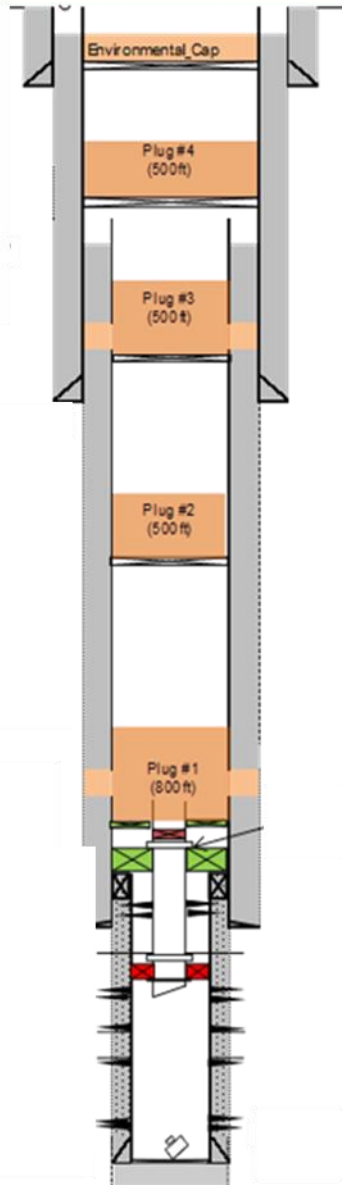


Proposed Abandonment



P&A or Plug and Wait, what are the options and how do you decide?

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SPE Aberdeen

Well Abandonment 2021

10 - 14 May

Introduction

- ▶ Well Decommissioning on fixed platforms - this has been my focus for a number of years.
 - ▶ Assets where there may be a gap of several years between COP and P&A
 - ▶ Many challenges to manage the end of life phase of an asset but when to P&A is a key issue
 - ▶ Abandon now or postpone until nearer topside removal?
 - ▶ Logically doing it now might be better but there are arguments for delay
 - ▶ We framed this presentation around the question 'How do you decide?' but maybe 'How do you decide this is acceptable?' is maybe a better summary.
- ▶ Why delay?
 - ▶ Finance availability
 - ▶ We're just not ready
 - ▶ Operational platform
 - ▶ Developing Technology
 - ▶ Campaign / Multi Operator Approach
 - ▶ Future Use

Economics

To illustrate the economic issues, consider an example North Sea asset:

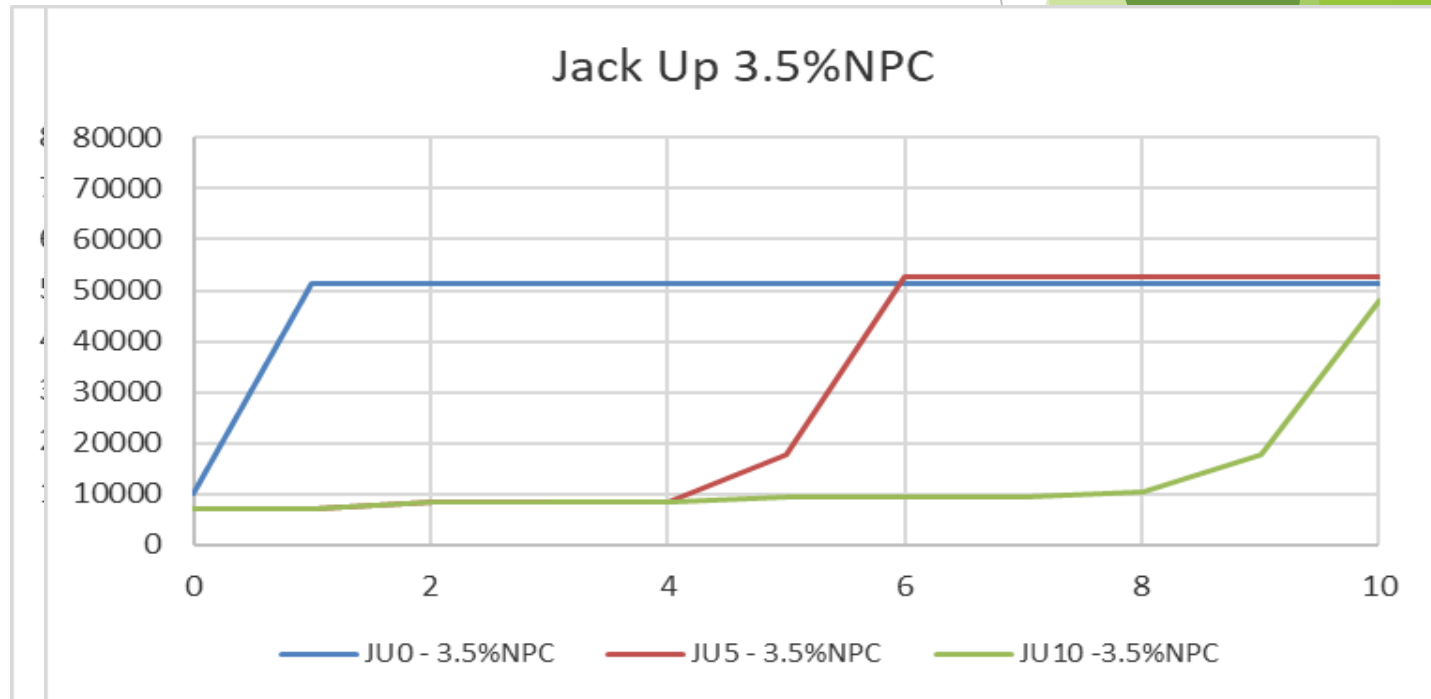
- ▶ North Sea Platform
- ▶ 12 wells - Options for Rig Reactivation, Jack-Up MODU, Modular Rig
- ▶ Years 0 to 10. Costs for rig reactivation plus facilities upgrades to support well operations
- ▶ Well plugging year 1, well maintenance every 3rd year
- ▶ Facilities upgrade year before platform operations restart for platform based operations
- ▶ Rig Reactivation >£25 million
- ▶ Allowance for rig mods / interface for MR and JU
- ▶ Allowance for facilities upgrade to support platform based operations
- ▶ Well plugging ~£600k per well with maintenance work ~£1.2million every 3rd year
- ▶ P&A - varies for each option range
 - ▶ RR 240 days, £115k/day
 - ▶ MR 228 days, £145k/day
 - ▶ JU 204 days, £210k/day

Economics #1

- ▶ Ignoring platform operating costs first.
- ▶ Total Cost compared to NPC at 3.5% or 8% discount Rate.
- ▶ Based on UK Govt. Dept of Finance Net Present Cost Calculator
- ▶ Delaying P&A pushes Total Cost UP
 - ▶ Additional cost of plugging plus interventions during idle phase
- ▶ Considering NPC delaying an expense shows an advantage
 - ▶ Total Cost for RR = £52.600 million
 - ▶ Cost of Rig Reactivation Yr-0 and P&A Yr-1
 - ▶ NPC if delay 10 years = £37.485million
 - ▶ Plugging Yr-0
 - ▶ Rig Reactivation Yr-9, P&A Yr-10

Example #1	Cost	P&A now	Delay 5 years	Delay 10 years
Rig Reactivation	Total Cost	57600	67200	68400
	3.5%DR NPC	56667	57042	51820
Modular Rig	Total Cost	51060	60660	61660
	3.5%DR NPC	49942	51380	46734
Jack-up	Total Cost	52840	62440	63640
	3.5%DR NPC	51391	52601	47949

All values £'000

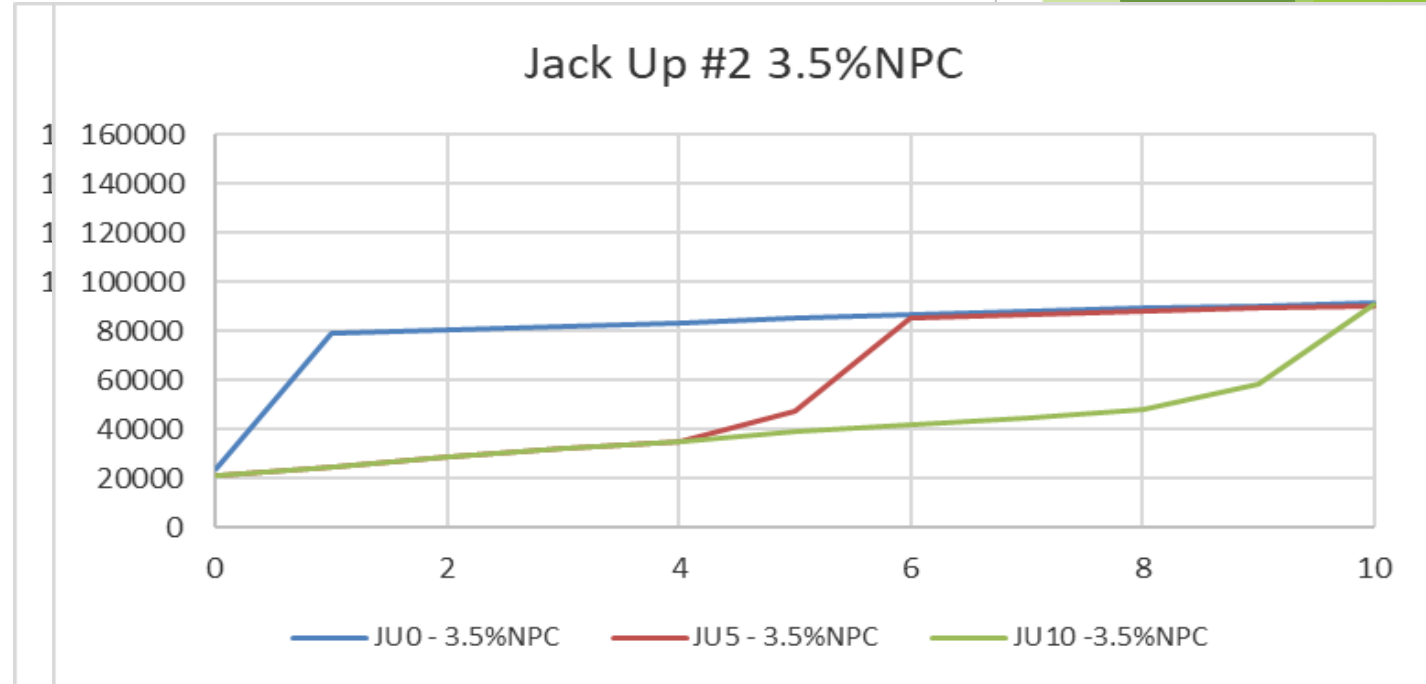


Economics #2

- ▶ Include Platform Operating Costs
 - ▶ 3 levels
 1. Fully operational
 2. Reduced cost after plugging
 3. Minimum cost after P&A
- ▶ Operating Cost at £14 million pa for fully manned / operating asset
- ▶ Reduced Operating Cost at £3.5 million pa after plugging
- ▶ Minimum Operating cost at £1.75 million pa after P&A
- ▶ The benefit of the JU option becomes significant when considering platform operating costs
 - ▶ No facilities reinstatement costs and operating costs when completing later P&A

Example #1	Cost	P&A now	Delay 5 years	Delay 10 years
Rig Reactivation	Total Cost	101350	130200	138400
	3.5%DR NPC	97056	112304	110076
Modular Rig	Total Cost	94810	123660	131660
	3.5%DR NPC	90332	106642	104990
Jack-up	Total Cost	96590	104440	112640
	3.5%DR NPC	91781	90480	91057

All values £'000



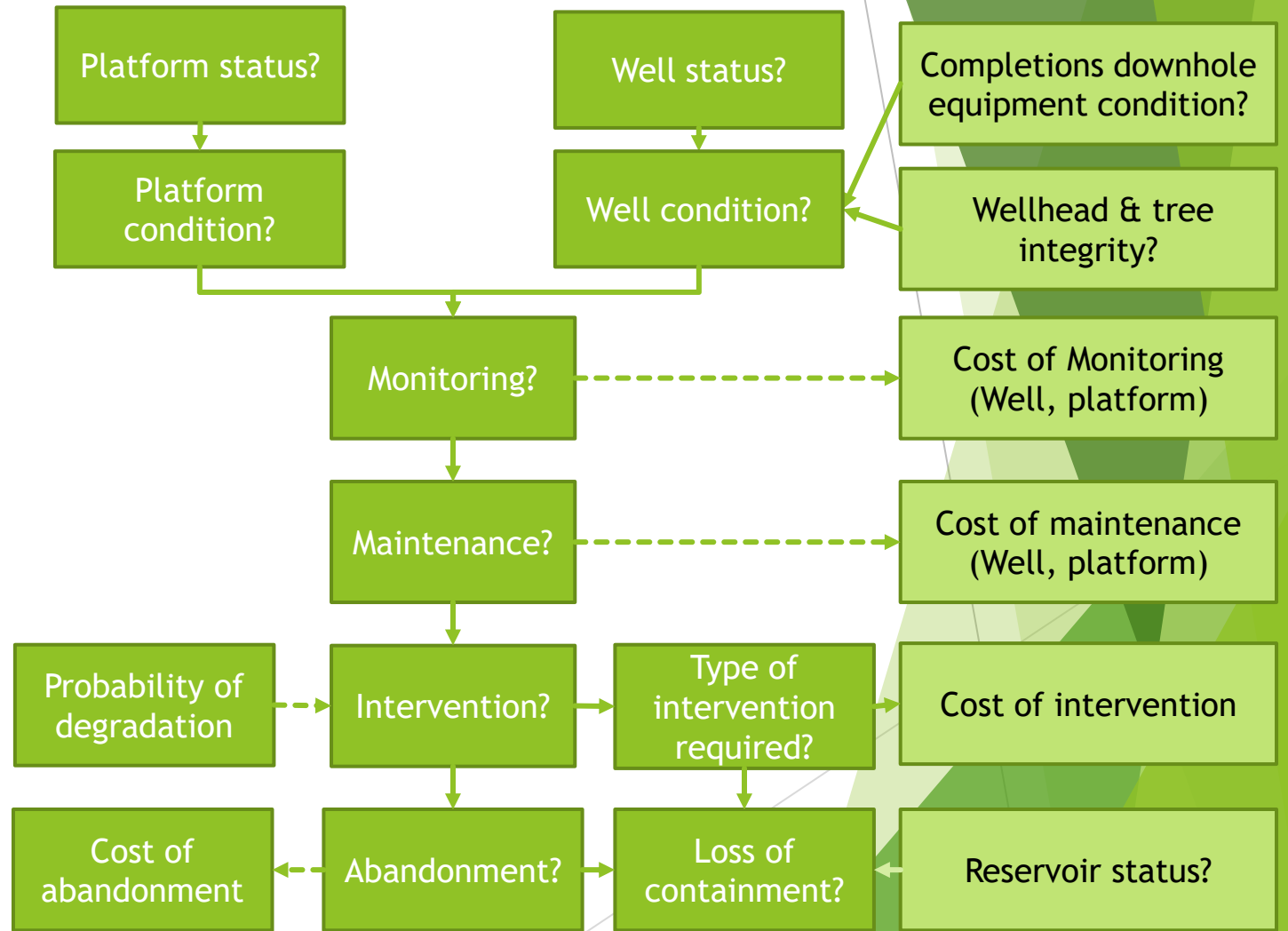
Risk based approach

- ▶ Financial focus doesn't recognise the changing risks
- ▶ These risks have a huge potential impact on the financial decision

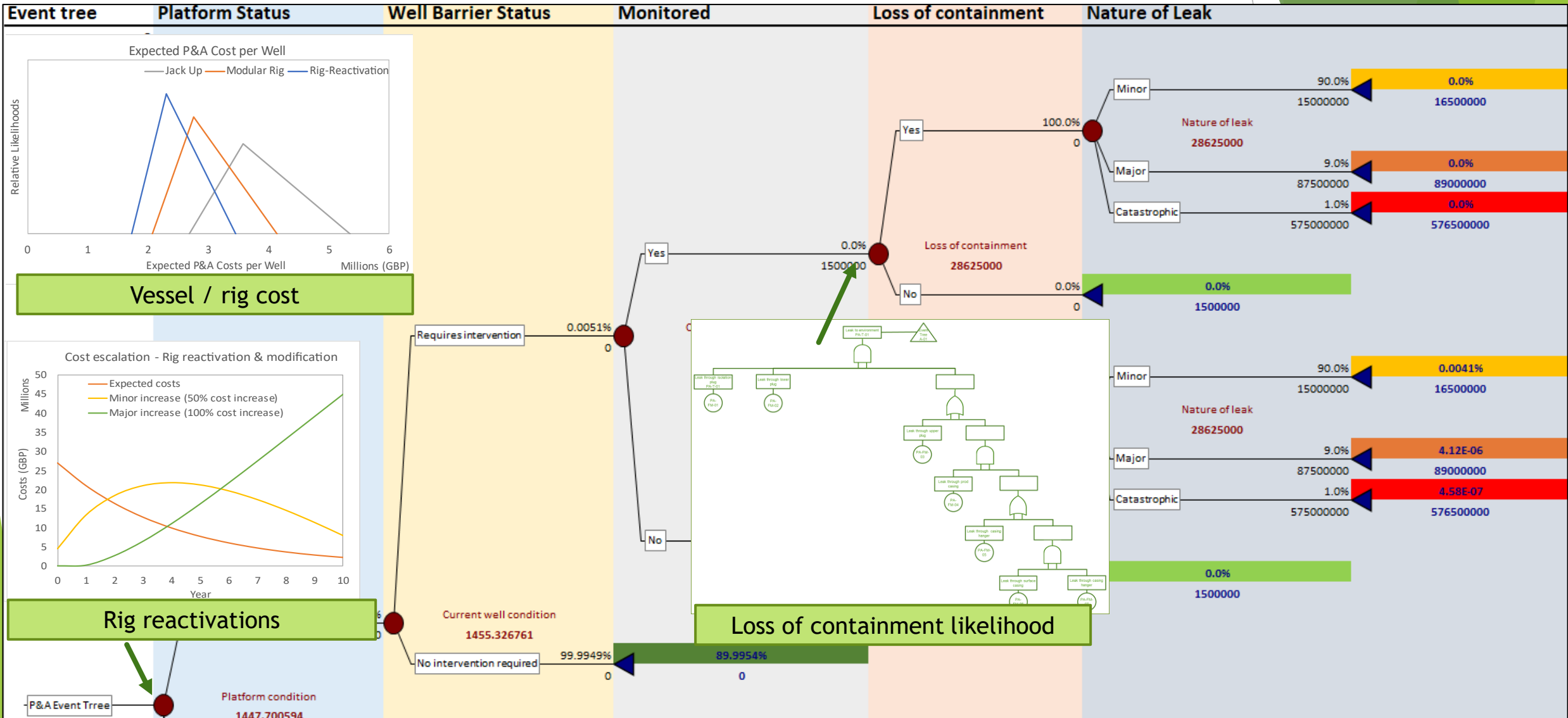


Risk factors affecting decision

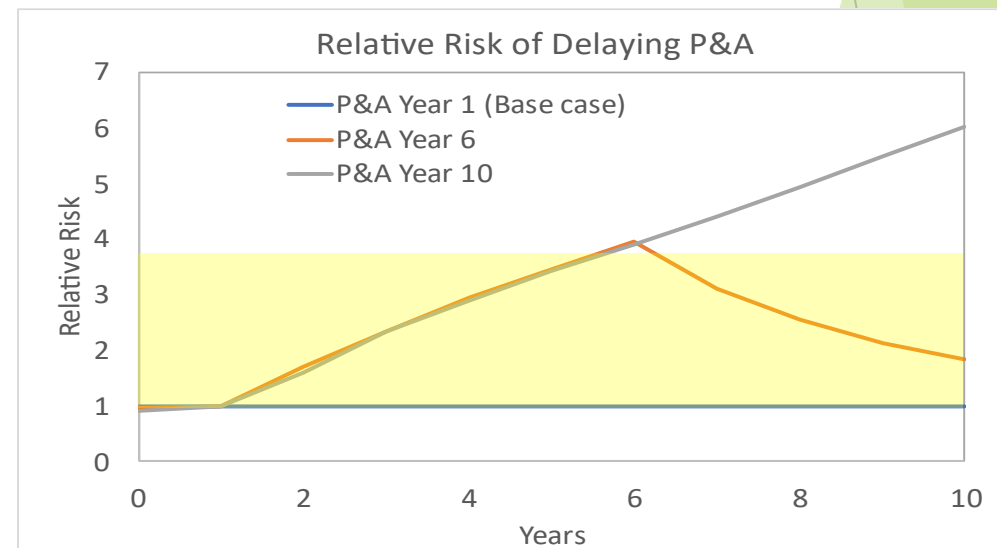
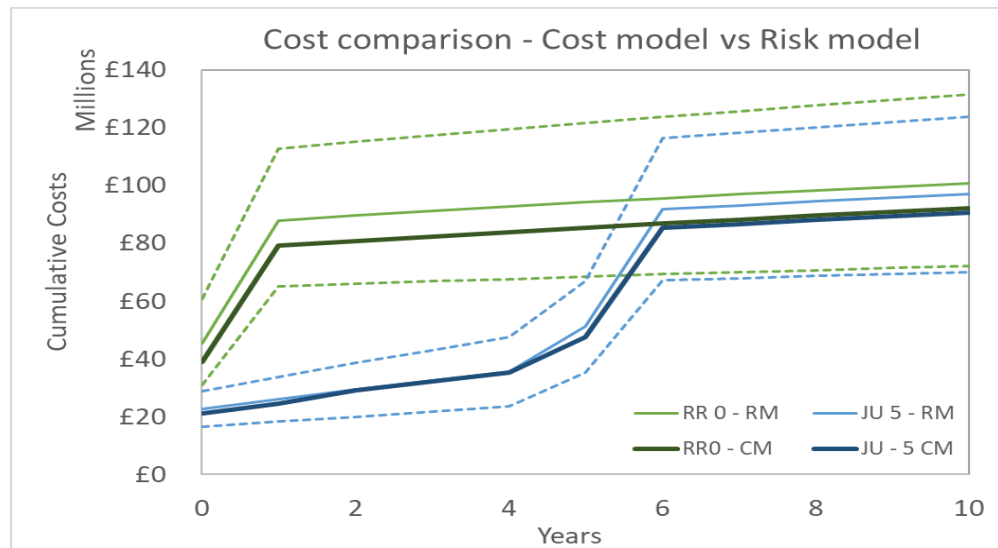
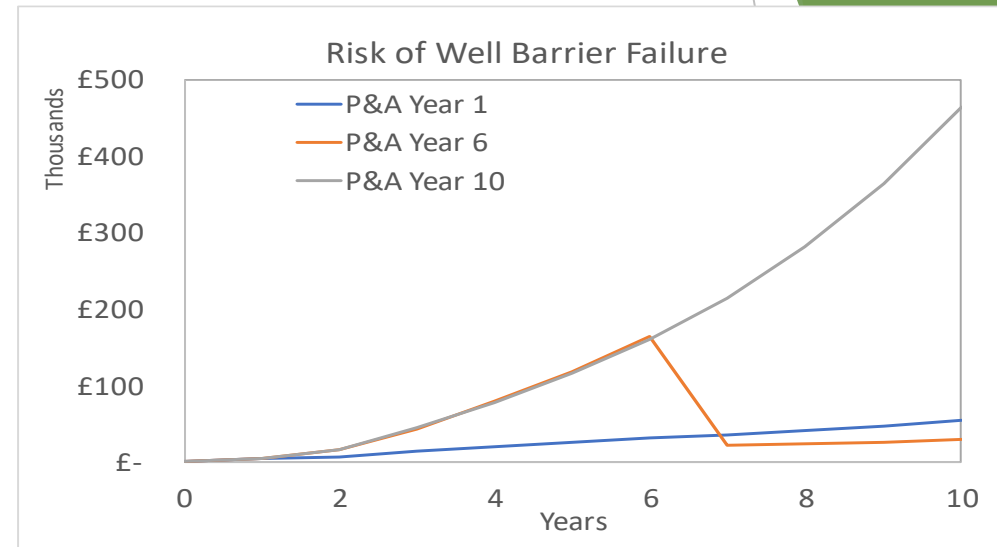
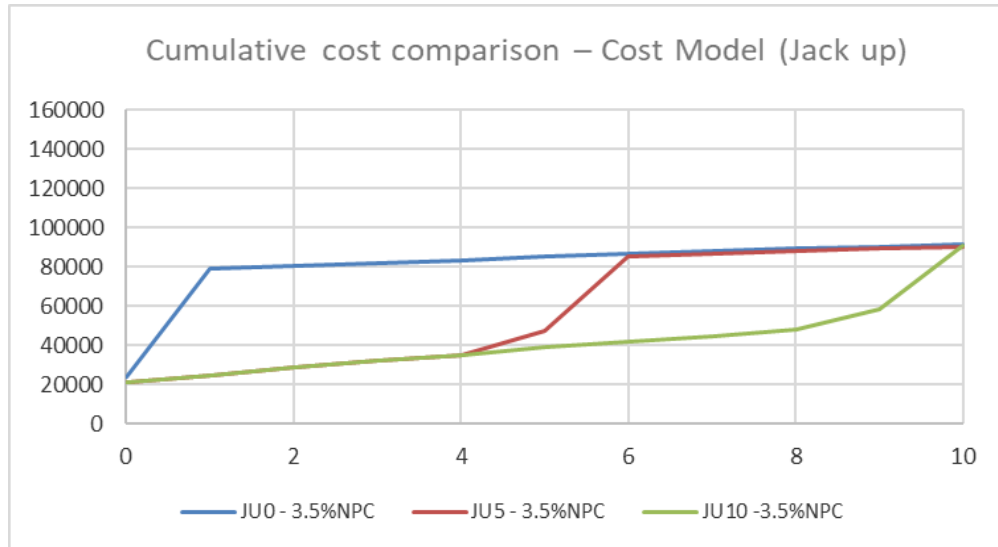
Reservoir Risks	<ul style="list-style-type: none"> Reservoir status Reservoir repressurisation
Well Risks	<ul style="list-style-type: none"> Well status Well condition/ degradation Well maintenance/ intervention Loss of containment
Asset Risks	<ul style="list-style-type: none"> Facilities status Facilities condition/ degradation Facilities maintenance/ intervention
Financial Risks	<ul style="list-style-type: none"> Rig / manning cost Re-activation cost Monitoring cost Abandonment cost



Inputs to risk-based approach

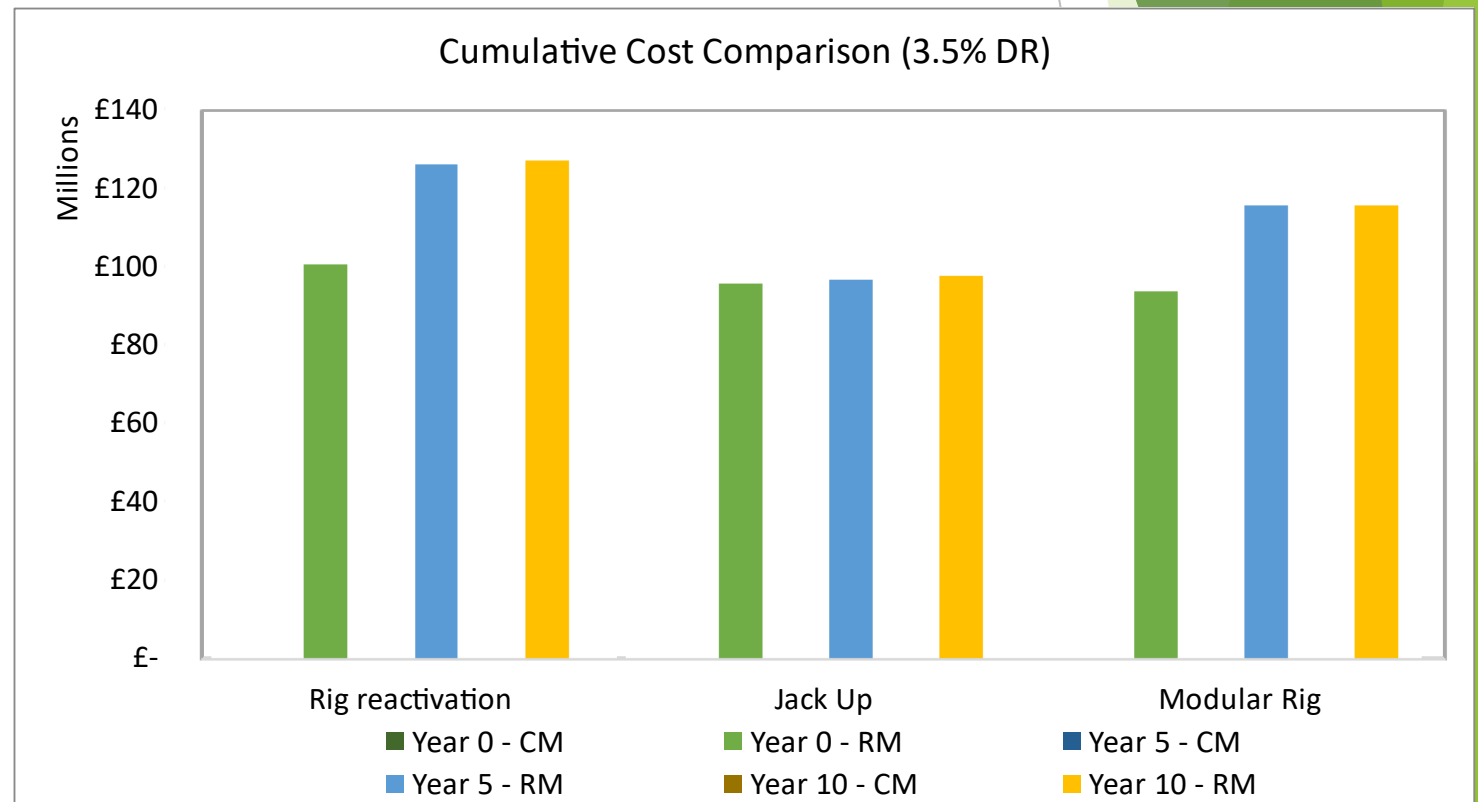


Comparison of decision options



Summary of Risk based approach

- ▶ Cost model is more optimistic than the risk model
- ▶ Differences are greater where the risk of rig repair increases over time
- ▶ If delayed P&A is preferred, best option for this example would be to use Jack Up by Year 5
- ▶ Additional risks and uncertainties can be incorporated into the model
 - ▶ Reservoir recharge
 - ▶ Cross flow
 - ▶ Barrier verification



So What?

▶ Effective plugging

- ▶ Depends on the well condition but this can be considered a viable option
- ▶ Allow for intervention during plugged time frame - requires facilities to support operations

▶ Is it economic?

- ▶ There is greater cost uncertainty with a delay.
- ▶ Net Present Cost can help illustrate impact of delaying a significant expenditure.
- ▶ A significant reduction in the cost of running the asset during a dormant period is essential. Minimum or zero manning is key.

▶ Assess the RISK

- ▶ Needs a good understanding of the current condition of the asset and facilities that will be required to support intervention and later P&A is essential
- ▶ Develop an event tree that considers key risks that may impact the asset and the cost model
- ▶ There may be increased risk but this is a balance:
 - ▶ What is the company attitude to risk?
 - ▶ Is the increase in risk justifiable?

Conclusions

- ▶ Valid Business Reason and careful consideration of Risk and Economic Analysis can make this an appropriate option for offshore assets.
- ▶ Significant reductions in the asset operational cost (eg reduced or minimum manning) are essential to support a delay option.
- ▶ There is greater cost uncertainty in any delayed option.
- ▶ The increased risk profile is only supported by a reduction in cost.
- ▶ The risk appetite of an organisation is an important consideration.
- ▶ Better industry data to support this type of risk model is required.

Questions?



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