Containment Risks and Insurance Implications for UKCS Stores

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INTRODUCTION

This poster is about containment risks at typical stores on the UKCS and how insurance can support these risks, based on generic learnings from the first two UK CCUS clusters. We relate the impact of business regime to the appropriate level of insurance cover for T&SCo and government stakeholders.

While only storage projects that have 'no significant risk of leakage' will gain regulatory approval, the residual high-impact / low-probability containment risks on approved projects will require management to ensure T&SCo stability. Insurance for these risks supports investor confidence and can provide a financial security for carbon storage permit (aligned with UK / EU regulations).

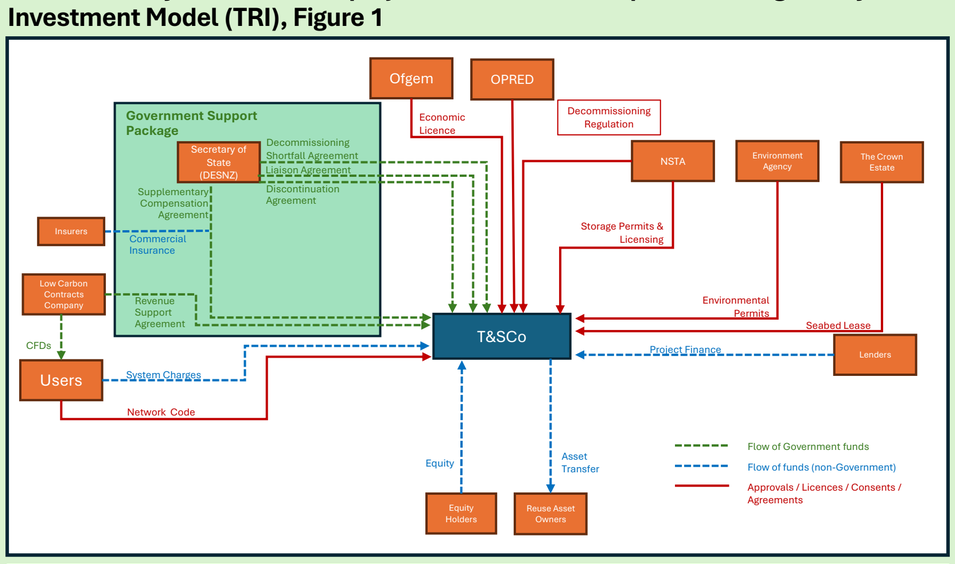
Unexpected liabilities may relate to:

- costs to remediate a leak path (via a well path, facilities, in-field facilities such as pipelines or possibly geology);
- consequences of a leak (environmental remediation, third-party liability, ETS repayments, business interruption);
- discontinuation of the store (including debt repayment and liabilities for users).

Some liabilities are new (e.g. geological leakage), some extend from current oil and gas insurance provision (e.g. well and other mechanical leakage).

Financial close was achieved for NEP's East Coast Cluster (Dec 2024) and HyNet Liverpool Bay Project (April 2025), under the UK Transportation Regulatory Investment (TRI) model, which includes an Economic Licence, Government Support Package (GSP) and commercial insurance (Figure 1). The GSP responds to leakage risk at a store. The Supplemental Compensation Agreement (SCA) is part of the GSP. The SCA aligns with and stands behind commercial insurance to ensure all the residual low probability, high impact containment risks are covered at the required level.

Flow of Money for UK Track 1 projects under the Transportation Regulatory Investment Model (TRI), Figure 1



To assess the appropriate level of insurance and potential liabilities for each project, assessments of (1) the leakage risks (probabilities of occurrence and consequences including leak rates), (2) policy details and (3) business regime are needed.

(1) UNDERSTANDING LEAKAGE RISKS

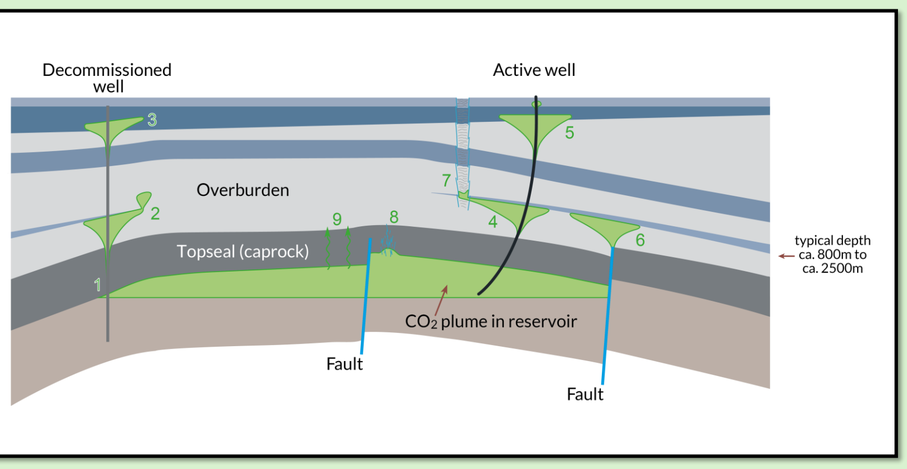
Leakage Probabilities & Rates for a Reasonable Worst Case (RWC)

Leakage from the storage complex could occur associated with mechanical features (wells, pipelines, facilities), geological features (or geological properties), or a combination of the two (Figure 2). Leakage risks will be assessed in a Containment Risk Assessment for each potential site (UK and EU sites). Not all leakage will be to surface with associated emissions.

Generic well and geological leakage risk data for notional, typical sites are simplified and summarised in Figure 3 taken from "**Deep geological storage of carbon dioxide (CO2), offshore UK: containment certainty"** (QR code links to report).

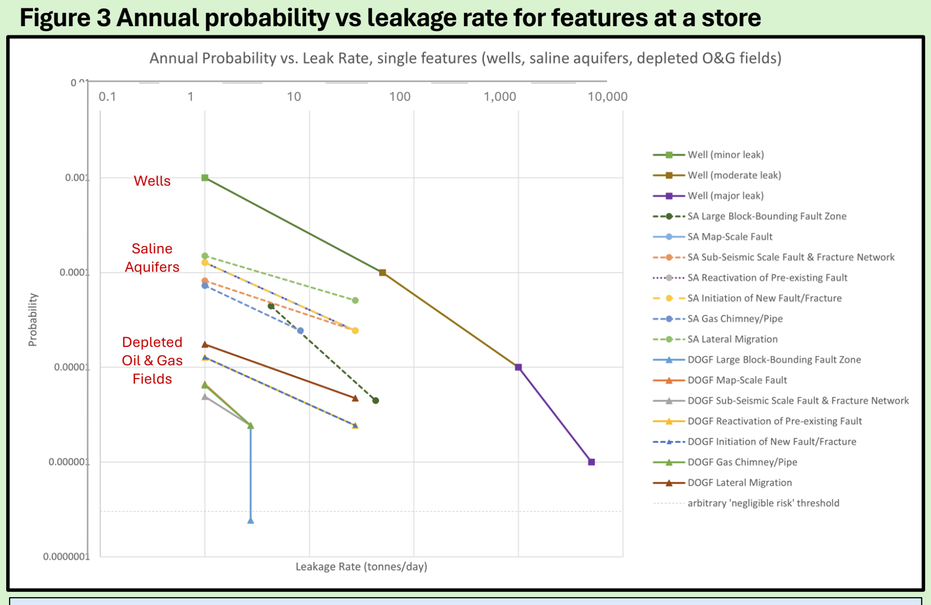
Leakage data for wells is extrapolated from oil and gas datasets, risk data for geological leakage relies on analogues.

Figure 2 Geological Containment Risk at a Typical Storage Site



QR code links to report " Deep geological storage of carbon dioxide (CO2), offshore UK: containment certainty"

Figure 3 Annual probability vs leakage rate for features at a store



Evaluating Leakage Liabilities at Real Sites

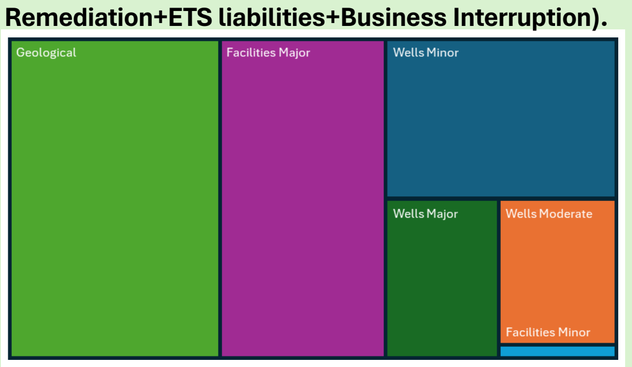
To estimate RWC risks for specific sites from the range of probabilities of well leakage in the 'containment certainty' report, specifics of the site are considered (e.g. type of site, well condition and design, pressure regime, number of risked features, risk management strategy, seismic monitoring sensitivity, operating pressure limits). Mechanical leakage risks at the injection site or in the transportation network are also included.

Cost analysis is underpinned by definition of nominal remediations, their costs, durations and leaked amounts (Figure 4).

Monitoring can be used to demonstrate containment and conformance. It can be used to identify **Significant Irregularities** (SIs)*, which may be precursors to leakage. The UK Supplemental Compensation Agreement (SCA) recognises SIs with severe impact, hence these are also included in modelling liabilities.

Recognition of an actual or potential leakage event may be the basis for an associated claim for ETS liabilities, environmental remediation, 3rd party claims, and business interruption (which can all be estimated from assumptions about leaked mass, carbon price, durations of business interruption).

Figure 4 Relative Costs of RWC Loss of Containment Event (by event type and leak rate, summing Remediation+ETS liabilities+Business Interruption).

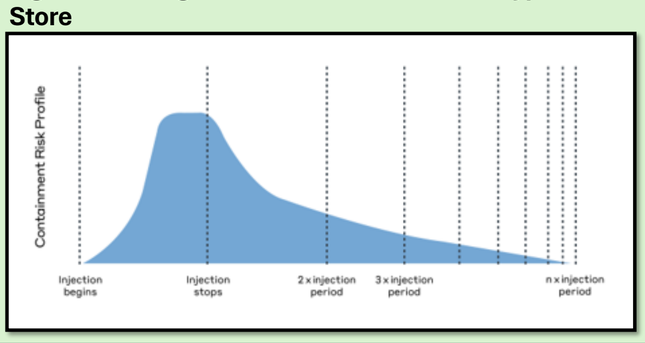


Risks through time: The probability of a leak is related to the aperture of the leakage pathway. Leakage rate depends on aperture, differential pressure and viscosity.

Geological risks through operations increase, as the amount of injected CO_2 increases, the pressure changes and/or the CO_2 plume migrates, Figure 5. The exact profile will be site -specific.

Mechanical risks through time are modelled with a constant probability of occurrence per year. The available well leak data from oil and gas operations do not show if or how the leak probability changes with time.

Figure 5 Geological Containment Risk at a Typical Store



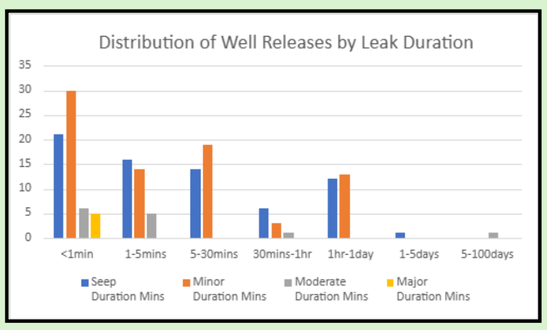
(2) IMPACT OF INSURANCE POLICY DETAILS

Insurance policies define conditions for a valid claim, retentions (below which there will be no payout) and an upper limit for a claim.

- For example, commercial insurance for Loss of Well Control usually only applies if the flow cannot be controlled using equipment onsite. The majority of events covered by the probabilities in Figure 3 can rapidly be controlled (Figure 6). It is likely that most leak events below 1 day would be classified as controlled, meaning that up to 98.8% of the well events should be excluded from the calculations of insurance / GSP liabilities.
- A similar picture of exclusions applies to leaks from facilities.
- An associated claim for ETS liabilities, environmental remediation, 3rd party claims, and business interruption (BI) may therefore not be valid, however there is other support available under the UK TRI model (Figure 1).

In the UK the SCA is only triggered in the event of a valid insurance claim after the commercial limit has been exceeded (unless 'Unavailability' of commercial insurance has been recognised). This means that in calculating governmental liabilities, the claims that do not meet policy conditions or surpass retention values or exceed the policy limit need to be stripped out.

Figure 6 Well leak data from the HSE "Offshore Hydrocarbon Releases 1992-2015"



(3) COMMERCIAL INSURANCE AND BUSINESS / REGULATORY REGIME

The differing levels of risk and reward, from regulated assets to a free market, should be reflected in the insurance cover.

- Insurance concepts of Maximum Possible Loss (MPL, a worst plausible failure scenario) and Probable Maximum Loss (Reasonable Worst Case) are useful when considering where to set the upper limit for cover.
- UK regulated Track 1 project limits reflect an MPL scenario, with cover for geological leakage. Insurance cover up to an MPL scenario reduces exposure for the T&SCo and reduces government exposure (by allowing every chance of remediation before a decision to discontinue a store).
- What role does the MPL limit have in non-UK jurisdictions? Do developers need to define these to understand residual risk beyond commercial insurance?

Alignment of the business model response (including GSP) and commercial insurance is vital.

- The significant differences between the CCUS business model compared with oil and gas, means that the BI cover required needs careful consideration (not necessarily a simple extrapolation of previous policies). In the UK this has been aligned in detail with the wider business model.

Any gaps between commercial policy details and Government Support Package (GSP) have been identified for UK Track 1 stores (e.g. BI cover for severe geological SIs within the site).

- ETS Liability limits under commercial insurance may be financial, while SCA limit is a tonnage.
- Beyond the UK, insurance can align with regulatory requirements to provide Financial Security for carbon storage permits. In the UK, insurance covers some events that are not covered by the GSP, but the cover is necessary for store permit conditions
- For example, remediation of environmental damage from escape of high salinity brines is not covered under the SCA. Any security is provided entirely through commercial insurance.
- To insure a well an insurable interest in the well must be demonstrated, even if the T&SCo or parent company has never had equity in the well (e.g. a legacy well). The Containment Risk Assessment within the carbon storage permit applications can demonstrate an insurable interest.

The authors provided technical advisory services to the UK Department for Energy Security and Net Zero on developing the business policy for carbon storage and provided technical assurance for the UK Track 1 T&S Networks. We are available for consultancy.

* **Definition**

Significant Irregularity *means any irregularity in the injection or storage operations or in the condition of the storage complex itself, which implies the risk of a leakage or risk to the environment or human health; from DIRECTIVE 2009/31/EC*

Glossary

BI	Business Interruption	*SCA*	Supplemental Compensation Agreement
GSP	Government Support Package	*SI*	Significant Irregularity
RWC	Reasonable Worst Case	*T&SCo*	Transport & Storage company