

What Does Forever in Well Decommissioning Mean?

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The Acknowledged Legacy of the UKCS



8 x GBS = 1.8 million tonnes

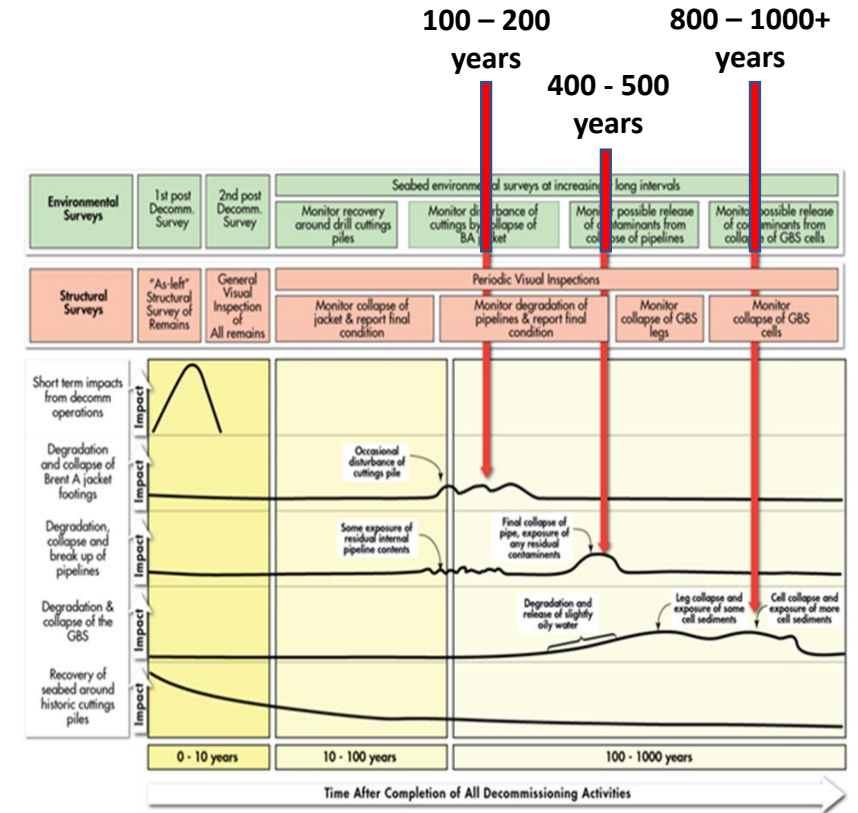


31 x footings = 404,000 tonnes

20,000 km of + 6" pipeline = ~1.1 million tonnes



- Decommissioning Operations
- Steel Jacket Footings
- Pipelines
- GBS
- Seabed / Cutting Piles

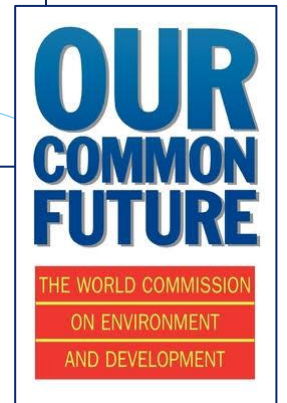
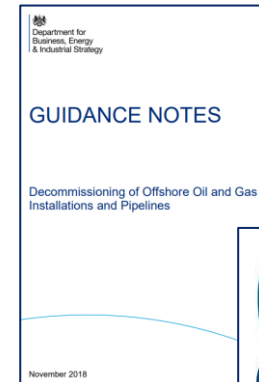


Shell, 2017. Brent Field Decommissioning Programmes. Page 303

"Owners to pay government a sufficient sum to insure against a potential liability some time in the future would seem to be a prudent course of action." (House of Lords, 1996)

Sustainable Decommissioning

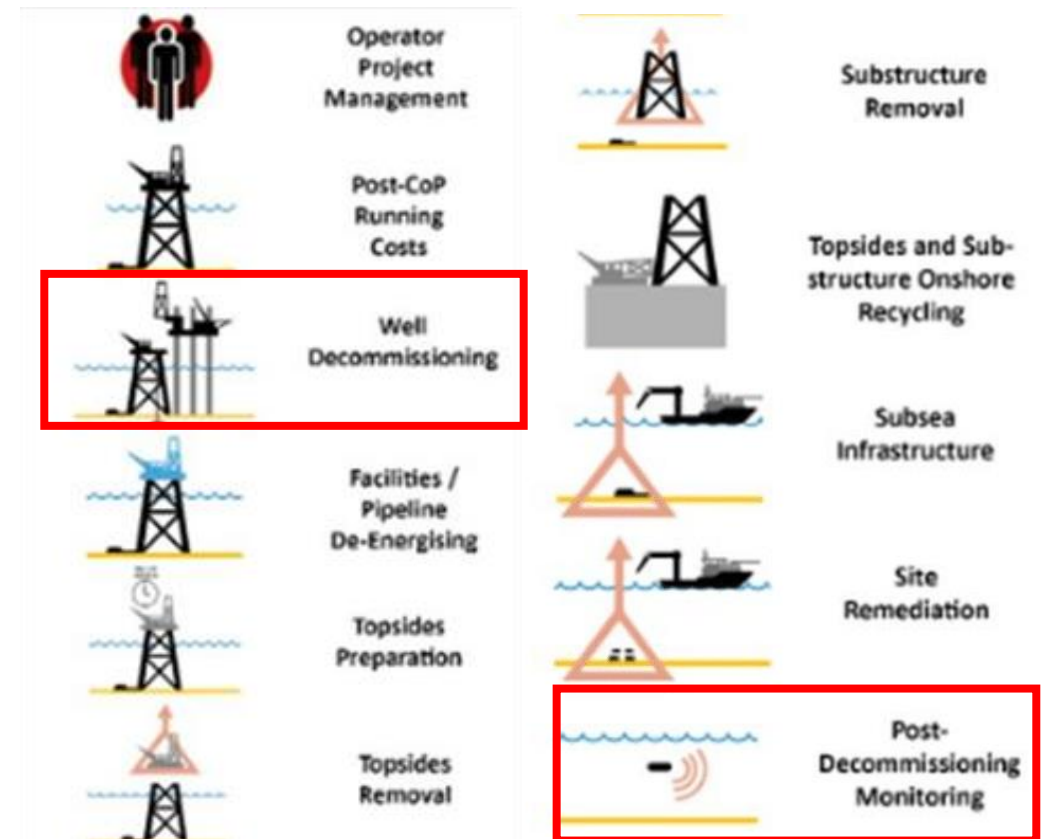
- The Polluter Pays Principle
 - Requires that the costs of pollution prevention, control and reduction measures must be borne by the polluter OSPAR
 - (The Government) expects those who have benefitted from exploitation or production hydrocarbons in the UKCS to bear the responsibility for decommissioning OPRED Guidance Notes
- The Precautionary Approach
 - Preventive measures are to be taken when there are reasonable grounds for concern that human activities may bring about hazards....even when there is no conclusive evidence of a causal relationship OSPAR
 - Aim to achieve a clear sea bed OPRED Guidance Notes
- Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs Brundtland Report



• *“Decommissioning is an activity that has long-term orientation which is in conflict with the world’s more short-term economics-based approach” Heffron, 2018*

Agenda

- Introduction
- The Post-Decommissioning Regime
- Well Abandonment
 - The Well Abandonment Regime
 - Legacy
 - Risks and Uncertainties
 - What is the Residual Liability
- Conclusions and Suggestions



OEUK's 11 element decommissioning Work Breakdown Structure (WBS). Should there be a 12th?

Post-Decommissioning Regime

Petroleum Act 1998

- Section 29 Notice
 - A holder remains liable until Sect 29 withdrawn (not surrender of licence)
 - Section 34 allows retrospective liability to be applied
- Decommissioning Programme
 - Section 29 holders' commitments approved by the Secretary of State
 - Installations, pipelines (and some wells)
 - 'Maintenance'
 - Estimate of cost (WBS 11 = £300 million)
- Infrastructure Act 2015
 - Maximisation of economic return
- Energy Act
 - Ensures sufficient funds are available
- Health and Safety
 - Strict liability

OPRED Guidance Notes

- Secretary of State's interpretation of the regime
 - *"This guidance is not a substitute for any regulation or law and is not legal advice. It does not have binding legal effect"* CCUS Guidance Notes
- States OSPAR & Decision 98/3 as the primary international commitment
- Underpinning principles: Guidance 1.1
 - Precaution aims for a 'clear seabed'
 - 'Polluter Pays', not the taxpayer
- Expectation owners have a 'liability in perpetuity' Guidance 17.2
- 'Risk-based' monitoring programme
 - Risk vs uncertainty
- 'Voluntary' donation to the FLTF
 - £750,000 per footing / GBS (~£30m)
 - £3,000 per km of exposed pipeline (~£5m)
- Aspiration for mutual management plan or instrument (Guidance 17.3)

The scope of liability is, inevitably, ill defined but assigned to an entity unable to directly discharge their obligations

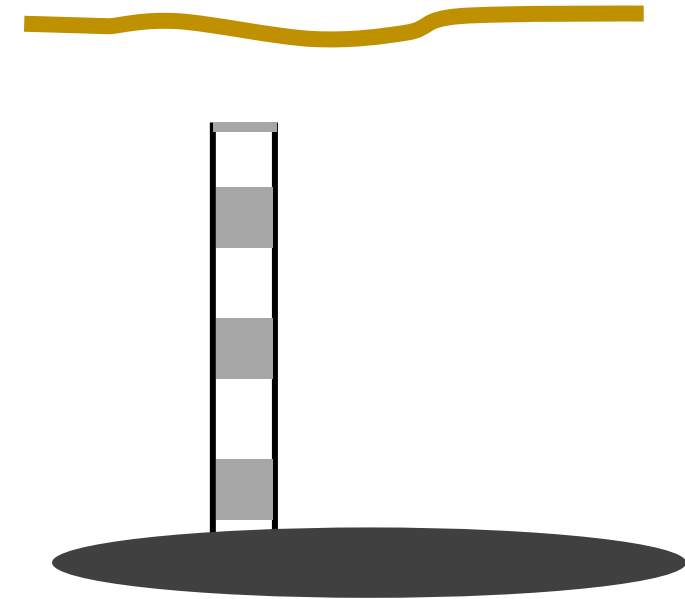
Well Abandonment Regime

- Well Abandonment Regime
 - The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996
 - “Reasonably Practicable”
 - “...no unplanned escape of fluids from it or from the reservoir to which it led” (Para 15)
 - The Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015
 - Strict Liability for an event on an installation
 - License holders and HSE are ‘competent’
- Post-Abandonment Obligations
 - Statutory via the Petroleum Act 1998
 - Wells identified in Decommissioning Programme
 - Wells connected to an installation (Esso vs Apache)
 - ‘Orphan Wells’ allocated via Sect 29
 - Contractual owing to licencing of a ‘right’
 - ***NSTA must approve abandonment plan (17(2))***
 - ***‘Casings and fittings’ become the property of the Minister (MC 19(14))***

Liability for an abandoned wells is transferred to the State – it is a societal problem

Legacy - Wells

- Inventory NSTA Well Insight 2022
 - >8,000 wells drilled to date
 - 2,629 operating wells (970 plugged)
 - 189 wells with integrity issues (7%)
 - >5,000 phase 1 – 3 abandonment
- ‘Best Practice’ OGUK Guidance 2015
 - ‘Restoring the cap rock’
 - Minimum of 2 plugs, ~100-200ft of ‘good cement’
 - Presumption of ‘permanent’ solution
 - Acknowledgement of uncertainty beyond 30 years
 - Phase 3 abandonment = removal of the wellhead
 - No monitoring requirement
- Financial Provision
 - OPOL doesn’t extend beyond Phase 2 abandonment
 - No obvious provision beyond £300 million



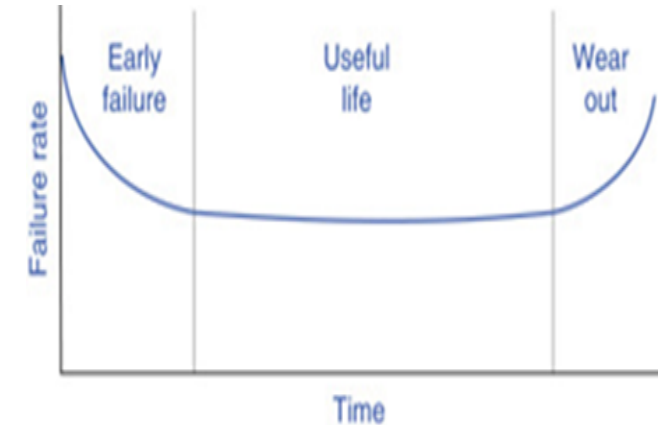
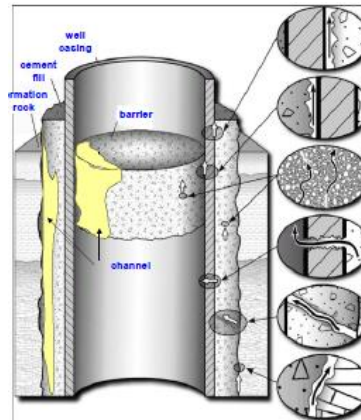
Legal Status – ‘what is an abandoned well?’

Any residual risk comes for the reservoir, the well enables potential harm to be caused

Risk and Uncertainty

- How permanent is well abandonment?
 - Material failure
 - Human error
 - Ground movement
 - Material degradation
- What is well failure?
 - Is 'no unplanned leakage' zero?
 - When is a leak a seep?
- Social Risk
 - Improved plugging technologies
 - Subjective and fluid
 - Political pressure leading to policy change
 - Legal test cases establishing precedent
 - O&G, CCUS, Nuclear

OEUK Potential failure modes

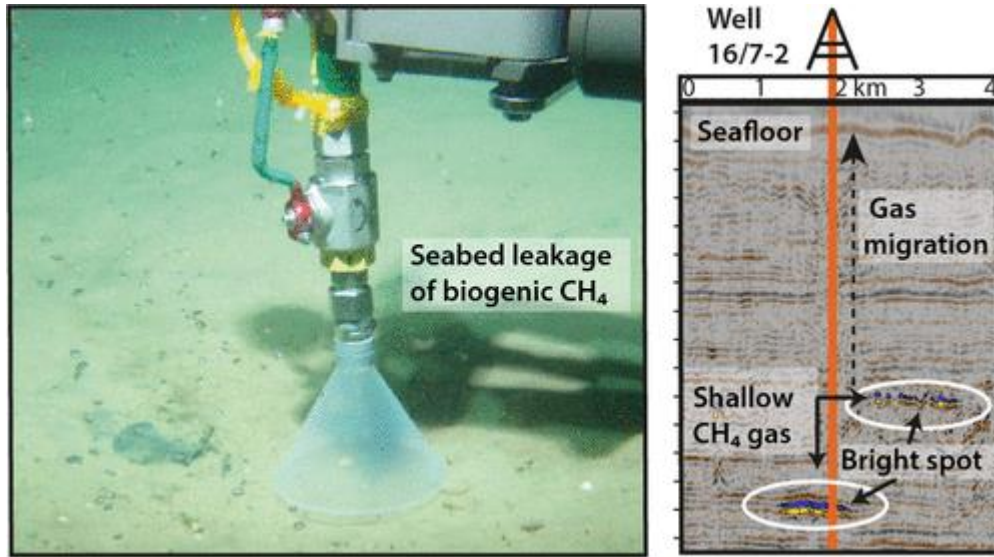


Bathtub curve – does everything fail eventually?

	Flow rate m ³ / yr	Remarks
Regulation Implication	0	'No unplanned leakage' Offshore Installations and Wells (Design and Construction, etc) Regulations (SI 1996/913) (15 (b))
Equivalent to cap rock	10	OGUK (2015) Guidelines on Qualification of materials for the Abandonment of Wells
Natural fugitive leak rate	20	
Expected HPHT well	1650	
API 14B acceptance level	200,000	Subsurface safety valve (i.e. in the well)

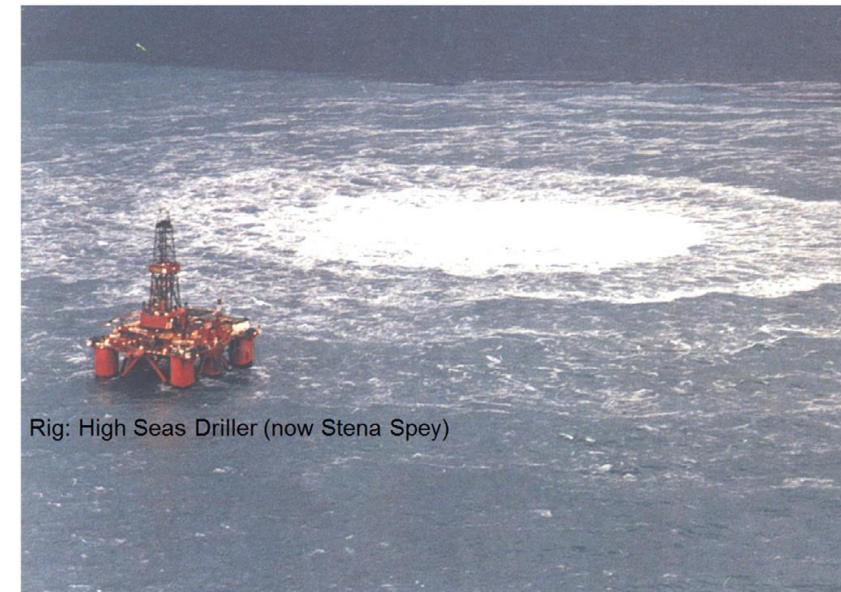
At least theoretically abandoned wells can fail

Is There a Problem?



Vielstädte, L. *et al.* (2017)

- *Shallow gas migration from 3 x CNS abandoned wells*
- *Implies ~33% of CNS wells may leak*
- *<1 – 2 kt methane/year, ~42% may reach the surface*



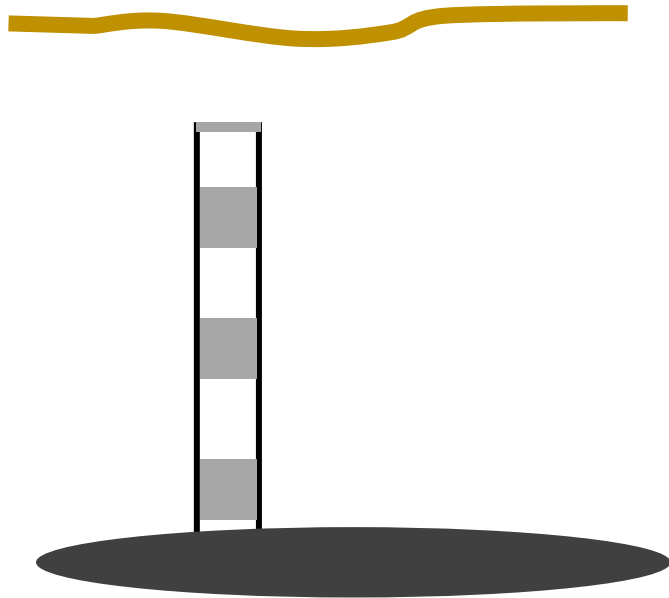
von Deimling *et al.* (2015)

- *Abandoned well site 22/4b*
- *Blow out 1994, still present 2005, 2006, 2012*
- *0.7 kt methane/year*

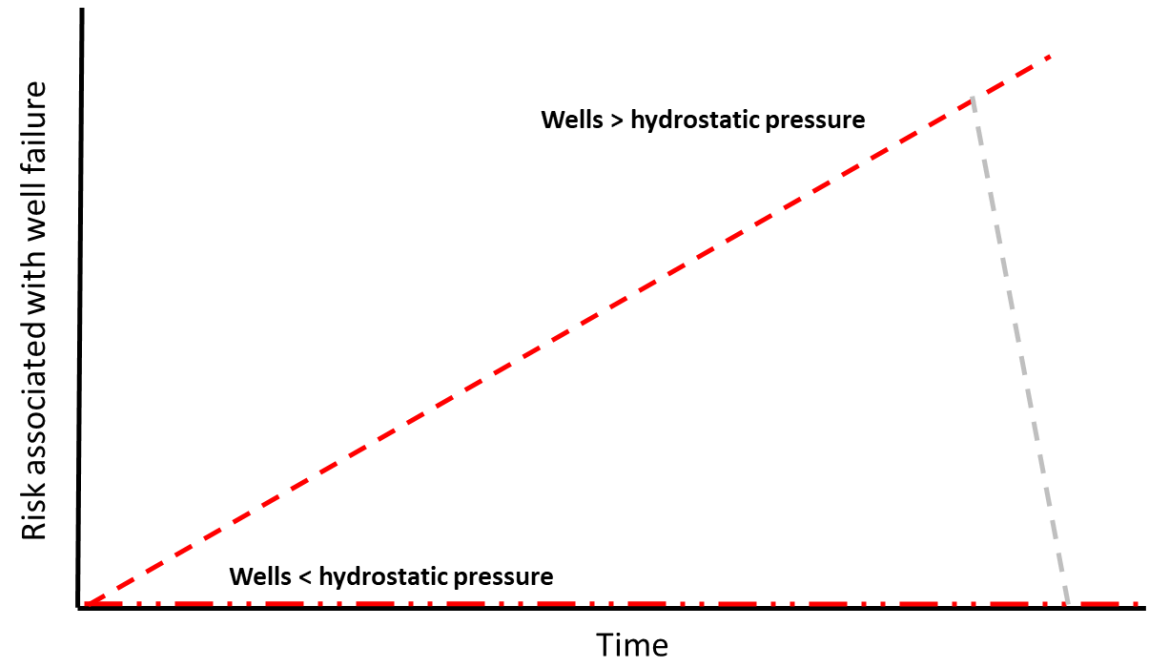
Precautionary principle: “where there are threats of serious or irreversible environmental damage, a lack of scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation”

What is the Residual Liability?

How Much to Fix a Leaking Well?



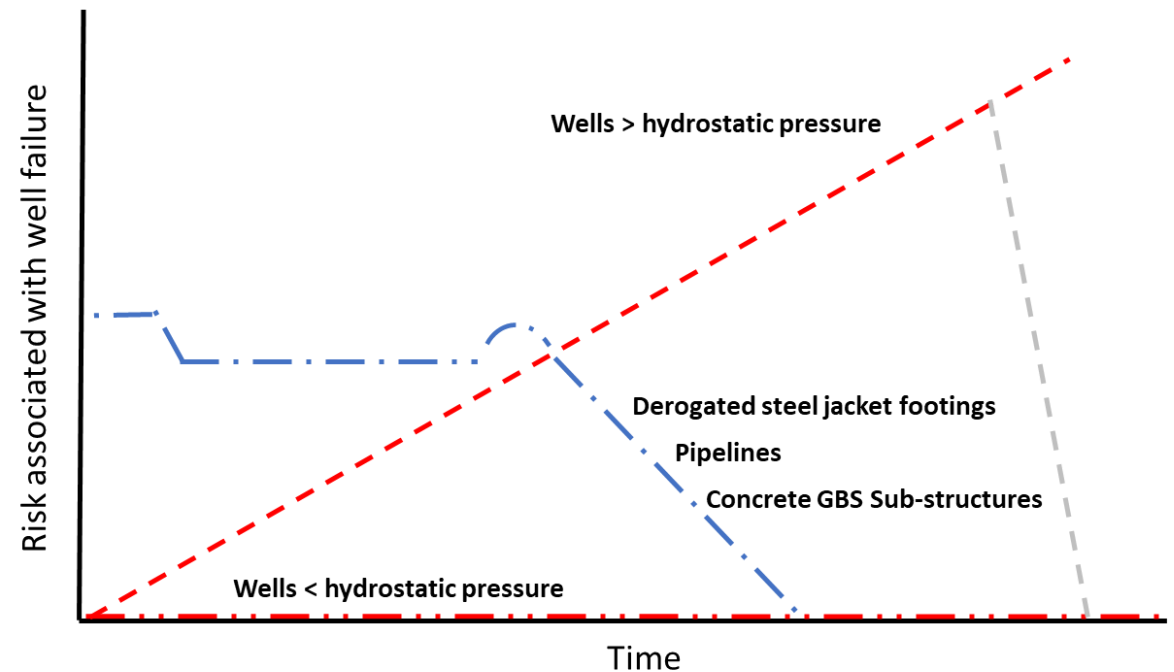
How Many Wells Could Leak?



How many wells need to leak until there is a problem?

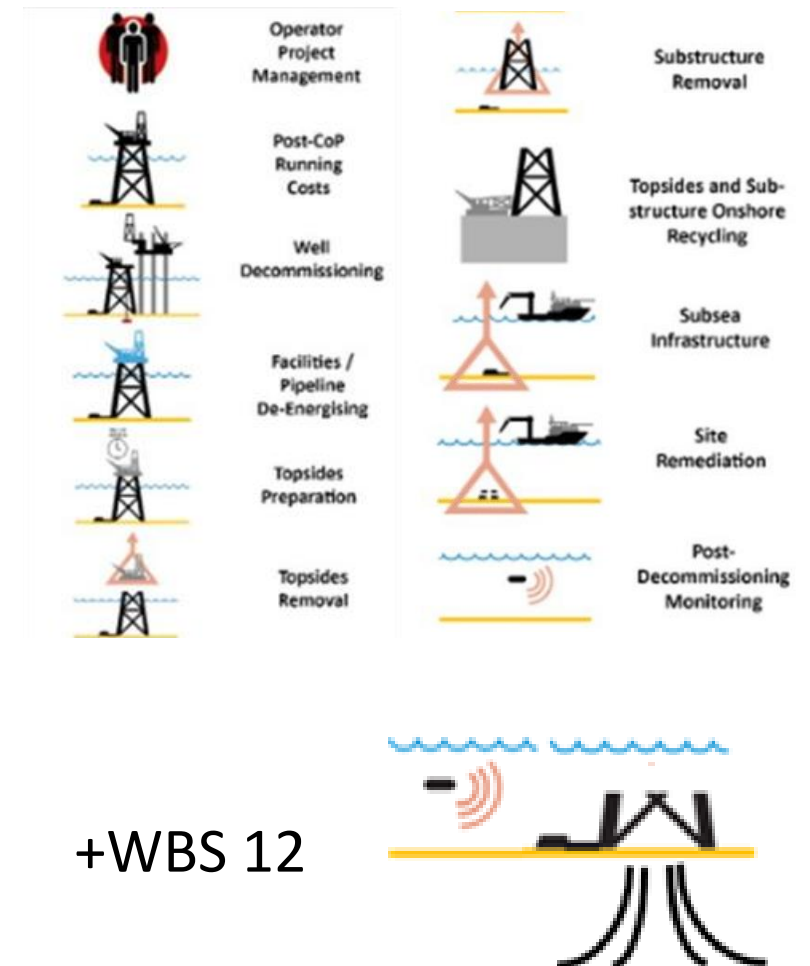
Conclusions

- Post-decommissioning regime has yet to be tackled in detail
- The transfer of liability to the Government makes decommissioning a social issue
- The risk-based approach struggles with uncertainty and subjective perspective
- The scale of residual liability is a mix of knowns and unknowns



Suggestions

- Acknowledge a 12 element decommissioning WBS
 - WBS 11: Quantifiable by risk-based analysis
 - WBS 12: True uncertainty (unknowables)
- If some of the residual liabilities are society's they should be able to understand them?
 - Publish the decommissioning estimates
- If abandoned wells could leak, they should be monitored and managed?
 - Establish an organisation motivated to deal with residual liabilities



References

Slide 1:

Slide 3:

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Slide 12: