



North Sea
Transition
Authority

Legacy Wells and Carbon Storage:

a UK perspective, lessons learned and best practice

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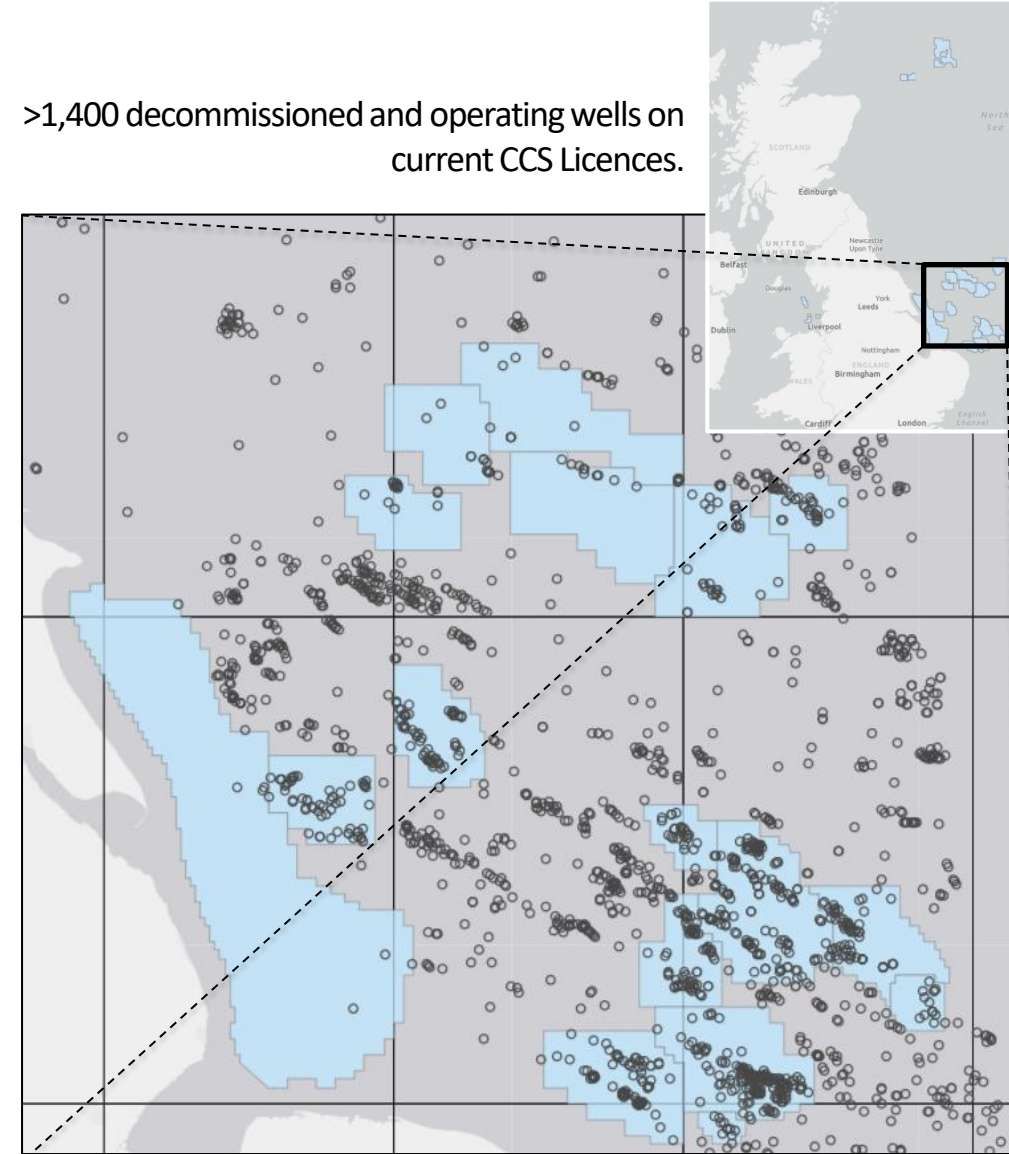
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- **UK Overview**
- **The Early Risk Assessment**
- **An approach to Legacy wells**
- **Lessons from the ERA**
- **Barrier compliance / Plumbing**
- **Data / Screening**

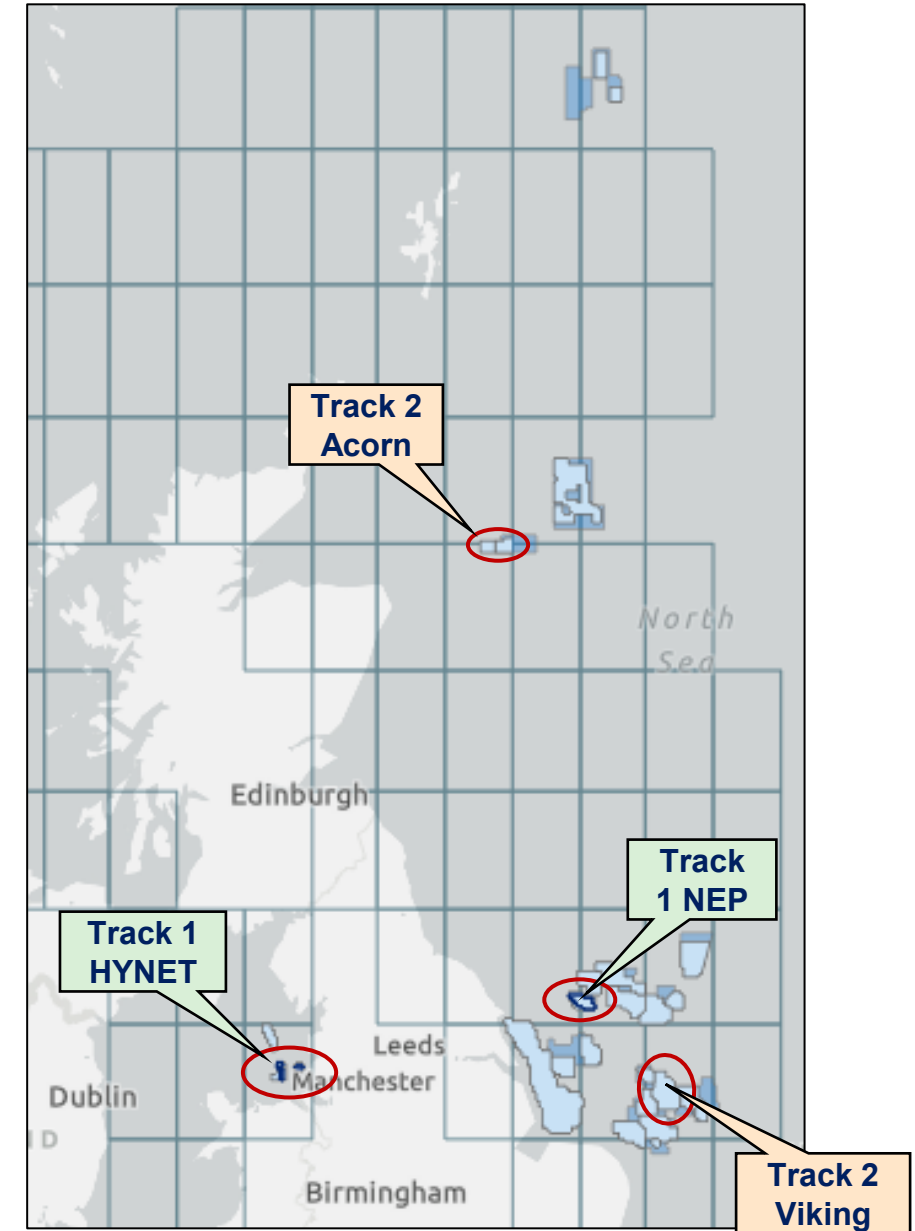
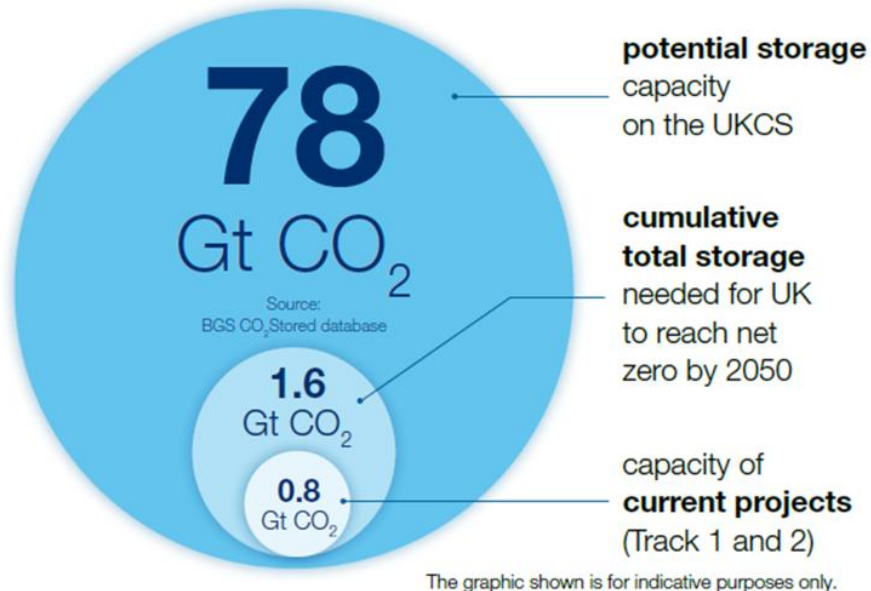
>1,400 decommissioned and operating wells on current CCS Licences.



UK Overview

- 21 New Licences awarded in UK 1st Carbon Storage Round in 2023
- 2 x Track 1 projects granted permits in Dec '24 & April '25
- Perenco extended CO₂ well injection test on CS009, Q1 2025
- ENI appraisal well on CS008, Q2 2025

UKCS potential



Early Risk Assessment (ERA)



North Sea Transition Authority



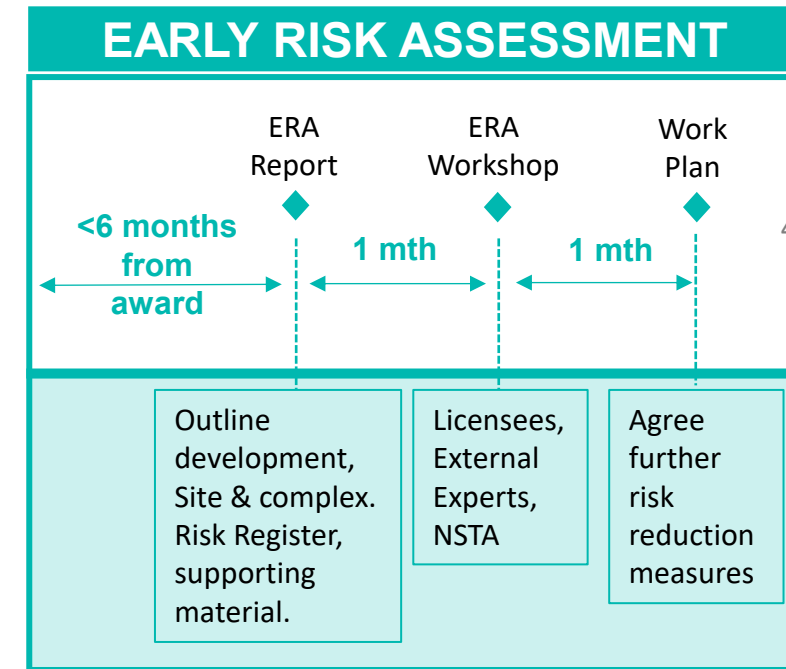
Purpose:

- To identify and define any potential threats to the containment of CO₂, storage capacity, and injectivity; and the key uncertainties in defining the proposed storage site and storage complex.
- To Identify risk reduction measures and the need for further studies, data gathering and/or appraisal activity.
- To identify resource requirements and risk dependencies.

The ERA directly prepares the ground for the permit application → Site Characterisation and Containment Risk Assessment and MMV reports.

(Well integrity is part of Site Characterisation)

(Pursuant to Annex I of EU Directive 2009/31/EC: ...presence and condition of natural and man-made pathways, including wells and boreholes which could provide leakage pathways)



Key Deliverables:

- Detailed risk register.
- Project appraisal schedule and plan.

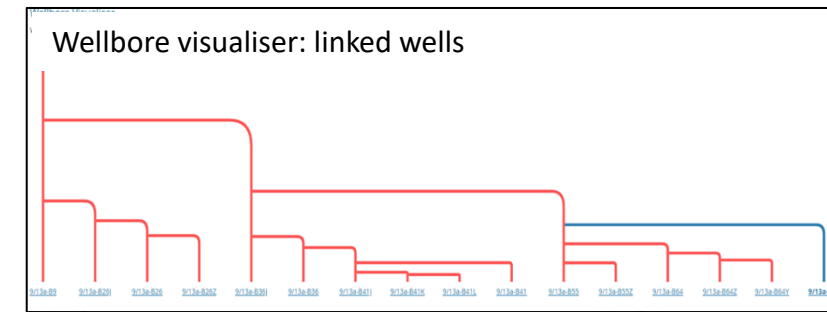
Legacy wells are defined as ALL existing wells in a CS license area and those outside the license area that could see a pressure increase.

- Data availability on **structure maps** and in tables; show where data is held vs needed and where it is not available in the National Data Repository (NDR).
- Identify any non-decommissioned wells.
- **Provide a risk assessment** of each well batching the risks e.g.
 - Wells with no likely issues
 - Wells with uncertainty whether intervention may be required
 - Wells that are high risk/have inadequate barriers
 - Wells without enough data.
- Provide plumbing diagrams.
- Identify where further studies and risk analysis is required. Provide a detailed plan.

Green	Fully meets OEUK Guidelines for CO ₂ storage
Amber	Barriers in place but do not meet guidelines
Blue (1)	Insufficient information found (so far)
Blue (2)	Wells still to be abandoned
Red	CO ₂ must not reach the well

*Updated OEUK Guidelines expected
– this will evolve*

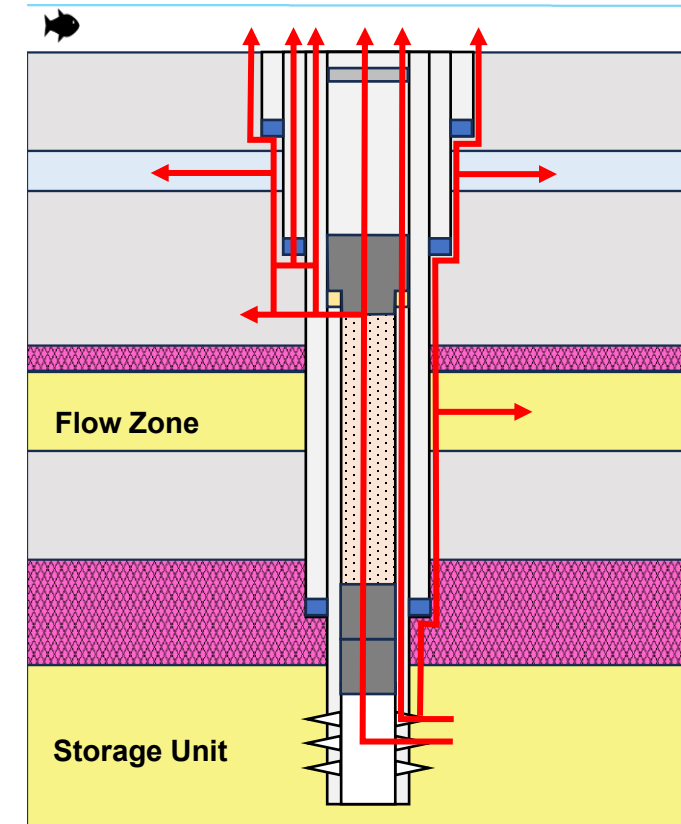
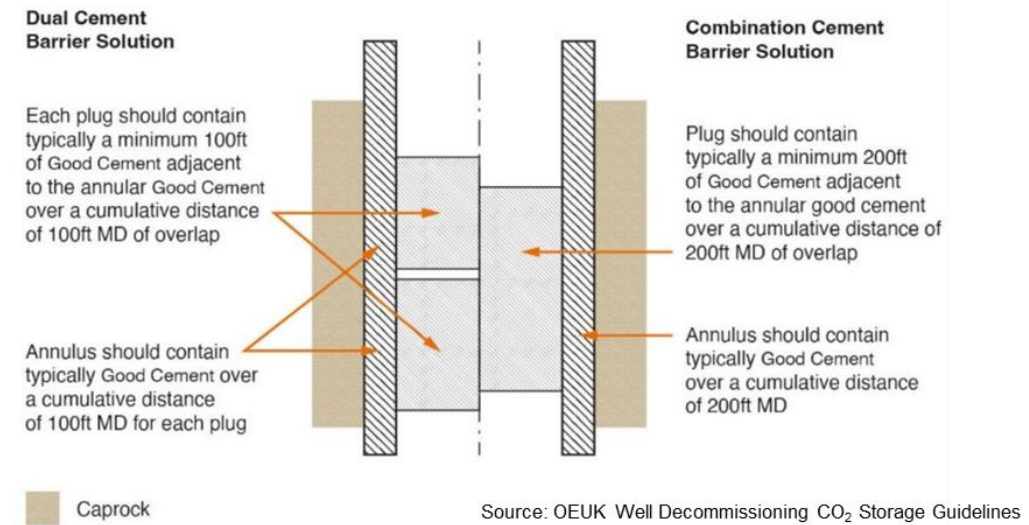
- Risk and well assessment methodology needs to be consistent with to OEUK Well Decommissioning for CO2.
- Concept of migration vs leakage should be applied as per definitions in legislation.
- Most engineering analysis is required where wells do not meet OEUK Guidelines
- Project delivery can be impacted by a large volume of well integrity work, mainly for depleted fields.
- Projects that are advanced in their assessment benefitted from very early prioritisation and screening of the wells.
- Simple early screening for well barriers can screen out some stores.
- Well interventions / new drilling / other legacy wells need inclusion in the legacy well initial assessment.
- Ongoing Hydrocarbon abandonment plans need to align with CS reuse – early stakeholder engagement!
- Data QC & Data availability are a big issue – allow time and resource.
- Resealing lithologies may need to be considered.
- Crossflow risks needs to be distinguished from CO2 containment risks.
- Unsatisfactory (red) wells will require remediation or may mean part of the store cannot be developed → impact on **Site/Complex?**



Are my barriers compliant?

- From OEUK guidelines for CO₂ well decommissioning:
 - All zones requiring isolation must be isolated.
 - 2 x 100 ft barriers or 1 x 200 ft combination barrier of **good** cement across the wellbore and adjacent annulus.
 - Barriers must be verified.
 - Zones must be evaluated for their current & future pressure states.
- Barriers may have been suitable for hydrocarbons at the time of abandonment but may not be compliant for CO₂.
- Sealing formations can be considered if verified and adjacent to annular isolation.*
- Annular materials e.g. mud solids are not compliant.

* if it can be verified that the cumulative length of the resulting seal of the formation against the casing is adequate to prevent flow of the present fluids at the maximum anticipated pressures, then such a seal is acceptable as a replacement for a good annulus cement bond.



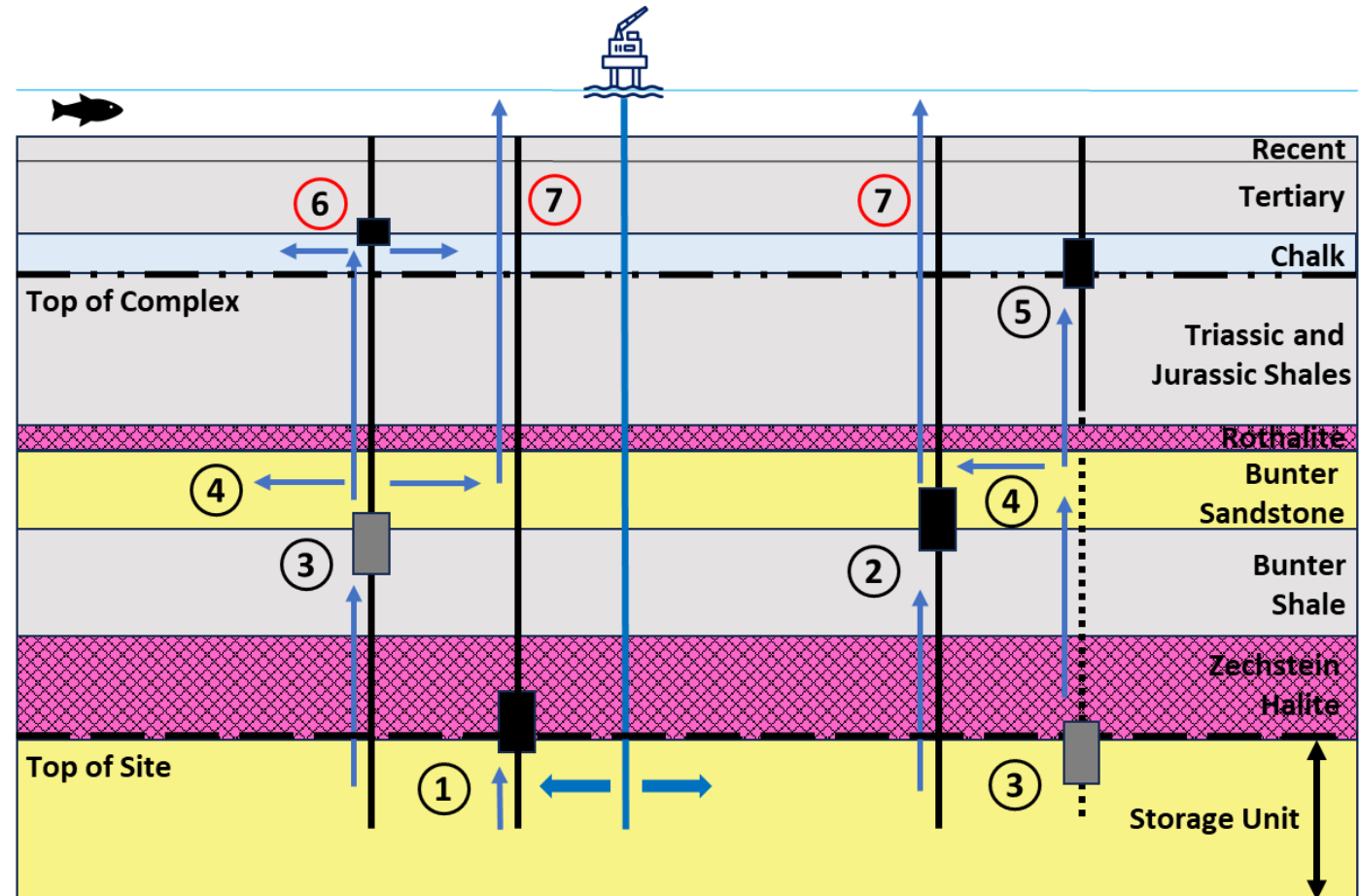
Are my barriers compliant?



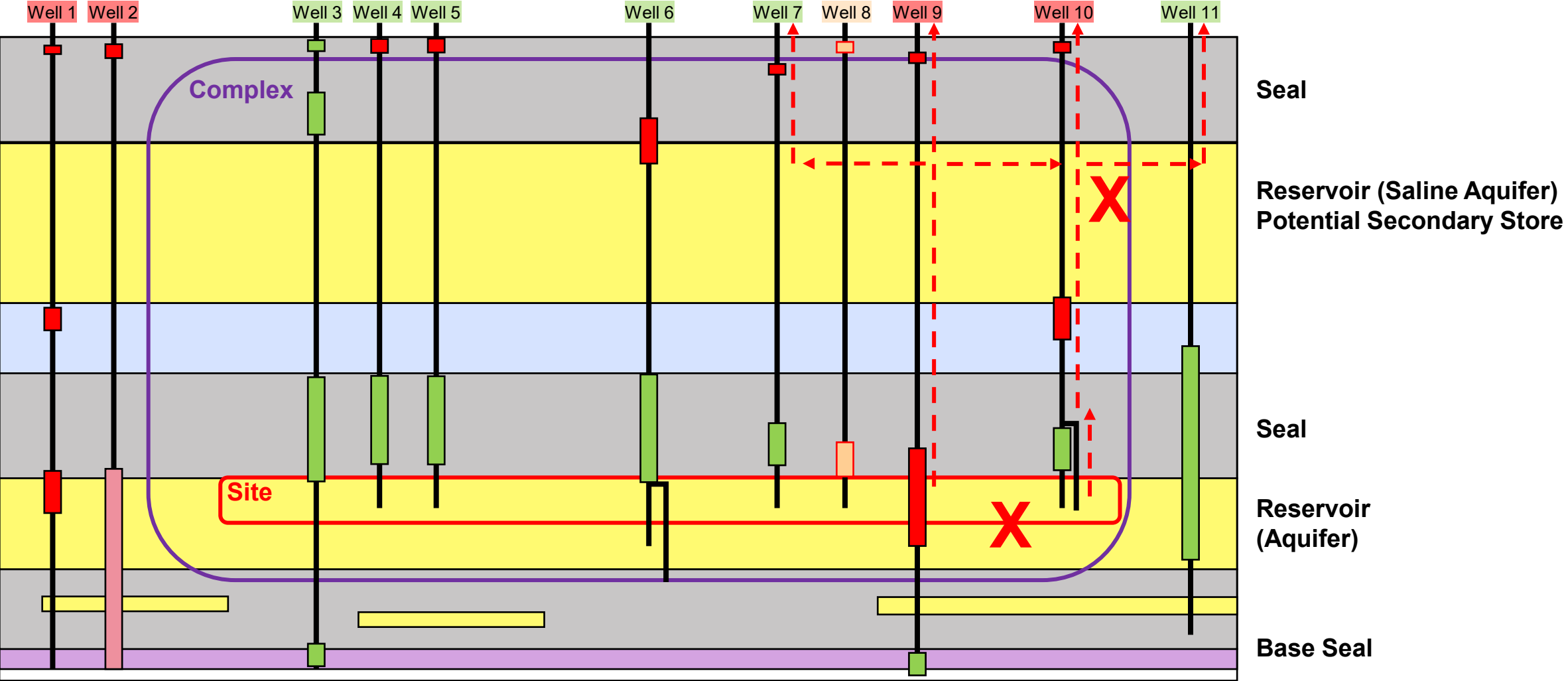
- Wells lacking barriers above an aquifer can provide potential leak pathways, e.g., Bunter Sandstone

Potential CO₂ migration and leakage pathways

1. Compliant barrier – no leakage
2. Compliant barrier
3. Non-compliant barrier fails, CO₂ migrates.
4. Cross-flow CO₂ enters Bunter
– in complex, migration.
5. Compliant barrier
– migration within complex.
6. Cross-flow CO₂ enters Chalk
– out of complex, leak
7. No barrier above complex, CO₂ to surface
– out of complex, leak



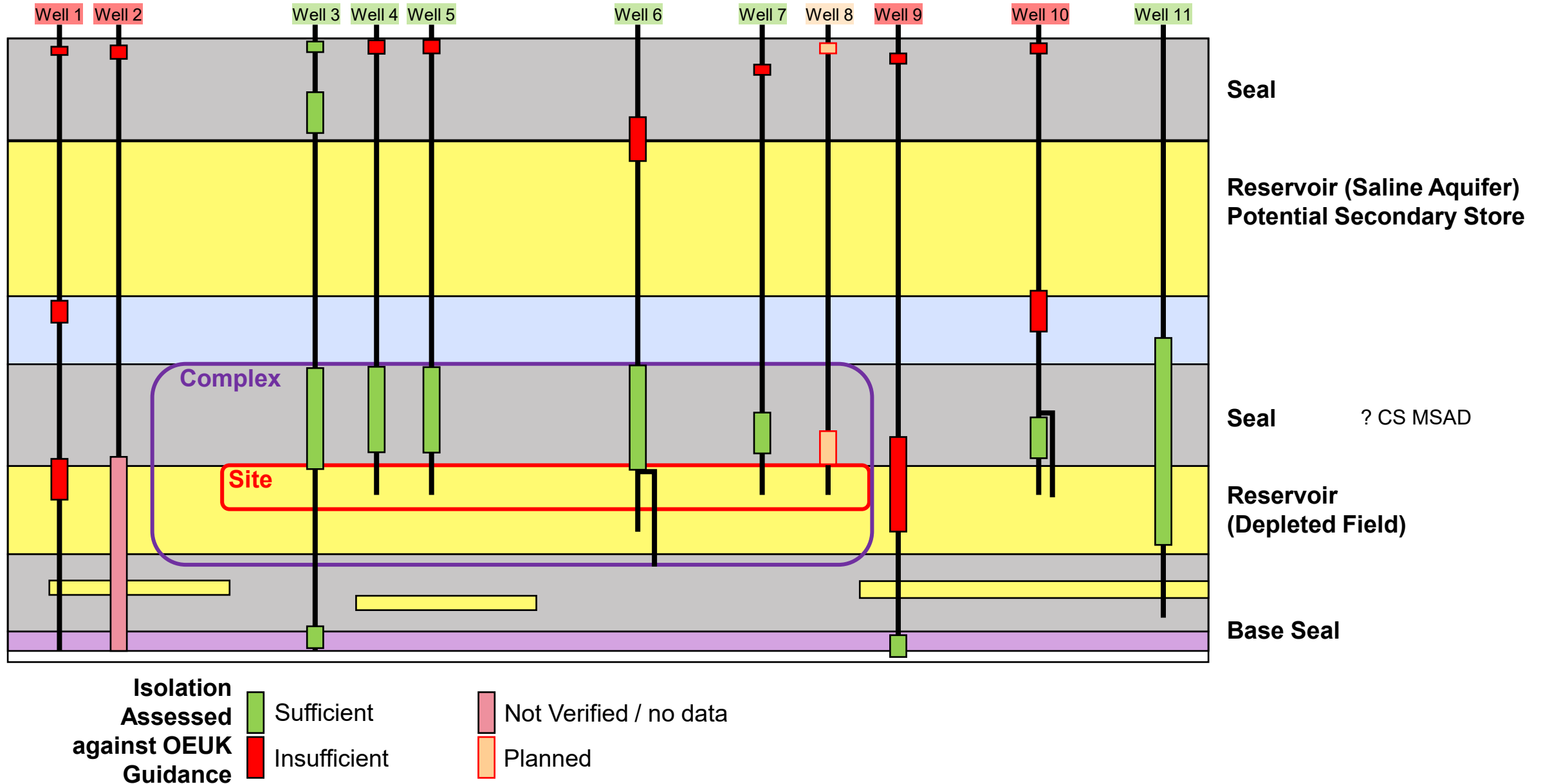
Snakes and Ladders



Isolation Assessed against OEUK Guidance

Sufficient	Not Verified / no data
Insufficient	Planned

Snakes and Ladders



Access and early assessment of available well data – NSTA to roll out an NDR dashboard.

Well Registration No.
All

Wellbore Mechanical Status
All

Field Name
All

Field Geographic Area
All

Current Wellbore Intent
All

Data Reporting Group
All

Classification Tags Explained

Available - An item with this assigned classification Tag (C-Tag) can be downloaded from the NDR

Not Acquired - The data reporting group has indicated that activities that would result in the reporting of data under this classification tag never happened.

Not Available - The data reporting group have indicated they have looked for the data relating to this activity as they know it was undertaken but are unable to currently report this to the NDR

Request - Nothing is reported against this C-Tag in the NDR. Please submit a missing data request via the NDR to address this

UKCS Wellbore Data Availability Report

Home

Previous

Info

Help

Clear all slicers

Pre Drilling Operations

Field Name	PRE_DPROG	PRE_GEN	PRE_EOJR
ABBEY 47/03i- 17Z	Available	Request	Available
ABIGAIL 29/10b- 8Z	Available	Available	Available
AFFLECK 30/19a- 7	Available	Not Acquired	Available
30/19a- 7Y	Not Acquired	Not Acquired	Not Acquired
30/19a- 7Z	Not Acquired	Not Acquired	Not Acquired

Drilling Operations

Field Name	DRILL_CEMENT	DRILL_DAILY	DRILL_DEV	DRILL_EOWR	DRILL_EOJR
ABBEY 47/03i- 17Z	Available	Available	Request	Available	Request
ABIGAIL 29/10b- 8Z	Available	Available	Available	Available	Available
AFFLECK 30/19a- 7	Request	Available	Available	Available	Request
30/19a- 7Y	Request	Available	Available	Available	Available
30/19a- 7Z	Request	Available	Available	Available	Request

Completion Operations

Field Name	COMPL_DAILY	COMPL_EOJR	COMPL_PI
ABBEY 47/03i- 17Z	Request	Available	Available
ABIGAIL 29/10b- 8Z	Available	Available	Available
AFFLECK 30/19a- 7	Request	Request	Request
30/19a- 7Y	Request	Request	Request
30/19a- 7Z	Request	Request	Request

Data Collection & Interpretation

Field Name	DRILL_CEMENT	DRILL_DAILY	DRILL_DEV	DRILL_EOWR	DRILL_FLUID	DRILL_GEN	DRILL_MWD	DWL_MUD	DWL_MWD	DWL_WIRE	GEOL_GE
ABBEY 47/03i- 17Z	Available	Available	Request	Available	Request	Available	Available	Available	Available	Request	Request
ABIGAIL 29/10b- 8Z	Available	Available	Available	Available	Available	Available	Available	Available	Available	Not Acquired	Available
AFFLECK 30/19a- 7	Request	Available	Available	Available	Request	Available	Available	Not Acquired	Available	Not Acquired	Available
30/19a- 7Y	Request	Available	Available	Available	Available	Available	Available	Available	Available	Available	Request
30/19a- 7Z	Request	Available	Available	Available	Request	Available	Available	Not Acquired	Available	Available	Available
30/19a-A1	Available	Request	Available	Available	Available	Available	Available	Not Acquired	Available	Available	Available

Abandonment Operations

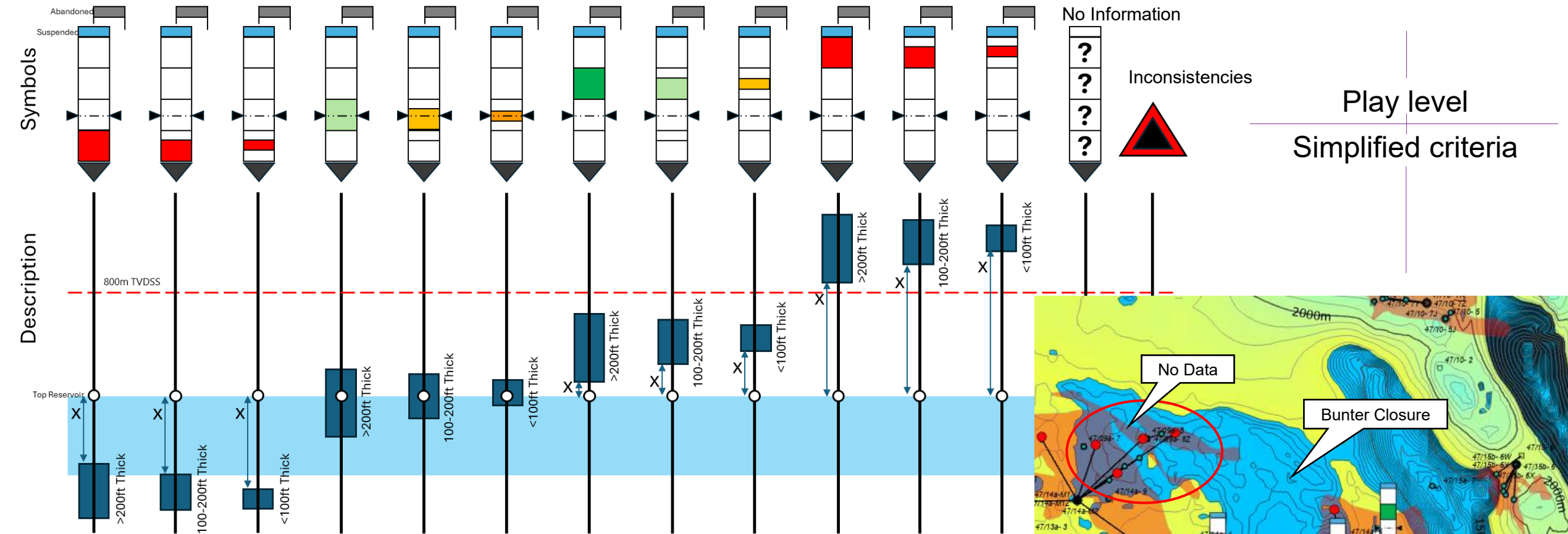
Field Name	ABANDON_CEMENT	ABANDON_DAILY	ABANDON_EOJR	ABANDON_HSE	ABANDON_PROG	ABANDON_SEABED	DWL_ABANDON	ENG_ABAND	LO
ABBEY 47/03i- 17Z	Request	Request	Request	Request	Request	Request	Request	Request	Request
ABIGAIL 29/10b- 8Z	Request	Request	Request	Request	Request	Request	Request	Request	Request
AFFLECK 30/19a- 7	Request	Request	Request	Request	Request	Available	Request	Not Acquired	Request
30/19a- 7Y	Available	Not Available	Available	Not Available	Available	Available	Request	Not Acquired	Request
30/19a- 7Z	Request	Request	Request	Request	Request	Request	Request	Not Acquired	Request
30/19a-A1	Request	Request	Request	Request	Request	Request	Request	Not Acquired	Request

UKCS Wellbore Current Mechanical Status

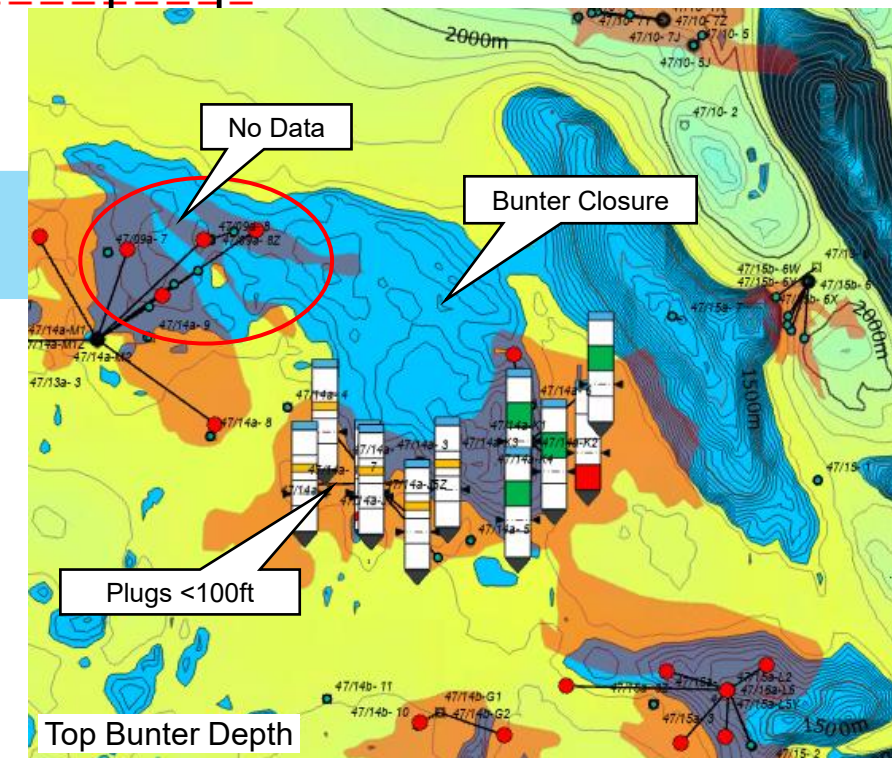
Wellbore ... ● Abandoned Phase 3 ● Abandoned Phase 4

Category	Count	Percentage
Abandoned Phase 3	7597	48.56%
Abandoned Phase 4	2866	18.32%
Other	1952	12.32%
Other	863	5.52%
Other	1783	11.4%
Other	20	0.13%

Early Screening



- Early screening out (e.g. the 'overburden aquifer' problem).
- Highlights areas for attention.
- Early regional or 'play-scale' view of risk.



- An early risk assessment:
 - identifies potential threats; identifies the need for risk reduction measures
 - groups wells by risk profile
 - highlights where data is lacking and requires attention
 - determines which wells need further work - prioritises
 - identifies the risk dependencies (subsurface integration)
- Most engineering analysis is needed for wells that do not meet OEUK guidance.
- The outcome of well assessments can be a constraint on the store or plume extent – may change the site / complex definition.
- Early, high-level screening can save time and resource.