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Decommissioning and Restoration – Fostering Excellence through Regulations, Innovation, and Sustainable Practices

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Utilizing Acid Sulfamic and Anti-calcareous Descaler for Effective Marine Growth Removal for Subsea P&A

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Background

- In areas where sunlight can still reach the seabed, marine growth can hinder proper sealing of the blowout preventer (BOP) with subsea tree or wellhead. In previous plug and abandonment (P&A) operations, it was observed that multiple runs of a wellhead cleaning tool were required.
- Marine growth typically being removed using high pressure water jet. It works for general removal, but:
  - Not suitable for profile cleaning/internal area
  - Not suitable for elastic marine growth type

Mitigation

- By incorporating acid sulfamic or anti-calcareous agents responsibly into P&A programs, operators can reduce non-productive time and optimize operational efficiency of P&A and decommissioning works.

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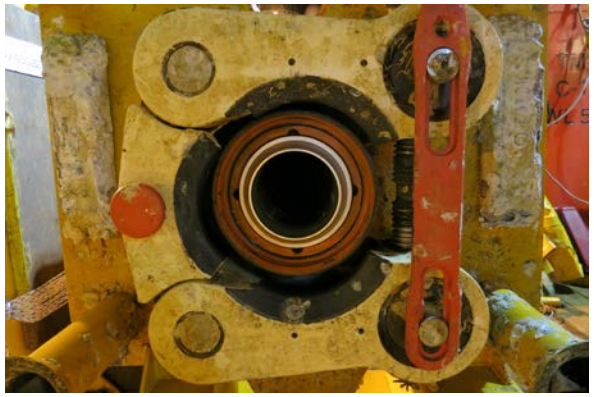
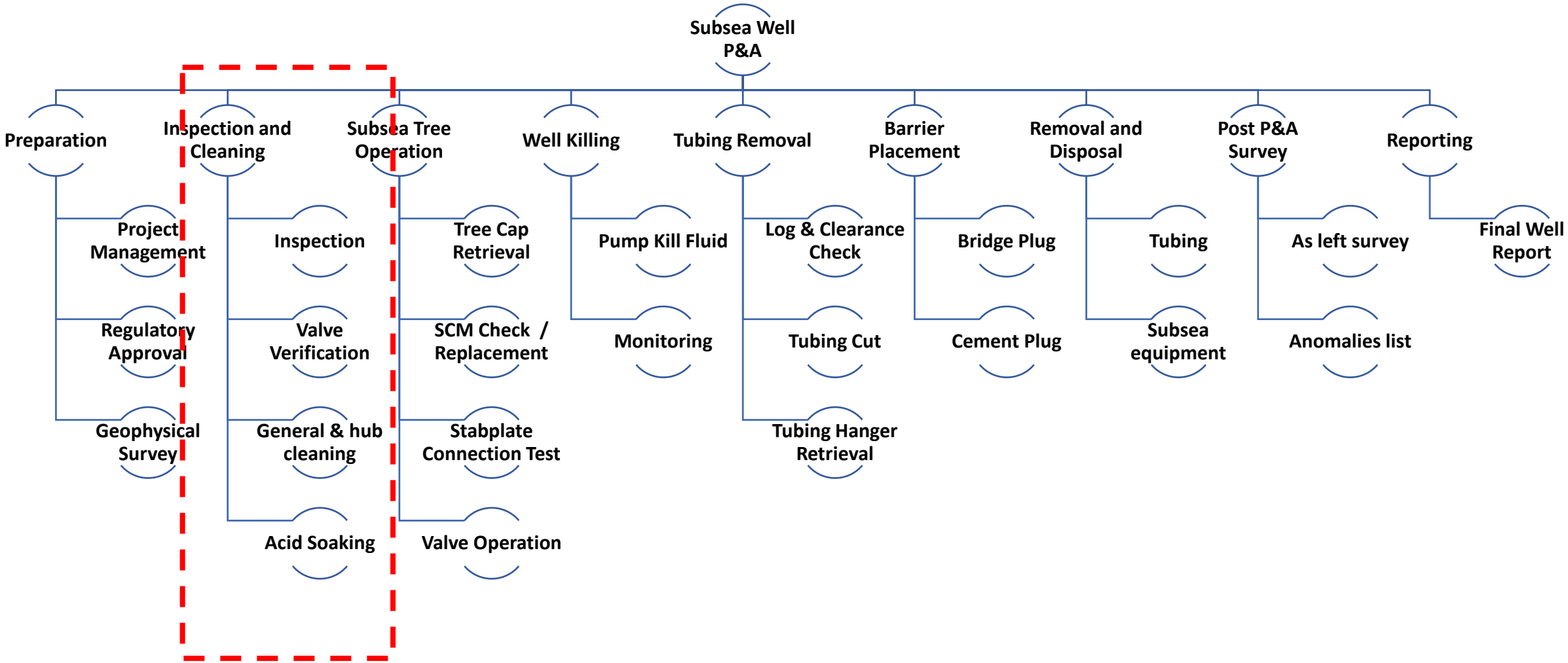
Example of Marine Growth at Subsea Shallow Water



Subsea Well P&A Typical Operation

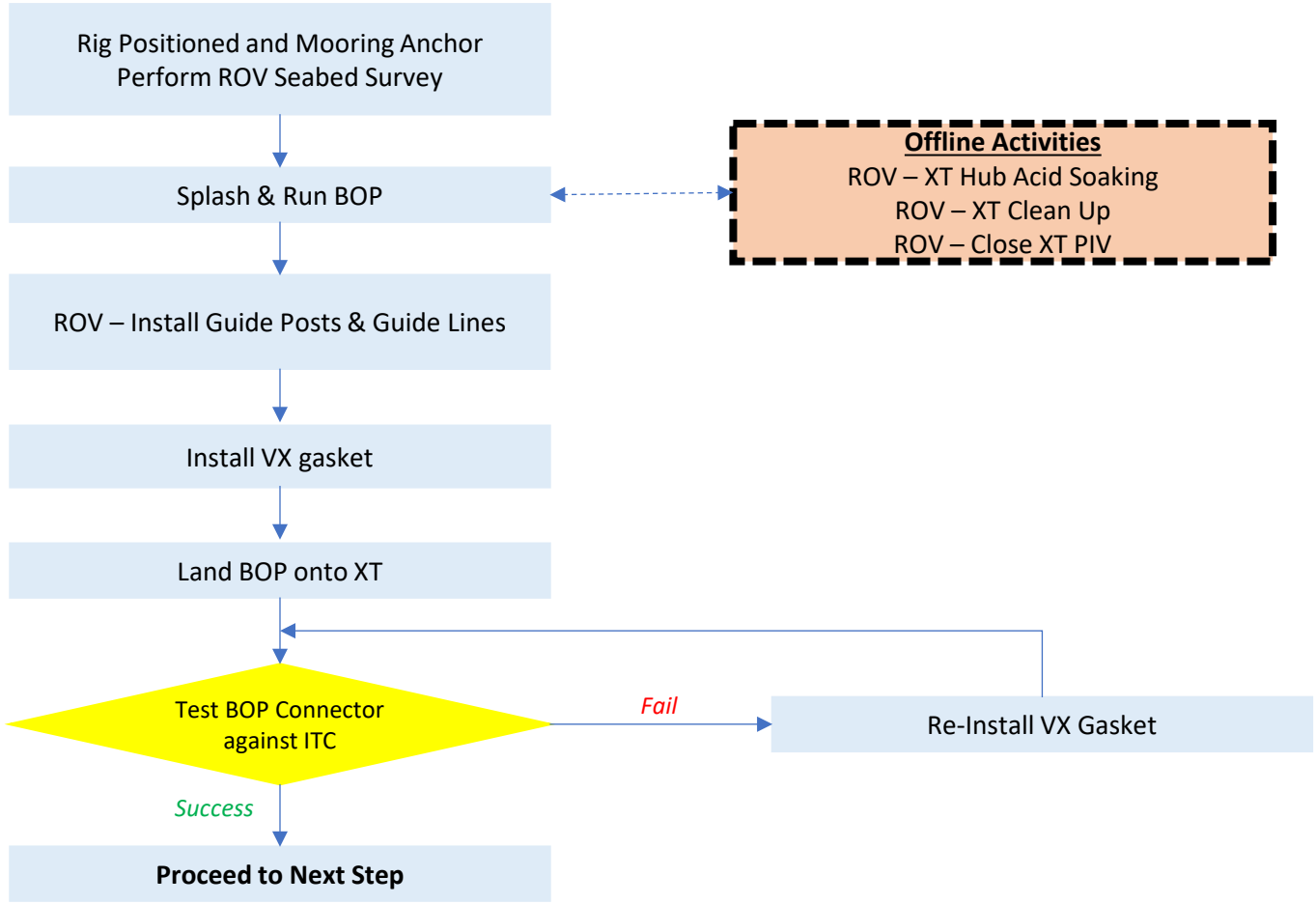


Chemical Agent Soaking

1st in Malaysia using GREEN rated PLONOR agent for Subsea P&A

BOP Preparation before splash BOP at Subsea Well

- Remove BOP guide funnel
- Perform IBWM and BOP checks
- Ram Changeout
- BOP Frame Modification
- BOP Pre-Deployment test



BOP = Blow Out Preventer
IBWM = In Between Well Maintenance
ITC = Internal Tree Cap
PIV = Production Isolation Valve

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Methodology for Utilizing Acid or Descaler Agent

To ensure that marine growth removal is effective and efficient, the following shall be taken into consideration:

- Capable personnel to handle the chemical
- Detailed handling procedures offshore
- Location for soaking (outer surface or internal hubs)
- Design of the chemical (buoyancy, volume, concentration, and etc.)
- Design of shroud or containment
- Materials compatibility
- Host authority requirements and regulations

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Engineering Effective Solution

Shroud and Containment Design & Chemical Buoyancy Engineering Check

- The process of diluting marine growth using acid spans approximately 2-4 hours, and additional soaking round may be conducted if deemed necessary

Buoyancy Type	Characteristic and Application
Positive buoyancy chemical design	• Lower density than seawater, are conducive to floating and covering a larger area, such as the surfaces of subsea trees and the ROV panel. • Suitable for external marine growth with broader coverage but may lack precision in pinpointing isolated locations.
Negative buoyancy chemical design	• Higher density than seawater • Specifically tailored to target connectors, hubs, and interfaces at the ROV panel itself.

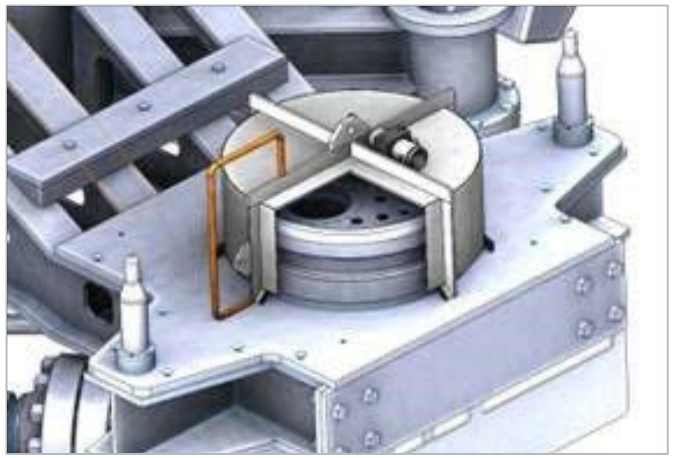

Figure 1: Shroud Design for Negative Buoyancy Agent (courtesy of TMT)

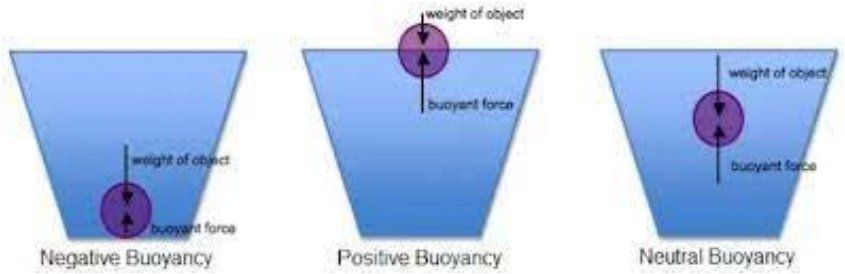

Figure 2: Buoyancy Concept

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Material Compatibility Check

- For material compatibility, it is important to check the material of the surface that will be in touch with the chemical
  - ❖ For short term soaking, diluted acid sulfamic with low concentration can be considered for optimization.
  - ❖ For long term soaking, a more detailed assessment shall be undertaken with OEM and chemical suppliers.

Sealing Type	Material	Resistance/ Compatibility with Diluted Acid Sulfamic	Resistance/ Compatibility to Descaler Agent
Primary	Metal to Metal Typical: Stainless Steel or CRA	Yes	Yes
Secondary	Non-metallic Typical: Polytetrafluoroethylene (PTFE), Hydrogenated Nitrile Butadiene Rubber (HNBR), and Polyetheretherketone (PEEK) material	For short term	Yes (subject to chemical suppliers' formula)

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Host Authority and Regulatory Compliance

- **Declare Chemical Operations:** Report any use of acid or descaler chemicals in the sea due to potential harm to sensitive marine areas and endangered species.
- **Select Environmentally Safe Descalers:** Choose descaler agents that pose little or no risk to the environment (PLONOR) to minimize potential harm.
- **Understand PLONOR Classification:** PLONOR chemicals are assessed to have minimal risks to human health and the environment when used as intended and the list is updated from time to time.
- **Adhere to Safety Protocols:** Follow proper safety protocols to maintain the PLONOR status, ensuring safe handling, usage, and disposal to comply with stringent environmental regulations.

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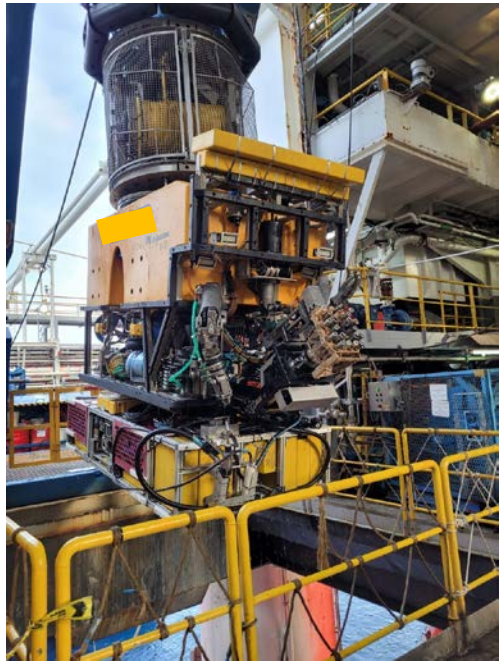
Offshore Preparation & Application

Corrosion Cap for Injection

Ensure cap is suitable for acid injection

ROV with Injection Skid



Verify interface of injection skid with ROV

Wellhead Cleaning Tool (WHCT)

Verify cleaning tool profile with OEM

Hot Stab

Confirm injection mechanism via hot stab /wand

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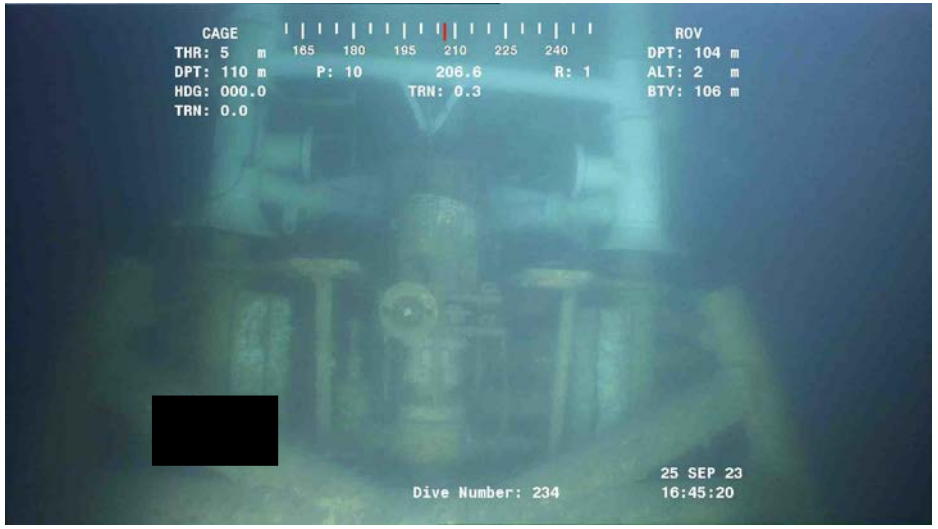
Offshore Execution

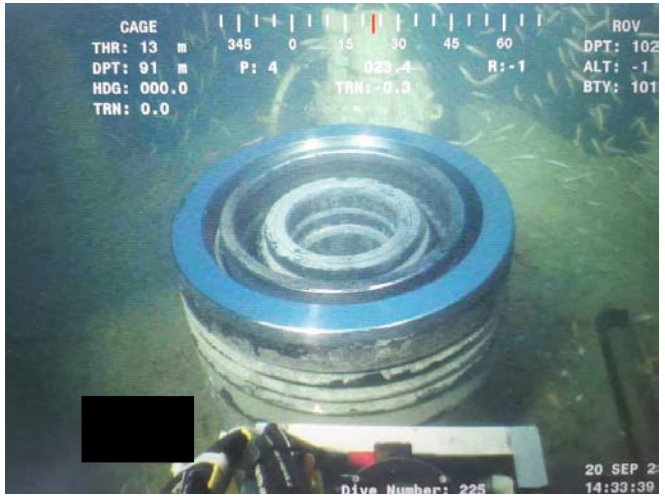
1. Acid Soaking via ROV hotstab

2. Retrieving the Corrosion Cap



5. Land BOP to Top of Subsea Tree

3. Cleaning using WHCT



4. Post Cleaning of Profile

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Case Study:

Comparison of Wellhead Cleaning Offshore Duration

Field X (2020) Without Subsea Decalcification Fluid	Days	Field Y (2023) With Subsea Decalcification Fluid	Days
ROV inspection & valve verification	0.5	ROV inspection & valve verification	0.5
Removal of subsea tree cap	1.0	Removal of subsea tree cap	1.0
Water jet clean the VX profile hub	0.2	Water jet clean the VX profile hub	0.2
Use mechanical VX cleaning tool and clean until meet acceptance criteria. Repeat until profile is shiny.	3.0	Acid soaking	0.2
		Use mechanical VX cleaning tool and clean until meet acceptance criteria. Repeat until profile is shiny	0.8
TOTAL	**4.7**	**TOTAL**	**2.7**

The above shows savings of 2 rig operational days for a single well for wellhead cleaning activity offshore. The savings would be bigger for a longer P&A campaign with multiple wells planned to be cleaned prior to well entry.

Conclusion and Key Takeaway

- Acid sulfamic and anti-calcareous descaler are excellent option to remove marine growth, especially for P&A operation where subsea facilities are already in service for long number of years with high volume of marine growth.
- The deployment of acid sulfamic or decalcification fluid should be carried out with consultation with Original Equipment Manufacturer (OEM) and chemical supplier.
- For each well, it is anticipated up to 2 days performance improvement for wellhead cleaning cost for fields that are impacted with marine growth.
- The acid or descaler soaking method can be adopted upfront during General Visual Inspection campaign prior to rig mobilization for further optimization.

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Acknowledgements / Thank You / Questions

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