

Unlocking CCUS by Solving the Legacy Well Crisis



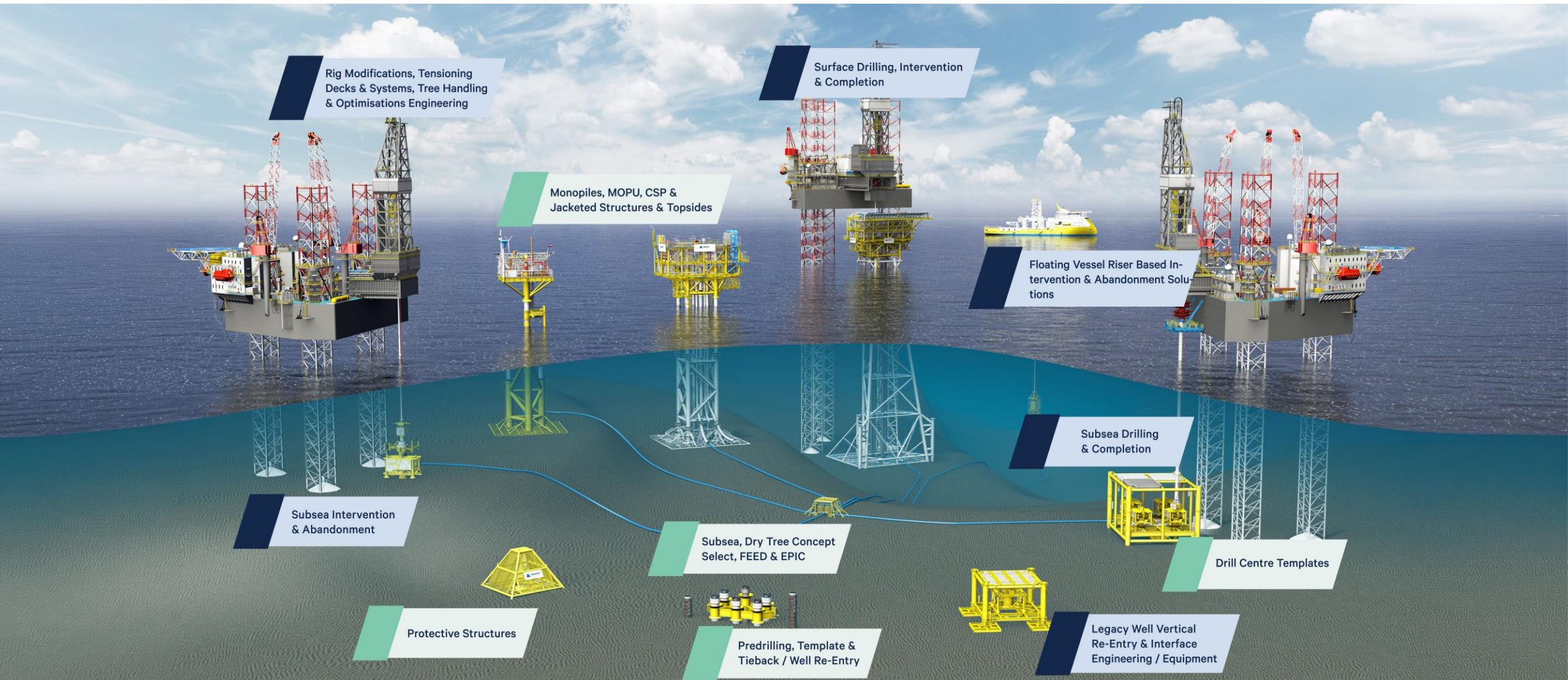
Aquaterra Energy Supporting Offshore Field Developments

Intelligent engineering, products and services from conception to closure

Well Access



Offshore Field Development



The legacy well challenge in offshore CCS

This presentation will explore:

- Why containment integrity is now the CCS gating factor
- What “legacy wells” are and why they matter for CO₂ storage
- The re-abandonment challenge (and why old approaches don’t scale)
- A practical route: vertical re-entry enabled by the RAF



CCS is moving from ambition to execution

The needs for secure, scalable storage integrity

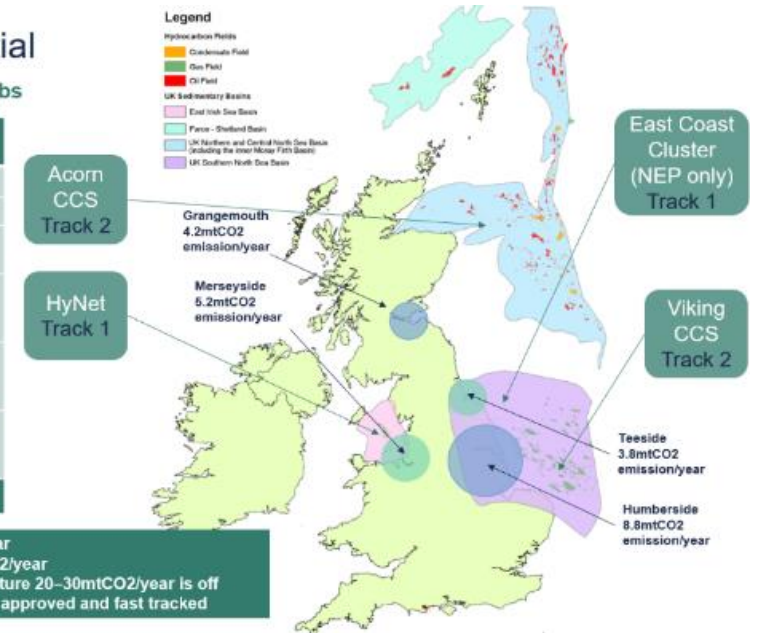
- CCS is now a defined part of Europe's industrial decarbonisation strategy
- Focus is shifting from capture concepts to integrated CCS networks
- Offshore CCS activity is growing across the North Sea, Irish Sea, Adriatic and Black Sea
- The North Sea is leading, with major projects moving through delivery, permitting and development
- As projects scale, legacy well integrity is becoming a critical storage requirement

UK Storage potential

And planned CO₂ storage hubs

Category	Estimated CO ₂ capacity (Mt)
Oil fields	1175
Gas fields	5140
Gas/condensate fields	1200
Southern North Sea basin saline aquifers	Up to 14250
East Irish Sea basin saline aquifers	Up to 630
North and central North Sea	Not quantified fully but potentially large
Total	22395

Track 1 emissions/year = 9mtCO₂/year
 Track 1 + 2 emissions/year = 22mtCO₂/year
 UK Gov 2030 target (set 2021), to capture 20–30mtCO₂/year is off target unless Track 2 / other projects approved and fast tracked



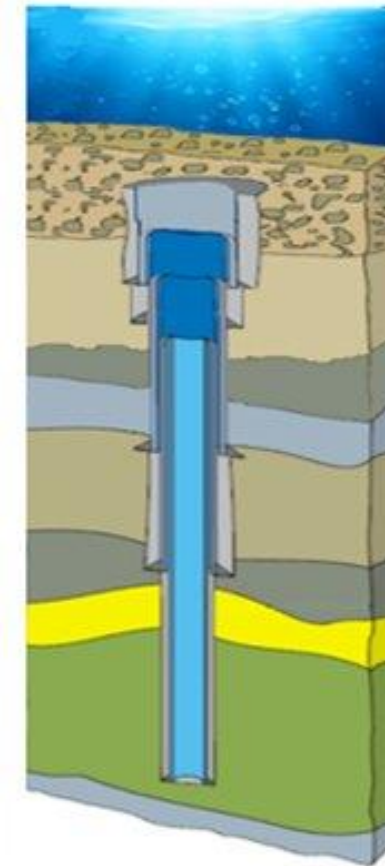
UK Continental Shelf storage potential

Up to 78 billion tonnes of potential CO₂ storage capacity in depleted reservoirs and saline aquifers.

Why Legacy Wells Matter for CCS

Old Wells, New Storage Requirements

- Mature basins contain decades of exploration/production wells, many abandoned before CO₂ storage was considered
- Older wells can have uncertain barrier quality, casing condition, or incomplete records
- Some legacy wells are abandoned below seabed (e.g., ~10'–100'), increasing location/access complexity
- For CCS, legacy wells are no longer just historic oil and gas infrastructure, they are now fundamental to the storage integrity case



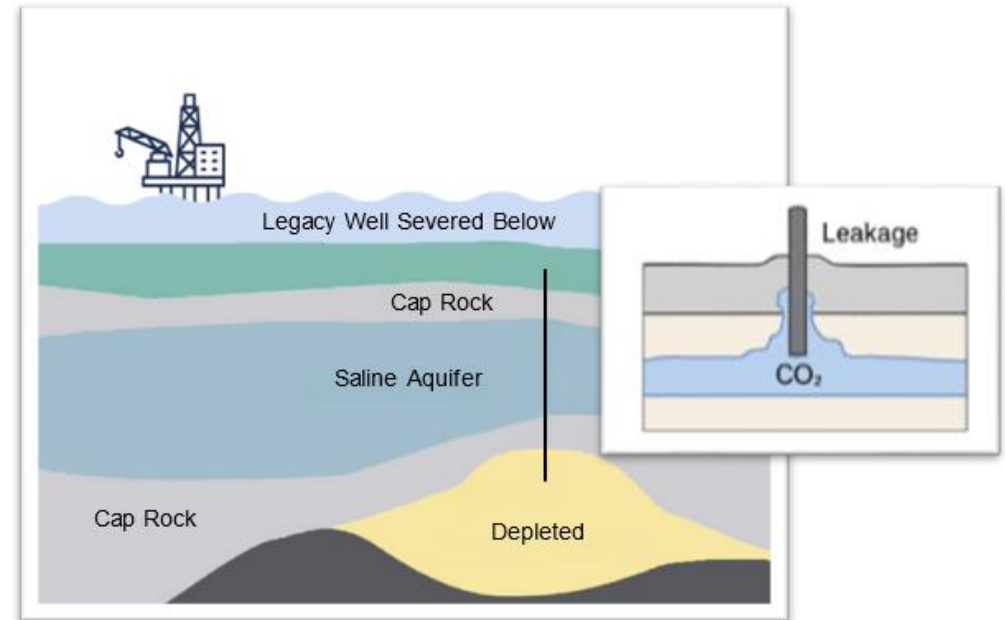
Legacy Well
Abandoned Below Seabed
~ 10' to 100'
Unconsolidated
Cap Rock
Saline Aquifer
Cap Rock
Gas Zone
Oil Zone

For CCS, legacy wells are no longer just historic oil and gas infrastructure. They are part of the storage integrity case.

The Roadblock to Offshore CCS: Legacy Well Integrity

The UK's CCS opportunity depends on managing legacy well risk at scale

- In the UK context, more than 1,400 decommissioned and operating wells sit on current CCS licences
- Legacy wells are critical vulnerabilities and potential leak paths for pressurised CO₂ containment
- Legacy wells are not designed for long-term CO₂ containment or pressurised conditions
- The issue is not only identifying risk — it's managing it at scale

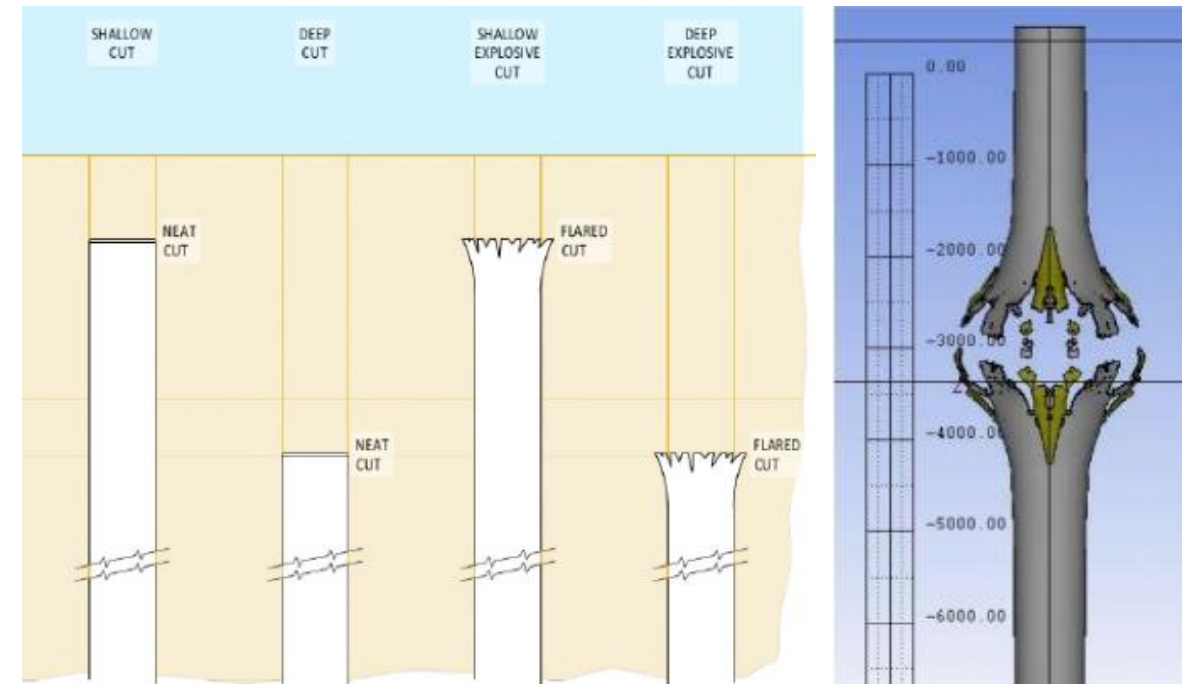


Storage integrity is not just a subsurface issue. It is also a legacy well integrity challenge.

Why Abandonment Becomes Re-Abandonment

Old abandonments must be revisited for new storage requirements

- Legacy wells were abandoned for hydrocarbon end-of-life, not CO₂ storage
- Many sit below the mudline, with limited access and unknown condition
- Historic abandonment methods may not meet modern containment standards
- Pressurised CO₂ storage raises the integrity requirement
- Re-abandonment is the process of re-accessing and securing these wells

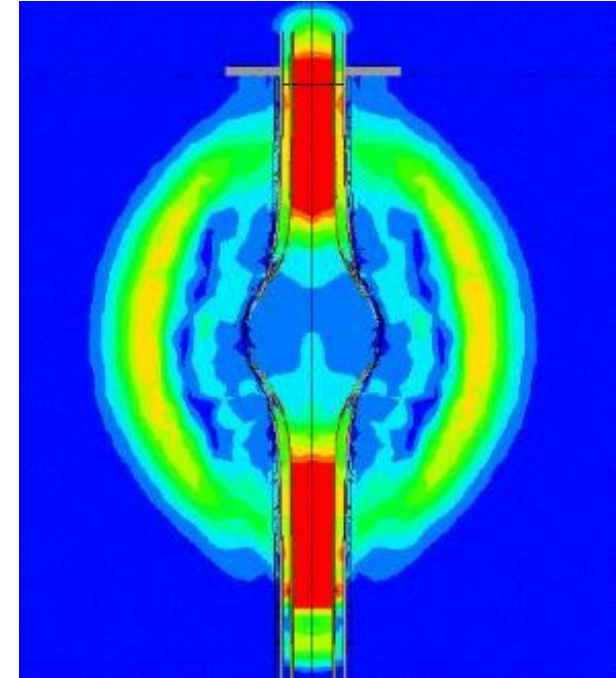


Solving this safely and efficiently is critical to unlocking offshore CCUS

The Challenge of Uncertainty, Access and Cost

Unknowns drive complexity, risk and cost

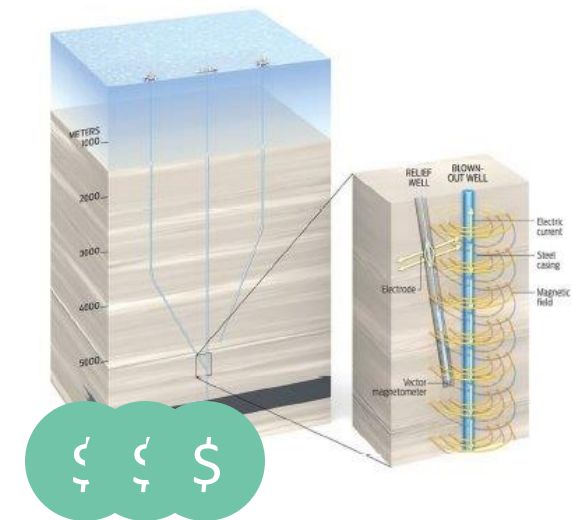
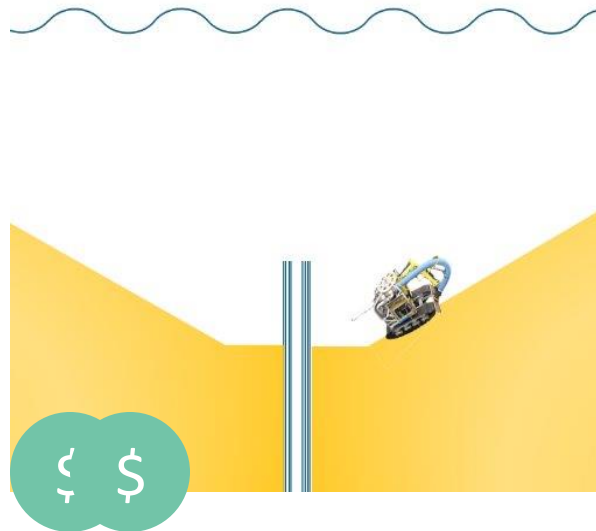
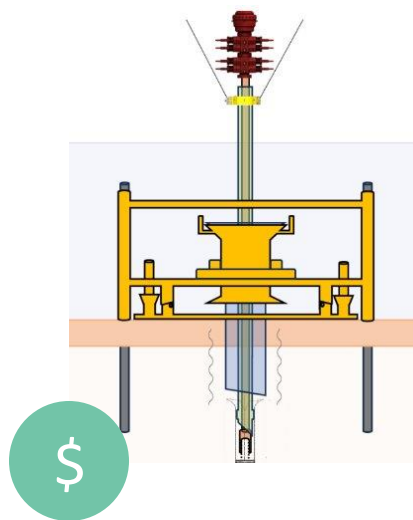
- Locations can be uncertain, buried or obstructed by seabed conditions
- Integrity is often unknown due to age, materials, plug quality or incomplete records
- Traditional remediation can require interception, relief wells or excavation
- These routes are often high-risk, high-cost and difficult to plan with confidence



Without a reliable re-entry route, legacy wells can become a major blocker to offshore CO₂ storage.

Re-entry Options for Legacy Wells – The Scaling Problem

Vertical re-entry	Excavation	Offset/intersect well
lowest cost/duration; needs confirmed well centre	large undertaking; may affect jack-up placement; higher disturbance	highly complex; highest cost/duration; depends on historical trajectory data



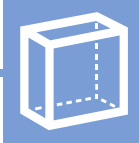
A scalable route: Zone in -> Re-enter -> Re-abandon



Zone In

Locate the abandoned well with increased accuracy – moving from desktop study to physical survey to zone in on exact location.

Locate & Mark the Well



Re-enter

Re-enter the well with structural support that distributes weight of drilling/milling unit and stabilises for cleaning. Install environmental barrier.

Well Support and Environmental Barrier



Re-abandon

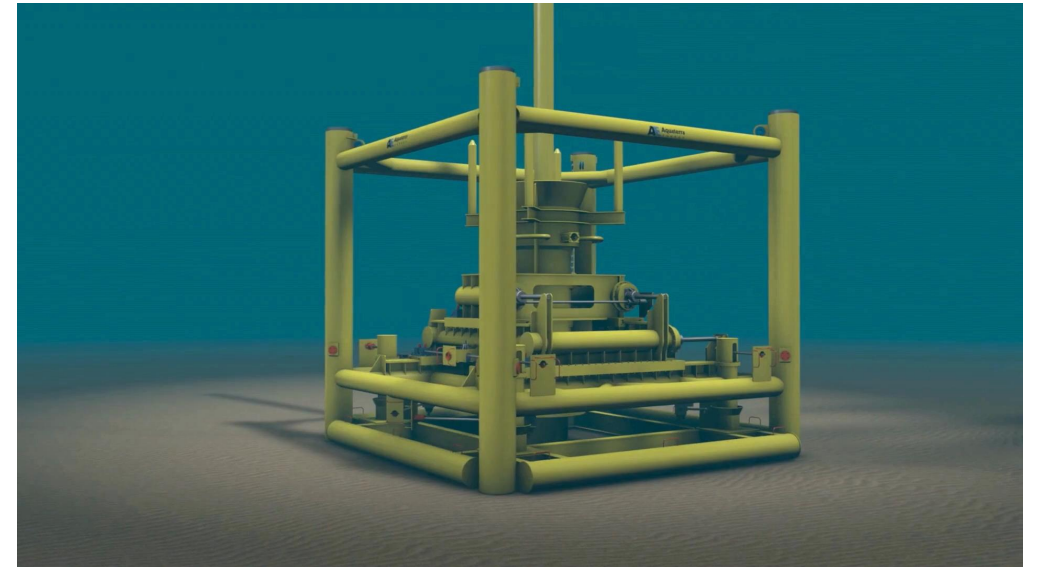
Re-abandon the well with pressurised system to support long-term CO2 storage.

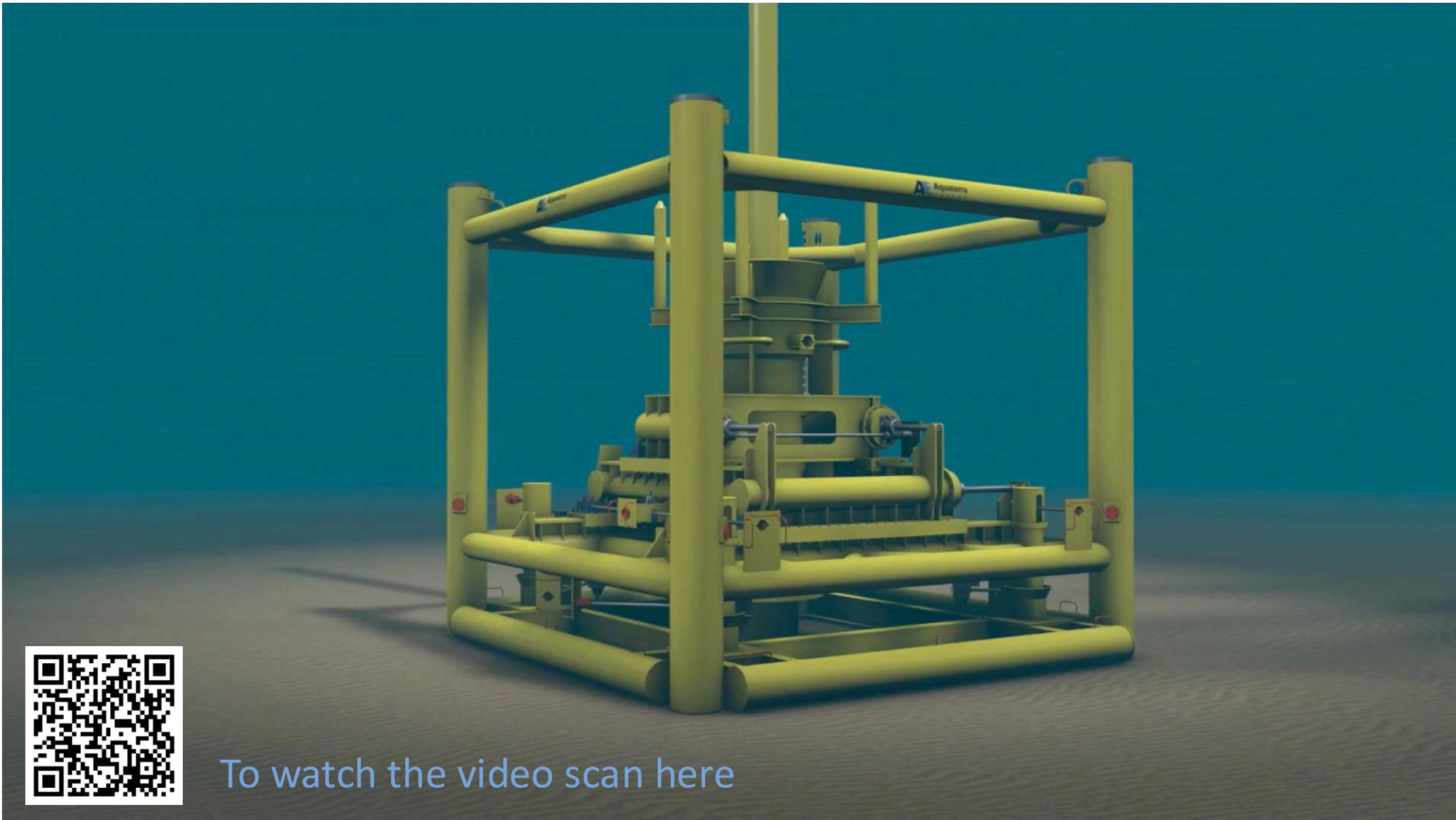
Pressure Retaining Barrier

Introducing the Recoverable Abandonment Frame

A repeatable route to secure vertical re-entry for legacy wells

- Part of a patent-pending vertical well re-entry solution
- Enables a vertical re-entry tieback method supporting safe re-entry, remediation and permanent abandonment
- Designed to provide structural support and reduce loads while regaining secure well access
- The RAF doesn't just make re-entry possible — it makes it repeatable and economically viable.

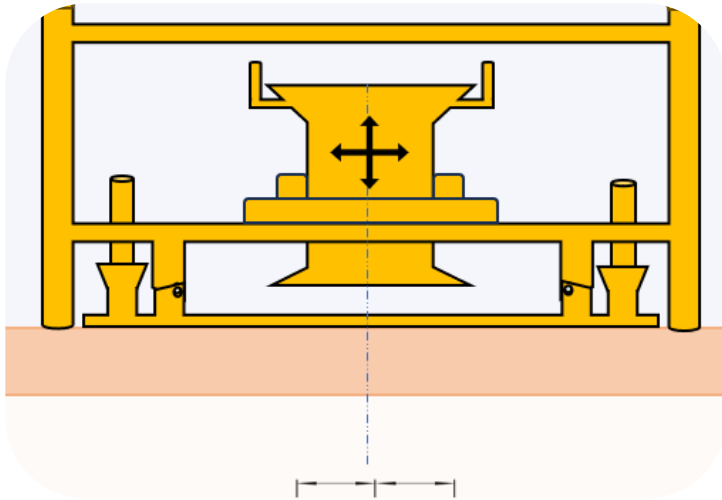




To watch the video scan here

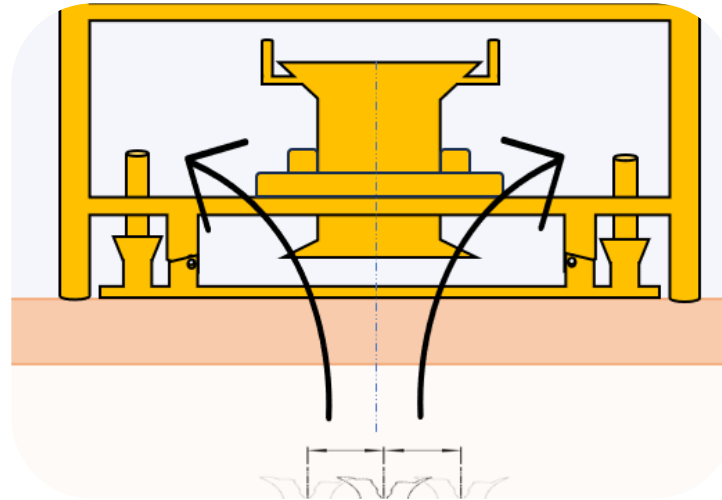
RAF + Vertical Re-entry

Controlled access whilst isolating loads



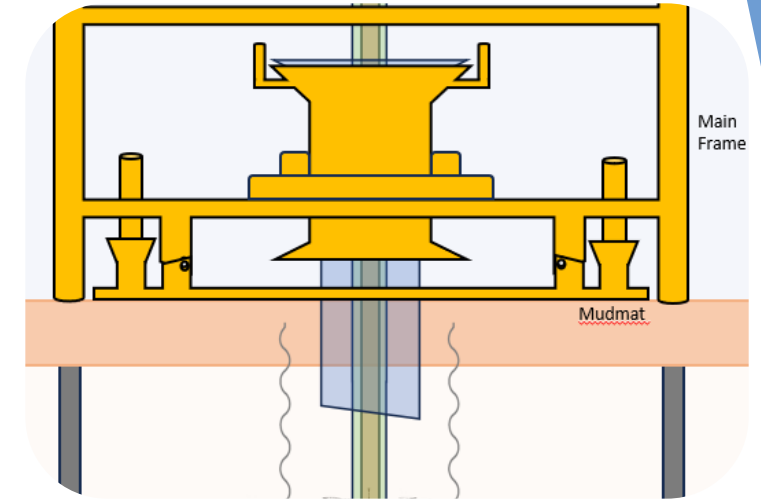
Adjustable Positioning

- Aligns over the confirmed well centre
- Accounts for location and installation tolerances
- Supports accurate vertical access



Load Isolation

- Reacts milling, tieback and pressure-control loads away from the legacy well
- Transfers operational loads into the seabed
- Protects compromised casing and conductor sections



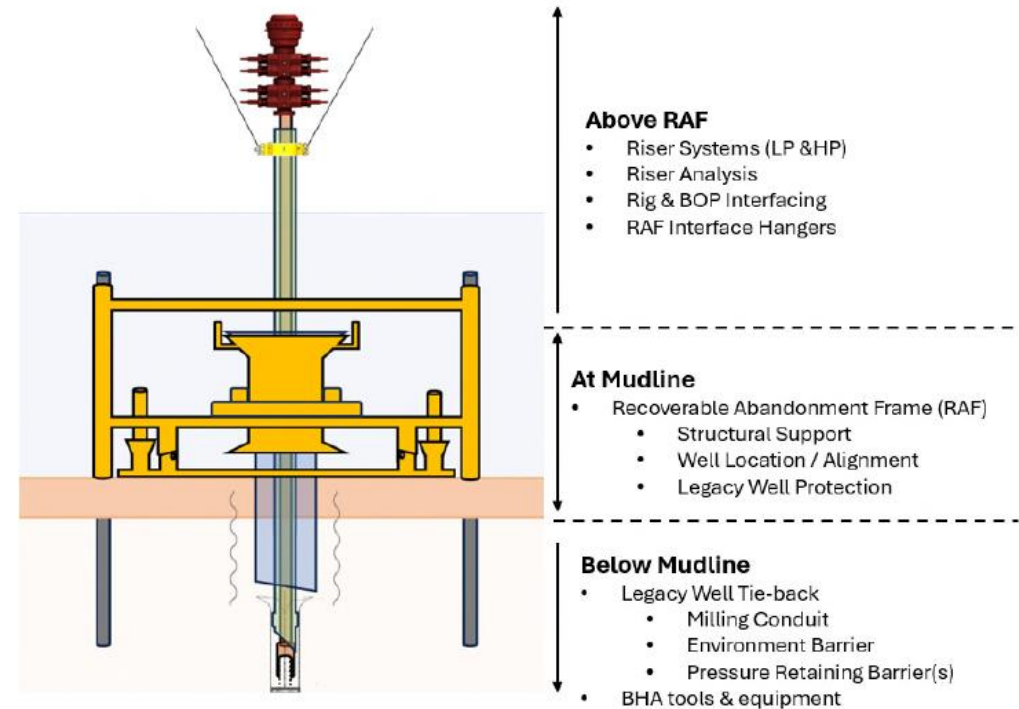
Barrier Installation

- Supports environmental barrier installation
- Enables pressure-retaining tieback
- Allows re-abandonment to be completed for long-term CO₂ containment

RAF + Vertical Re-entry

Controlled access whilst isolating loads

- Deployed over confirmed well centre for direct vertical re-entry
- Adjustable positioning + 60-inch milling conduit for controlled access
- Diverts operational loads away from compromised legacy casing into seabed
- Enables barrier installation for secure re-abandonment; recoverable/reusable



Well Access for Re-Abandonment

Controlled Access whilst isolating Loads

Milling Conduit

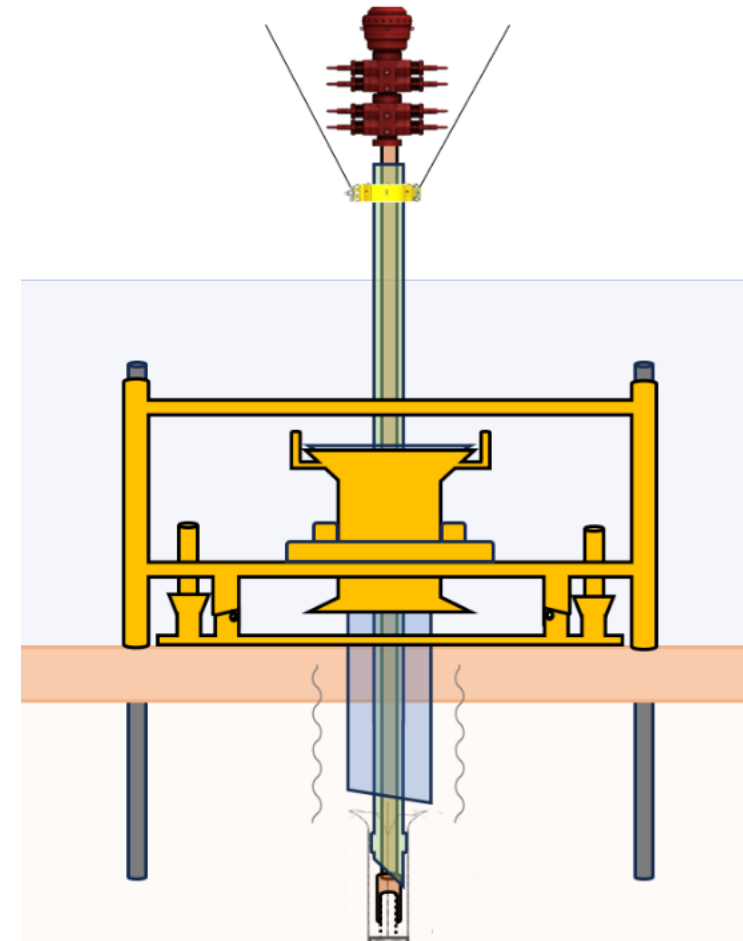
- Provides a controlled access path to the severed well
- Supports clean-up, milling and debris removal
- Helps maintain access without relying on the legacy casing

Environmental Barrier

- Creates a controlled interface with the legacy well
- Helps prevent sediment or debris re-entering the cleared wellbore
- Supports circulation during re-entry operations

Pressure Retaining Barrier

- Provides pressure containment for abandonment activities
- Enables connection to inner casing strings where required
- Supports final P&A for long-term CO₂ containment



From Concept to Fabrication

RAF for the Northern Endurance Partnership (NEP)

- RAF system moving into fabrication for first deployment on Northern Endurance Partnership
- Developed to help prevent historic wells becoming weak points in future CO₂ storage sites
- Aquaterra estimates the RAF could reduce abandonment costs by up to £20m per well
- The solution could also cut re-abandonment timelines by as much as 50%
- Fabrication is being delivered by Derrick Services Ltd in Great Yarmouth, supporting the UK supply chain



From concept to fabrication, RAF is helping turn legacy well risk into a practical route for CCS delivery.

Key Takeaways

RAF for the Northern Endurance Partnership (NEP)

- Offshore CCS depends on secure, long-term containment integrity
- Legacy wells must be addressed as part of the storage integrity case
- Historic abandonment alone may not meet future CO₂ storage requirements
- Traditional remediation routes are often too complex and costly to scale
- RAF provides a practical, repeatable route to vertical re-entry and re-abandonment
- Progression into fabrication for NEP demonstrates real-world industry readiness



Thank you

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