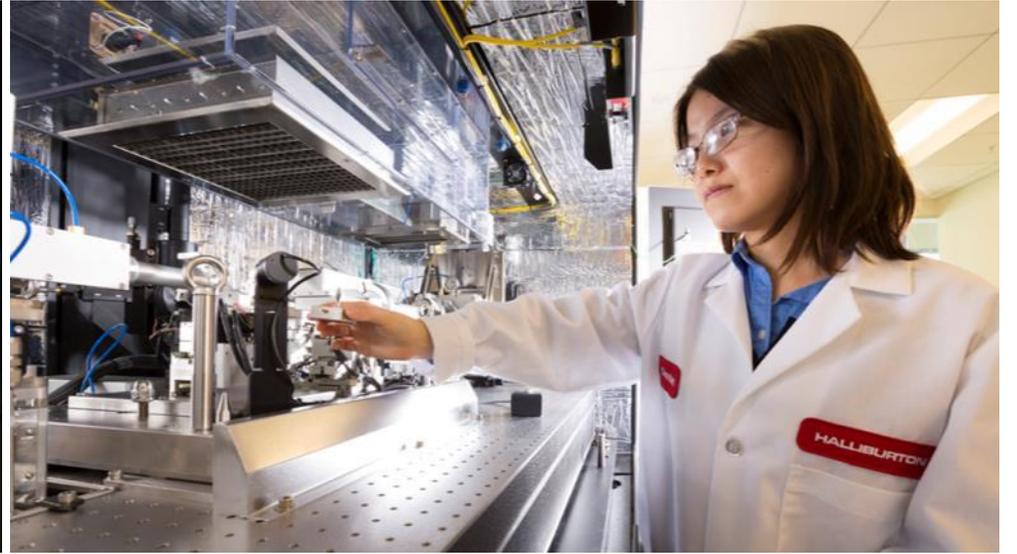
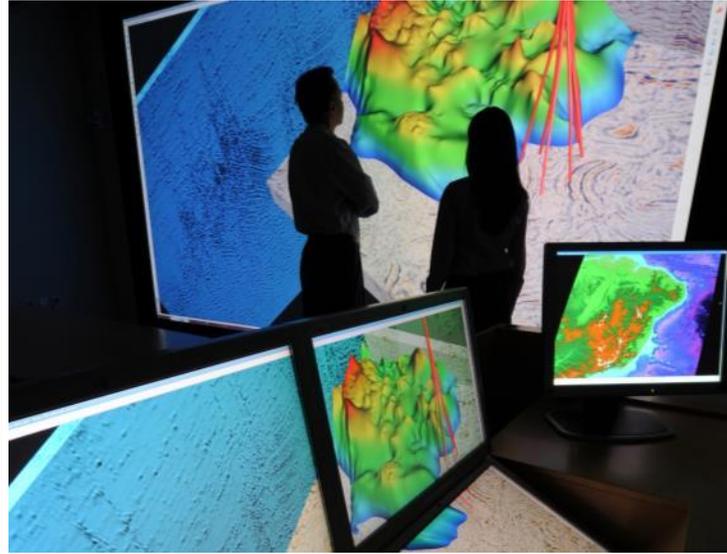


HALLIBURTON

Norsk Olje & Gass – 8'th P&A Seminar

Quality Airport Hotel, Sola

18.10.2018



Jotun B P&A Project

Jan Tore Helgesen

Senior Project Manager



Jotun B P&A - Challenge

Challenge

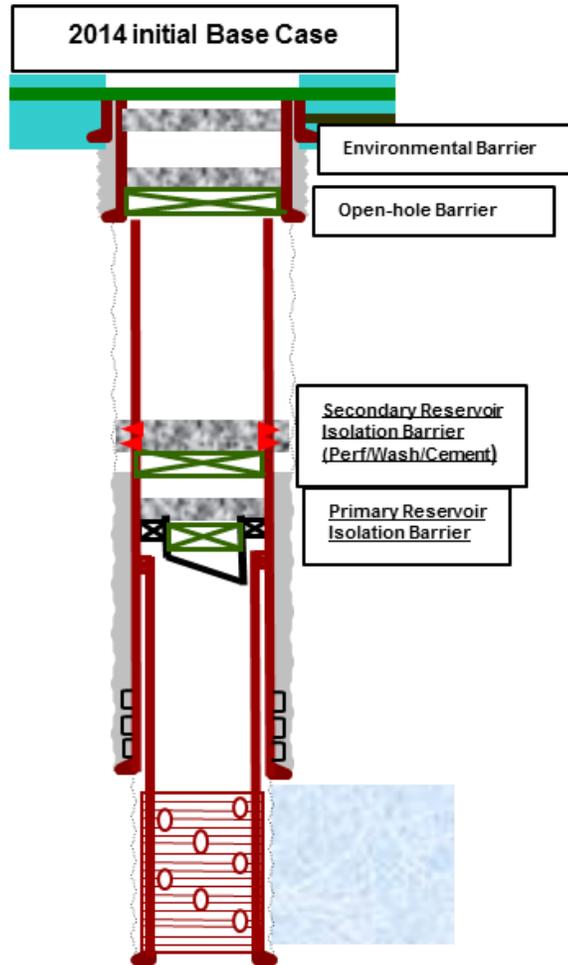
- P&A of 20 wells according to regulatory and internal company requirements
- Aging facility (unmanned) with inoperable rig
- Low POB (max 60)
- Safe and effective execution at lowest possible complexity and overall project cost



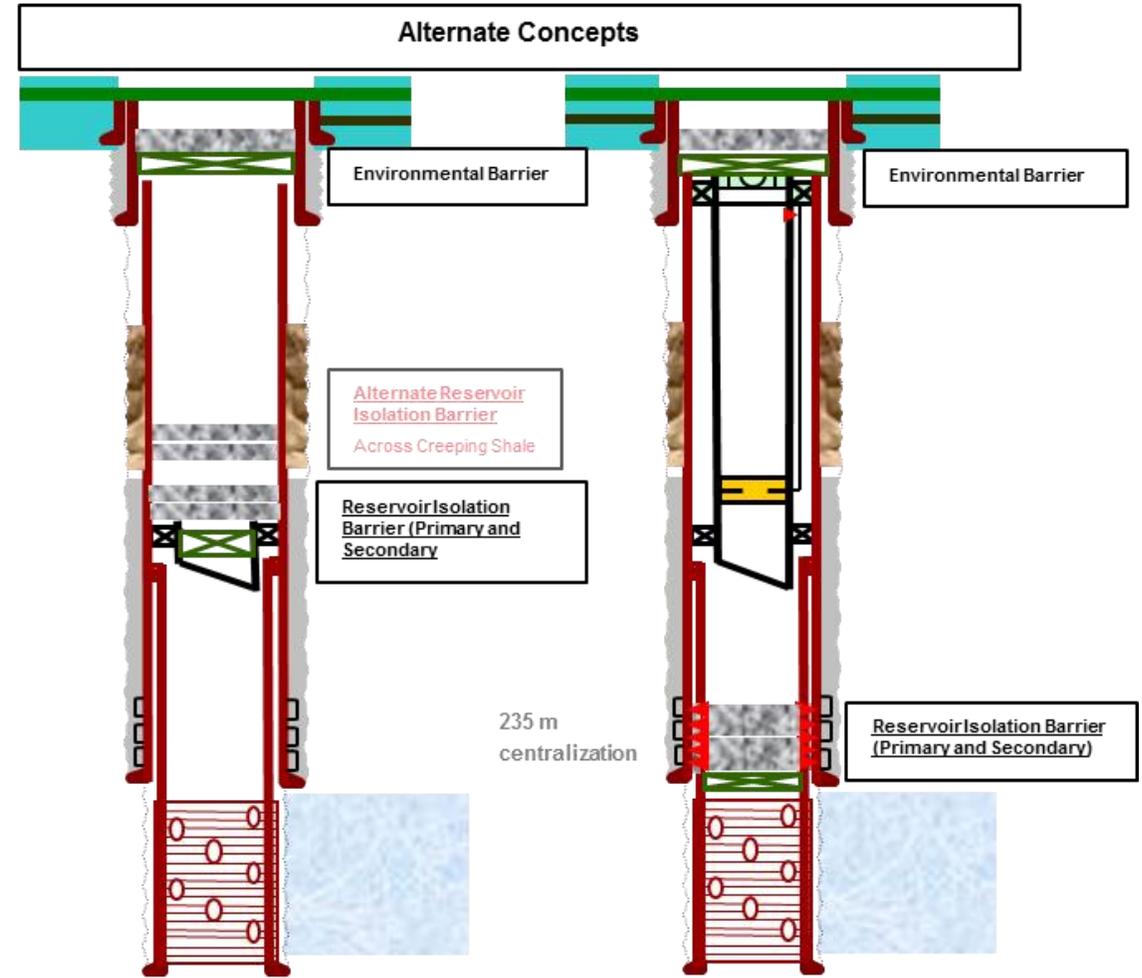


Jotun B P&A - Solution

Studies - Subsurface concept evolution



- Separate primary and secondary reservoir barriers due to suspect cement quality
- Open-hole barrier to avoid undesirable crossflow



- Combination primary/secondary barrier based on cement records (majority wells)
- Open-hole barrier not required based on geophysical analysis

- Combination primary/secondary barrier above reservoir, near casing shoe
- Open-hole barrier not required based on geophysical analysis

Studies – Topside and Commercial concepts

Considerations

- Is the old platform rig the best solution for P&A?
What is the cost to refurbish the existing rig?
- Can part of the scope be executed “rig less”?
- What type of rig do you need?
How much of the scope needs a rig?
- Can the reservoir barrier be placed with coil tubing?
- Will appropriately equipped, purpose-built P&A unit be more cost effective than a traditional modular rig?
- Lowest day rate and minimize mob/ demob costs
- What other Decom activities can be executed in parallel with P&A of the wells?
- What is current production rate, and when does project go from positive to negative cash flow? COP?
- Which contract form will maximize synergies, execution efficiency and minimize interfaces and overall cost?
- How to de-risk the project and be less schedule driven



Jotun B Drilling Rig



Jack-up Drilling Rig



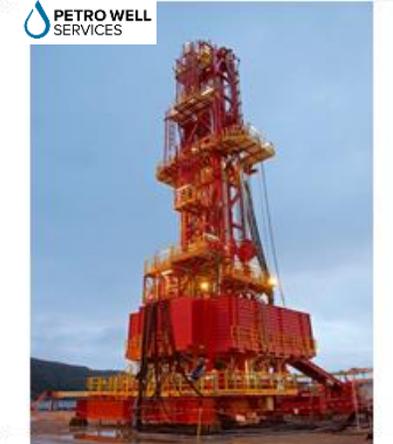
Modular Drilling Rig



Wireline



Coil Tubing



P&A Unit

Jotun B P&A Solution - Phased approach

Phase 1 (Preparation/Integration)

Remove old derrick and drilling systems to prepare platform for P&A Equipment

Phase 2 (Wireline Diagnostics)

Tubing drift, perforation of tubing to allow for flushing of 'A' annulus and Ultrasonic tool run on B10 to verify presence of creeping shale

Phase 3 (Coil Tubing – Reservoir Isolation)

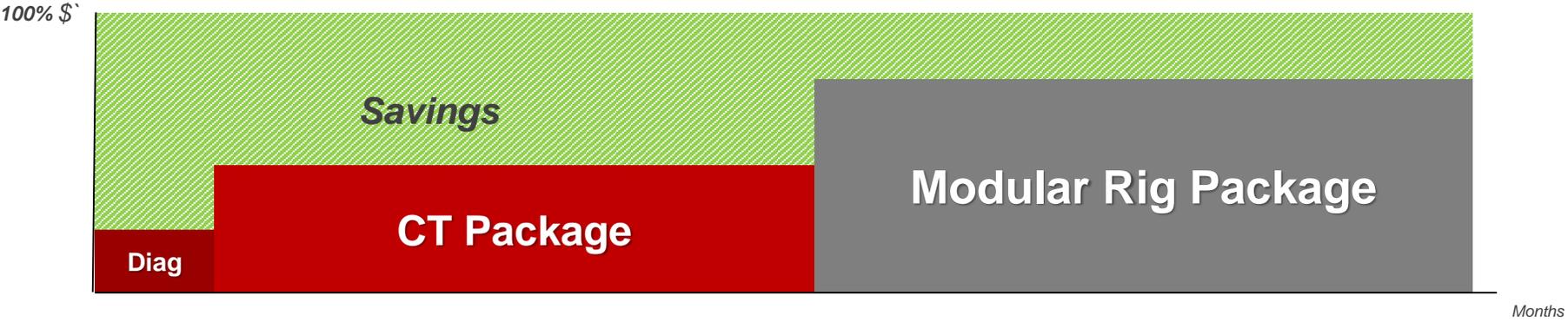
Install reservoir isolation barrier in minimum 12 of 17 producers

Phase 4 (P&A Unit – Wellbore Isolation)

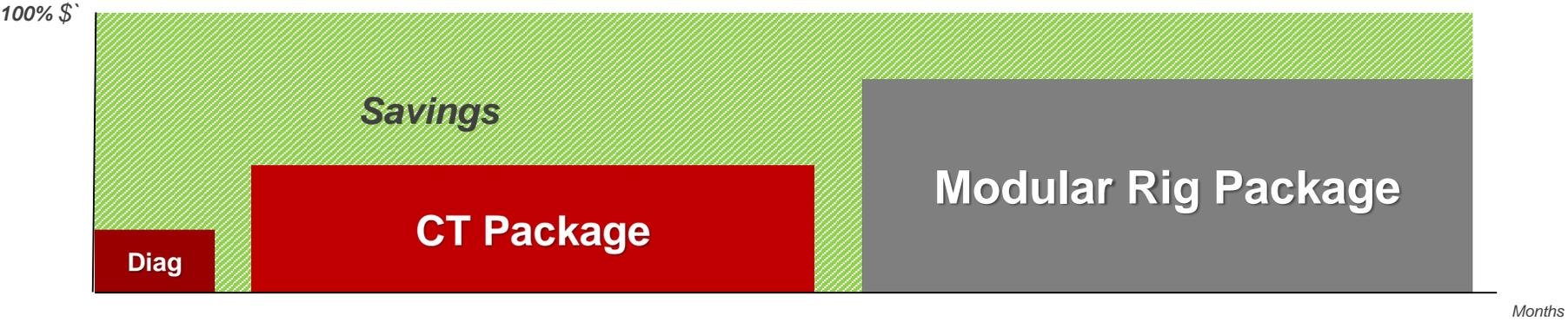
Install reservoir isolation and environmental barriers in remaining wells



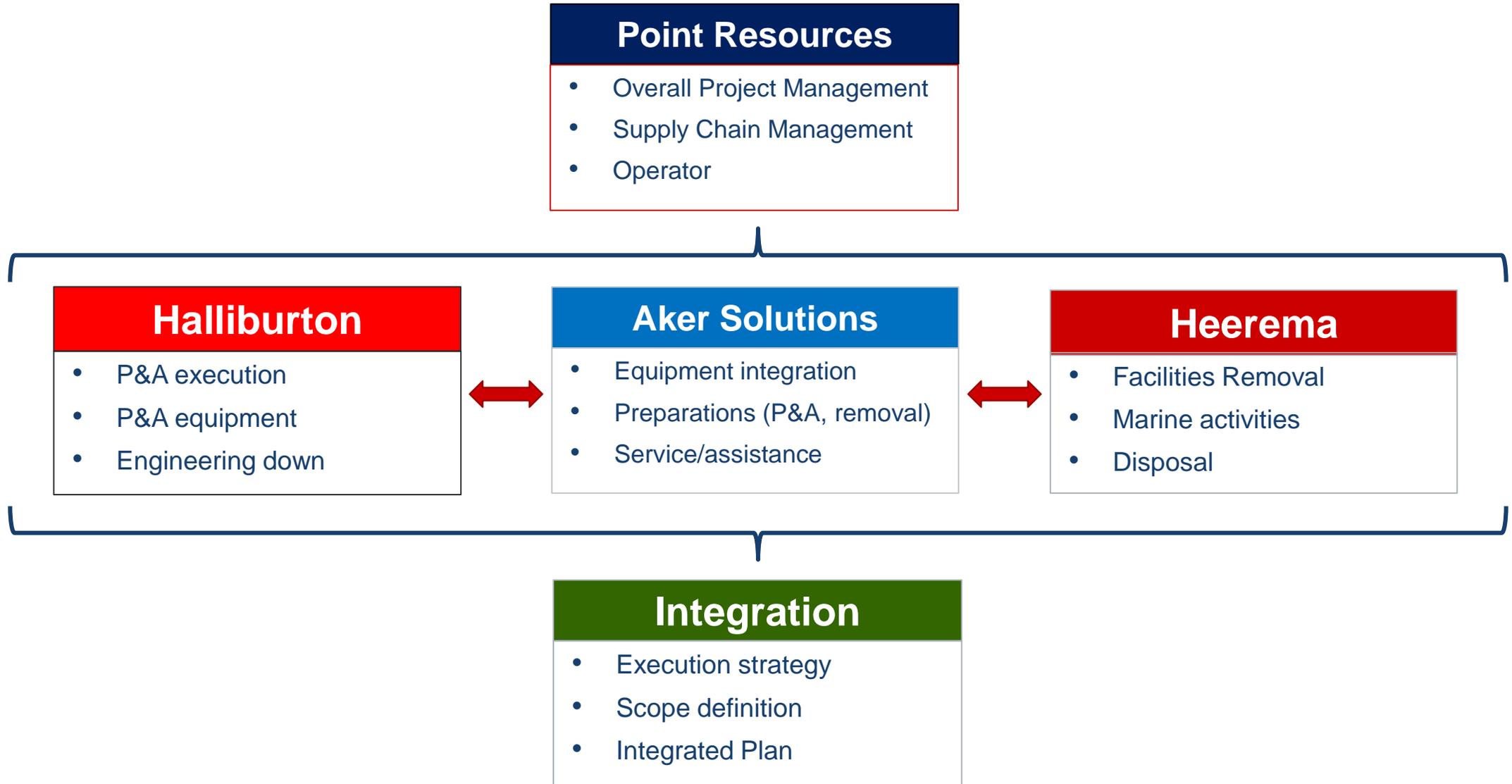
Project Risk and Commercial drivers – Phased approach



Project Risk and Commercial drivers – Phased approach



One Integrated Team > Remove Silos > Release Opportunities



One Integrated Team > Remove Silos > Release Opportunities

ExxonMobil / Point Resources

Halliburton

C&PM CT WPS TSS PE CMT HCT PPS BAR BSS

Aker Solutions

Petro Well Services AS

Cameron

Ardyne

OWS

Other

MH Wirth

Pal

Aker Solutions

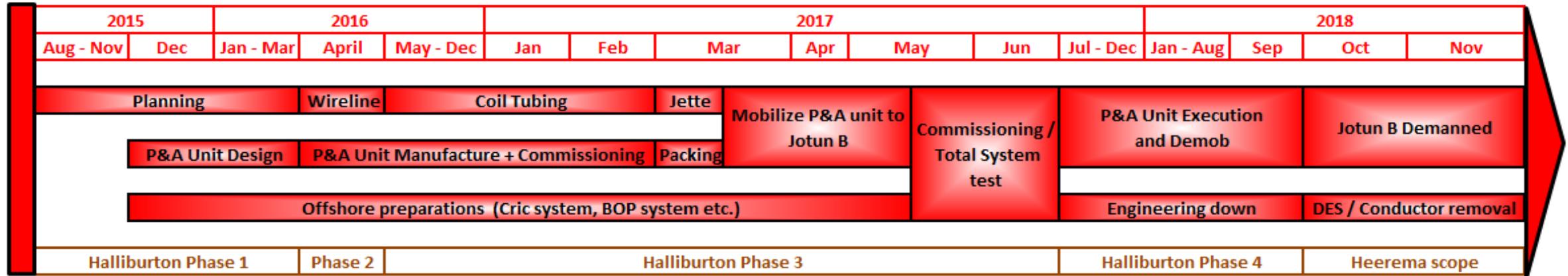
Other

Contract Structure



Jotun B P&A - Execution

Jotun B P&A - Timeline

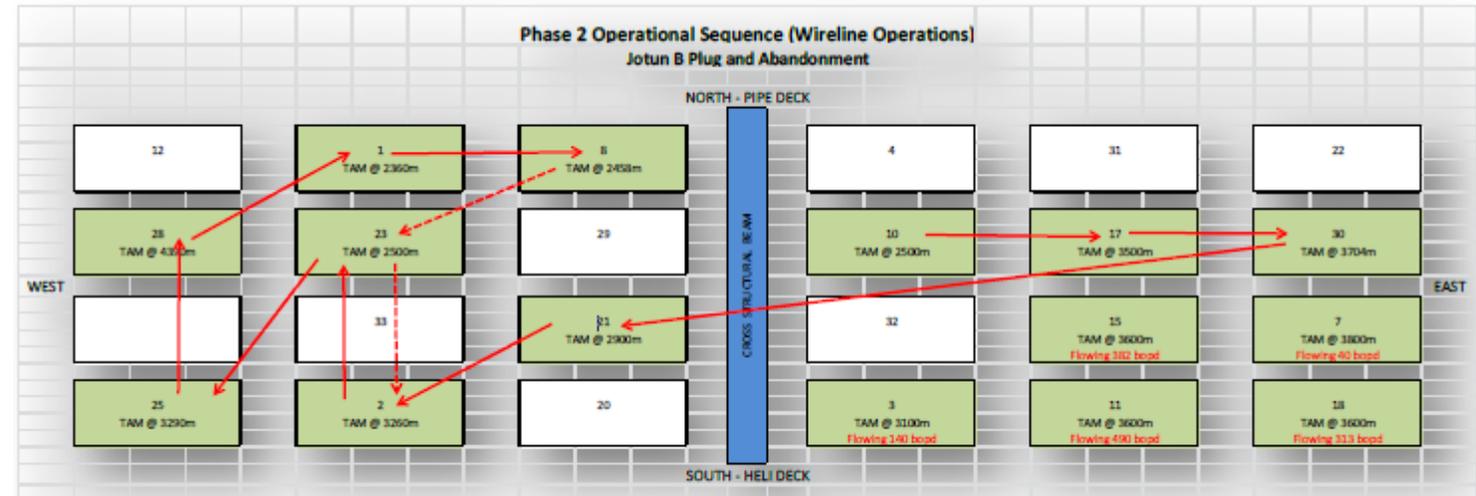




Phase 2 – Wireline Operations

Summary - Wireline

- Key objectives: confirm access to all shut in producers (9 wells) via wireline through the upper completion, establish circulation holes above the packer and conduct circulation to the A annulus above the production packer to allow displacement of annular volume with kill fluid. Additionally one waste injector was logged to identify potential isolation by creeping shale formation
- Wireline operations conducted in the time interval 11.03.16 – 02.04.16
- Drift access was confirmed on all producers
- Annulus circulation conducted on 8 of 9 producers
- Scale was identified in the injector, giving first indication of scale build up enabling preparing for scale removal in the coil phase
- Creeping shale identified





Phase 3 – Coil Tubing Operations





2016/12/13

Coil Tubing Jotun P&A Key Facts

Phase 3 – Set Reservoir barrier(s) with Coiled Tubing

■ Total no of wells completed	16 wells
■ Total no of cement jobs	38 jobs
■ No of Coiled tubing runs completed	177 runs
■ Total running footage (1 way)	1,767 million (580 km)
■ Total CT operating hours	7240 hrs
■ Total uptime %	97.02 %
■ Total downtime %	2.98 %
■ Total CT NPT hours	216.05 (12 incidents)
■ Total man hours	28,962 hrs
■ Total LTI	0 hrs



Coil Tubing String Applications – Jotun B

P&A activities using Coiled Tubing

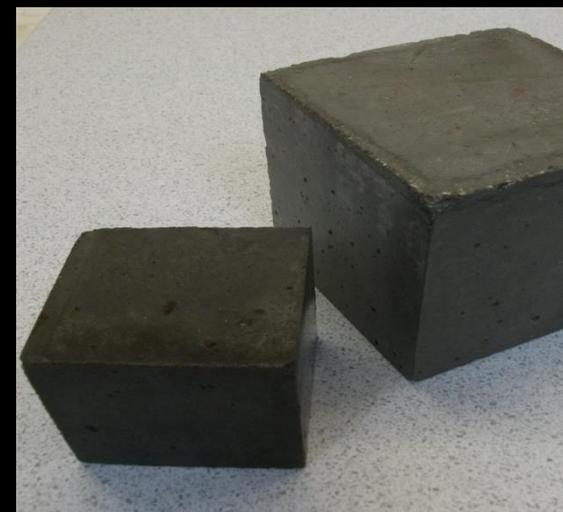
- Drift - SpinCat (rotating jetting) wash
- Milling (cement and scale)
- Acidizing
- MCCL runs
- Perforating 100 m – 150 m sections
- Pulsonix (fluidic oscillator) wash
- TAM Packer setting
- Cementing
- Tubing Punch



Coil Tubing String Applications – Jotun B

P&A fluids pumped thru Coiled Tubing string

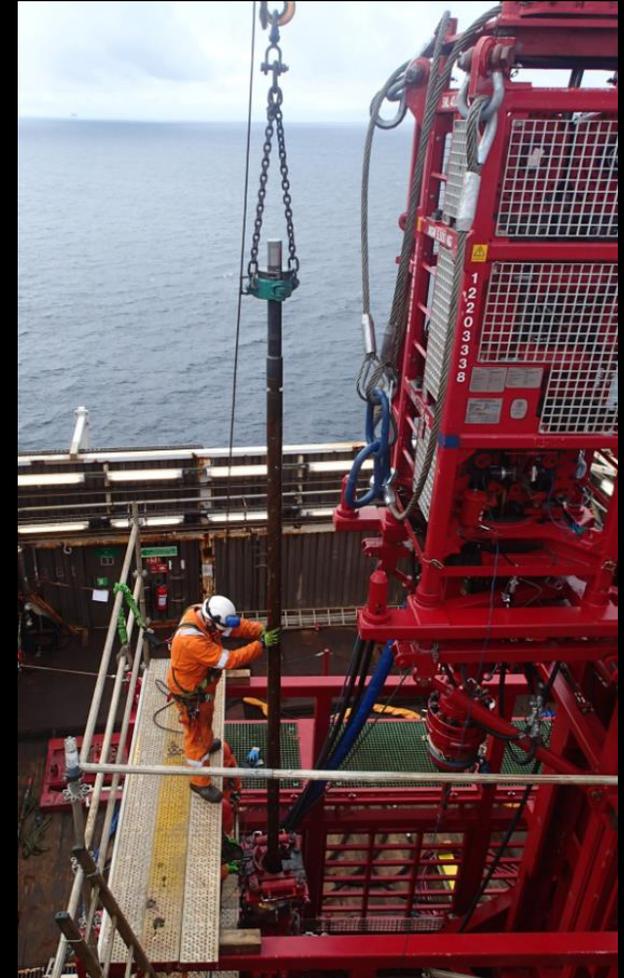
- Freshwater
- Seawater
- Acid (Organic blend & 15% HCL)
- Soda Ash
- Cement (12.5 ppg AbandaCem L)
- Viscous Gel pill (Barazan)
- Clean up pill (Bar-None/DeepClean)



TCP Phase 3 Jotun P&A Key Facts

Phase 3 – Tubing Conveyed Perforation data

- Total no of wells serviced 15 wells
- Total no of perforation runs 46 runs
- Perforated interval 3,174 meters
- Number of shots 67,626 holes
- Explosives consumption 1,887 kg
- Total uptime % 100 %
- Total downtime % 0 %
- Total LTI 0 hrs





Phase 4 – P&A Unit Operations

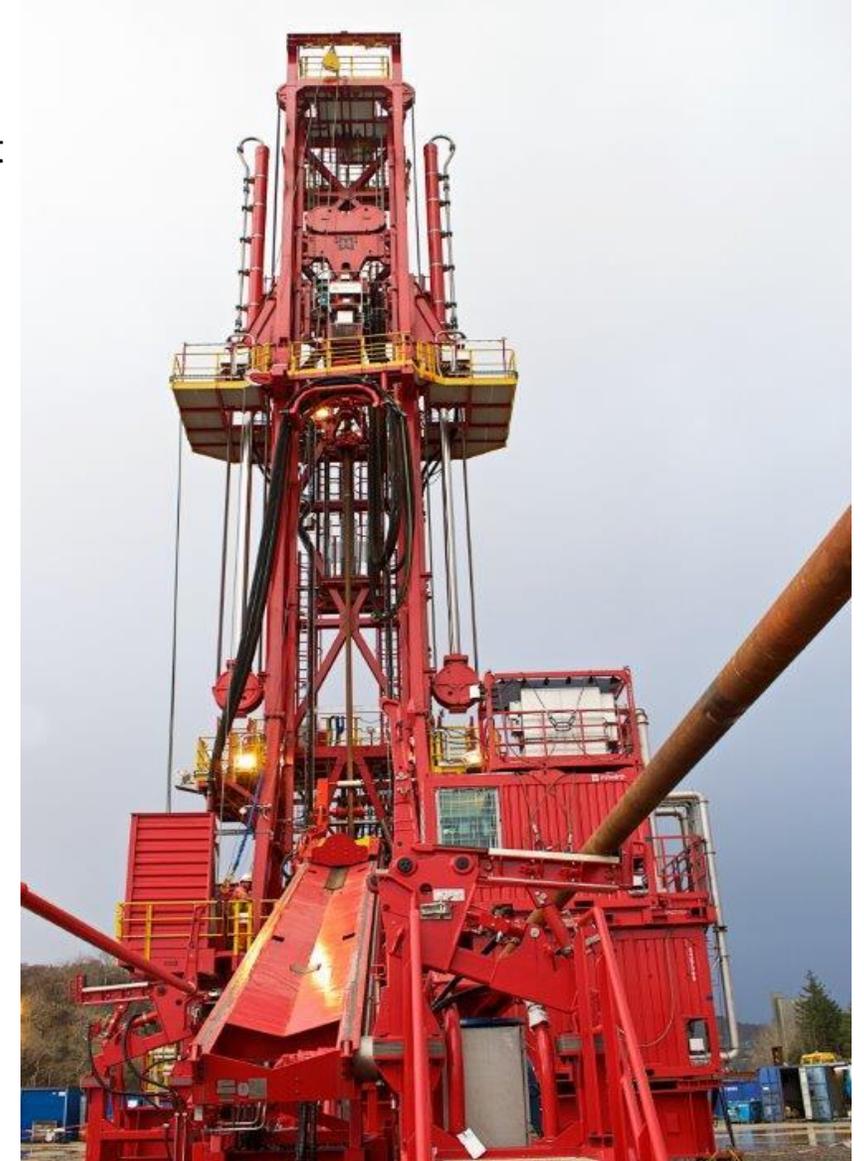
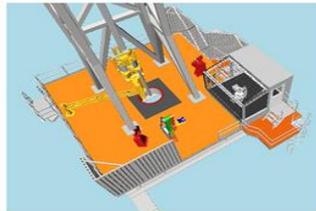
Optimus Modular P&A Unit

Novel design based on standard components

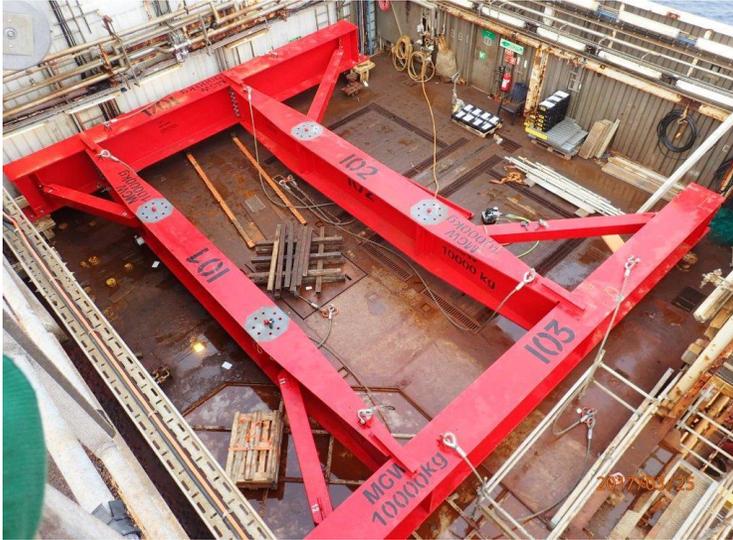
- Cost effective P&A and Drilling applications – low footprint, flexible lay out
- NORSOK based design, NORSOK Z-015 certified – temporary equipment
- 350 MT (Max 500 MT) Hydraulic hoisting system, 51 000 ft/lbs Top Drive
- All Electric Hydraulic system – silent rig
- Fully automated pipe handling system
- Low POB

From Concept to Completed Commissioning in 11 Months

Contract award 08.04.2016
Concept agreed 09.06.2016



Optimus P&A unit

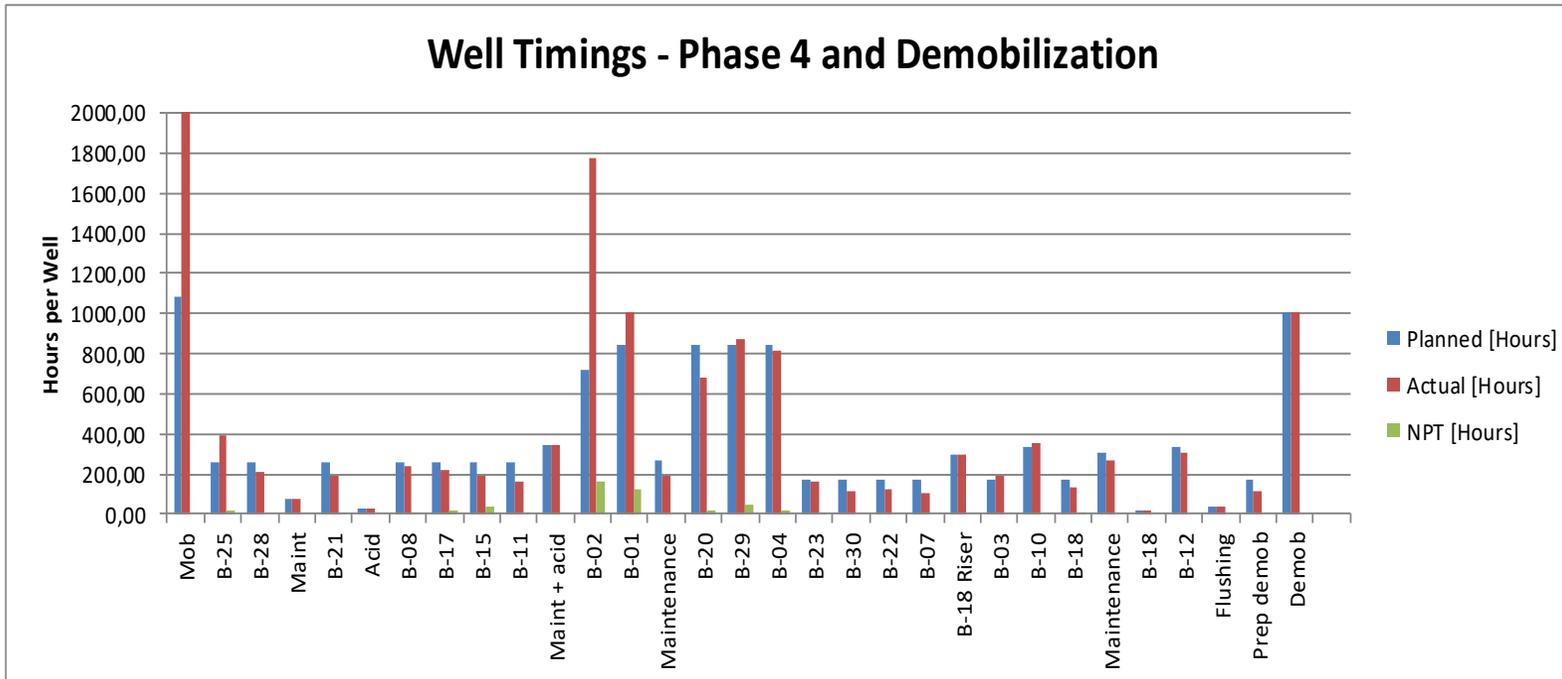


Optimus P&A unit

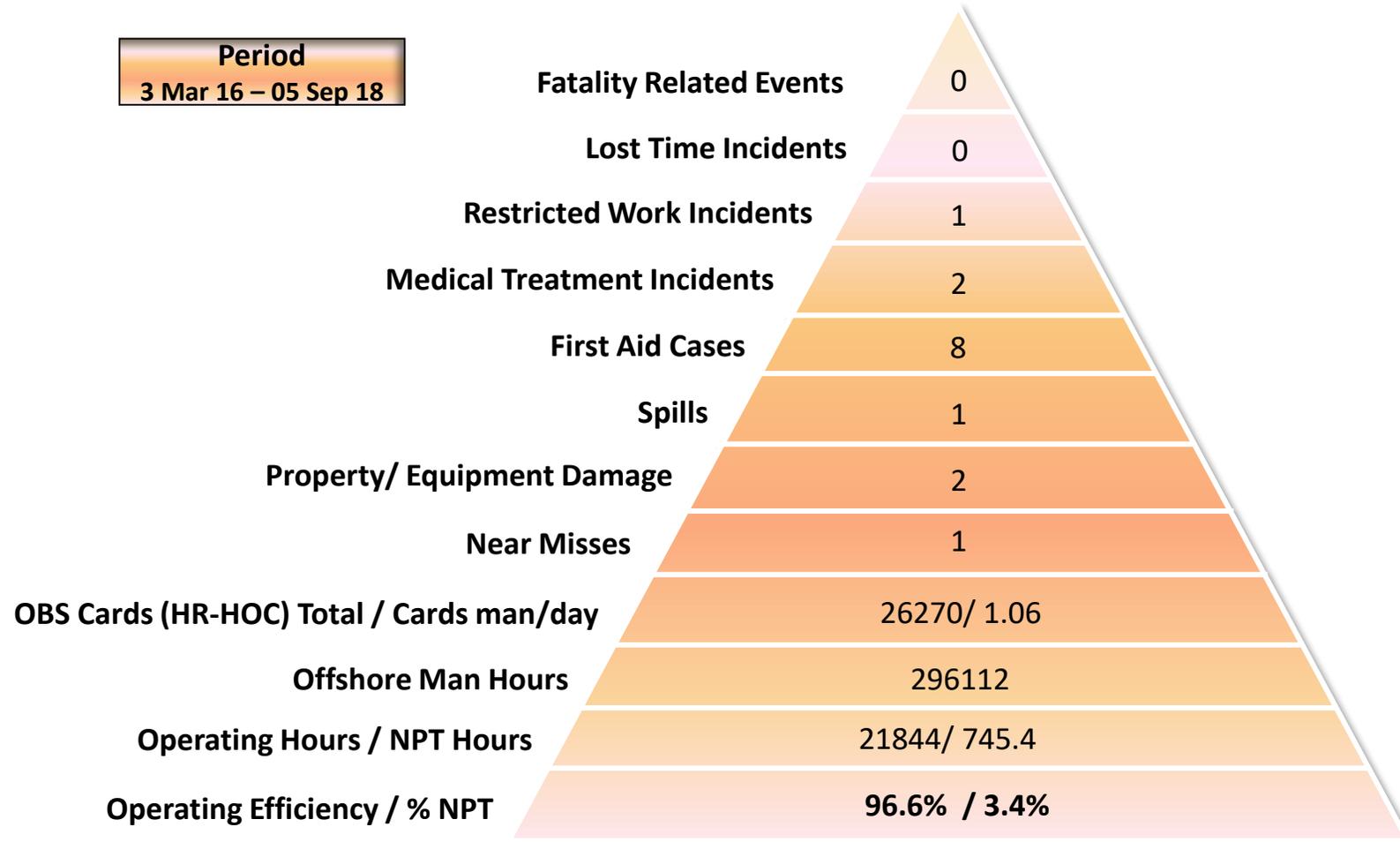


Phase 4 - P&A unit installation and operation

- Overall P&A Unit worked as intended – efficient automated pipe handling
- Equipment integration is a significant part of the scope
- Smooth start up – few technical start-up problems
- One operations stop due to tubing and drillpipe Hi-Po events
- 97% productive time from start to finish



Performance Summary Jotun B P&A



Overall Project Summary

Treat P&A as a Project and an integrated part of Decom

- Perform studies to establish cost efficient concepts
Focus on link between barrier & topsides concepts (rig/ rig-less)
- Mobilize a competent X-functional Project Team early
(minimize interface challenges and capture functional strengths)
- Identify potential technology requirements early
(e.g. PWC, plugging methodology, logging technology, etc.)
- Identify synergies between disciplines traditionally separated
(e.g. Engineering down in parallel with P&A operation)



Overall Project Summary

Successfully utilized an unconventional strategy for P&A

- Placing reservoir barriers below production packer using coil tubing is a technically viable and a cost effective method
- A purpose built P&A unit is an efficient solution for P&A
- Contractor selected based on ability to execute a bundled program (WL, CT and P&A unit execution).
This also enables an untraditional multidiscipline organization utilizing X training
- Ensure that regulatory requirements are understood (barriers and equipment classification)



Overall Project Summary

Contract strategy

- One contractor capable for delivering the entire well scope
- Early engagement / cooperation with EPC contractor
- Ensure clear responsibility definition in the Contracts
- Define all the interfaces and develop an Interface Management Plan
- Develop Work Breakdown Structure suited for P&A execution and rig construction
- Make sure that the link between P&A execution and facilities removal is understood





THANK YOU