UK Carbon Capture and Storage Demonstration Competition

UKCCS - KT - S10.5 - FEED - 001
Insurance Strategy Report

April 2011
ScottishPower CCS Consortium
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Information provided further to UK Government’s Carbon Capture and Storage ("CCS") competition to develop a full-scale CCS facility (the "Competition")

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UKCCS - KT - S10.5 - SP - 001 Insurability Report
EXECUTIVE SUMMARY

The Carbon Dioxide associated with generating electricity from fossil fuel combustion is recognised to be a significant contributor of the UK’s emissions of greenhouse gases. Burning pulverized coal, the flue emissions from the Power Plant contain approximately 10% to 15% CO₂ by volume and the ScottishPower led CCS Project intends to capture the gas using post-combustion technology, and transport it to a storage location where it can be permanently isolated from the atmosphere and elements of the environment where it could cause damage or harm.

Risk management concerns related to the ownership and operation of carbon capture and sequestration facilities have not been fully addressed to date. The principal aims of both operator and government are aligned in that both would like to be assured that:-

- Insurance funds are readily accessible if and when they are needed and adequate to pay for the worst-case loses
- The financial community (Lenders) is comfortable with the protection afforded
- That insurance is available and if necessary transferable upon change in ownership(s)
- That the cost of insurance does not make commercial development and operation of CO₂ capture and sequestration facilities economically impractical

This report considers the risks and insurance associated with the important stages of CO₂ capture and sequestration from drilling and construction, operation, monitoring, testing and closure and the associated impact on the electricity producing plant. Focussing on the highlight issues, new exposures evolve that are not currently considered by either the Power or Energy insurance markets relating to long term storage risks and associated gradual pollution. Options for meeting financial responsibility requirements include assurance based on financial capability, insurance, bonds, escrow accounts, corporate guarantees of parent entities, letters of credit and other financial instruments.

The insurance issues and risk considerations highlighted in this report are not presented as definitive solutions, and the tailoring of these to the Authority and Consortium’s specific requirements and profile will necessarily be subject to further review as contract negotiations continue.

LEGAL STRUCTURE

At this point, the legal structure of the Consortium and the ownership of the assets associated with the project are still in development. To have the right to insure, an insured must have an insurable interest in the subject matter of the insurance, which is to say that he stands to benefit from the subject matter or will suffer from its loss. The legal structure and risk allocation within the Consortium will determine who has insurable interest, and therefore whether e.g. a construction (CAR) policy can be placed covering the whole chain, or whether
each Consortium member will require to look after their own assets and liabilities only. This applies equally to the operational phase as it does to construction.

The legal structure of the Consortium therefore will impact the final design of an insurance programme in terms of a placing strategy, risk retention levels and utilisation of Captive insurers, however what does not change is the range of insurance cover or other risk transfer solutions that will require to be placed for this project. Solutions are required in order to facilitate the transfer of risk for the full CCS chain, defined over 5 key phases: Design and Construction, Commissioning and Proving, Operation, Decommissioning and Post-Closure monitoring and maintenance.

**Construction Phase**

The Consortium has already indicated its familiarity and experience of insuring high value assets, major construction projects and complex, multi-disciplinary operations. Much of the insurance required for the project is therefore seen as being ‘business as usual’.

It is certain that during Construction, additional insurance will be required to be purchased specific to the project. Common with industry approach to insuring major and complex projects, it is likely that Owner Controlled Construction Insurance will be placed. This model has the advantages of a policy being placed for the duration of the project which can be tailored specifically to the risks inherent in the project. As noted above, the final legal structure of the Consortium will determine whether this is a single project policy or whether individual policies will be placed covering each Consortium member’s assets. It is likely that both Onshore and Offshore CAR policies will need to be placed, in recognition of the differing risk exposures and the differing appetite of the Onshore and Offshore CAR insurance markets.

**Operational Phase**

The operational phase will cover the various elements of the CCS chain, from capture, through to onshore transportation, offshore transportation, and finally injection and storage. Aside from the long-term storage risks, the main risks perceived during this period are property damage and business interruption risks, and various liability risks such as third party, environmental and directors’ and officers’ liability. At the operational stage, there is likely to be less requirement for the placing of project specific insurances, as each member of the Consortium already procures a wide range of insurance cover to manage their current operations, and discussions with brokers and insurers indicate that although CCS operations will represent expansion of main activities it will not represent a material change in risk profile that would significantly impact insurance arrangements. It is therefore likely that existing operational programmes would be extended to include the new operations. The final decision on this cannot be taken however until the Consortium legal structure is finalised, and then a determination made on whether additional standalone project policies will require to be placed once the project reaches operational stage, or whether the various elements of the CCS chain will be subsumed into the members’ main programmes.
Utilisation of existing programmes does not mean zero cost, but could ensure good economies of scale. The costs of any incremental activities on partners’ global programmes will be captured.

**INSURANCE MARKET AND PLACING OF RISKS**

The London Insurance Market is at the centre of the global insurance arena and has a tradition of being able to provide solutions to respond to new or evolving risks. For new and developing risks in the UK it is the market which is usually most suited to address the needs of projects within the UK and beyond.

The focus of discussions to date has therefore been with London market insurers (including London representative offices of global insurers). The extensive footprint of Consortium members means that the Consortium is well positioned to engage with all Global Insurance Markets, and the use of global brokers, Aon, enables assessment of any solutions being offered or developed elsewhere, particularly in the United States.

Within the insurance market there are companies who customarily would look to be proactive and ‘take the lead’ in addressing evolving risks whilst others are content to wait until the risks are better understood or are only prepared to consider a proposal once full underwriting information is provided. Aon have identified that the same approach applies with the risk associated with long term storage of CO$_2$.

This highlights a second major hurdle in determining the insurance strategy for CCS. A lack of basic underwriting information, including the absence of claims history, unproven technology, and undefined liabilities make it difficult to engage with insurers to a comprehensive degree. The lack of underwriting data also makes it extremely difficult for any insurer to price the risk.

**OTHER KEY CONSIDERATIONS**

Other aspects that require consideration when designing the insurance strategy include restrictions in cover, future insurability, escalating cost of insurance and indemnity.

1. **Indemnity** is another basic principle of insurance and states that a loss must be able to be quantified in monetary terms. If the loss cannot be quantified, then it cannot be insured since any insurance claim can only be defined in monetary terms. Until the regulatory regime is defined, it is uncertain what the extent of liability for CO$_2$ release is. While it is envisaged this will be some function of the purchase of compensatory carbon allowances, or potential fines or penalties, it is difficult to confirm the full financial impact in the future, or indeed contemplate compensation for undetermined long term damage to the environment.

2. Operational insurances are likely to be structured over a single annual period, particularly for Third Party Liability, and often for Environmental Protection. There is a risk that following a leakage incident whether insurance would be able to be renewed, and if available at what increased cost? The Consortium considers this is
an area that the Government must be able to respond to if the market for insurance disappears.

3. It is considered that at the early stage of development of new and unproven technology that cover may be provided on less comprehensive terms, particularly in the area of mechanical breakdown. A *restrictive type of cover* may be all that is available for the assets themselves, resulting in greater risk being borne by the Consortium for breakdowns.

4. Underwriter review: Geological site characterization of existing or proposed geological formations to assure sequestration wells and facilities are appropriately sited and warranty surveying for offshore construction

5. The establishment of clearly defined property rights and a logical liability scheme to deal with issues such as subsurface trespass and retrospective liability.

6. The well construction issues with materials compatible with the CO\(_2\) injection and in a manner that prevents fluid movement into unintended zones (incl Blowout – pressure increasing wells)

7. Periodic re-evaluation requirements of the Area of Review around the injection well to incorporate monitoring and operational data and verify that CO\(_2\) is moving as predicted within the subsurface

8. Financial responsibility requirements to assure that funds will be available for well plugging, site care, closure, monitoring, emergency and remedial response activities.

**MAIN CONCLUSIONS**

In this report we have considered 5 distinct phases of the CCS operation lifecycle to establish the extent and nature of the risks and available insurance solutions. Our main conclusions are as follows:-

**Construction:**

- The risk exposures associated with every part of the construction project are considered “business as usual” for the Consortium owners and their respective interests and whether purchased individually or as a combined joint venture, cover is readily available in the form of CAR, DSU, TPL and EIL policies. Associated risks are captured by Consortium owners’ existing corporate insurances.

- Existing property (assets) can be covered under Consortium members’ property policies or scheduled as existing property to a standalone JV purchased TPL policy.

**Commissioning & Proving:**
• We have highlighted the unique nature of the risks in the quasi construction / operation phase where the change over in policies must be detailed to ensure no gaps in cover, but also the importance for combined management of the Commissioning & Proving phase.

• Overall the risks in this phase do not present any specific insurability issues, although a Total Cost of Risk approach suggests the Consortium might consider purchase of construction insurances on a Consortium JV policy, particularly for EIL cover.

Operations:

• For the most part the CCS operation is considered as “business as usual” for the Consortium members with existing insurances providing cover, with EIL policies providing protection for costs associated with clean up and third party damage cover for the ‘new’ risk regarding pollution due to a known release of CO₂.

• Currently there is no available cover for any risk of long term impact to the environment, particularly associated with the underground storage aspect of the operation.

• Similarly the financial consequences of lost CO₂, such as any requirement to purchase offsetting CO₂ credits, are not currently an insurable risk.

• Any insurance product for EIL is likely to require a minimum 3 year period, with premium paid up front, which brings into consideration the issue of re-insurability of this risk following a leakage incident which erodes the aggregate limit or is such a large loss making the risk generally uninsurable.

Decommissioning:

• Decommissioning risks are treated in the same way as construction, but contract strategy may lead the Consortium members to consider a contractor purchased DAR insurance, particularly for the offshore works.

Post-Closure:

• To date, there has not been any advancement in resolving the difficulties of insurability of this risk with regard to quantification of the exposure and insurer security for the long term exposures. The long term nature of coverage will mean any insurance solution is uneconomic and unlikely to be acceptable to regulators.

• However as CCS develops as an industry, insurance solutions, such as a mutual fund, may provide a solution to the long term exposure. The responsibility for post-closure care must be established and financial responsibility assured to prevent releases of sequestered gas.

• Insurance and mutual funds can only offer a finite level of assurance, and beyond this the government will be required to offer additional support both in terms of value and
longevity of assurance. It is considered that government support will therefore be required irrespective of whether insurance or other solutions are available.

- In the case of a mutual fund, it is not certain how this may work, however the following issues would require to be addressed: current lack of liquidity/number of CCS projects, costs, and control. A reasonable payment to a fund that releases the storage Consortium from long-term liabilities may be a possible solution.
INTRODUCTION

The Report intends to cover all issues of risk transfer for the full lifecycle of the CCS project (incl. post project liabilities) with the purpose of:-

- Identifying the risk exposures confronting the project, including consequential loss
- Ascertaining current Risk Transfer potential for each of the identified risks
- Proposing solutions for potential Risk Transfer for uninsurable items
- Identifying Risks that cannot be Transferred

Most of the risks and the associated insurance / risk transfer solutions are currently well understood and to aid understanding all the risks and commentaries are set out in a single table for each of the main phases of the project:-

1. Construction
2. Commissioning and Proving
3. Operations
4. Decommissioning
5. Post Closure Monitoring / Handover

The risks considered are associated with the physical project components only and not associated risks, which might include:-

6. Pandemic sickness significantly impacting the workforce
7. Issues associated with professional negligence (professional indemnity)
8. Slips & falls and associated potential employers liability issues
9. Political risk
10. Political violence or terrorism

The key issues are lifted from the table and discussed in more detail in the Discussion sections of the report with key findings set out in the Conclusions. Most of the key issues relate to the use of new technology and issues regarding potential CO$_2$ leakage and the storage reservoir.
BACKGROUND

The following graphic identifies the main physical components of the CCS project and the Consortium partners’ responsibility split.

CCS Scheme Split of Responsibilities

LONGANNET POWER STATION

The elements of the CCS Chain that will be located at Longannet Power Station include:

- Carbon Capture Plant (CCP)
- CO2 compression and drying plant
- A Combined Heat and Power (CHP) plant to provide heat and power to the CCP
- Cooling water system
- Effluent treatment system
- Minor utilities.

All these elements will be contained within the existing boundaries of the Longannet Power Station. A single CO2 interface will occur at the pipeline exit from the site boundary where the CO2 will pass from ScottishPower to National Grid.

Aker Clean Carbon is responsible for managing the design and construction of the new plant and interfaces with the existing power plant. ScottishPower shall take over responsibility for the operation of these facilities.
ONSHORE TRANSPORTATION TO ST FERGUS

The elements of the CCS Chain that comprise the onshore transportation arrangements to St Fergus are as follows:

- A new 900 mm (36") diameter pipeline between LPS and the existing National Transmission System (NTS) No 10 Feeder which is to be utilised for the transportation solution;

- The existing No 10 Feeder from the existing National Grid compressor stations at Avonbridge/Bathgate to the existing onshore terminal at St Fergus; and

- New compressor facility located in the vicinity of the St Fergus terminal.

The CO₂ interface between National Grid and Shell will occur downstream of the compressor facility at the point the CO₂ transfers across into the Shell St Fergus terminal.

The design and construction phase will be managed by National Grid. National Grid will also operate this facility.

ONSHORE/OFFSHORE TRANSPORTATION TO GOLDENEYE

The elements of the CCS Chain that make up the transportation of the CO₂ from St Fergus to Goldeneye comprise of:

- The new connecting pipe/pipeline from the St Fergus compressor station, across the south side of the Shell St Fergus terminal to the existing 20” Goldeneye pipeline

- Existing 20” pipeline to the Goldeneye platform

- Goldeneye platform and wells

Shell has complete responsibility for the design, construction and operation of this section of the chain from the point where the CO₂ pipeline from the compressor station crosses into the Shell St Fergus terminal.
INSURANCE

The insurance strategy may follow an Owner Controlled model for all insurances, and insurance will therefore be placed by ScottishPower/Consortium (collectively or individually) and will cover all relevant contractors and construction activities associated with the above elements.

However, at this point, no decisions have been made regarding the legal structure of the Consortium and the ownership of the assets associated with the project, which impacts the structure of the insurance policies.

General business or commercial contractual risks associated with the licensing, construction, operation and success of a carbon capture plant would not be considered to be for the insurance industry.

All insurance categories will be subject to general conditions. These include:-

- **Due Diligence** - An Assured is required to exercise due care and diligence in the conduct of its operations utilizing all safety and hazard control practices and or equipment generally considered to be prudent for such operations.

- **War and Terrorist Risks** - There is general market exclusion for war and terrorist risks. It is possible to buy some of the cover back at a premium to be agreed.

- **Warranties** - Policy warranties will exist and if breached may allow insurers to void the policy *ab initio* or from the date of the breach. For example, the well control policy will contain a warranty that a blow out preventer of standard make is employed in accordance with normal practice and that the Assured should use every endeavour that contractors fit storm chokes and other equipment to minimise pollution.
**Limits**

Minimum limits of insurance will be set out in contractual agreements; however as a general guide we would nevertheless anticipate the following limits as customary:

<table>
<thead>
<tr>
<th>Insurance</th>
<th>Financial Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Physical Damage</td>
<td>Property values as declared</td>
</tr>
<tr>
<td>Construction Physical Damage</td>
<td>100-125% of the contract value</td>
</tr>
<tr>
<td>Business Interruption</td>
<td>Indemnity period defined. Loss of profits or increased cost of working</td>
</tr>
<tr>
<td>Delay in Start Up</td>
<td>Up to 36 months. Increased cost of working, liquidated damages, penalties etc...</td>
</tr>
<tr>
<td>Workers’ Compensation and Employers’ Liability</td>
<td>US$1 Million / As required by legislation.</td>
</tr>
<tr>
<td>Commercial General Liability</td>
<td>US$10 Million</td>
</tr>
<tr>
<td>Environmental Impairment Liability</td>
<td>US$150 Million</td>
</tr>
<tr>
<td>Automobile Liability</td>
<td>Minimum US$1 Million / As required by legislation</td>
</tr>
<tr>
<td>Watercraft Liability</td>
<td>US$10 Million</td>
</tr>
<tr>
<td>Operators Extra Expense</td>
<td>3-5 times the drilling AFE (cost estimate to drill the well) is typically purchased</td>
</tr>
<tr>
<td>Aircraft Liability and Physical Damage</td>
<td>US$1 Million Each Person</td>
</tr>
<tr>
<td>Excess/Umbrella Liability</td>
<td>Typically US$50 Million for Well Control.</td>
</tr>
</tbody>
</table>

**Deductibles**

<table>
<thead>
<tr>
<th>Insurance</th>
<th>Deductibles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Physical Damage</td>
<td>US$100,000 upwards depending on the nature of the property and scheduled value US$1,000,000 to US$50,000,000</td>
</tr>
<tr>
<td>- Onshore</td>
<td></td>
</tr>
<tr>
<td>- Offshore</td>
<td></td>
</tr>
<tr>
<td>Construction Physical Damage</td>
<td>US$50,000 to US$500,000</td>
</tr>
<tr>
<td>- Onshore</td>
<td></td>
</tr>
<tr>
<td>- Offshore</td>
<td></td>
</tr>
<tr>
<td>Business Interruption</td>
<td>30, 45, 60 or 90 days</td>
</tr>
<tr>
<td>Delay in Start Up</td>
<td>30, 45, 60 or 90 days</td>
</tr>
<tr>
<td>Well control/redrill</td>
<td>US$1 Million</td>
</tr>
<tr>
<td>Third Party Liability</td>
<td>US$250,000 (can vary according to appetite for risk and premium costs)</td>
</tr>
<tr>
<td>Environmental Impairment Liability</td>
<td>USD 100,000 minimum</td>
</tr>
<tr>
<td>Equipment</td>
<td>USD100,000 (can vary according to appetite for risk and premium costs)</td>
</tr>
</tbody>
</table>
SECTION 1 – CONSTRUCTION

THE RISK

The works to be undertaken to bring the CCS project to operational status are not considered extraordinary. In summary the scope of works can be considered as follows:-

- Project Management
- Engineering
- Procurement/materials/equipment incl. land / ocean cargo transport and storage
- Construction:-
  - Civil works
  - Onshore pipelay, including river crossing(s)
  - Plant construction
  - Offshore Platform Modifications
- Marine operations incl. tow, offshore installation, tie-ins, etc.
- Testing and “dry” commissioning
- Drilling (workover) and completion activities

Whilst not considered unique the pertinent feature of the project is the extent of existing facilities in the chain of construction, namely:-

1. Longannet coal power plant at the CHP construction site & tie-ins
2. NTS No.10 feeder Pipeline & tie-ins
3. 20-inch Goldeneye pipeline & tie-in at shore
4. Goldeneye unmanned Offshore Platform & 5 Production Wells

The extent of offshore works is considered minimal. A normally unmanned platform, Goldeneye will require modification to provide some habitability, but no notable process plant works is required. Any work required to the 5 existing wells on board will be undertaken by a harsh environment class Jack Up unit over the platform well.
bay and drilling deck (at right). Recompletions are understood to be partial only (upper part).

The onshore works represent the majority of expenditure, but all works are considered ordinary and ‘business as usual’ for the Consortium partners.

Tie-ins of existing and new items, “dry” commissioning / start up represent the most hazardous phases of the construction, given the step out of technology for the CCS process. Compatibility of the produced gases/fluids with plant, pipework and wells, associated pressures and temperatures will all be key issues, both for risks of loss and/or personal injury and operability.

**RISK SUMMARIES**

(See risk table page 21)
Potential losses during the construction phase are tabulated below. The selection of loss scenarios is intended not only to provide an appreciation of the risks but also to address the nature of exposures that could confront the CCS project during the construction phase, for the purpose of assessing risk transfer.

**RISK TRANSFER**

**Contract Strategies**

**Responsibility**
Responsibility to complete any repairs is normally given to the contractors completing the original scope of work on the basis that their plant and machinery is already in place to complete repairs.

**Liability/Indemnity**
The ultimate liability for completing any repair following a loss varies depending upon the strategies of the contracting parties. If contractors agree to suffer the liability they will often purchase the insurance cover themselves or insist on being a named assured under the operators CAR policy.

In this case insurance will be owner controlled and as such we would expect the operator to take the liability in excess of an amount the contractors must retain, depending on the size of the contract, financial status of the contractor and/or the deductible of the CAR insurance policy. This is a common approach.

If the CCS Consortium operates as independent companies, their own inter-contractual relationships may also be material with regard to risk transfer. Negligence of a contractor working for one member of the Consortium may cause damage to existing property of another member, which whilst their respective insurance policies will pay compensation in the first
instance, the existing property insurer may then claim against the construction insurer
(covers the contractors work and liability), depending upon the contractual relationship of
the Consortium members. Such scenarios are best avoided but at least the Consortium
members liability / indemnity relationships need to be transparent to the insurance buying
process.

Normally contractors retain liability for any damage to their plant or machinery and/or injury to
their personnel and operators for any damage to their existing property or employees at the
work site.

Third party liability is dependent on the contract strategy of the parties. Operators tend not to
indemnify contractors for this exposure although they may assume liability at their owned
sites. The position is varied and no particular regime is assumed.

Lenders
Financing structure is not addressed in this document and we make no detailed comments
regarding lenders, other than to highlight their potential involvement.

We rarely see lenders involved in offshore construction. If involved with any of the insurances
during the construction phase, they can influence insurance buying, protecting their
investment in terms of requiring to be loss payees and limiting the extent to which Insurers
can void cover due to any vitiating acts of the assured(s). This can limit the market capacity
prepared to accept such terms.

Regulation
- Guidelines / Classification / Offshore
- Regulations - Fixed Property

Energy and construction insurances recognise that most projects today contain a large extent
of self certification and as such there are no warranties (nor exclusions) on insurance policies
regarding meeting certain regulatory codes or classification body rules although such details
form part of the information pack provided to insurers. This applies to both onshore and
offshore.

Insurance (refer to risk table page 21)

Damage to the Works
During the construction phase, risks relating to damage to the works are likely to be
addressed by a combination of risk transfer via contract (as discussed above) and the
placement of a Construction All Risk (CAR) insurance policy, which cover the contractors,
sub-contractors, the Authority and Consortium members. The names of the parties are either
listed in the schedule as principle insureds or referred to as other assureds, which
encompasses all the parties to the scope of work.

It is likely that Onshore and Offshore CAR policies will need to be separately placed, in
recognition of the differing risk exposures and the differing appetite of the Onshore and
Offshore CAR insurance markets.
However, the limited extent of offshore works may lead to onshore underwriters with offshore departments being able to take the offshore risk (minus the workscope for the wells) into a combined CAR policy. Alternatively such minor works can be taken by the platform owner, Shell, in to their corporate property programme that provides for Minor Works at the facility. Experience suggests the latter option includes retentions way in excess of the levels required for the construction, and therefore we can expect the risk to be covered under CAR insurance.

Physical damage to materials to be used for a project (whether in transit, in storage of forming part of the contract works) constitutes a large part of the total exposure. Excluded risks are mainly war and warlike events, political and public interference, loss and damage caused by nuclear accidents, wilful act of the management of the insured and consequential losses such as loss of use, penalties and performance guarantees of any kind.

The insured interest of suppliers may comprise plant or premises let to other insured parties, or services such as transport of materials and equipment. Such costs must always be included in the sum insured for the material damage section to be covered by the CAR policy.

Third party liabilities arising out of the construction activities may sometimes be heavy and cover can be purchased as an extension to the main CAR policy. This should not be viewed as a substitute for owner’s and contractor’s general liability insurance policy however. Alternatively a standalone TPL policy can be purchased and this is discussed in more detail below.

Purely financial exposures such as non-completion, consequences of financial failures etc are not covered by the CAR policy and must be insured separately in a specialised market or by bank guarantees. Generally, the Consortium does not consider insurance as an appropriate risk transfer mechanism for these types of risks.

General policy conditions, exclusions and extensions to cover for typical onshore CAR were set out in “Feed Insurance Strategy” report RT009 dated 31st July 2010. Appendix A includes a copy of the WELCAR form used for offshore CAR.

Wells
The oil and gas industry already insures drilling activities and operational wells under an Operators Extra Expense (OEE) policy, both for production and injection wells (water and gas) and it is anticipated that cover would apply for the injection wells related to CO₂ injection as it already does on enhanced oil recovery (EOR) projects, covering well blowout and cost of control related risks.

The insurance provides reimbursement for actual costs and or expenses of:

**A - Control of Well**
The policy should provide cover for the cost of bringing or attempting to bring a well under control including the drilling of a relief well.

**B - Redrill / Extra Expenses**
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The policy should provide cover for the cost of redrilling or restoring a well following a well that is out of control, back to the condition and depth it was in immediately prior to the loss.

C - Seepage/Pollution/Clean-up and Contamination

The policy should provide cover for the:-

− costs incurred by law or under a licence for remedial measures / clean-up costs
− defence costs arising from seepage and pollution or contamination from an occurrence during the policy period and arising from a well control incident.

Principle extensions to cover should include:-

− Underground Control of Well where there is an uncontrolled well flow from one underground zone to another, if controlling such flow is interfering with operations.
− Extended Redrill and Restoration cost incurred by the physical loss or damage to the drilling unit from specific named perils e.g. lightning, fire, explosion or implosion, collision etc.
− Cost of making wells safe incurred by the physical loss or damage to the drilling unit from specific named perils e.g. lightning, fire, explosion....
− Legal liability for any loss/damage to property in Operators Care Custody and Control. In hole equipment whilst in hole is only covered in the event of an incident giving rise to a Control of Well claim or fire, windstorm or loss of the drilling unit. Fishing costs will be limited to % of the value of the equipment.
− Removal of Wreckage or Debris

Overall principal exclusions applicable include:-

− Loss or damage from delay
− Any cost of redrilling or restoring a relief well
− Loss or Damage to Drilling Equipment (unless Care Custody and Control is purchased)

Financial impact resulting from delay of project completion

Delay to Start Up (DSU) coverage is currently available in the insurance market. Decisions regarding the purchase of this insurance will depend largely on the legal structure of the Consortium, the revenue streams associated with the project and how the project is being financed.

Any delay in the start-up of a construction project would immediately cause a loss in anticipated revenue. The potential triggers for such delays range from technical failures to cost overruns, force majeure events and onsite accidents. The principal’s risk of an economic
loss, i.e. a delay or interruption of anticipated revenue resulting from a delay in start-up is readily insurable, provided that the loss is derived from insured physical damage. DSU cover can be expensive given the potential exposure and is rarely purchased for offshore projects today, when the potential exists for project delays due to minor damage as a result of the constrained nature of offshore developments.

DSU cover is designed to secure the portion of revenue which the principal requires to service debt and/or realise anticipated profit. It provides fairly broad protection against delays arising from physical damage caused by any type of peril included in the relevant material damage cover of the CAR policy and/or marine cover. However, it does not cover delays caused by other events which are cited in an exclusion and consequently do not qualify as accidental physical damage. A prerequisite for triggering DSU cover is that the property insured under the material damage section sustains physical damage from an insured peril during the insurance period, and that any interference with the construction works or testing schedule caused by the loss occurrence either delays or interferes with the principal’s business operations.

Whilst such claims are amongst the hardest to prove to Insurers, if this condition is met, the principal is indemnified for the actual loss of gross profit he sustains if completion of the permanent works is delayed beyond the scheduled business commencement date. Indemnifiable costs also includes increased cost of working (ICOW) i.e. additional expenditures necessarily and reasonably incurred by the principal or on his behalf for the sole purpose of preventing or mitigating a delay.

DSU cover is bespoke to the risk and in this case consideration of both onshore and offshore exposures is required to provide a seamless policy for the works and the design start up date. Most of the important considerations were set out in “Feed Insurance Strategy” report RT009 dated 31st July 2010. In addition special conditions will apply including providing progress reports to Insurers.

**Third Party Liability**

This category covers the Assured’s legal liability (including express contractual liability) for damages for Bodily Injury, loss of or damage to Property of third parties.

One option is to transfer a proportion of this risk to contractors on a strict liability basis, with an at law risk allocation in excess of any agreed risk transfer. This risk allocation can be supported by the coverage provided by both the contractors’ and Consortium’s General Liability policies. The Consortium could also take out Third Party Liability (TPL) coverage under the CAR policy, or as a stand-alone TPL placement for the benefit of the contractors, the Consortium and the Authority, which is often the case if a higher limit is required than CAR insurers are prepared to provide.

Third Party Liability (TPL) cover will almost certainly be a contractual requirement for the construction project. Often some TPL cover will be included as an extension within the CAR policy since it is clearly advantageous for the employer and contractors to be sure that none of the participants in the project are without insurance protection against claims from third

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parties. Generally however, the liability coverage of the CAR policy will not extend to the activities of the contractors and subcontractors who are not directly related to the construction project. Individual general liability policies are tailored to cover the overall activities of principals and contractors. The CAR policy therefore restricts liability protection to occurrences immediately connected with the construction project, originating on the site or in its immediate vicinity.

Principal Exclusions of liability cover under CAR policies:

- Material damage to property insured under the main CAR policy
- Employers’ Liability
- Vehicles licensed for public highways, vessels and aircraft
- Vibration or lack of support, although this can be waived if certain disclosures are made.
- Liabilities arising out of:
  - Breach of Contract
  - Occupational Disease
  - Workers Compensation
  - Employers Liability
  - Damage to Property Owned leased rented or occupied by the assured
  - Property in the care Custody and Control of the assured
  - Fines, Penalties, Punitive Damages etc
  - Seepage and Pollution (since this is already covered under the OEE policy – Seepage and Pollution), but if there are any pollution exposures from any other activities this will need to be amended
  - War

In addition for offshore drilling works, further specific exclusions will be:-

- Loss of Well or Hole or reservoir
- Loss of equipment down hole except as provide by the Care Custody and Control insurance below

For onshore works, extension of the CAR TPL cover to the maintenance period is often included, though only for the contractor’s legal liability and not for the owner’s. For offshore wording TPL cover is not included for the maintenance period.

Defence costs are typically covered with prior written consent from Insurers.

More details regarding TPL cover are provided in Section 3.
Damage to Contractors’ property
- Machinery, equipment, tools

This exposure can be transferred via contract to the contractors, as per Knock for Knock contracting arrangements used in the energy industry to provide clarity and consistency in risk allocation.

It is customary in the various agreements for equipment to remain the risk and responsibility of the contractor. There are circumstances, however, where the CCS Consortium members might be obliged to take on the risk, e.g. during storage at shore bases and during transportation to offshore site. The Consortium will be able to purchase coverage for this risk as a separate cargo based insurance cover or add this by endorsement to the respective policies (e.g. OEE policy for well drilling equipment).

Injury to Contractors’ Employees
- Injury, disease, illness, death

This exposure can be transferred via contract to the contractors, as per Knock for Knock contracting arrangements used in the energy industry to provide clarity and consistency in risk allocation. This risk allocation can be supported by a requirement for contractors to carry a certain level of Employers Liability insurance and accompanying requirement for their insurer to waive rights to subrogation against the Consortium members and the Authority.

Pollution from Contractors’ assets
This exposure can be transferred via contract to the contractors, as per Knock for Knock contracting arrangements used in the energy industry to provide clarity and consistency in risk allocation. This risk allocation can be supported by a requirement for contractors to carry sudden and accidental pollution cover under their General Third Party Liability insurance.

Contractors’ consequential loss
This exposure can be transferred via contract to the contractors, as per Knock for Knock contracting arrangements used in the energy industry.

Project cost exceeds budget
This pure financial risk is likely to be most effectively managed via the contracting strategy, project management process and contingency planning, rather than being transferred to the insurance market or via contract.

Additional Insurance
Other Insurances such as Employers’ Liability, General Liability, Motor Third Party Liability, and Directors’ and Officers’ Liability will also be required during the construction phase but it is assumed that these will be incorporated into the Consortium Partners’ existing programmes.
In the case of CCS, Professional Indemnity (PI) insurance will be of particular relevance to the design and construction phases of the project. PI insurance is offered by insurers on a claims-made basis, therefore insurance must be maintained throughout the duration where a claim can be legally raised against the Insured. However, this cover is pertinent, more for design and engineering contractors and is a minor consideration for the Consortium members as owners and operators unless responsible for extensive aspects of the design and/or build.

**CONCLUSIONS**

The risk exposures associated with every part of the construction project are considered “business as usual” for the Consortium owners and their respective interests and whether purchased individually or as a combined joint venture, cover is readily available in the form of CAR, DSU, TPL and EIL policies. Associated risks are captured by Consortium owners corporate insurances such as PI, DNO, EL/Workers Comp etc...

Existing property (assets) can be covered under Consortium member’s property policies or, scheduled as existing property to a standalone JV purchased TPL policy.

The extent of offshore works is minimal and purchase of an offshore CAR standalone policy may be expensive when compared to the values involved. The risk can either be scheduled as minor works to the existing operating policy for the offshore platform and pipeline, but retentions will be much higher. It is expected that the preferred route will be a combined onshore / offshore CAR policy if full insurance cover is to be provided.
<table>
<thead>
<tr>
<th>Risk Exposure</th>
<th>([Likely] Loss category)</th>
<th>Policy (Market capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Phase</td>
<td></td>
<td>Available</td>
</tr>
<tr>
<td>Mechanical Failure during pre-commissioning start up of equipment CCS Plant</td>
<td>Physical Loss to Equipment, Pollution from Pipeline Leak, Delay to Start Up of CCS Plant</td>
<td>CAR, EIL, DSU</td>
</tr>
<tr>
<td>Explosion &amp; Fire of CCS Plant leading to damage to Power Plant</td>
<td>Personal Injury, Physical Loss to Plants, Delay to Start Up of CCS Plant, Shutdown of Power Plant</td>
<td>TPL/EL, CAR, DSU, Contingent BI</td>
</tr>
<tr>
<td>Leak at gas Compression Plant due to valve seal failure – defective part</td>
<td>Personal Injury, Physical Loss to Plant, Pollution from Pipeline Leak, Delay to Start Up of CCS Plant</td>
<td>TPL/EL, CAR, CPL, DSU</td>
</tr>
<tr>
<td>Failure of onshore pipeline due to accelerated corrosion</td>
<td>Physical Loss to Pipeline, Pollution from Pipeline Leak, Delay to Start Up of CCS Plant</td>
<td>CAR, CPL, DSU</td>
</tr>
<tr>
<td>Directional Drilling incident at River Forth crossing leads to sinking of a river vessel causing obstruction</td>
<td>Physical Loss to works, Wreck removal, TPL Loss of vessel, TPL river users claim</td>
<td>CAR, TPL, TPL</td>
</tr>
<tr>
<td>Anchor Drag Over Pipeline</td>
<td>Physical Loss to Pipeline, Pollution from Pipeline Leak, Delay to Start Up of CCS Plant</td>
<td>CAR, CPL, DSU</td>
</tr>
<tr>
<td>Well Blowout during workover /drilling</td>
<td>Personal Injury, Physical Loss to Platform, Pollution from well, Delay to Start Up of CCS Plant</td>
<td>EL, CAR, CPL, DSU</td>
</tr>
<tr>
<td>Explosion &amp; Fire to Power Plant leading to damage to CCS Plant</td>
<td>Personal Injury, Physical Loss to Plants, Shutdown of Power Plant, Delay to Start Up of CCS Plant</td>
<td>EL, PD, BI, DSU</td>
</tr>
</tbody>
</table>

**Key**
- **CAR**: Construction All Risks
- **EL**: Employer’s Liability
- **EIL**: Environmental Impairment Liability
- **CPL**: Contractors Pollution Liability
- **TPL**: Third Party Liability
- **GL**: General Liability
- **DSU**: Delay in Start Up (advanced loss of revenue)
- **BI**: Business Interruption (loss of revenue)
SECTION 2 – COMMISSIONING AND PROVING

THE RISK

The uncertainties surrounding the process of CCS, transport, compression and injection will necessitate an extensive Commissioning and Proving programme. The final phases of the construction works will be system (and part system) based bringing each element on line in a stepwise process.

Each Consortium member will bring their expertise to their individual piece of the project. Whilst a significant bonus for the safe and successful completion of the construction phase, each Consortium partner brings not only a different corporate culture but also a different industry culture. Additionally operations personnel will commence taking over facilities from construction project personnel. Safe coordination of the various interfaces will be of paramount importance for the management of this phase of the project. Insurers will expect to see a strong co-joined leadership group managing this phase at every level and the introduction of operations staff as early as possible into the project teams.

The period of early operations can be considered of higher risk due to the potential for defects to manifest themselves and the operating experience of the personnel being limited to commissioning the plant, transport, compression and injection facilities.

The potential for sudden and accidental CO$_2$ release is also considered for this phase.

RISK SUMMARIES

(See risk table page 25)

Potential losses during the completion and handover phase are tabulated below. The selection of loss scenarios is intended not only to provide an appreciation of the risks but also to address the nature of exposures that could confront the CCS project during the handover phase, for the purpose of assessing risk transfer.

RISK TRANSFER

Contract Strategies

Responsibility

Upon handover responsibility to complete any repairs is normally taken by the operator of the facilities with contractors limited to responding in relation to guarantees they have provided in their contract with the operator.
Guarantees normally respond to completing work at suppliers’ onshore sites rather than recompleting the work at the installed site. This impacts guarantee work associated with offshore facilities with the operator required to still pay for the offshore installation and tie in work.

**Liability/Indemnity**

Operating the facilities as independent companies, the CCS Consortium will be liable for damage to their own asset(s) or third party liabilities and will claim from their respective insurance policies that will pay compensation in the first instance.

The position is less clear regarding liability resulting from a sudden release of CO$_2$. The cause of such release is likely to be traceable and the fault related back to one of the Consortium members or all of them collectively. Contractual agreement between the parties will address this aspect.

The comments provided in Section 1 apply here should the damage result from a cause associated with the construction work.

**Regulation**

- Guidelines / Classification / Offshore
- Regulations - Fixed Property

There is no requirement for continued application of classification society rules for the offshore operations. Given the fixed asset nature of the offshore facilities all the ongoing certification will be by the UK government authorities.

We expect significant regulatory involvement with the running of the first CCS project in the UK, to include personnel safety, environmental impact and utilisation of new technology, particularly in the early stages. Attention will apply equally to new plant and existing facilities.

There are no specific warranties regarding maintenance of certificates for the operation of the facilities, however most policies specifically exclude any losses due solely to regulatory “interference”, such as shut downs for reviews or upgrades as a result of a department’s inspectors closing down the operation. Should an operator start up a plant without certification, particularly following a shut down by authorities, any claim is likely to be excluded from insurance cover on the basis of a lack of due diligence in operating the plant.

**Insurance**

During the construction phase, risks relating to damage to the works were covered under the CAR insurance. At handover coverage for the facilities reverts to the operating policies of the individual asset owners of the CCS Consortium.

Also at handover and during the start up period the CAR policy is extended for physical loss or damage due to defective work that took place during the construction period (CAR period). Defective work means defective design, material and/or workmanship.

However, it is possible that all or some of the facilities are not fully 100% commissioned at handover, with a punch list of work activities remaining. In this circumstance the operating

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insurance policies may not cover the non-commissioned asset(s) and the CAR policies will be extended to cover the period until commissioning is completed.

For any physical loss or damage event, the Consortium can claim, in the first instance, from the operating insurance. However, deductible levels may be significantly higher and if the loss is recoverable under the maintenance section of the CAR policy, the operating insurers may be left on notice whilst the claim is progressed against CAR insurers in the first instance. Operating insurers equally have a right of subrogation to pursue CAR insurers.

Third party liabilities, control of well, financial exposures, and/or damage to any contractors’ property or injury to personnel remaining at the sites, will be the subject of operating insurance programmes, which will operate as discussed in section 3. below.

**CONCLUSIONS**

The purpose of this section is to highlight the unique nature of the risks in the quasi construction / operation phase where the change over in policies must be dovetailed to ensure no gaps in cover, but also the importance for combined management of the start up and handover phase.

Contractual agreements will establish inception / handover of policies. Given the new technology we expect there might be a considerable period of “first gas” operations before management handover is completed.

Overall the risks in this phase do not present any specific insurability issues. Consideration of the potential issues should there be a pollution event suggest there could be a number of legal wrangles to establish liability amongst Consortium members and their respective contractors to such an extent that any perceived savings of rolling risks into existing corporate programmes may be eradicated.

In view of these issues the Consortium might consider purchase of construction insurances on a Consortium JV policy, particularly for EIL cover.
<table>
<thead>
<tr>
<th>Risk Exposure</th>
<th>([Likely] Loss category)</th>
<th>Policy (Market capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handover &amp; Start Up Phase</td>
<td></td>
<td>Available</td>
</tr>
<tr>
<td>Mechanical Failure during early operations of CCS Plant</td>
<td>Physical Loss to Pipeline</td>
<td>Restricted</td>
</tr>
<tr>
<td></td>
<td>Pollution from Pipeline Leak</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td></td>
</tr>
<tr>
<td>Explosion &amp; Fire of CCS Plant leading to damage to Power Plant during commissioning</td>
<td>Personal Injury</td>
<td>Available</td>
</tr>
<tr>
<td></td>
<td>Physical Loss to Plants</td>
<td>Restricted</td>
</tr>
<tr>
<td></td>
<td>Delay to Start Up of CCS Plant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shutdown of Power Plant</td>
<td></td>
</tr>
<tr>
<td>Leak at gas Compression Plant due to valve seal failure – defective part – leading to sudden release of large quantity of CO₂</td>
<td>Personal Injury</td>
<td>Available</td>
</tr>
<tr>
<td></td>
<td>Physical Loss to Plant</td>
<td>Restricted</td>
</tr>
<tr>
<td></td>
<td>Pollution from Pipeline Leak</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Financial Loss (Carbon Credits)</td>
<td></td>
</tr>
<tr>
<td>During start up casing shoe fractures under pressure preventing injection to continue</td>
<td>Recompletion / Redrilling of well</td>
<td>Available</td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td>Restricted</td>
</tr>
<tr>
<td>Failure of onshore pipeline due to accelerated corrosion during early operations</td>
<td>Physical Loss to Pipeline</td>
<td>Available</td>
</tr>
<tr>
<td></td>
<td>Pollution from Pipeline Leak</td>
<td>Restricted</td>
</tr>
<tr>
<td></td>
<td>Delay to Start Up of CCS Plant</td>
<td></td>
</tr>
</tbody>
</table>

**Key**
- CAR: Construction All Risks
- EL: Employer’s Liability
- EIL: Environmental Impairment Liability
- CPL: Contractors Pollution Liability
- TPL: Third Party Liability
- GL: General Liability
- DSU: Delay in Start Up (advanced loss of revenue)
- BI: Business Interruption (loss of revenue)
SECTION 3 – OPERATIONS

THE RISK

The Carbon Capture Plant (CCP) is provided by Aker Clean Carbon. The 2-train process includes use of the proprietary ACC amine and is designed to capture 90% of CO\(_2\) from the flue gas by the following simplified process:

- Amine is passed through the flue gas and absorbs the CO\(_2\).
- The clean flue gas is returned to the flare system and released to atmosphere
- The amine is treated (heated) in order for the CO\(_2\) to be stripped from the Amine
- The amine is regenerated into the process
- The CO\(_2\) is cleaned, dried and compressed to 34 bara and exported from the plant in a gaseous state
- The CO\(_2\) is transported by 36-inch pipeline to St Fergus
- The CO\(_2\) is compressed to condensate at 80 to 120 bara
- The CO\(_2\) is transported by 20-inch pipeline to Goldeneye Platform
- The CO\(_2\) is injected into the reservoir via the wells

The associated risks are commensurate with “business as usual” operations for the Consortium companies, including the process of gas or liquid injection into an oil & gas reservoir.

From Insurers perspective, the unknown risks are associated with handling and storage of large quantities of CO\(_2\) in so far as uncertainty as to the effects of the chemistry and pressures might have for the permeability or structural integrity of the transport systems and/or geological formation(s). However, gas transportation management is well established generally and we understand there is significant experience of naturally populated CO\(_2\) reservoirs in the oil & gas industry.

In general, CCS risks associated with CO\(_2\) affected contamination can be broken down as follows:-

- Risks to underground sources of drinking water, which include:-
  - Formation of carbonic acid, lowering the pH causing naturally occurring metals, such as arsenic, to dissociate and move into the water.
- Hydrogen sulphide or nitrous oxide present in the CO\textsubscript{2} stream could endanger drinking water if high volumes of CO\textsubscript{2} present.

- Forcing in salt into the drinking water source.

- Loss of drinking water due to geological fracturing.

- Released CO\textsubscript{2} at high concentrations can cause injury to human health including asphyxiation, increased breathing rate and/or vision and hearing impairment.

- Risks to ecosystems include:
  
  - Exposure to can CO\textsubscript{2} can cause chronic and acute health effects in birds and mammals.
  
  - Increased CO\textsubscript{2} concentration levels may adversely impact both plant and soil dwelling organisms.

  - Increased CO\textsubscript{2} can impede fish respiration to lethal levels, reduces calcification in shelled organisms and adversely affects photosynthesis of some aquatic organisms.

- Geomechanical and geophysical risks include the improper injection CO\textsubscript{2} to raise pressure in the formation causing earthquakes.

**RISK SUMMARIES**

(See risk table page 35)

Potential losses during the operating phase are tabulated below. The selection of loss scenarios is intended not only to provide an appreciation of the risks but also to address the exposures that could confront the CCS project during the operating phase, for the purpose of assessing risk transfer.

**RISK TRANSFER**

**Contract Strategies**

- Responsibility
- Liability/Indemnity

The operation will be run in three distinct parts by the three Consortium members separately, not as one joint body:

1. ScottishPower – completing capture and sequestration and delivery of compressed gas to the plant pipeline battery limit.
2. National Grid – transporting the gas to St Fergus and re-compressing and delivery up to the booster station pipeline battery limit.

3. Shell – transport of gas offshore and well injection into the formation via the Goldeneye platform

Whilst a joint management body may oversee combined operations and provide a single point of contact for regulators etc, but from an Insurance perspective the operations are seen as 3 separate and exclusive elements.

Responsibility

Responsibility to complete any repairs will be taken by the Consortium owner of the affected facility or their contractor (if operations are contracted out and contract terms dictate). Recovery of lost CO₂ is not considered.

Responsibility to remediate affected third parties will be defined by the relevant law in relation to the determined cause of the incident.

Liability/Indemnity

Operating the CCS process as independent companies, the inter-contractual relationships between the Consortium members will be material with regard to risk transfer. Hold harmless agreements will exist for the physical facilities between defined battery limits and as such, each Consortium member will be liable for the cost of repair and present a claim to it’s operating programme insurer(s).

Less clear is the ownership of the produced CO₂, at any stage from manufacture to injection and storage, and therefore liability associated with any contamination or personal injury resulting from a sudden release or gradual pollution. Contractual agreement between the parties will address this aspect, but each party expects to insure their exposures separately.

This is also true of the contractual arrangement between ScottishPower and Aker Clean Carbon. Any licensing matters will need to be incorporated into the liability / indemnity arrangements of this contract.

Lenders

We make no detailed comments regarding lenders, other than to highlight their potential involvement. Given the existing portfolio of assets insured by each Consortium partner we don’t perceive lenders influencing insurance buying by this phase of the project.

Regulation

- Guidelines / Classification / Offshore
- Regulations - Fixed Property

Given the fixed asset nature of the offshore facilities all the ongoing certification will be by the UK government authorities. CCS operations regulation will include personnel safety, environmental impact and plant / pipeline integrity.
The Consortium members all have existing operating relationships with regulatory bodies and a strong performance record and as such Insurers will not be concerned with this aspect. In any event most policies specifically exclude any losses due solely to regulatory “interference”, such as shut downs for reviews or upgrades as a result of a department’s inspectors closing down the operation. Should an operator start up a plant without certification, particularly following a shut down by authorities, any claim is likely to be excluded from insurance cover on the basis of a lack of due diligence in operating the plant.

Insurance (see risk table page 35)

Property & Business Interruption (BI)

This section provides cover for the consequences of Physical Loss or Damage to Property owned or operated by the Insured or in which the Insured has an interest or has assumed responsibility to insure under a legal contract.

In terms of infrastructure, from the CO2 capture equipment at the source, through pipelines and the associated separation, compression and injection facilities, the risks will be insurable to the extent of any other physical assets. Limited insurance is available for subsurface assets such as down-hole equipment while no coverage would be available for damage to the storage reservoir itself.

As per the comments above, Control of Well exposures can be insured under an operational insurance programme.

Property Damage and Business Interruption cover is often the single biggest insurance protection purchased for large industrial operational assets and is purchased on an All-Risks basis to give the widest possible cover for physical loss, destruction, or damage by any cause including machinery breakdown. It is often coupled with a business interruption extension. Similar to the DSU extension on the CAR policy, Business Interruption (BI) will provide insurance for loss of earnings (or increased cost of working), but requires to be activated by a property damage (PD) event of a type covered by the PD policy.

Decisions regarding the purchase of Business Interruption (BI) insurance coverage will depend largely on the legal structure of the Consortium, the revenue streams associated with the project and how the project is being financed.

The policy will also cover minor works to cover physical loss or damage to scheduled property, during maintenance or residual works to the said scheduled property. Property is also covered whilst in permanent or temporary store and/or in-transit, including equipment in the Insured’s Care, Custody and Control.

There is nothing extraordinary regarding this aspect of risk transfer.

General policy conditions, exclusions and extensions to cover for typical onshore Property and Business Interruption were set out in “Feed Insurance Strategy” report RT009 dated 31st July 2010.

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General Liability
This category covers the Assured’s legal liability for damages for Bodily Injury, loss of or
damage to Property of third parties arising from the CCS Consortium members’ operations.

Coverage for third party liabilities is insurable in terms of bodily injury/death and property
damage resulting from a sudden escape of CO$_2$ although bespoke pollution (EIL) cover (discussed below) may provide more comprehensive terms. General Third Party Liability coverage would provide cover for third party liabilities arising out of operations. Pollution coverage would be on a sudden and accidental basis and would need to be quantifiable to be insurable.

Each member of the Consortium may insure it’s Liability exposures under umbrella general
liability programmes, which will include coverage for motor vehicles, environmental damage,
professional indemnity etc.. There will be no specific requirement for a standalone TPL cover.

Environmental Impairment Liability (EIL)
EIL insurance is available from a number of insurers and is designed to cover the insured’s legal liability resulting from a claim arising from a pollution event or pollution condition as defined within the policy. Comprehensive cover for such events is difficult to obtain through the General Liability policy wording.

EIL policy language does not depend on ‘damage to property’ nor on the insured’s ‘liability for damages’. Cover is triggered by a legal obligation to pay for:

a) remediation expenses imposed by a competent authority such as the Environment Agency or the local authority

b) an appropriate claim from a third party for property/asset Damage and/or bodily injury/illness as a result of the pollution condition

These obligations may relate to on or off-site pollution conditions.

Site-specific policies are placed on a claims made basis for pollution conditions that existed before the inception date of the policy. Generally this relates to unknown conditions, but may also be available for known pollution depending on the specific circumstances. Such policies are usually available for terms of up to 10 years.

In addition, policies are available for ‘new conditions’ i.e. pollution conditions created after the inception of the policy. As a standalone, ‘new conditions’ cover is generally placed as an annually renewable policy, but can be secured for periods of up to 5-years. Such covers can be combined with the pre-existing conditions cover into a single policy. (N.B: these policies are triggered by the pollution condition whether or not it is sudden or gradual).

To consider, is the re-insurability of this risk following a leakage incident which erodes the aggregate limit or is such a large loss making the risk generally uninsurable. Arguably this applies to all specialist liability covers, but the new technology and nature of this exposure makes this aspect a concern that needs to be addressed.

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Various products and combinations are available to cover single sites and portfolios of sites. Cover options can be summarised as the costs relating to:

- On-site clean-up costs (remediation) of pre-existing conditions
- On-site clean-up of new conditions
- Third party claims for on-site bodily injury and property damage
- Third party claims for off-site bodily injury and property damage
- Third party claims for off-site clean-up resulting from pre-existing conditions
- Third party claims for off-site clean-up resulting from new conditions
- Third party claims for on-site clean-up – waste disposal sites
- Third party claims for off-site bodily injury, property damage or clean-up – waste disposal sites
- Business interruption coverage – including profit loss or loss of rental value and extra expense
- Legal expense and defence
- Pollution conditions resulting from transported cargo

The inclusion of specific risks is negotiable e.g. known conditions, known or unknown storage tanks etc. Similarly standard exclusion clauses can also be modified or deleted as a result of negotiation.

The table below highlights the coverage benefits in obtaining specific EIL coverage and what gaps are present in the Public or General Liability form.

<table>
<thead>
<tr>
<th>Pollution Type</th>
<th>Public Liability Sudden</th>
<th>Public Liability Gradual</th>
<th>EIL Insurance Sudden</th>
<th>EIL Insurance Gradual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third Party Property Damage and Bodily Injury</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>On-site clean up (first party)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Off-site clean up (third party)</td>
<td>Sometimes Not ELD*</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Regulatory or Statutory notices of remediation costs (e.g. Bartoline)</td>
<td>Sometimes Not ELD*</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>EU Environmental Liability Directive (ELD)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- primary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- compensatory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- complimentary damages</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Defence Costs for Company and Employees</td>
<td>Sometimes Not ELD*</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Investigation Costs</td>
<td>Sometimes Not ELD*</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>First – Party Business Interruption</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Transportation - Clean up costs</td>
<td>Sometimes Not ELD*</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Historical Pollution Conditions</td>
<td>No</td>
<td>No</td>
<td>Yes with information</td>
<td>Yes with information</td>
</tr>
</tbody>
</table>
Whilst each of the lead insurers has their own core wording there is no common market wording for any EIL policy. Insurers’ own core wordings are amended by endorsement to meet the specific case requirements so that each placement is bespoke.

Gradual CO\(_2\) pollution, however, will not be regarded as a ‘new condition’, or simply a matter of wording re-arrangement as Insurers will treat the risk as a completely new exposure requiring special consideration.

It should also be noted that sub-surface risks are in the main uninsurable from a liability perspective. This is largely due to a lack of actuarial data and the huge challenges in determining damage and collecting accurate information to determine a claim.

**CCS - Environmental Impairment Liability (Long Term Storage)**

As mentioned above insurance coverage for quantifiable sudden and accidental release of CO\(_2\) and resulting bodily injury or property damage including pollution (contamination) clean up etc. can be insured under tailored existing EIL programmes of the Consortium partners.

The unique risk exposure during the Operation, Decommissioning, and Post-Closure maintenance phases is gradual seepage of CO\(_2\) from the reservoir. These long term storage risks are typically addressed by underwriters who specialise in Environmental Liabilities and underwriters who specialise in Third Party Liability Insurance.

In order to assess the current position of the insurance market on CCS we approached a number of such insurers.

When considering this issue it is important to distinguish between the immediate and known environmental impact that a gradual release would have and the unknown impact of carbon release in the very long term. The insurers have sought to provide protection for costs associated with clean up and third party damage that have been discovered at a point in time and can be quantified. There is not cover for any risk of long term impact to the environment.

More recently insurance products have been provided by insurers to respond to the strict liability imposed on the industry by virtue of the Environmental Liability Directive. This is a specialised area for insurers and typically handled separately to the traditional Third Party Liability insurance. To the extent that a liability was assumed under contract, associated with a loss event and could be quantified then it was considered that insurance protection could be sought up to a limit of liability that would depend on market capacity and the requirements of the insured.

To date Zurich is the only market with a specific CCS oriented product. This policy provides an unusual combination of coverages that address specific risk issues that are relevant to the ownership and operation of carbon capture and sequestration facilities. It is most like package programs that are written for oil and gas lease operators and includes some of the coverages often found in these programs.

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While the Policy is identified as a Carbon Capture and Sequestration Liability Policy, it does not provide full liability protection. The owner or operator will still need to purchase a Commercial General Liability Policy along with the Zurich policy. It should also be noted that the Pollution Event Coverage offered in the Zurich policy is not a replacement for the coverages offered in site-specific pollution liability forms or in contractor’s liability policies that may still be required since the coverage here is limited to protection for claims arising out a release of a Gas Stream from an insured Storage Location.

This cover is considered to be expensive and other environmental insurers consider CCS cover can be given under normal EIL cover or an extended version if it was felt necessary to define.

Our review of insurers suggests the following markets and capacity, in addition to Zurich:-

- AXA EUR 50m
- ACE EUR 30m
- Chartis EUR 50m
- Chubb EUR 50m
- Liberty EUR 20m
- XL USD 50m

CVStarr is a new entrant to the market but their intention is as yet unknown. Munich Re is involved in CCS issues around their carbon credit programme and may consider providing capacity on a project basis.

Total capacity is therefore theoretically around EUR230m however in practice the entire market is never used on a single risk, given the many differences in their proposed wording form. Maximum limits are more like EUR150m on a layered basis.

Defence and claims investigation costs would be provided but will erode policy limits.

Cover periods are typically up to 3 years, but we are aware of an existing programme in the USA with an aggregated USD 100m limit for a 10 year period.

**Financial Loss Insurance (Carbon Credits)**

The issue of what, if any, liability there would be for the return of any subsidies or tax incentives over a long period in the event that the carbon was released is also considered an issue. If the requirement to make the project commercially viable involved carbon offsets or other incentives then again, providing these could be quantified, it was likely that cover could be obtained for any associated loss of such incentives.

Currently the financial consequences of lost CO₂, such as any requirement to purchase offsetting CO₂ credits, are not currently an insurable risk. Insurers including Munich Re, Zurich

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and Ace have developed products to address some of the liability risks associated with CCS projects. It is possible that similar insurance products will emerge in response to a demand for risk transfer via the insurance market, and that other insurers will make capacity available for these risks.

However, currently it is difficult to state with conviction that the insurance industry will provide an adequate and cost effective solution to managing these risks.

**Operating Costs exceeds Budget**

This pure financial risk is likely to be most effectively managed via contingency planning, rather than being transferred to the insurance market.

**Additional Insurance**

Other Insurances such as Employers’ Liability, Professional Indemnity and Directors’ and Officers’ Liability will also be required during the operations phase but it is assumed that these will be incorporated into the Consortium Partners’ existing programmes.

**CONCLUSIONS**

For the most part the CCS operation is considered as “business as usual” for the Consortium members with existing insurances providing cover except for the ‘new’ risk regarding pollution due to a release of CO₂.

When considering this issue it is important to distinguish between the immediate and known environmental impact that a gradual release would have and the unknown impact of carbon release in the very long term. Under an EIL cover, insurers should provide protection for costs associated with clean up and third party damage that have been discovered at a point in time and can be quantified.

However, currently there is no available cover for any risk of long term impact to the environment, particularly associated with the underground storage aspect of the operation. Similarly the financial consequences of lost CO2, such as any requirement to purchase offsetting CO2 credits, are not currently an insurable risk.

Insurers including Munich Re, Zurich and Ace have developed products to address some of the liability risks associated with CCS projects. It is possible that similar insurance products will emerge in response to a demand for risk transfer via the insurance market, and that other insurers will make capacity available for these risks. We expect any product to require a minimum 3 year period, with premium paid up front.

This brings in a further consideration, namely the re-insurability of this risk following a leakage incident which erodes the aggregate limit or is such a large loss making the risk generally uninsurable. Arguably this applies to all specialist liability covers, but the new technology and nature of this exposure makes this aspect a concern that needs to be addressed.
<table>
<thead>
<tr>
<th>Risk Exposure</th>
<th>([Likely] Loss category)</th>
<th>Policy (Market capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchor Drag Over Pipeline</td>
<td>Physical Loss to Pipeline</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Pollution from Pipeline Leak</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Shutdown of Sequestration Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td></td>
<td>Slowdown of Power Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td>Explosion &amp; Fire of CCS Plant leading to damage to Power Plant</td>
<td>Personal Injury</td>
<td>EL</td>
</tr>
<tr>
<td></td>
<td>Physical Loss to Plants</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td>BI</td>
</tr>
<tr>
<td></td>
<td>Shutdown of Power Plant</td>
<td>BI</td>
</tr>
<tr>
<td>Leak at gas Compression Plant due to valve seal failure – defective part</td>
<td>Personal Injury</td>
<td>EL</td>
</tr>
<tr>
<td></td>
<td>Physical Loss to Plant</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Pollution from Pipeline Leak</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td></td>
<td>Slowdown of Power Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td>Failure of onshore pipeline due to flooding &amp; land slippage</td>
<td>Physical Loss to Pipeline</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Pollution from Pipeline Leak</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td></td>
<td>Slowdown of Power Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td>Well Blowout during workover leading to loss of jack up drilling rig</td>
<td>Personal Injury</td>
<td>EL</td>
</tr>
<tr>
<td></td>
<td>Physical Loss of Drilling rig</td>
<td>TPL/GL</td>
</tr>
<tr>
<td></td>
<td>Physical damage to Platform</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Pollution from well</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td></td>
<td>Slowdown of Power Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td>Explosion &amp; Fire to Power Plant leading to damage to CCS Plant – leads to damage at compressor station due to improper shutdown following stoppage of flow</td>
<td>Personal Injury</td>
<td>EL</td>
</tr>
<tr>
<td></td>
<td>Physical Loss to Plants</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td>BI</td>
</tr>
<tr>
<td></td>
<td>Damage to Compressor Station</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Escape of CO₂</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Slowdown of Power Plant</td>
<td>BI</td>
</tr>
<tr>
<td>Collision with Platform causes fire.</td>
<td>Personal Injury</td>
<td>EL</td>
</tr>
<tr>
<td></td>
<td>Physical Loss to Plants</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Shutdown of CCS Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td></td>
<td>Damage to Compressor Station</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Escape of CO₂</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Slowdown of Power Plant</td>
<td>Contingent BI</td>
</tr>
<tr>
<td>Polluted ground water due to gradual seepage of CO₂ into water table</td>
<td>Pollution</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Loss of use TPL</td>
<td></td>
</tr>
<tr>
<td>Seismic event releases large quantity of CO₂ into atmosphere through fault lines and affects geology of neighbouring oil field halting production of Oil &amp; Gas.</td>
<td>Pollution</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Finance Loss (Carbon Credits) -</td>
<td></td>
</tr>
<tr>
<td>Pressure of CO₂ in field causes previously abandoned oil &amp; gas well to start seeping pollutant materials (oil, metals)</td>
<td>Physical damage to well(s)</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Pollution</td>
<td>EIL</td>
</tr>
</tbody>
</table>
SECTION 4 – DECOMMISSIONING

THE RISK

On completion of operations, whether due to closure of the power plant or complete filling of the storage reservoir, a process of decommissioning to leave the work sites in “as before” condition will be undertaken. On shore facilities are removed, scrapped and sites cleaned.

For the offshore works a section of the offshore pipeline in deeper water (>50m) may be cleaned and abandoned. The Goldeneye platform (at left) may be cut away at a section above the seabed, but we expect it will be completely removed.

The work normally follows a path of ‘reverse engineering’ of the original project works. Wells are plugged and abandoned by Jack Up rig per industry standards. Any hazardous materials are removed and disposed of at shore. The possibility exists for recovery of certain components of the facilities for re-use, which presents residual value of property. Otherwise materials are removed and scrapped onshore.

We consider decommissioning operations to present little financial exposure to the Consortium members due to the lack of residual value in the removed parts. The major exposure is environmental impact of the work (eg. protection of marine mammals if explosives are used to dismantle the jacket) or third party liability relating to dropped objects.

RISK SUMMARIES

(See risk table page 39)

Potential losses during the decommissioning phase are tabulated below. The selection of loss scenarios is intended not only to provide an appreciation of the risks but also to address the nature of exposures that could confront the CCS project during this phase, for the purpose of assessing risk transfer.

RISK TRANSFER

Contract Strategies

- Responsibility
- Liability/Indemnity

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UKCCS - KT - S10.5 - SP - 001 Insurability Report
The lack of residual value in the removed items and the need to incentivise contractors to exercise care may lead to the CCS Consortium members to push responsibility and liability on to the decommissioning contractors. This may lead to contractor’s purchase of insurance.

However, for the purpose of this review we consider the Consortium members will continue to operate a strategy of owner purchased insurance and our considerations with regard to the original construction apply.

**Regulation**

- Guidelines / Classification / Offshore
- Regulations - Fixed Property

Regulations apply to the removal of any hazardous waste, but there are no specific regulations covering the decommissioning operation, except the requirements regarding the condition in which the decommissioned sites must be left, and environmental impact studies associated with the work.

**Insurance** (see Table page 39)

**Damage to the Works**

The main focus is the offshore works that carry the highest risk exposure.

The CAR insurance market has adapted to the demand for a decommissioning specific product with a ‘Decommissioning All Risks’ (DAR) insurance product based largely on the coverage provided under a traditional CAR policy. This product has been used to manage some of the risks associated with recent North Sea decommissioning projects, and will be further tested over the coming years as additional North Sea platforms are decommissioned.

Third party liabilities arising out of the decommissioning activities may sometimes be heavy and cover can be purchased as an extension to the main DAR policy. This should not be viewed as a substitute for owner’s and contractor’s general liability insurance policy however. Alternatively a standalone TPL policy can be purchased.

**Damage to owner’s existing property**

The most appropriate solution for this risk exposure will depend on the legal structure of the Consortium and the ownership of the assets associated with the project, however should insurance be required this could be purchased via an extension to the DAR policy.

**Wells**

Proposals for managing these risks are in line with those put forward for the same risks in the Construction Phase.

**Financial impact resulting from delay of project completion**

The extent to which any delay in the completion of decommissioning causes a loss in anticipated revenue is not readily apparent. If quantifiable the risk can be insured, however, this pure financial risk is likely to be most effectively managed via the decommissioning.
project management process and contingency planning, rather than being transferred to the insurance market or via contract.

There is a financial assurance insurance product underwritten by Zurich that may provide coverage for this exposure, however, further investigation is required regarding the coverage and capacity available and the premium cost associated with this insurance product.

**Third Party Liability (including environmental impairment)**
Proposals for managing these risks are in line with those put forward for the same risks in the Construction and/or Operational Phase.

**Damage to Contractors’ property**
- Machinery, equipment, tools

Proposals for managing these risks are in line with those put forward for the same risks in the Construction Phase.

**Injury to Contractors’ Employees**
- Injury, disease, illness, death

Proposals for managing these risks are in line with those put forward for the same risks in the Construction Phase.

**Pollution from Contractors’ assets**
Proposals for managing these risks are in line with those put forward for the same risks in the Construction Phase.

**Contractors’ consequential loss**
Proposals for managing these risks are in line with those put forward for the same risks in the Construction Phase.

**Project cost exceeds budget**
The risks associated with decommissioning costs exceeding budget is one that remains a challenge for the energy industry. The insurance market has yet to provide a suitable solution that is relevant, efficient and economic; however the CCS product underwritten by Zurich attempts to address these risks, but would require further investigation.

**Additional Insurance**
Other Insurances such as Employers’ Liability, General Liability, Motor Third Party Liability, and Directors’ and Officers’ Liability will also be required during the decommissioning phase but it is assumed that these will be incorporated into the Consortium Partners’ existing programmes.
**CONCLUSIONS**

Decommissioning risks are treated in the same way as construction with increased costs of working associated with a loss event the equivalent of a Physical Damage (PD) loss.

The lack of residual value may lead to a contract strategy that passes liability to the decommissioning contractor who would then purchase DAR insurance.

<table>
<thead>
<tr>
<th>Risk Exposure</th>
<th>([Likely] Loss category)</th>
<th>Policy (Market capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decommissioning Phase</td>
<td></td>
<td>Available, Restricted/Unknown, Unavailable</td>
</tr>
<tr>
<td>Collision with Platform causes fire during</td>
<td>Personal Injury, Physical Loss to Platform, Escape of CO₂</td>
<td>EL, DAR, EIL</td>
</tr>
<tr>
<td>decommissioning operations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dropped objects during pipeline removal damages</td>
<td>Loss of use / Physical Damage to Third Party, Debris Removal</td>
<td>TPL, DAR</td>
</tr>
<tr>
<td>adjacent Oil &amp; Gas pipeline</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION 5 – POST CLOSURE

THE RISK

Once a geological sequestration facility has been closed and wells not necessary for post-closure monitoring have been capped, the risks change from those that are experienced during other phases. For this CCS project, post decommissioning, only the wells and potentially portions of the pipeline and platform substructure will remain.

The arrangements for monitoring through one or more wells and the associated risks are not specifically considered here. The length of time required for monitoring is also unclear.

Escapes of sequestered CO$_2$ may still occur resulting in bodily injury, property damage or environmental damage, including, global warming when released to the atmosphere. The risk of blowout of decommissioned oil and gas wells is considered low, with thousands of plugged oil & gas wells existing without incident to date in UK waters. However, the CCS pressured formations are considered more prone to blow out given concerns that casing materials can deteriorate due to the corrosive nature of liquid CO$_2$ creating leak paths to the surface.

Underground migration of stored materials and displacement of contaminants is also possible, to the effects of the chemistry and pressures might have for the permeability or structural integrity of the geological formation(s), as described during the operating phase (Section 3 above).

In summary, risks are restricted to those associated with loss of CO$_2$ namely:-

- Costs to stop the leakage
- Third Party Liability (such as, soil/groundwater contamination, escape to atmosphere)
- Loss of carbon credits (financial consequences to holder of credits)

Requirements for certain types of financial responsibility are expected to be imposed although there is no clear guidance of the basis of this security from the oil and gas industry, which is in progress of decommissioning offshore oil and gas fields in UK waters. Assurance may be provided by virtue of adequate company credit ratings, in line with current practice for decommissioning liabilities in the UK. For CCS, other options that may be considered include: bonds, escrow accounts, corporate guarantees of parent entities, letters of credit and other financial instruments, but at this time the Consortium will also consider insurance solutions. Regardless of the ultimate solutions, the mechanisms that UK authorities will want to see in place must assure the following:

- That funds are readily accessible if and when they are needed
• That minimum standards are required for all owners and operators to assure that third-party generators of CO\textsubscript{2} and the financial community are comfortable with the protection afforded

• That the cost of these mechanisms does not make commercial development and operation of CO\textsubscript{2} capture and sequestration facilities economically impractical

**RISK SUMMARIES**
(See risk table page 43)
Potential losses during the post-closure phase are tabulated above. The selection of loss scenarios is intended to not only to provide an appreciation of the risks but also to address the nature of exposures that could confront the CCS project during the post-closure phase, for the purpose of assessing risk transfer.

**RISK TRANSFER**

**Contract Strategies**
- Responsibility
- Liability/Indemnity

Depending upon the circumstances, it may be difficult to determine who is liable for a post-operations phase release since it may not be immediately detected and it may involve materials deposited by a number of different operators that used the facility while it was in oil and gas production. It is also not clear how long monitoring will be required to assure that conditions underground are stable.

Liabilities associated with the site currently reside with the original block licence holders for oil and gas extraction, but a change of use application may give responsibility and liability to the Consortium partners.

**Regulation**
- Guidelines / Classification / Offshore
- Regulations - Fixed Property

We are not aware of the regulatory regime surrounding long term CO\textsubscript{2} storage post closure of CCS operations. We can be certain that liability for the closed site will exist in perpetuity.

**Insurance (see risk table page 43)**

**Property & Business Interruption (BI)**
The lack of defined ownership by the Consortium partners for the substructure reservoir and the unquantifiable cost or possibility for any repair of its integrity make this element of cover neither required nor insurable.
General Liability
The issues regarding the management of these risks are in line with those put forward for the same risks in the Operational Phase, with closed sites scheduled to the original asset owners policy.

Environmental Impairment Liability (Long Term Storage)
To date, there has not been any advancement in resolving the difficulties of insurability of this risk namely:-

- lack of actuarial data to quantify the exposure;
- insurer security concerns;
- adequacy of insurance as cost inflation erodes the value of the insurance policy limits over time.

As mentioned above insurance coverage for quantifiable sudden and accidental release of CO₂ and resulting bodily injury or property damage including pollution (contamination) clean up etc. can be insured under tailored existing EIL programmes of the Consortium partners.

The unique risk exposure during Post-Closure maintenance phase is gradual seepage of CO₂ from the reservoir. The insurability of these risks is in line with those put forward for the same risks in the Operational Phase. However, the long term nature of coverage will mean such an insurance solution is uneconomic and unacceptable to regulators.

Financial Loss Insurance (Carbon Credits)
The issues regarding the management of these risks are in line with those put forward for the same risks in the Operational Phase.

Maintenance Costs exceeds Budget
As mentioned above in the Construction section, this risk is likely to be most effectively managed via the project management process and contingency planning, rather than being transferred to the insurance market. Insurance products available from Zurich may however potentially address this risk and require further investigation.

Additional Insurance
Other Insurances such as Employers’ Liability, Professional Indemnity and Directors’ and Officers’ Liability could be required dependant upon the circumstances of any liability claim against the Consortium members. It is assumed that these would continue to be incorporated into the Consortium Partners’ existing programmes.

CONCLUSIONS
To date, there has not been any advancement in resolving the difficulties of insurability of this risk with regard to quantification of the exposure and insurer security for the long term
The long term nature of coverage will mean any insurance solution is uneconomic and unlikely to be acceptable to regulators.

However as CCS develops as an industry, insurance solutions, such as a mutual fund, may provide a solution to the long term exposure.

<table>
<thead>
<tr>
<th>Risk Exposure</th>
<th>([Likely] Loss category)</th>
<th>Policy (Market capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Closure Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polluted ground water due to gradual seepage of CO₂ into water table</td>
<td>Pollution</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Loss of use to Third Party</td>
<td>TPL</td>
</tr>
<tr>
<td>Seismic event releases large quantity of CO₂ into atmosphere</td>
<td>Pollution / Escape of CO₂</td>
<td>EIL</td>
</tr>
<tr>
<td>Seismic event leads to gradual release of large quantities of CO₂ into water column and atmosphere</td>
<td>Pollution / Escape of CO₂</td>
<td>EIL</td>
</tr>
<tr>
<td>Pressure of CO₂ infield causes previously abandoned oil &amp; gas well to start seeping pollutant materials (oil, metals)</td>
<td>Physical damage to well(s)</td>
<td>PD</td>
</tr>
<tr>
<td></td>
<td>Pollution</td>
<td>EIL</td>
</tr>
<tr>
<td>Abandoned CO₂ starts seeping into adjacent oil &amp; gas production field reservoir reducing production rates</td>
<td>Pollution</td>
<td>EIL</td>
</tr>
<tr>
<td></td>
<td>Loss of Revenue to others</td>
<td></td>
</tr>
</tbody>
</table>