



Degraded components

Regular review of Integrity risks



Corrosion Risk Assessments and RBIs



Most effective tool for optimising limited resources.

Assessments based on current operating envelope:

- ✓ Max possible pressure and overpressure protection
- ✓ Remaining life (based on MAWP) vs CoP



RBI results provide information

- ✓ Suspend inspection due post CoP
- ✓ Modify scope of inspection
- ✓ Reduced focus on low-risk assets

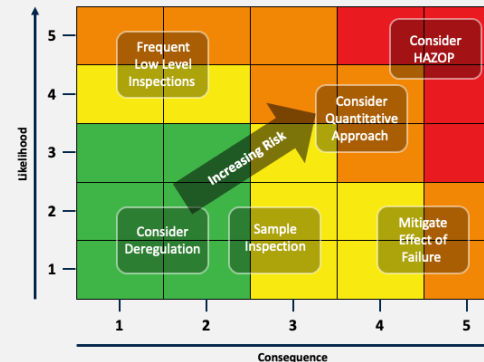


Leverage on technology enablers

- ✓ Drones and robotics
- ✓ Digital dashboards
- ✓ Remote monitoring
- ✓ Predictive models and analytics

RISK BASED INSPECTION

Analysis of Risk



Typical risk matrix



Internal of a pressure vessel

Corrosion Management Plans

 Materials selection - Carbon Steel vs CRAs

 Coatings/linings

- ✓ Localised repairs? Single coat?

 Chemical treatments

- ✓ Opportunity to optimise

 Inspection

- ✓ Efforts focused on safety & business critical
- ✓ Circuits/Vessels required post CoP
- ✓ Limited resources and timing

 Modifications – design and operations

 Repairs vs. Replacements

- ✓ Review of DLR and planned replacements

 Cathodic Protection

- ✓ Requirements beyond CoP



Offshore inspection via rope access



Inline pipeline inspection using NDT

Corrosion Influencing factors



Corrosion monitoring



Chemical management



Regular review of process parameters

- ✓ Pressure profiles
- ✓ Temperature
- ✓ Flow regimes



Regular review of corrosion KPIs vs. thresholds

- ✓ Chemical deployment
- ✓ Sampled data
- ✓ Operational pigging
- ✓ Moisture content



Corrosion monitoring

- ✓ Coupons
- ✓ Online monitoring probes
- ✓ UT sensors



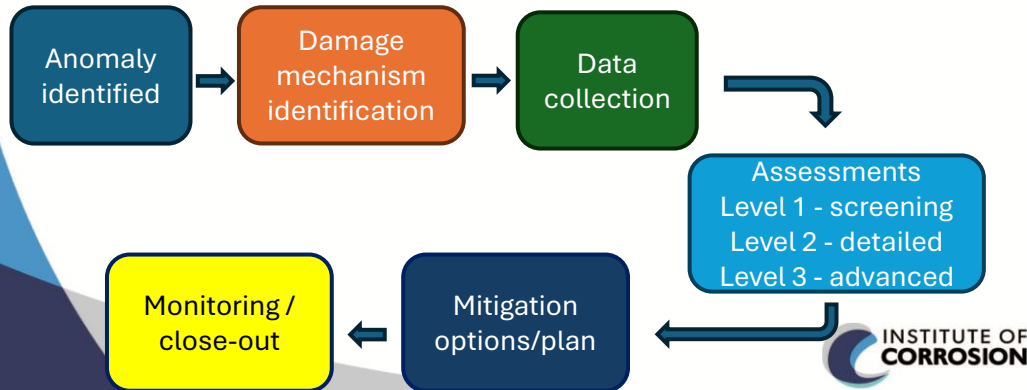
Operational cleaning pig



Process gas composition

Anomaly Management

- Structured, risk-based, ongoing
 - ✓ Identify, assess, prioritize, mitigate, and close defects
- Focus on safety critical areas
 - ✓ Escape routes, handrails, gratings etc
- Repair critical defects
- Monitor stable degradation scenarios
- Accept low risk anomalies
- Use of software



Fabric maintenance activities



Subsea clamp installation

Advancing Corrosion Science & Engineering

Problem



Accelerated internal corrosion

Flow rate increased



Oversized process facilities

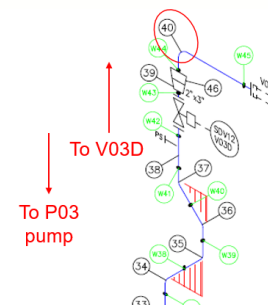
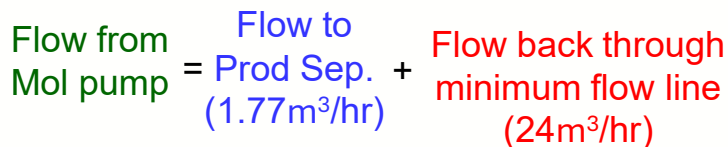


Higher shear stresses



Increased degradation rates

Line replaced with corrosion resistant alloy material



Case Study 2 – Cathodic Protection Retrofit

Problem



Platform and riser protected CP

✓ ICCP skids have mounted anodes

✓ Mechanical and electrochemical



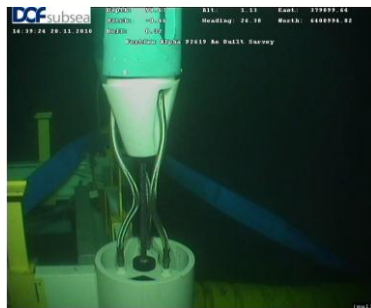
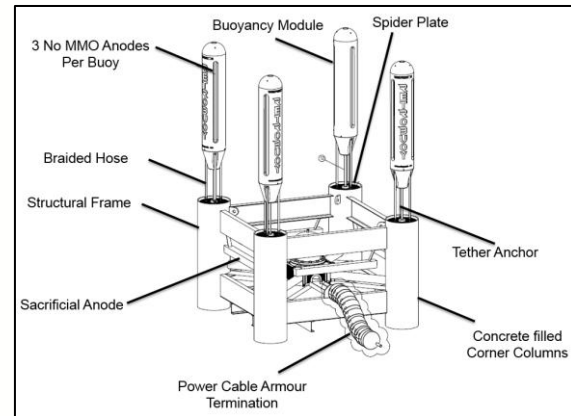
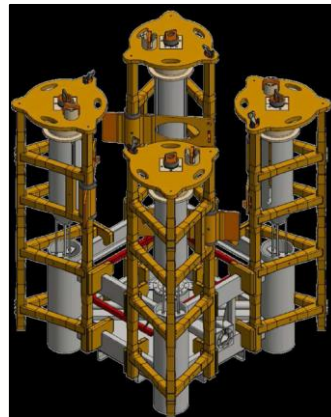
Degradation of components

✓ Stray current and wave motion

Solution



Non-metallic anode clamp as mitigation



Questions

