Peterhead CCS Project

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Executive Summary

This documents details the risk management plan to be followed for the Peterhead Carbon Capture and Storage (CCS) Project.

The purpose of risk management is to achieve business objectives, safeguard company assets from inappropriate use, loss or fraud, facilitate safe operations and enable compliance with the boundaries set by the Shell Control Framework. Subsets of Business Risk are, for example Health, Safety, Security and Environment (HSSE), Opportunity, Project, Operations, Reputation, Legal, Tax, Commercial and Financial risk. The focus of project risk management is to identify, manage and report upside and downside risks that drive top quartile project delivery.

The objective of project risk management is to provide information to decision-makers while they select the correct concept, perform basic and detailed design work and manage the project through execution. Risk management integrates input from the risk register (both upside and downside risks), cost estimate and schedule into a probabilistic risk analysis to provide ranges of possible outcomes of final cost and schedule along with the key drivers that may impact the project. This document describes how risks are managed from commencement of the project to handover of the offshore CO_2 store post injection, as well as describing the key open risks at the end of the Front End Engineering Design (FEED) Risk Reduction Phase.

At the end of FEED, the Top 50 risks that require further mitigation during future phases of the project reflect a diverse mix of both technical & non-technical factors, covering the entire TECOP and NTR risk spectrum (refer to Section 9 for full description of TECOP and NTR). A full description of these risks and their associated mitigation actions is represented in Appendix 1 of this document. The technical risks include 'first of a kind' risks such as solvent degradation levels, increased corrosion levels in wells due to combination of CO_2 and water, degradation products and emissions, low temperature requirements for subsurface safety valves, etc. There are also risks which are characterised as more 'business as usual' such as horizontal direction drilling of the new pipeline section from onshore, availability/reliability of the single gas turbine, integrity issues on existing Goldeneye infrastructure, etc.

Whilst very few of the individual elements of the Project are novel, the integration of on/offshore, brown/greenfield elements, partnering with a power company, a complex commercial construct mixed with visible public exposure make the project largely driven by non-technical factors. Specific non-technical risks related to 'first of a kind' features such as the CCS Competition including continued UK Government support, the granting of the Carbon Storage Permit and any associated onerous conditions in the permit award, immature regulatory framework for carbon capture plant operations, etc. Other non-technical risks of a more 'business as usual' nature relate to engagement of external stakeholders such as local communities, NGO's and other influential or interested external stakeholders.

This document was first produced in August 2013, updated during the FEED phase incorporating risk management processes of SSE and the FEED contractors, with this further update documenting the evolution towards the Execute phase risk management process. This document will continually be updated as the project progresses and is a subject of DECC Knowledge Transfer during Execute, should the Project proceed.

1. Introduction

1.1. Project Introduction

The Peterhead CCS Project aims to capture around one million tonnes of CO_2 per annum, over a period of up to 15 years, from an existing Combined Cycle Gas Turbine (CCGT) located at SSE's Peterhead Power Station in Aberdeenshire, Scotland. This would be the world's first commercial-scale demonstration of post combustion CO_2 capture, transport and offshore geological storage from a gas-fired power station.

As the Goldeneye gas-condensate field has ceased production, the production facility will be modified to allow the injection of dense phase CO_2 captured from the post-combustion gases of Peterhead Power Station into the depleted Goldeneye reservoir.

The CO_2 will be captured from the flue gas produced by one of the gas turbines at Peterhead Power Station (GT13) using amine-based technology provided by Cansolv (a wholly-owned subsidiary of Shell). After capture the CO_2 will be routed to a compression facility, where it will be compressed, cooled and conditioned for water and oxygen removal to meet suitable transportation and storage specifications. The resulting dense phase CO_2 stream will be transported direct offshore to the wellhead platform via a new offshore pipeline which will tie in subsea to the existing Goldeneye pipeline.

Once at the platform the CO_2 will be injected into the Goldeneye CO_2 Store (a depleted hydrocarbon gas reservoir), more than 2 km under the seabed of the North Sea. The project layout is depicted in Figure 1-1 below:

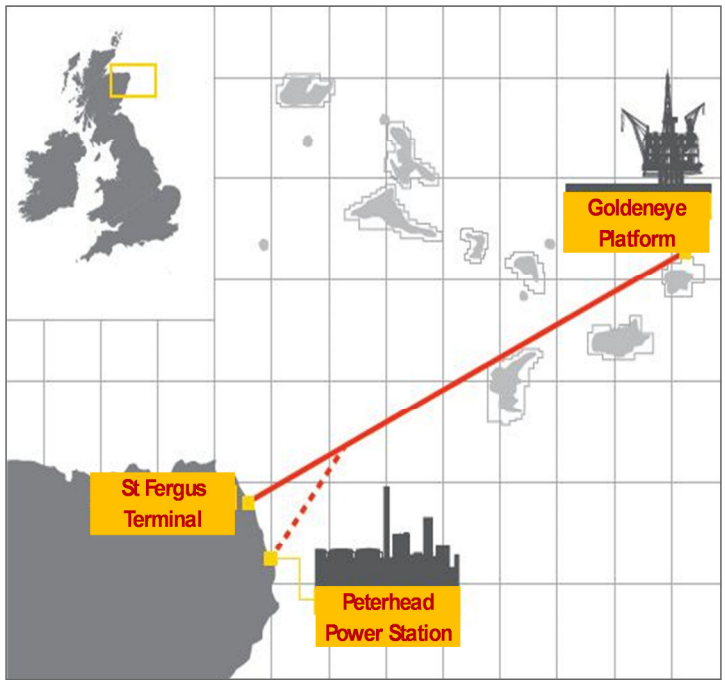

Figure 1-1: Project Location.

2. Purpose of the Risk Management System

The Project Risk Management System (RMS) identifies and evaluates the significant risks to the achievement of project objectives, sets boundaries for risk acceptance and manages the risk mitigation actions. The purpose is to reduce the probability and potential impacts of downside risk, increase the probability and positive effects of upside risk and ensure that recovery actions are in place should the downside risk occur, during different phases of the project, by anticipating and managing the risks pro-actively using a structured approach.

Project Risk Management aims to ensure that the maximum value is created by the decisions made in the front-end, and the promised value is delivered during execution and operation. This is achieved by providing information to decision-makers while they select the optimal concept, perform basic and detailed design work and manage the project through execution.

3. Scope

This RMS has been set up as a suitable system for use throughout the project phases and therefore will be maintained and updated throughout the remainder of the project. The primary aim of the RMS at this stage of the project is to capture the high-level risks associated with the ability to demonstrate the techno-economic feasibility of clean power production through the development and operation of a complete Carbon Capture and Storage (CCS) chain integrated with an existing Combined Cycle Gas Turbine (CCGT). Risks captured via the risk management system are key to decision-making during the project.

The project risk management process is relevant for internal and external stakeholders; specifically the Department of Energy and Climate Change (DECC) who consider the FEED phase to be the main risk reduction phase of the project. As customers of this demonstration are the UK Government, specifically DECC via the UK CCS Commercialisation competition, one of the measures of success for the RMS will be subsequent replication of the Peterhead CCS design, construction and/or operation under the Electricity Market Reform (EMR) regulations.

The project risk management process described within this document complies with the mandatory requirements described in Shell's Project Standards & Project Guides relating to capital project risk management. This plan is scaled appropriately to fit the dimensions, risk levels and timescales of the opportunity, determined by the requirements for this particular opportunity. This plan will be reviewed periodically and updated to reflect significant changes; the Decision Executive (DE) will approve the plan with Business Opportunity Manager (BOM), with further updates being agreed between Project Manager (PM) and BOM and formally supported by the Project Finance Manager.

3.1. Upside and Downside risks

The RMS applies equally to downside and upside risks (opportunities) in order to provide a balanced view of the project uncertainty, maximise the likelihood of the project achieving its objectives and maintain risk exposure at an acceptable level. Therefore both types of risk will be included in the project Risk register and receive equal attention. All project risks will be jointly owned by the BOM and PM across the entire TECOP (Technical, Economic, Commercial, Organisational, Political) and NTR (non-technical risk) spectrum, and managed by risk owners within the wider project organisation (including partners and contractors) via the planned execution of activities.

3.2. Project Risk Management Assurance

Evaluation of the RMS and its implementation, including the quality of the Risk register, is a key component of Shell's Project Assurance Process, and will be evaluated as part of the Project Health Checks, Project Execution Reviews (PER), Estimate and Schedule Assurance Reviews (ESAR) and any Shell internal audits deemed necessary and which are to be conducted throughout the project lifecycle. The project has been classified within Shell as Premium Assurance in the Opportunity Assurance Plan endorsed by the project DE, and a Value Assurance Manager has been appointed to the project within Shell in order to ensure the appropriate level of focus on assurance and value improvement.

Risks in the project Risk register are assessed against the impact categories agreed by the senior project leadership and are across the full spectrum of the TECOP and NTR categories. These risk assessment impact categories are aligned to the risk metrics used by DECC and reflected in a project specific risk assessment matrix (RAM, refer to Appendix 2).

3.3. Integration with Cost and Schedule Estimation

Certain risks in the Risk register contribute directly to schedule and cost uncertainty for the project. These risks will be included in the Cost and Schedule Risk Analyses (CSRA), to be conducted in accordance with Shell's Project Cost & Planning Risk Procedure (Project Guide 20b).

For the purposes of CSRA, the cost and schedule inputs are provided by the Project Services Manager and the subsequent probabilistic model is developed, reviewed and validated by an analyst from the Shell Risk group, who also ensures the project risks (including NTR) are accurately reflected in the model. The Quantitative Cost and/or Schedule Risk Assessment Reports, which document the outcomes from the CSRA, are formally approved by the Project Manager. The "roles and responsibilities" section within this document contains further information in this regard.

As new risk and uncertainty events are conducted with respect to cost line items and schedule activities, new risks may be identified or existing risks may be further refined for use in the CSRAs. The project risk register will be updated accordingly, and further quantitative assessments recorded. Risks in the risk register are assessed quantitatively against the agreed Risk Assessment Matrix.

3.4. Integration of Project Risk with Hazard and Effects Management Process

Shell's Health, Safety, Security and Environment (HSSE) function has its own risk management framework, which is described in the Project HSSE Plan. The bulk of the HSSE risks are managed via the Project HSSE management system and controls. However, the following types of HSSE risks may warrant inclusion in the project risk register:

- Major Hazards, i.e. Red risks plus A5 and B5 (critical or severe) risks on the HSE Risk Assessment Matrix (RAM - refer to Appendix 2 for Shell's HSE RAM).
- Other significant risks somewhat unique to the project for which active action planning and follow-up is required.
- HSSE risks with significant regulatory or stakeholder implications.
- Other HSSE Risks as identified by the HSSE lead for the project.

HSE participation is expected for all project risk events. HSSE risks identified during project risk events will be evaluated for inclusion in the Hazards & Effects Register. All project risks will be evaluated for possible HSSE consequences, and the assessments included in the project risk

register. Project risks identified during Hazard & Effects Management Process (HEMP) events will be evaluated for inclusion in the project risk register.

3.5. NTR – Non-Technical Risk(s)

A Non-Technical Risk (NTR) is a risk directly affecting a specific project, caused by (non-contractor) external stakeholders, that triggers a deviation from the locally established and/or expected behaviours / practices / regulations. NTR quantification/qualification is part of an ongoing directed focus within Shell and routinely captured as part of risk management practices with detailed mitigation plans in place. Further information on NTR is available in Section 9 of this document.

4. Process Overview

The following risk management process will be utilised across the entire project.

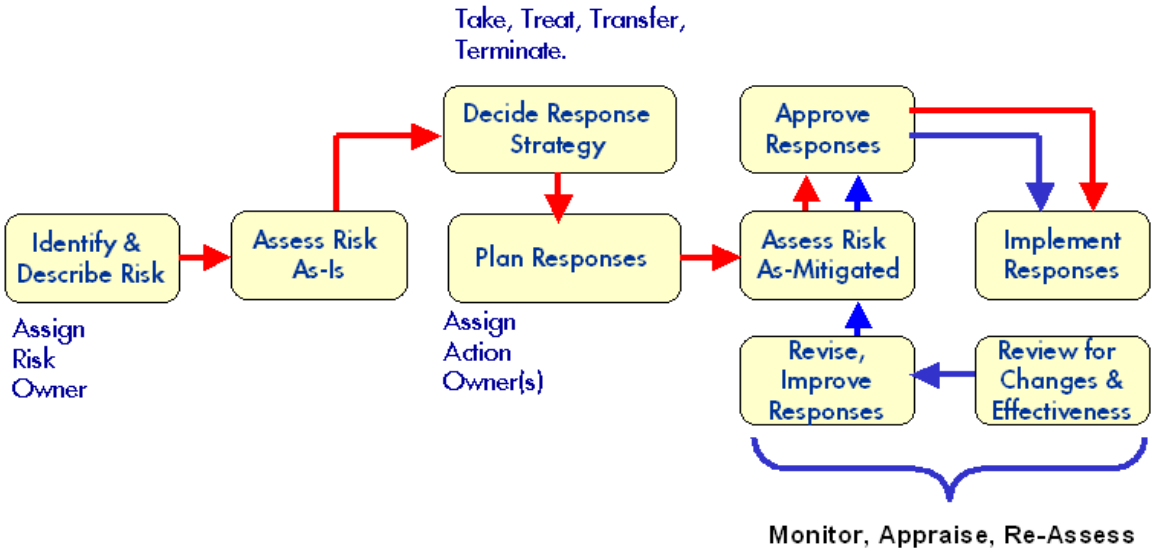

Figure 4-1: Project Risk Management Process

4.1. Identify and Describe Risks

Each team within the Shell Venture and Project Management organisations (refer to Section 4.2) is responsible for the identification, assessment and monitoring of the risks and opportunities related to their area of responsibility. This will be supplemented by parallel processes within the SSE and contractor organisations, and the risk identification process will be facilitated by the project Risk Co-ordinator and Project Finance Manager with management support from the project leadership.

Risk identification will be achieved through a number of different means, e.g.:

- Risk Identification Workshops (Shell, SSE and contractors).
- Project members' routine work.
- Past relevant project reviews – e.g. Longannet CCS project, Quest, Great Island.
- Regular engagement with key external stakeholders, e.g. SSE, DECC, FEED and EPC contractors, Programme Management Office (PMO) contractor, regulators, etc.

- Ongoing engagement and consultation with local communities affected by the project and with other relevant stakeholder groups with interest in the project
- Knowledge sharing and lessons learned with other projects, with particular emphasis on other CCS projects or projects with similar characteristics.

In addition to the Shell Venture and Project Management organisations (refer to Section 4.2), who are responsible for risk management, a number of other stakeholders maintain risk management processes and risk registers. The processes and registers are broadly aligned with the Shell project risk management process and risk register, and are routinely incorporated into the project's risk review and reporting process. These stakeholders are:

- SSE, including Power Station: FEED and EPC Contractors
- Onshore contractors: FEED and Onshore CCC EPC
- Subsea contractors: FEED & Subsea/Pipeline/Landfall EPCI
- Offshore contractors: FEED (Shell Design Office) and Goldeneye Mods EPC
- Other Shell teams out with the project, e.g. Onshore asset team, Wells function, Logistics, etc.

Risks start out as *Proposed*. Once the risk has been properly stated and described, and the Risk Owner identified and agreed, the risk is *Accepted (and moved to Active status in Easyrisk™)*. It is then the job of the Risk Owner to assess the risk As-Is, decide the response strategy, plan the responses, assign action owners, and re-assess the risk As-Mitigated.

Risk Title and Description Requirements

In order to be *Approved*, the risk must be described using the Structured 3 Part Risk Statement:

> As a result of **<definite cause>**,
> **<possible event>** may occur,
> which would lead to **<consequences for the project objective(s)>**

The risk Title should be specific enough for its meaning to be easily understood by people unfamiliar with the project details, without the benefit of the full risk description.

Figure 4-2: Risk Assessment

4.2. Assess Risk Severity As-is

Risk Owners assess risks for probability and impact using the project risk assessment matrix (RAM) to determine Risk Severity. See APPENDIX 2 for the risk assessment matrix.

Risks are assessed initially by accounting for all risk responses *already in place* or assumed to be *naturally available* if the risk occurs. These responses are considered when assessing the As-Is Severity, and are recorded in the risk register.

Assessed risks are reviewed and recommended for agreement at the level most familiar with the risk and its potential impact on the project objectives. Agreement is sought at the level responsible for responding to the Consequences should the risk occur. Guidance on appropriate authorities for recommending and agreeing the risks are given in the table below.

Table 4-1: Risk Severity

Risk Severity	Agree	Recommend	Review/Report Progress
Top Risks (Very High)	Vice President (VP) or equivalent	DE/BOM	Monthly review. Progress reported during regular Decision Review Board (DRB) engagements. Monitored by Project Finance Manager.
Critical (High)	DE/BOM	PM	Monthly review. Progress reported during regular DRB engagements. Monitored by Project Finance Manager.
Severe (Medium)	DE/BOM	PM	Bi-monthly review. Progress reported during regular DRB engagements. Monitored by Project Finance Manager.
Material (Low)	PM	Team Lead	Quarterly review to assess growth potential, progress on response plans.
Small (Very Low)	PM	Team Lead	Quarterly review to assess growth potential, progress on response plans.

"Agree" means:

1. The risk is valid and should be included in the Risk register.
2. The risk severity, both pre- and post-mitigated, and response strategy are appropriate.
3. Risk mitigation plans are acceptable and resourced appropriately.
4. Risk information will be communicated as necessary to provide transparency, especially for risks with "Take" strategy.

These levels of "agree" and "recommend" have been selected based on the following venture and project management structures:

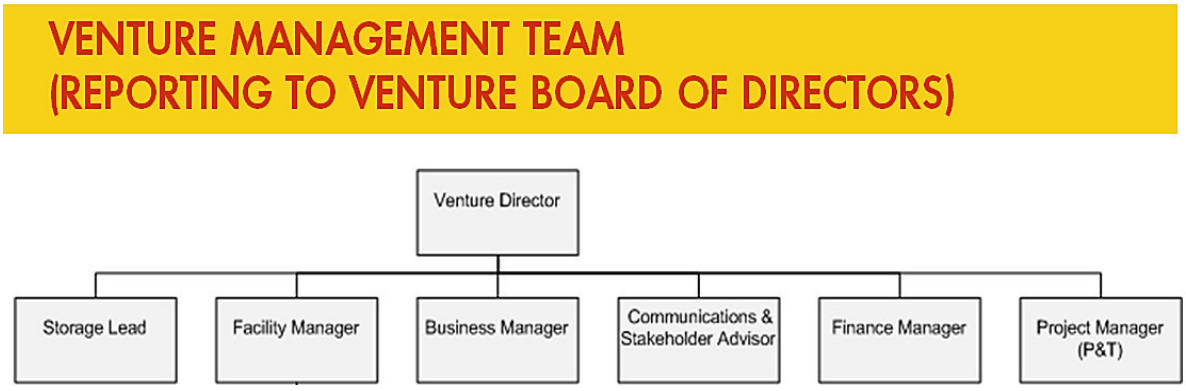

Figure 4-3: Venture Management Organisation

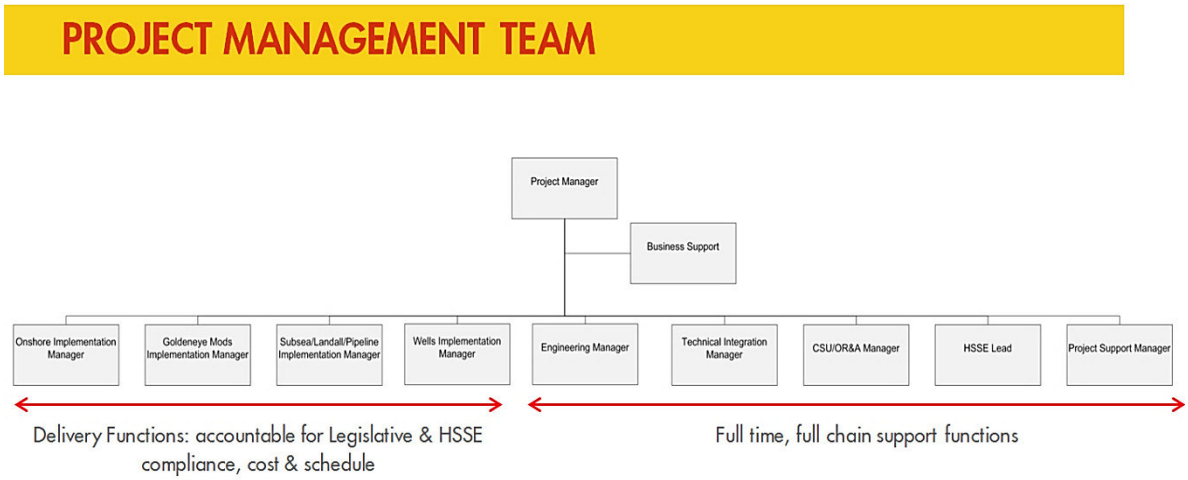

Figure 4-4: Project Management Organisation

4.3. Decide Response Strategy

Prior to deciding the appropriate risk response strategy, a decision must be taken as to the manageability of the risk. The three possible options are:

- Can control.
- Can influence.
- Cannot control.

Once the manageability of the risk has been assessed, the risk should then be assessed for the appropriate risk response strategy. There are four possible response strategies for risks:

Table 4-2: Response strategies for threats and opportunities

Threats	Opportunities
Terminate / Forego Activity	Exploit
Transfer / Share	Share
Treat (Accept & Control)	Enhance
Take (Accept without Controls)	Take (Accept without Controls)

Response strategies and actions should be considered together in arriving at an appropriate response. For example:

- There may be risks for which no action is possible, or no cost-effective, timely action is available. These risks may have to be "Taken" for the project to proceed as planned.
- There may be risks that are outside the authority / control of the project team, or may require actions by persons who are not members of the project team. These risks may be "Transferred" out of the team, to a higher level of authority or to another business group.
- There may be risks that are potentially so damaging to the project objectives that they could stop the project, or require an alternative solution to be found to avoid the risk. If an alternative is required, these risks may have to be "Terminated".

- There may be opportunities to exploit the full value from the opportunity.
- There may be opportunities to share with a third party as part of a negotiating position.
- There may be actions that can be taken to enhance the value of an opportunity.
- It may be decided to just accept an opportunity without taking any measures to try and improve the likelihood or nature of the impact of the opportunity.

4.4. Plan Responses and Assess As-Mitigated

Risk Owners are responsible for planning the responses appropriate to the strategy selected. Actions must reduce the probability of occurrence (preventive) and / or reduce the impact of a risk once it has occurred (recovery) for Treatable risks; or ensure appropriate communication in the case of risks with Take, Transfer or Terminate strategies.

The Risk Owner ensures that the planned responses have the desired effect by assessing the *As-Mitigated* Severity. In addition, he /she makes sure that the proposed risk responses are SMART – Specific, Measurable, Actionable, Realistic, and Time Based. Delivery of the action is determined with respect to the date when the risk event might be expected to occur. Each risk must be assigned a Finish Date in the Risk register.

The Risk Owner assigns Action Owners to execute the planned responses. Required completion of the actions is required prior to the risk Finish Date.

4.5. Approve Responses

Once planning is complete, the risk is reviewed at the appropriate level in the project organisation for the risk severity (see Section 4.2), recommended and agreed, and the status in the Risk register is changed to *Active*. The Risk Co-ordinator updates the risk register to reflect any changes to the planned responses, and ensures that the actions are included in the project work plans.

4.6. Implement Responses

Once the response plan has been approved, the Risk Owner discusses the Response Plan with the Action Owners, who commence work at the agreed start date. Once actions are in progress, the Action Owner (or Risk Owner on their behalf) regularly provides updates to the Risk Co-ordinator in order to document progress. Actions are tracked by the risk owners as part of the monthly review process.

4.7. Monitor, Appraise and Re-Assess

The overall project Risk register is maintained in EasyRisk™, supplemented from separate risk registers owned and maintained by SSE and the various contractors utilised during Define and Execute phases. All team members who have been designated as risk or action owners have access to the Risk register, and can either enter EasyRisk™ directly or provide changes to the Risk Co-ordinator for incorporation. Access to EasyRisk™ is arranged and controlled via the Risk Co-ordinator, who also provides training to end users.

It is the responsibility of every Risk Owner to regularly review his/her risks to see if:

- The risk needs to be re-assessed due to changes in the risk landscape.
- The risk response strategy is still appropriate or needs to be changed.
- Response planning and implementation are progressing on schedule, and any schedule changes are reflected in the response planning.

4.7.1. Management Monitoring

Management monitoring of risks will be included in all management meetings to ensure that risk management receives an appropriate focus across the project. Risks will be discussed at different meetings based on their severity:

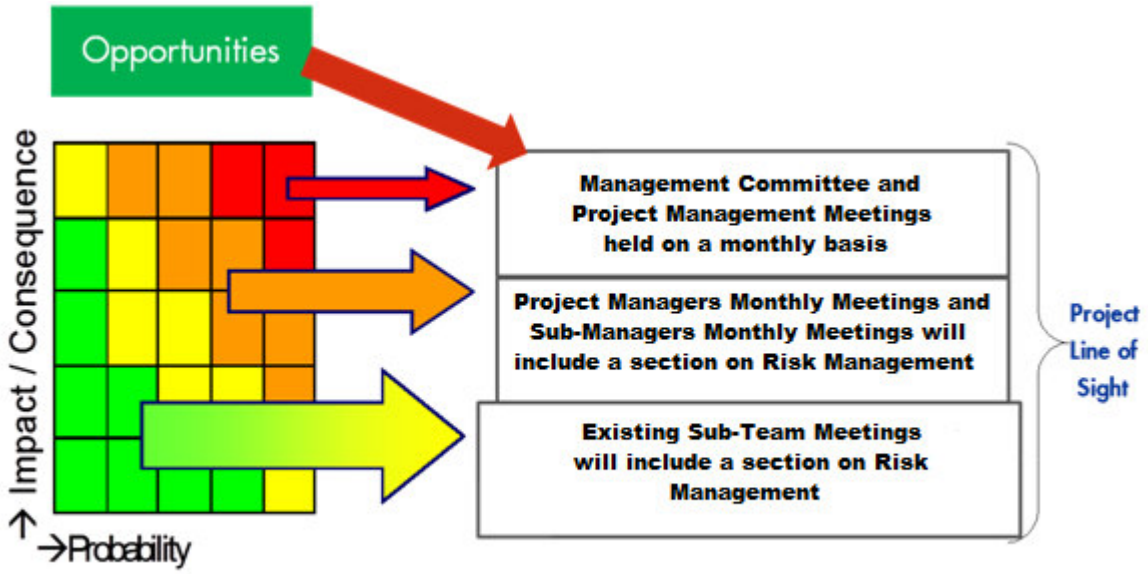

Figure 4-5: Overview of management risk reviews

Each team within the project is responsible for the management of their own risks and actions, and Easyrisk™ (refer to Section 7 - Tools) has been structured in such a way to support risk analysis and reporting for each team within the project. The management risk reporting will reflect a rolled-up view of the project, incorporating all of the open risks being managed by each team.

All opportunities will be discussed by senior project leadership to ensure a sufficient focus is maintained on enhancing or exploiting these.

4.8. Closing Risks

A risk can only be closed out when responses are implemented, the risk has occurred and now is in the past, larger risks are split up into smaller risks or the situation that creates the risk has been removed. The Risk Owner will ensure closed risks are reflected appropriately in Easyrisk™, either directly or with support from the project Risk Co-ordinator, including a full audit trail as to the reasons for the risk being considered closed. A list of closed risks will be provided in the monthly risk reporting cycle, which is fully described in Section 5 of this document.

5. Reporting and Communication

In order to communicate risks effectively within the organisation and integrate risk management into the normal project management practices the project will:

- Include risk management as a standing agenda item at the monthly Project Controls meetings. This is primarily to agree new risks, or changes to existing risks, as well as prioritisation of top risks.
- Discuss selected top project risks once a month where results of any significant risk activities that took place during the previous month are summarised and upcoming planned events are announced.
- Risk Co-ordinator and Project Finance Manager will work with each of the teams within the project to ensure risks are regularly monitored and accurately reflected in the monthly and quarterly project reports. Each team is to be supplied with a bespoke monthly risk report in order to manage the risk process as a matter of routine.
- Risk Management is included within the monthly project report on all areas of project management, with details of the Top Project risks.
- The risk reporting requirements of the customer (DECC) are satisfied in the monthly project report, consistent with the format agreed by the Contract Management Group.
- The version of the monthly project report released to non-Shell stakeholders (e.g., DECC) will ensure sensitive internal and proprietary information relating to risk is removed.
- Issue a quarterly risk report for senior management (i.e. DRB), providing a view of functional/project and asset risks, status, mitigation plans and timing of implementation.
- Ensure risk-based approach is used for DRB engagements, with particular focus on the main project value drivers & threats.

6. Roles and Responsibilities

Risk management for the Peterhead CCS Project is supported as follows:

6.1. Business Opportunity Manager (BOM)

The Business Opportunity Manager (BOM) is the champion of the risk management process, approves the Risk Management Plan, approves changes to the project Risk Assessment Matrix with the PM and takes the lead in reporting of key risks to the DE and DRB. The BOM also actively manages his/her own risks and actions.

6.2. Project Manager (PM)

The Project Manager approves the Risk Management Plan and approves changes to the project Risk Assessment Matrix with the BOM. The PM also actively manages his/her own risks and actions.

6.3. Risk Co-Ordinator

The Risk Management Process for the Project is executed by the Aberdeen Risk Management Team, supported by the Project Finance Manager. The Risk Co-ordinator role resides within the Project Support team (which reports to the Project Support Manager in the Project Manager's organisation), and regularly supports the Project Finance Manager, PM and BOM on effectively implementing the risk management process. The Risk Co-ordinator and Project Finance Manager will ensure a collaborative approach to risk management is taken across the whole Project.

The key responsibilities are:

- Writing/updating the Risk Management Plan.
- Routine maintenance of the Project Risk register and ensuring its overall quality.
- Generating monthly status reports to go in the monthly project management report.
- Generating quarterly risk status reports for issuing to project stakeholders.
- Facilitating regular risk engagements with the project team, including endorsement sessions.
- Facilitating bi-annual Cost/Schedule Risk Analysis (CSRA) including report-out.

6.4. Project Finance Manager

The Risk Management Process for the Project is supported by the Project Finance Manager, while the routine execution of the risk management process is administered by the Shell Risk Management Team in Aberdeen. The Project Finance Manager works closely with the Risk Co-ordinator, PM and BOM on effectively implementing the risk management process. The Risk Co-ordinator and Project Finance Manager will ensure a collaborative approach to risk management is taken across the whole Project. The key responsibilities are:

- Reviewing and approving the Risk Management Plan.
- Participating in regular risk engagements with the project team, including endorsement sessions.
- Generating top risk reports for stakeholders (internal, partner & customer).
- Preparing and issuing an endorsed risk report for quarterly DRB review.

6.5. Risk Owners

Risk Owners are responsible for monitoring and maintaining their own risks; verifying the Action Plans with Action Owners; and tracking progress. This includes ensuring that risk responses are integrated into team work plans (i.e. time and resources allocated to risk responses).

6.6. Action Owners

Action Owners are responsible for executing their risk response plans as agreed with the Risk Owner and for updating the Risk register accordingly.

6.7. Shell Owner's Team Members

Every team member is responsible for risk identification and mitigation where achievement of project objectives could be jeopardised. Any Team Member can propose a risk via the Risk Co-ordinator or Project Finance Manager for consideration in the next monthly risk review cycle.

6.8. Interface with Contractors

Basic Design and Engineering and project execution are often done by third-party (EPC) contractors, and monitored by Shell staff. To be truly effective, project risk management should be done together with the contractors - to get their input and/or to support them in the role of Risk Owners. This collaborative effort applies mostly to Technical, HSSE, and Organisational risks; Economic, Commercial and Political risks normally remain internal to the owner team.

Even if risks are transferred to or shared with contractors, the associated costs are frequently borne by the owner, directly or indirectly. Risk management requirements for contractors, including reporting and communication, should be spelled out in the contracts and invitations to tender (ITTs). How effectively contractors participate in Shell's risk management process, and how active their own risk management process is, depends a lot on the type of contract (e.g.

lump sum or reimbursable) and contractual arrangements and the building of effective relations between Shell and its contractors.

The project teams must create an environment of cooperation, partnership and transparency to identify, discuss and manage openly the project risks with the contractors. The number of risks in the risk register related to contractor tasks with contractors being the risk owners is a health check of this good relationship and effective risk management.

Based on the proposals received from all of the tenderers for the three Shell EPC scopes, the risk management processes have been reviewed and evaluated with no major concerns raised. It is envisaged that the successful tenderer will administer a fit-for-purpose risk management process, and will link to the Shell risk management process in a collaborative and efficient manner to allow for a holistic approach to risk management and reporting for the entire project. Further details will be added to this risk management plan once the successful tenderer is known and the contract has been awarded.

7. Tools

The Peterhead CCS Project will utilise the EasyRisk™ system as a risk register which is the recommended Shell tool for major/flagship projects and provides complete traceability and auditability. This will form the latest, most current view on risk status across the project at any point throughout the project lifecycle. The project has been set up as one discrete project in Easyrisk™, separate from previous CCS projects (e.g. Longannet), and has been designed to provide flexible analysis & reporting of project risk across a number of different attributes (list below).

The Peterhead CCS Project's Risk register contains the following information, amongst others, in Easyrisk™ for each risk:

- Unique sequential risk number (D denotes downside, U denotes upside).
- Risk Title.
- Risk Description.
- Audit Trail.
- Risk Owner.
- Project Phase (Define etc.) when risk must be addressed; Project Phase when risk is expected to occur.
- TECOP category or categories (should reflect consequences for which risk is assessed).
- Affected part of CCS chain (area of CCS project value chain that the risk relates to, equivalent to team in project organisation).
- As-Is Risk Assessment of Impact by Consequence (including assumptions and reasoning). A risk may have more than one Impact, but only one Probability.
- Residual Risk Assessment (including assumptions & reasoning).
- Response Strategy (Take, Treat, Transfer, Terminate).
- Status (Proposed; Accepted; In Progress; Taken; Closed with close-out date, detailed close-out note and document if applicable) .
- Review & Target Dates.
- Associated Risk Responses (Actions).
- Main stakeholders (e.g. DECC, SSE etc.).

For Risk Responses (Actions):

- Unique sequential risk number (D denotes downside, U denotes upside).

- Action Title.
- Action Description.
- Action Owner.
- Action type: Preventive, Recovery, Information Gathering.
- Start Date, Planned Finish, Actual Finish.
- Audit Trail.

NB: The attributes above are the key risk reporting criteria captured in Shell's Easyrisk™ tool, some of which may differ from the risk registers maintained by SSE or contractors. However, the basic structure of risk identification, description and evaluation is aligned across all of the stakeholders, with the appropriate Shell project team member assigned ownership for risks across the broader project organisation.

7.1. Risk Management System Status

Risk and Action Activity is evaluated based upon a monthly review by the Risk Co-ordinator or Project Finance Manager of:

- Number of due and overdue risks and actions per owner.
- Number of risks and actions added, closed, re-assessed.

Changes during the period are shown in the risk section of the Monthly Project Management Report and the Quarterly Risk Management Report.

Corrective actions are created and taken by the Risk Co-ordinator or Project Finance Manager where necessary to bring progress to acceptable levels.

8. Risk Process per Project Phase

8.1. Differentiation of risk management across phases

In earlier phases the focus of the risk management effort is increasingly on the actions to mitigate risks, or a conscious choice to take the risk.

During the pre-FEED phase, the specific risks (likelihood, impact and range of outcomes) for each of the identified concepts / options need to be evaluated to support the decision as to which option to select. The understanding of the risks, uncertainties and proposed responses shall be fully integrated both into the economics and into the wider decision-making process of the opportunity / project. The potential impact of significant risks should be fully described and discussed with decision-makers such as the DE.

During the FEED, Execute and Operate phases, the Risk Management Plan puts in place the required detailed practical measures to address the risks. This may be in such things as specific clauses in the commercial agreements of the opportunity or in the operational management systems and processes. Again risks and uncertainties must be fully integrated both into the economics and into the wider decision-making process of the opportunity / project.

8.2. Pre-FEED Phase

The Risk Co-ordinator created a resource plan for Risk Management support, this includes:

- Risk Management training for project staff.
- Workshops at the start and end of Pre-FEED phase.

- Scheduled risk management meetings & deliverables (including external stakeholders).

A Cost and Schedule Risk Analysis was conducted prior to the project moving into FEED.

The mitigation of risks is a key consideration in the DRB consideration of whether to move to the FEED phase in the project. The risk profile of the project was also a key consideration of the Estimate and Schedule Assurance Review conducted prior to the DRB consideration of the project.

8.3. FEED (risk reduction) Phase

The Risk Co-ordinator created a resource plan for Risk Management support, this included:

- Risk Management training for project staff.
- Kick-off risk workshop held immediately prior to start of FEED contracts, to identify all risks and opportunities, assigning correct action parties and SMART mitigation plans.
- Quarterly risk workshops, including input from the various FEED delivery teams.
- Scheduled risk management meetings and deliverables (including external stakeholders).

The risk management process utilised is broadly aligned with the previous phase is EasyRisk™ and continues to be used throughout FEED phase. The Risk Management System will be extended to include additional or evolving risks arising from execution planning in FEED phase.

Risks documented in the Risk register are a key input to the Cost and Schedule Risk Analyses, which are conducted bi-annually prior to the project taking the Final Investment Decision (FID).

The risk status of the project will be a key consideration in the Final Investment Decision and the DRB's consideration of readiness to move from FEED through to Execute.

8.4. Execute Phase

The risk management process to be delivered during Execute phase will be broadly aligned to the process executed during FEED phase, with more emphasis on collaboration and integration with the various key stakeholders in the project (DECC, SSE, contractors etc.). The risk management process will also become more closely aligned with the routine operational activities executed by the project team, linked to scheduled activities on the work plan and also a routine agenda item for discussion at weekly project leadership meetings.

Risk Management support is a dedicated position, which reports to the Project Services Manager. This position is also intended to co-ordinate the Management of Change process due to the integrated nature of both processes. In addition, it is required that the Risk Co-ordinator acts as the integrator of risk information between the various stakeholders in the project. Some of the key activities executed by the Risk Co-ordinator with regard to the risk management process are:

- Risk Management training for project staff.
- Kick-off risk workshop held immediately prior to start of EPC contracts, to identify all risks and opportunities, assigning correct action parties and SMART mitigation plans.
- Quarterly risk workshops, including input from the various EPC delivery teams.
- Scheduled risk management meetings and deliverables (including external stakeholders).
- Integration of risk information into the project risk management process from the various stakeholders (SSE and contractors).

- Monthly collaboration meetings with contractors risk focal points to share learnings and progress updates between the various organisations, including participation in risk workshops executed by other stakeholders.
- Continue to improve the Shell owner's team risk management process with lessons & best practices learned from other organisations.
- Support the Contract Management Group (Shell/DECC) in understanding risks which fall under the definition of "CCS Specific" in the Project Contract.
- DECC knowledge transfer requirement for an annual report on significant commercial, technical, stakeholder, consenting and other project risks, including but not limited to:
    - Insurance.
    - Financing and re-financing (where relevant).
    - Reduction through innovation.
    - Any other relevant information relating to risk and risk management.
    - The report should include details on how risks have been managed and steps taken to manage risk down (e.g. passing risk down the supply chain, including any pain-share/gain-share mechanisms).
- The intention is that EasyRisk™ will continue to be used by the Shell owner's team throughout Execute phase, supplemented with monthly risk updates from the contractor and SSE organisations (which are administered by risk focal points within those organisations). The Risk Management System will be extended to include additional or evolving risks arising from operational planning in Execute phase.

Risks documented in the Risk register are a key input to the Cost and Schedule Risk Analyses, which will continue to be conducted bi-annually in line with best practice.

The risk status of the project will continue to be a key emphasis area in DRB engagements, as well as in the project reporting requirements to the senior leadership within the Shell organisation.

It is also expected that there will be at least one Shell internal audit of the project risk management process during Execute phase, which the Risk Co-ordinator will play a lead role in facilitating, supported by the BOM, Project Manager and Project Finance Manager.

9. Risk Categories – TECOP and NTR

Risk breakdown structures are excellent tools for both risk identification as well classifying risks to assist with managing sub sections of the risk register. The Peterhead CCS Project uses TECOP and NTR in order to analyse sources of risk.

- **Technical**
  - Subsurface – Static
  - Subsurface – Dynamic
  - Surface
  - Infrastructure
  - Technology
  - Operability
  - Availability
  - Integrity
  - Sustainability
  - Health, Safety, Security and Environment
  - Maintenance
- **Economic**
  - Life-Cycle Cost
  - Phasing
  - Valuation Method
  - Capacity
  - Economic Model
  - Regret Costs
- **Commercial**
  - Contracting & Procurement
  - Financing
  - Business Controls
  - Legal
  - Terms & Conditions
  - Competition
  - Marketing
  - Liabilities
  - Collaboration Agreement
- **Organisational**
  - Structure
  - Resources
  - Competencies
  - Procedures
  - Project Controls
  - Knowledge Management
  - Systems and IT
  - Interfaces
  - Partners
  - Governance
- **Political**
  - Government
  - Stakeholders
  - Employment
  - Regulation
  - Security
  - Reputation
  - NGOs
  - Export Control
  - Localisation
  - Community

NTR is defined as: *a risk directly affecting a specific project, caused by (non-contractor) external stakeholders, that triggers a deviation from the locally established and/or expected behaviours/ practices/regulations.*

The key element is that a non-technical risk is related to *external stakeholders*, who might do something that could have an impact on the project (although this notion might not strictly apply to the risk of natural disasters, which could also be considered "non-technical"). The assumption that non-technical risk is (nearly) always associated with external stakeholder is important, as this will direct the understanding of the risk to the understanding of potential interests and behaviours of those stakeholders.

The risks that we may need to address can have a range of different issue generating sources, for example: *Socio-economic, Environmental, Security, Regulatory /political, Health, Commercial.*

10. Detailed Risk Management Roles and Responsibilities

Risk Management is the responsibility of all team members, including the external stakeholders. There are a number of specific roles that are key to success.

Table 10-1: Risk Management Roles and Responsibilities

Role	Responsibility
Decision Executive	• Sets project objectives. • Approves the project Risk Management Plan. • Approves the project Risk Assessment Matrix (RAM). • Approves the project Risk register. • Approves Resources for the risk management system. • Approves risk responses for severe risks at his Authority Level and assigns resources. • Escalates critical risks to appropriate Line of Sight. • Uses risk information in decision-making. • Customer of the ESAR.
BOM	• Champions the risk management system. • Owns the project Risk Management Plan. • Ensures risks appropriately reflect TECOP for the project. • Ensures Risk Management activities are executed effectively. • Initiates the ESAR (in absence of Project Manager).
Project Manager	• Reviews and agrees the project Risk Management Plan with BOM. • Approves risk responses and assigns resources for the risks at his Authority level. • Formally appoints risk owners. • Escalates risks beyond his Authority to BOM and DE. • Uses risk information for evaluating options and preparing decisions. • Initiates the ESAR. • Accountable for project to asset transition of risk management.
Project Finance Manager	• Formally supports the project Risk Management Plan before being operationalised. • Formally supports the project Risk Assessment Matrix (RAM). • Formally supports the Risk register. • Formally supports risk responses for severe risks at his Authority Level and assigns resources. • Formally supports the content of the project specific risk reports. • Responsible for ensuring project risks are presented and discussed at the venture/ opportunity level. • Accountable for generating the project specific risk reports. • Formally supports the project to asset transition of risk management.
Risk Co-ordinator	• Drafts & maintains the project Risk Management Plan with the Project Manager and Project Finance Manager. This includes the project Risk Assessment Matrix (RAM) and the project Risk Breakdown Structure (RBS), aligned to the CCS Chain links & EPC contract structure. • Trains and supports risk owners and project team. • Maintains the quality of the risk register. • Ensures that all relevant project areas and areas that overlap/interface with the project are considered during risk identification. • Ensures risks are correctly assessed and the logic recorded.

	• Ensures all recorded risk responses are agreed and resourced. • Ensures an audit trail is established/maintained for each risk and action. • Screens proposed risks and accepts/rejects into risk register. • Reports status of risk management system to management.
Risk Owner	• Describes and assesses the risk and proposes suitable risk responses (incl. cost/benefit analysis). • Obtains approval and resources (Action Owners) for planned responses. • Tracks progress, reviews risk, improves responses, closes risks. • Helps Risk Co-ordinator keep a continuous record of risk status in register.
Action Owner	• Executes actions as agreed with risk owner. • Helps Risk Co-ordinator record action status in risk register.
Team Member	• Identifies risks and proposes them to the risk register. • Feeds back effectiveness of risk responses to risk owner. • Is aware of top project risks and risks impacting own work.

11. Mitigation strategies for Top 5 CCS-Specific Risks

Certain risks recorded in the project risk register are characterised as unique to this project, and reflect the uncertainties associated with the "first-of-a-kind" technology involved in each chain link of the project. The Bidder views these risks as "CCS-specific", although it is recognised that the final determination of the classification of such risks should arise will be in accordance with the terms and conditions of the Project Contract. The Top 5 CCS Specific risks at the end of FEED phase are described in more detail below.

1. High Solvent Degradation (CCS-specific due to use of solvent)

Cause: Degradation rates can be calculated but not proven (no capture plant at this scale).

Event: degradation and make-up rates could be higher than anticipated

Consequence: increased OPEX risk affecting the economics of the project negatively; increases the waste disposal requirements; require plant to run at lower capacity to limit degradation rate

Mitigation strategy: In order to mitigate the risk, Cansolv have performed additional testing on the solvent at the Mongstad (TCM) pilot facility in Norway with the final results yet to be published. However, as long-term experience (>5 months) is not yet available, a residual risk remains until injection phase and could result in the potential for a change of materials, a re-design of the absorber and installation of additional equipment to reduce energy consumption.

2. Unexpected increase in well corrosion due to formation water + CO_2 (CCS-specific due to CO_2 interaction with formation water and well materials)

Cause: Unexpected combination of ions in the water caused by CO_2 interactions.

Event: Every time a well is turned off, water could possibly flow back into the well.

Consequence: The possible occasional presence of oxygen and/or solvent degradation products could react with the metal and cause corrosion and failure of the well components.

Mitigation strategy: The risk will be mitigated as much as possible by selection of appropriate well components to minimise corrosion risk, performing corrosion experiments and adopting a suitable sparing strategy. Other mitigating actions considered include performing Well Cat modelling, integrity logging during workover and recompleting the fifth well (or repair and retain

as a spare well with a reservoir abandonment only). However, the risk remains that unexpected and previously unseen corrosion could occur and require a well workover or sidetrack as a full remedial action.

3. Emission of nitrosamines/other degradation products (CCS-specific due to use of solvent)

Cause: Emissions and other degradation products from the onshore CCP which represent a perceived health risk

Event: Potential health impacts are not effectively communicated via public consultation (or fully understood by affected stakeholders), or Shell/third party emissions modelling is unacceptable to regulators.

Consequence: Cost increase and schedule delay from additional regulatory requirements, stakeholder reputation damage and possible litigation, HSSE impacts.

Mitigation strategy: Key mitigations were captured in the FEED design for the project after a Health Risk Assessment was completed, with more conservative emissions limits assumed than legislatively required (required to demonstrate ALARP and BAT, e.g. water and acid wash in absorber tower, Selective Catalytic Reducer (SCR) to reduce NOx, etc.). The modelling assumptions were tested and accepted by the regulator (SEPA), and reflected in the onshore planning application which was the subject of three phases of public consultation with the local community and which was approved by Aberdeenshire Council. In order to further mitigate the risk, Cansolv have performed additional testing on the solvent at the Mongstad (TCM) pilot facility in Norway with the final results yet to be published. However, the residual risk remains around current uncertainty related to long-term degradation of solvent and degradation of amines in the atmosphere.

4. Performance of Waste Water Treatment Plant (WWTP) based on FEED design (CCS-specific due to size and complexity of water treatment system)

Cause: WWTP design required to adequately treat waste water streams from both Shell and SSE facilities to meet discharge limits.

Event: Specialist FEED contractor designs a WWTP solution which is considerably larger and more complex than originally envisaged

Consequence: Concerns raised over operability/discharge limits, cost/schedule impacts.

Mitigation strategy: A small team was created within Shell to look at the various options to reduce the size and complexity of the FEED design offered by the subcontractor. The views of Shell subject matter experts in water treatment were captured as input to the study scope. The options studied ranged from looking at optimising the biological solution onsite to transporting some of the waste product offsite for remote disposal. The main reason for the high cost and complexity of the WWTP FEED design was the inclusion of the acid wash effluent stream containing around 10% amines. The amines are difficult to break down using biological treatment and since this effluent stream is relatively low in volume, it was decided to transport it by road tanker to a licensed incineration site for disposal rather than treating onsite. The availability of at least two suitable incineration sites was confirmed during the study to ensure a secure disposal route. Without the acid wash effluent stream, the onsite WWTP only has to handle large volumes of waste water containing traces of ammonia which is a more conventional and well understood process using biological treatment. The details of the revised treatment scope will be further defined during the detailed engineering phase by the EPC contractor responsible for the Onshore CCC scope.

5. **Scaled-up technology does not perform as expected (CCS-specific technology that still needs to be proven)**

Cause: Scale-up of the CO_2 capture technology has not been proven.

Event: Absorber does not perform as well as modelled once scaled up. Capture technology does not perform as effectively as modelled. The cool-down/warm-up time is excessive.

Consequence: Reduced injection volumes, operating cost increase, contingency increase.

Mitigation strategy: The system will be designed to have sufficient margin to cover scale-up issues, meaning the plant will be designed with significant margin (reducing the probability of poor performance) and reflect the definition of "clean electricity" agreed between Shell and the Authority in the Project Contract. A continuous action is to apply lessons from the Mongstad test centre, Saskpower at Boundary Dam, Quest and other CCS projects around the world as the project progresses, and also apply learnings from similar industries such as SO_2 capture systems.

12. Insurability of risks and conditions/terms of insurance

The insurance strategy for the Peterhead CCS project has been documented via a separate Key Knowledge Deliverable (Insurance Plan, KKD 11.148), and presented to the Authority in the earlier stages of FEED. The main features of the Insurance Plan are:

- Shell will, in consultation with the Authority, put in place a robust and cost-effective insurance programme to provide appropriate cover for both the Construction and Operational Phases of the CCS project. Shell envisage only placing insurance with insurers that meet minimum financial security requirements (being Standard and Poor's (A-) or equivalent by other rating agencies).
- The cost of risk, often materialising as insurance spend, during the lifecycle of a CCS project will present a significant cost to the venture. Implementation of a specific Project Risk Engineering Strategy is planned to reduce the overall "cost of risk" to the CCS project venture through effective Risk Engineering techniques including a Design Phase Risk and Insurance Review (DPRIR), and Risk/Insurance Underwriting and Loss Control Surveys.
- A Design Phase Risk and Insurance Review (DPRIR) will be conducted to identify and review the hazards, risks and risk controls associated with the design, construction (modification), commissioning, operation, closure and decommissioning and the post-decommissioning phases of Shell activities associated with the proposed Peterhead CCS project. The principal focus is on the various loss exposures for property damage, liability and production interruption including well control liabilities.
- The Insurance Plan lists various known and identified risks through various stages of the project life and provides assessment and possible insurance solutions or explains lack of solutions via standard insurance risk transfer methods.
- Insurance cannot be procured upfront for the whole lifecycle of the project, thus availability, price and terms and conditions of coverage may vary over time, especially if claims occur. A key constraint of insurance for CCS projects is the term of available insurance as insurance policy periods are generally short term. This means that policies are issued for up to a maximum number of 2/3 years.
- Separate insurance solutions are required in order to facilitate the management of risk for the full CCS chain, defined over 4 key phases: 1) Design and Construction, 2) Operation, 3) Closure and Decommissioning, and 4) Post-Closure monitoring and maintenance.

- Coverage may be very expensive and/or restricted for the "novel" aspects of the project (CCS liability, financial risks of repurchase of carbon credits, subsurface migration/pollution, etc.).
- Until the regulatory regime is defined, it is uncertain what the extent of liability for CO_2 release is. At present, no requirement for re-purchase of credits or financial penalties is expected in case of accidental CO_2 release from the reservoir. Protection against repayment of carbon credits (European Union Allowances (EUAs) is currently uninsurable.

13. Risks in utilising existing plant or plant elements

The risks involved in utilising existing onshore plant or plant elements have largely been addressed directly by SSE as the power station owner, or indirectly via the FEED Contractors deliverables for the onshore carbon capture and power station scopes as well as subsea pipeline scope. The key risks can be categorised into the following areas:

1. Existing site systems out with original design life and/or shorter than CfD term

Cause: existing site infrastructure which is planned to be used to supply utilities to the carbon capture process is not fit for purpose over the required lifetime of operation.

Event: existing site infrastructure fails, causing disruption to carbon capture process

Consequence: requirement for repair/replacement, exposure to liabilities for loss of availability.

Mitigation strategy: The FEED Contractor assessed the suitability of the existing plant before considering necessary upgrade and life extension works. A series of site assessments (civil, electrical, mechanical, controls/instrumentation, rotating equipment) were also completed by SSE, providing sufficient certainty that the systems were suitable for the CfD duration.

2. Incompatible interfaces between carbon capture plant and power station

Cause: Incompatibility of interfaces at the battery limits between Capture and Compression plants and Peterhead Power Station service systems

Event: unable to effectively interface PPS and CCP equipment for CCS operations

Consequence: redesign/rework or poor operability, resulting in cost/schedule overruns.

Mitigation strategy: Appointment of a single FEED Contractor for both scopes and joint development of the Battery Limit Schedule and Interface Schedule, which determines the interface points for the various CCS chain links as well as responsibility for executing work scopes (included in the design documentation and shared with the EPC contractors). Further focus will be placed on effectively managing interfaces between the project stakeholders (specifically Shell, SSE, Cansolv and EPC contractors).

3. **Impact of CCP construction on existing site operations**

Cause: Construction works completed whilst Peterhead Power Station is operational.

Event: Construction works impact on business-as-usual operations at PPS

Consequence: Loss of availability of Block 1, negatively impacting revenues earned.

Mitigation strategy: Execution of constructability reviews with Shell, SSE and FEED contractor staff, integrated schedule management with the power station on planned shutdowns and also included in the ITT packages sent to the EPC contractors. Consideration will be given

to whether Business Interruption insurance may be possible in order to provide financial cover in the event the risk materialises.

4. **Impact of over-pressurisation on Heat Recovery Steam Generator (HRSG), or Selective Catalytic Reducer (SCR) impact on HRSG**

Cause: Over-pressurisation of the HRSG due to operations of the CCP, or installation of SCR affects plant performance

Event: Booster fan high over-speed due to blockage in the flue system, for example.

Consequence: This would potentially result in asset damage (HRSG casing) and consequential costs for repair, and/or loss of availability payments

Mitigation strategy: Modelling and assurance of the FEED design for the process control system ensures that it will protect the HRSG and GT, and appropriate QA process in place during detailed engineering to ensure good design. Ensure process control system is reviewed during the beginning of detailed design. HRSG13 has been designed as 'SCR ready' with an appropriately-sized spool piece for an SCR reactor at an appropriate flue gas temperature, ensuring the SCR impacts on performance are well understood and externally assured by a specialist vendor undertaking a feasibility study including some limited assessment of construction issues. SSE's Civil Team has assessed the load on the existing super-structure and based on current information, it is expected to be within the capacity of the structure.

5. **Supply of utilities to carbon capture plant impacts power station operations (including potential encroachment with live HV cables)**

Cause: SSE will be contractually required to supply utilities to the CCP from the existing power station. Possible encroachment with live HV cables associated with Block 1.

Event: Designs are not robust and utilities cannot be provided by the existing station, station power supplies affected during excavation works.

Consequence: Operation of the existing power station compromised

Mitigation strategy: FEED design for utilities is adequate, including agreed utility requirements determined & quantified for demand planning by Shell and SSE. Site segregation and construction sequencing agreed between Shell and SSE, and will lead to routing cables away from existing HV cables where possible and also limiting the working areas near existing HV cabling.

6. **Shared water treatment facilities for carbon capture plant and power station, including provision of cooling water for CCP**

Cause: SEPA have stated that they view the power station and CCP facilities as one site, albeit with different emissions and discharge permits for the different parts / operators. For discharges to sea they have an expectation that the power station discharge will be treated with the capture plant effluent in the new water treatment facilities.

Event: SEPA determined that the existing power station waste water must be treated via a new combined Waste Water Treatment Plant (WWTP), and installed water treatment plant at the power station cannot supply water of an appropriate quantity and quality for the life-time of CCS operation. Also existing cooling water systems (culverts etc.) may not be suitable for operation at the elevated operating pressures which are required of the CCP (approximately 4 barg)

Consequence: Significant changes to the existing power station drainage systems at significant additional cost, resulting in cost overruns and/or schedule delays.

Mitigation strategy: Incorporated in the design requirements for a combined WWTP, with the final solution still under review as the initial design offered by the specialist FEED subcontractor was considered to be large, technically complex and expensive. The final WWTP solution will be fully completed by end of FEED. An assessment of the existing waste treatment plant was undertaken to determine spare capacity and quality of treated water, with a plentiful supply of spare capacity confirmed. Further investigations took place during FEED with Shell/Cansolv to determine the exact pressure requirements of CCP and the limitations of existing systems, with the final cooling water design requiring booster pumps to mitigate this risk.

7. **Existing pipeline inspection encounters unacceptable levels of corrosion**

Cause: Corrosion levels higher than expected, existing pipeline unsuitable for CO_2 service

Event: Routine inspection of pipeline highlights excessive levels of corrosion prior to injection

Consequence: Cost/schedule impact of having to repair/replace corroded pipeline section

Mitigation strategy: Multiple pig runs to confirm the integrity of the pipeline have been executed since the platform ceased hydrocarbon production and the pipeline was flushed and 'hydrocarbon-freed'. A desktop review by Shell TA's has also confirmed the integrity of the pipeline, and a final intelligent pig run will be completed 9 months prior to commission to provide assurance of the integrity prior to service commencement.

14. Risks causing significant delay to the Bidder's project

All of the risks in this section have been assessed as Low or Very Low in likelihood, as per the project RAM in Appendix 2 of this document, but are considered to have the most significant potential for delays to the Programme of the Bidder's project:

1. **Horizontal Directional Drilling (HDD) not possible for pipeline**

Cause: HDD proves difficult or impossible due to unfavourable ground geology.

Event: Pipeline hole not stable enough for preferred approach of HDD

Consequence: Have to look at alternative construction i.e. Open cut, meaning offshore concept needs to be re-visited resulting in cost and schedule impact

Mitigation strategy: Borehole surveys during FEED including external review by a specialist vendor, completing an open cut alternative FEED in the event HDD is unsuccessful. A pilot hole was also drilled to almost full length of the final hole, providing some certainty that ground conditions allow successful HDD. If the risk occurs, the open cut alternative will be adopted, impacting the programme by six months.

2. **Goldeneye integrity issues prior to first injection**

Cause: Goldeneye infrastructure preserved since cessation of hydrocarbon production, in preparation for decommissioning.

Event: Sections of infrastructure inspected prior to injection require upgrade

Consequence: Cost growth due to poor Goldeneye condition prior to first injection

Mitigation strategy: Existing infrastructure extensively surveyed, with further work planned to ensure integrity before and during the construction period. If a significant issue is discovered that requires immediate correction (e.g., pipeline section replacement, well remediation, etc.), it is estimated that this will impact the programme by six months.

3. **Unable to qualify rig for CO_2 intervention**

Cause: Lack of industry experience for CO_2 offshore drilling rigs means the modification scope required for safe operation on a pure CO_2 intervention is currently uncertain.

Event: Unable to find rig suitable for CO_2 intervention

Consequence: Prohibitive cost of developing new technology to use existing rig.

Mitigation strategy: Early works have included a feasibility study with specialist rig qualification companies to identify requirements for rig qualification and, for wireline interventions, working with Schlumberger on Decateur onshore experience in the US. In the event a suitable rig cannot be secured for CO_2 intervention, refitting an alternative rig could potentially result in a delay to the programme of six months.

4. **Redesign should the Competent Authority not agree that COMAH requirements have been suitably addressed in the project design**

Cause: Competent Authority does not agree that COMAH requirements have been suitably addressed in the project design.

Event: Project required by the Competent Authority to modify design.

Consequence: CAPEX/schedule overruns, relationships and reputation damaged

Mitigation strategy: Instructions provided to the Onshore CCC EPC contractor about the requirement to complete the COMAH report as part of their scope, and Shell to complete assessments on possible combustible products and toxicity on the solvent & associated degradation products. If this risk occurs during the engineering phase of the project, it is estimated to result in a four to six month delay to the Programme.

15. Risks and mitigations associated with consents

At the end of FEED, it is envisaged that risk and uncertainty will still exist in relation to three main consents required by the project. Each of these risks is described in detail below, including the mitigation strategy employed to reduce the risk to an acceptable level.

1. **Carbon Storage Permit will not formally be in place before Shell FID**

Cause: Delays in submitting the Carbon Storage Permit application to the EU Scientific Panel for review/comment.

Event: formal award of the permit is not expected until Q1 2016.

Consequence: Delay to Shell Final Investment Decision due to delayed permit award.

Mitigation strategy: In light of the assurance provided by the British Geological Society (BGS) external review on the Goldeneye store, the work done by Shell to develop the Monitoring Measurement and Verification (MMV) plan and extensive dialogue between Shell and the Competent Authority (DECC EDU/OGA) including the work done to agree the technical and commercial principles for the permit award, and also taking into account that Shell will receive feedback from the EU panel throughout the review process, a positive FID decision may still be given by Shell's Executive Committee on the condition that no significant changes are mandated in the formal permit award by the Secretary of State, who has already indicated he is minded to approve on the basis of Shell's original permit application. Shell will continue to work closely with the various regulatory and advisory bodies to ensure a successful outcome for all parties prior to the start of the next phase.

2. **REACH registration by Cansolv for solvent use in Europe**

Cause: REACH chemical registration dossier (and associated documents e.g. eMSDS etc.) and requirements for REACH authorisation are not properly documented and aligned with the PCCS timeline for the solvent to be available for use by the project.

Event: Cansolv unable to secure REACH registration to allow solvent transportation.

Consequence: Redesign of the capture plant (cost, schedule, operability impact)

Mitigation strategy: The Shell project team will continue to support their Cansolv counterparts to accelerate the registration process, in particular in completion of the chemical registration dossier and other documentation required to complete the process.

3. Pollution prevention and control (PPC) permit challenged by regulators

Cause: SEPA requirements for PPC may be more onerous than current FEED design.

Event: At the time of application for the PPC permit, redesign may be required after completion of the detailed engineering phase.

Consequence: Significant cost and schedule impact, possible resubmission of the onshore planning application.

Mitigation strategy: In order to mitigate this risk, extensive efforts have been made by the Shell project team to engage SEPA, provide them with data relevant to the proposed design and incorporate their views on what is Best Available Technique (BAT) and/or ALARP (As Low As Reasonable Practical) in the project design, which have been also been incorporated in the onshore planning application approved by Aberdeenshire Council. This also includes the SEPA recommendation for a combined water treatment plant for joint power station and CCP use, as described in more detail in section 13 of this document. The Shell project team will continue to work with the regulators in order to ensure a smooth process towards the award of the PPC permit.

16. Glossary of Terms

These definitions are used in the Peterhead CCS Project's Risk Management Plan:

Term	Definition
AfL	Agreement for Lease
ALARP	As Low As Reasonably Practicable
BAT	Best Available Techniques
BOM	Business Opportunity Manager
CCGT	Combined Cycle Gas Turbine
CCP	Carbon Capture Plant
CCS	Carbon Capture and Storage
CO_2	Carbon dioxide
COMAH	Control of Major Accident Hazards
Consequence	Same as Impact
Contingency	A fall back plan in case the mitigating actions fail and the risk occurs. Sometimes this is a dollar amount reserved for this purpose, and sometimes it is a set of actions.
CSRA	Cost and Schedule Risk Analyses
Current Risk	Assessment of the probability and impact of risk at the time of assessment, including all risk responses in place or naturally available without any preparation.
DE	Decision Executive
DECC	Department of Energy and Climate Change
DECC EDU	Department of Energy and Climate Change Energy Development Unit
Downside Risk	Outcome that is worse than the reference case
DPRIR	Design Phase Risk and Insurance Review
DRB	Decision Review Board
EMR	Electricity Market Reform
EOR	Enhanced Oil Recovery
EPC	Engineering, Procurement and Construction
ESAR	Economic and Schedule Assurance Review
FEED	Front End Engineering Design
FID	Final Investment Decision
GT	Gas Turbine
HDD	Horizontal Directional Drilling
HEMP	Hazard and Effects Management Process
HRSG	Heat Recovery Steam Generator
HSSE	Health Safety Security Environment
HV	High Voltage
Impact	Effect of the risk on the project objectives; This is expressed descriptively or numerically.
Impact Score	A value in the 0 – 5 range linking the qualitative impact assessment to a numerical score. The links are "None"=0, "Very Low" =1, "Low"=2, "Medium"=3, "High"=4, "Very High"=5. See APPENDIX 2 for full details.
Information Gathering	Actions to gather more information about a risk before deciding on the final response strategy
Issue	Actual problem that can affect objectives if not managed (potential for loss).
IT	Information Technology
ITT	Invitation to tender
KKD	Key Knowledge Deliverable

Mitigation	A type of Risk Response (used often in the context of downside risk)
MMV	Measurement, Monitoring and Verification
NOx	Nitrogen Oxides
NTR	Non-Technical Risk
OGA	Oil & Gas Authority
OPEX	Operating Expenditure
Opportunity	Potential for gain (favourable condition or situation, good idea, or risk response)
PER	Project Execution Review
PM	Project Manager
PMO	Programme Management Office
PPC	Pollution Prevention and Control
Preventive Risk Response	Actions taken before the risk occurs to reduce the probability and/or impact
Probability	Likelihood of occurrence of the risk, measured in %
Probability Score	A value in the 0 – 5 range linking the qualitative likelihood assessment to a numerical score. The links are "None"=0, "Very Low" =1, "Low"=2, "Medium"=3, "High"=4, "Very High"=5. See APPENDIX 2 for full details.
Project Risk Picture	A snap shot view (moment in time) of the project's risk assessment matrix, showing how many/which risks are of a certain severity
QA	Quality Assurance
RAM	Reliability, Availability and Maintainability, or Risk Assessment Matrix (see below)
RBS	Risk Breakdown Structure
Recovery Risk Response	Actions taken after the risk event occurs to reduce its impact/capture the value
Residual Risk	Predicted probability and impact after implementing all planned new risk responses
Risk	Uncertain future event that, if it occurs, will affect project objectives either positively (upside) or negatively (downside)
Risk Assessment Matrix	A 5X5 grid of Probability vs Impact. See APPENDIX 2 for full details.
Risk register	The document listing and describing all identified risks with response strategies, actions and owners.
Risk Response	Action taken to influence probability of risk occurring or impact on the project
Risk Response Strategy	Take (accept as-is, no further action), Treat (Mitigate), Transfer (share with/give over to others), or Terminate (change plan or scope to avoid).
Risk Severity	Expected impact of risk on project objectives (probability*impact=exposure)
RMS	Risk Management System
SCR	Selective Catalytic Reduction
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SSE	SSE Generation Ltd
TBA	To be Assigned
TECOP	Technical, Economic, Commercial, Organisational and Political risk areas.
Threat	Unfavourable condition or situation that can lead to risk (e.g., uncertainty, etc.)
Uncertainty	An unknown due to inherent lack of knowledge or ambiguity (weather, subsurface, etc.)
Upside Risk	Outcome that is better than the reference case
VP	Vice President
WWTP	Waste Water Treatment Plant

APPENDIX 1. Risk register

The project risk registers for the start and end of FEED are provided below.

A1.1. Open Risks At The Start of FEED

Risk ID	Risk Title	Risk Description	Risk Status	Planned Finish	Probability Potential risk	Consequence Potential risk Capex Cost	Schedule	Reputation	HSSE	Operability	Probability Residual risk	Consequence Residual risk Capex Cost	Schedule	Reputation	HSSE	Operability
D-0245	Staff experience with CO_2 moving on from project	Cause: Limited in-house staff who are experienced with CO_2 and a protracted process for confirmation if project approval to go ahead. Event: Staff move onto other projects resulting in a loss of CO_2 or CCS expertise or resource requirements are in excess of those planned. Consequence: Loss of experience, delay in project, reduced chance of success.	In Progress	30/12/2014	Very High		High			High	Low		Low			Low
D-0347	Late decisions by SSE may delay the schedule	Cause: Different governance processes/project drivers for Shell and SSE. Event: Key SSE decisions/activities may not be made in line with the overall integrated schedule Consequence: Schedule delay.	In Progress	31/12/2019	Very High		Medium						Low			
D-0299	Revision of CCS Directive in 2015 has onerous consequences	Cause: NGO / public pressure to tighten regulatory framework around CCS operations. Event: CCS Directive contains 2015 review date, and the outcome of review potentially has onerous implications for the project. Consequence: Cost and schedule implications for the project, with the imposition of additional obligations or constraints.	In Progress	01/12/2015	High	High	High			High	Medium	Low	Low			Low
D-0209	Competition complexity causes project delay and budget over-run	Cause: The magnitude/scale and complexity of the overall project (i.e. the long chain from the operating power plant to inject in depleted gas reservoir) and complexity of DECC competitive bid process and potentially changing political landscape over the next 18 months. Event: Do not have full control of cost and schedule due to DECC driven processes and timeline. Consequence: Project delay and budget overrun.	In Progress	30/12/2019	High	High	High	Medium			Medium	Medium	Medium	Medium		
D-0327	Cost escalation due to lack of competition and single source negotiation	Cause: Possible EPC Contractors have indicated that if the FEED Contractor is also allowed to bid for the EPC for the CCCC plant then the tender exercise will not be a level playing field. Event: Other contractors decline to bid. Consequence: Cost escalation due to lack of competition and single source negotiation.	In Progress	30/11/2015	High	Medium					Low	Very Low				
D-0220	Extended Post-Closeout Monitoring Requested by Regulator	Cause: Due to first of a kind nature of activity and uncertainty over CO_2 monitoring, regulator requests additional post closeout monitoring. Event: Monitoring is determined to require the platform to be left in place post cessation of injection. Consequence: Increased Opex and greater safety and environmental monitoring requirements.	Accepted	01/07/2015	Medium	High	High			High	Very Low	Medium	Medium			Medium
D-0211	Difficulties in agreeing CfD while EMR is ongoing.	Cause: The Electricity Market Reform (EMR) is currently ongoing; therefore there is a lack of clarity around the Project Contract/CfD structure. Event: Cannot enter into effective negotiations with DECC on the structure and terms of the contract/CfD. Consequence: Delay in signing project contract erodes shareholder value.	In Progress	07/12/2015	Medium		High			Very High	Very Low		Low			Very Low

Risk ID	Risk Title	Risk Description	Risk Status	Planned Finish	Probability Potential risk	Consequence Potential risk Capex Cost	Schedule	Reputation	HSSE	Operability	Probability Residual risk	Consequence Residual risk Capex Cost	Schedule	Reputation	HSSE	Operability
D-0223	Failure of Authority to obtain State Aid clearance for CfD Contract	Cause: CfD is considered to be a State Aid subsidy. Event: Legal challenge may be made against the provision of ALL CfD aid/funding from the state. Consequence: Onerous conditions lead to risk of project cancellation, or prolonged EU review process leads to excessive delay which affects Shell Bid.	In Progress	30/11/2015	Medium		High			Very High	Very Low		Very Low			Very Low
D-0272	Horizontal Directional Drilling (HDD) not possible for pipeline	Cause: Unfavourable geological ground conditions mean HDD proves difficult or impossible. Event: Pipeline hole not stable enough for preferred approach of HDD. Consequence: Have to look at alternative construction i.e. Open cut, meaning offshore concept needs to be re-visited resulting in cost and schedule impact.	Accepted	30/12/2017	Medium	Very High	High	High			Low	Medium	Low	Very Low		
D-0309	Higher levels of solvent degradation than model based design	Cause: Degradation/ make-up rates can be calculated but not proven (no capture plant at this scale). Event: degradation and make-up rates could be higher than anticipated. Consequence: OPEX increase from increased solvent, also increases the waste treatment requirements.	Accepted	06/05/2019	Medium	Very High		Medium		Medium	Very Low	Low		Low		Low
D-0330	Lack of availability or interest of subsea/pipelay vessels will cause delays to the project	Cause: Pipeline installation is to be tendered to main subsea vendors. Peterhead CCS work is small and there may not be interest in this work or vessel availability. Event: EPC contractors decline to bid for work Consequence: Cost escalation due to lack of competition or interest from the market.	In Progress	30/06/2015	Medium	High	Very High				Low	Medium	Medium			
D-0212	Delays or changes to project caused by senior Shell or SSE leadership changes	Cause: Leadership changes are a natural feature of all organisations but further change in leadership & business environment could impact attitude towards project. Event: Change in leadership brings change in appetite for CCS. Consequence: New leadership decides to re-scrutinise the project, causing delay in schedule & cost increase. Possible reputational impact with the public and the UK Government.	In Progress	26/03/2019	Low	Very High	Medium	Very High			Low	Very Low	Very Low	Very Low		
D-0243	Poorly managed interface with Goldeneye Decommissioning project	Cause: Goldeneye Decommissioning project is in early stages and interfaces between CCS & decommissioning project are insufficient. Event: Misalignment of asset decommissioning timeline with DECC CCS Competition results in decommissioning of equipment required for CCS project. Consequence: Schedule and cost impacts.	In Progress	30/12/2015	Low	Very High	Very High				Very Low	Low	Low			
D-0219	High public & regulator expectations around MMV	Cause: PCCS is a demonstration project and a past statement was made for a case for over monitoring the first few projects to address public concerns over CO_2 storage. There is uncertainty within regulatory parties regarding the monitoring and verification of CO_2. Event: Increased regulatory scrutiny and uncertainties delay permits and consents being issued by the regulator or lead to a requirement for more (or longer) monitoring than planned e.g. monitoring and verification plan, storage permit, monitoring facilities. Changes in academic/regulatory understanding of elements (like seasonal	Accepted	01/07/2015	Medium	High	Medium			Medium	Medium	Low	Low			Low

Risk ID	Risk Title	Risk Description	Risk Status	Planned Finish	Probability Potential risk	Consequence Potential risk Capex Cost	Schedule	Reputation	HSSE	Operability	Probability Residual risk	Consequence Residual risk Capex Cost	Schedule	Reputation	HSSE	Operability
		variability) might contribute to this risk. Consequence: Increased monitoring requirements leading to increased costs (capex and Opex). Delay in approval of storage permit.														
D-0225	Unforeseen challenges occur during the commissioning phase	Cause: Lack of operating familiarity with CO_2 and Amine within the consortium Event: Unforeseen challenges occur during commissioning/operations. Consequence: Higher Operating Cost, Higher Commissioning Cost, Reputation Damage, Shutdowns.	In Progress	30/12/2014	Medium	Medium	High				Low	Low	Low			
D-0242	Public opposition to siting of capture technology at PPS (visual/discharges/noise)	Cause: Capture technology at PPS Event: Public opposition to the capture technology at PPS. CCS project perceived as tipping point for unacceptable pollution levels in NE Scotland. Consequence: Refusal of permits or delay. Schedule delays. Negative reputational impact.	In Progress	30/12/2017	Medium		Medium	High			Very Low		Medium	Low		
D-0259	Scaled up technology does not perform as expected	Cause: Scale up of the CO_2 capture technology has not been proven. Event: Absorber does not perform as well as modelled once scaled up. Capture technology does not perform as effectively as modelled. The cool/warm up time is excessive. Consequence: Reduced injection volumes, Operating Cost Increases, Potential Total failure, Level of contingency increases.	In Progress	01/04/2019	Low	High	Very High	High		Very High	Very Low	Very Low	Very Low	Very Low		Very Low
D-0304	Onerous site closure obligations	Cause: Risk tolerance of regulators for early demonstration projects leads to onerous site closure obligations. Event: Submission of Storage Permit application for Goldeneye. Consequence: Elevated project costs and possible delay / extension to decommissioning and handover.	Accepted	01/07/2015	Medium		Medium			High	Low		Low			Low
D-0358	Well cementations unsuitable for CO_2 injection	Cause: Poor cementation of Goldeneye production wells. Event: When wells worked over, cement bond found to be unsuitable on multiple wells. - Potential leak to surface. Consequence: New wells will need to be drilled (or sidetracks).	Accepted	30/09/2019	Low	Very High	Very High	High	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
D-0269	Lack of suitable & available jack-up rig for well workover campaign	Cause: A short duration rig contract is required in a market where there is only around a dozen suitable jack-up rigs - it addition to short duration, Goldeneye is in water depth which is the upper limit of jack ups and there are only a few capable rigs worldwide. Event: It may not be possible to procure a suitable jack-up rig at the desired time (drilling contractor interest levels could be low). Consequence: Delays to schedule and/or increased cost for Rig hire.	In Progress	30/12/2018	Medium	High	High				Low	Low	Low			

Risk ID	Risk Title	Risk Description	Risk Status	Planned Finish	Probability Potential risk	Consequence Potential risk Capex Cost	Schedule	Reputation	HSSE	Operability	Probability Residual risk	Consequence Residual risk Capex Cost	Schedule	Reputation	HSSE	Operability
D-0344	Other gas turbines (GT11/GT12) remain shut-in at the power station	Cause: Power market conditions could mean GT11/GT12 gas turbines not operated & burden GT13 for CCS with increased running costs Event: GT11 and/or GT12 not running & GT13 attracts greater share of power station costs. Consequence: More operating costs are assigned to the CCS project; possibly prohibitive costs.	Accepted	06/06/2019	Low	Very High		Very High			Very Low	Very Low		Very Low		
D-0273	Protracted acquisition of Goldeneye offshore facilities, or proposed terms not acceptable	Cause: Peterhead CCS Project needs to secure the pipeline and platform from the current owners. Event: Negotiations take longer than expected. Decommissioning team may not keep waiting for CCS and may just decommission the platform. Consequence: Schedule delays, Cost increases.	In Progress	31/12/2014	Medium	High	High				Very Low	Medium	High			
D-0368	Negative effect of dense phase CO_2 on non-metallic elastomers	Cause: Solvent effect of CO_2 on elastomers Event: Deterioration of elastomers. Consequence: Leakage or failure of CO2, leads to Opex increases.	Accepted	30/12/2014	Medium	High	High			High	Low	High	High			High
D-0375	Increased corrosion Conductor/Surface casing (non CO_2 related)	Cause: Conductor/Surface casing corrosion (non CO_2 related). Event: Corrosion - structural risk. Consequence: Well has to be abandoned, increased cost from drilling new well.	In Progress	30/11/2023	Low	Very High	Very High			High	Very Low	High	High			High
D-0244	Limited POB increases offshore construction cost	Cause: Offshore POB is limited (e.g. inability to secure Heavy Duty rig or accommodation vessel). Event: Costs of installation offshore escalate, or work has to be switched onshore at extra cost. Consequence: Increased capex and delayed schedule.	Proposed	30/12/2017	Low	Very High	Very High				Very Low	Medium	Medium			
D-0257	Unplanned temporary / permanent technical unavailability of single GT	Cause: GT breaks or lifetime is exceeded. Event: GT doesn't last until end of injection period. Consequence: Requirement to connect a second GT part way through the project leading to additional CAPEX requirement and loss of CfD revenue.	In Progress	30/11/2015	Low	Very High	Very High	Medium		High	Very Low	Low	Low	Low		Low
D-0396	Cost growth because of poor Goldeneye physical condition prior to first injection	Cause: Goldeneye infrastructure preserved since cessation of hydrocarbon production, in preparation for decommissioning. Event: Some sections of infrastructure inspected prior to injection & require upgrade for injection. Consequence: Cost growth because of poor Goldeneye physical condition prior to first injection.	Accepted	30/12/2017	Low	Very High	Very High	Medium		Very Low	Very Low	Very Low	Very Low	Very Low		Very Low
D-0314	Adverse public and/or stakeholder to Peterhead Power Station COMAH classification.	Cause: Chemicals used at capture plant force reclassification of PPS for COMAH purposes. Event: PPS re classified as a COMAH Tier 1 site. Consequence: Public reaction or support to the classification change causes a reputational impact.	In Progress	30/07/2014	Medium			Medium			Very Low			Very Low		
D-0351	DECC does not accept commercial deviations from the bid	Cause: DECC require that Shell adhere to the terms of the Bid, to the extent that such changes are unrelated to any changes made by DECC to the Bid submitted by Shell. Event: DECC request changes to be made by Shell to its Bid. Consequence: Reputational damage between DECC & the participants in the project.	In Progress	30/11/2015	Medium			Medium			Low			Low		

Risk ID	Risk Title	Risk Description	Risk Status	Planned Finish	Probability Potential risk	Consequence Potential risk Capex Cost	Schedule	Reputation	HSSE	Operability	Probability Residual risk	Consequence Residual risk Capex Cost	Schedule	Reputation	HSSE	Operability
D-0247	Dense phase CO_2 release from offshore facilities	Cause: Riser release due to, for example, external corrosion, ship collision. Topsides release due to dropped object, human error, etc. Event: CO_2 Release. Consequence: Offshore facility engulfed in CO_2 with potential for serious injury and potential fatalities. Reputational impact.	In Progress	30/12/2014	Very Low			High	High	High	Very Low			Medium	Medium	Medium
D-0228	Soft seal material selection is unsuitable	Cause: Seals are unproven with CO_2. Event: Performance may be below expected standards. Consequence: Loss of containment of CO_2, resulting in increased Opex & reputational damage for CO_2 release.	Accepted	31/12/2014	Medium			High		High	Very Low			Low		Low
D-0306	Local communities do not feel benefit from CCS project	Cause: No dedicated strategy to maximise positive benefits; i.e. local content and Social Investment. Event: Local community feel aggrieved that balance of impacts and benefits is not right and they are taking on additional impacts for little benefit. Consequences: Conditions imposed by regulator as part of permit conditions, negative reputational impact.	Accepted	30/12/2020	Medium			High			Low			Low		
D-0226	Operations Staff lack CO_2 operating experience	Cause: Operations staff has little or no CO_2 operating experience. Event: Lack of knowledge leads to poor operability. Consequence: Potential loss of containment, inefficient operations leading to higher cost.	In Progress	30/11/2015	Medium			Medium		Medium	Low			Low		Low
D-0301	Overlap with adjacent licensed acreage	Cause: Desire to define storage site and / or storage complex boundaries that overlap with adjacent licensed acreage. Event: Shell is required as site Operator to consult with the Operators of license acreage where overlaps occur. These other Operators object on the grounds of unacceptable operational conflict. Consequence: Lengthy negotiations with DECC and other operators to persuade them of limited operational impact. Possible additional monitoring.	Proposed	01/07/2015	Medium		Medium			Medium	Low		Low			Low
D-0371	Shell's Bid, or Bid Update (ISBU) is challenged because due (ITPD) process has not been followed	Cause: This could occur if for example the Bidder is rendered ineligible, or the Bid invalid, an ISBU submission is not made in the time window stipulated under the ITPD. Event: Reserve Bidder or other 3rd party challenge validity of Shell Bid. Consequence: Schedule delay while challenge resolved, reputational damage.	In Progress	31/12/2015	Medium		Medium	Medium			Low		Low	Low		
D-0222	Major legislative changes occur which affect the viability of the CCS Competition and/or the project	Cause: Project must comply with UK legislation and EU requirements. Event: UK legislative changes/ EU requirements alter occur impacting project. Consequence: Cost impact, schedule delay or project is deemed unviable.	In Progress	31/12/2045	High	Medium	Low	Low		Medium	Medium	Very Low	Very Low	Very Low		Very Low
D-0246	Restricted CCS supply chain due to lack of resources	Cause: CCS supply chain restrictions. Event: Impacts supply chain due to material/human resource scarcity in the area Consequence: May impact cost during Concept Select, Define/FEED, Development and Construction of the project. Project stage gates not achieved & schedule delays experienced.	In Progress	30/12/2017	Medium	Medium	Medium				Low	Medium	Medium			

Risk ID	Risk Title	Risk Description	Risk Status	Planned Finish	Probability Potential risk	Consequence Potential risk Capex Cost	Schedule	Reputation	HSSE	Operability	Probability Residual risk	Consequence Residual risk Capex Cost	Schedule	Reputation	HSSE	Operability
D-0262	Unforeseen ground conditions/contamination are uncovered	Cause: Excavation of ground is required during project construction. Event: Unforeseen ground conditions/contamination is uncovered. Consequence: Additional costs for re-design of the foundations or removal of contamination.	In Progress	13/11/2014	Medium	Medium	Medium				Very Low	Low	Low			
D-0342	Immature regulatory requirements around capture plant chemicals influences costs and schedule	Cause: Immature regulatory requirements around capture plant chemicals. Event: Permits not in on time - regulatory requirements enforce change to plant. Consequence: Cost and schedule impact.	In Progress	15/11/2015	Medium	Medium	Medium				Very Low	Very Low	Very Low			
D-0288	Novel Materials and Equipment	Cause: Materials and equipment will be of a novel plant and reuse. Event: Unforeseen premature degradation of plant and especially existing equipment. Consequence: Additional Opex costs and deferments of injection while the work is carried out.	In Progress	30/06/2017	Low					High	Very Low					Medium
D-0284	Flakes of epoxy resin from pipeline block well filters	Cause: Reuse of the existing goldeneye pipelines Event: Portions of the epoxy resin coating flake off and well filters block frequently. Consequence: More filter cleaning is required therefore requiring more platform visits and man-hour exposures.	Proposed	30/12/2014	Low					Low	Low					Low
D-0352	Early Contaminants left in the pipeline at start-up block well filters	Cause: Use of the new offshore pipeline and existing Goldeneye pipelines. Event: Early contaminants at start-up / commissioning phase, i.e. any debris /dust/ etc. on flushing the pipeline, will block well filters frequently. Consequence: More filter cleaning is required therefore requiring more platform visits and man-hour exposures.	Proposed	30/12/2014	Low					Low	Very Low					Very Low
D-0365	Failure of CO_2 gas detection	Cause: CO_2 detector failure due to temperature drop Event: Failure of CO_2 gas detection. Consequence: HSSE exposure, unable to inject CO_2, potential health impact.	Accepted	30/12/2029	Low			High		High	Very Low			Medium		Medium
D-0250	Emission of nitrosamine and other degradation products	Cause: Flue gas emission. Event: Long term health impacts are not fully understood. Consequence: Litigation, HSSE impacts.	In Progress	30/07/2014	Low			High	High	Medium	Very Low			Low	Low	Low
D-0400	3rd party indicates that store is unsuitable delaying license and subsequent FID	Cause: 3rd party/NGO/academic performs survey of seabed near store. Event: survey identifies elevated CO_2, hydrocarbon, or other issue near store. Consequence: significant reputation/press attention, significant cost to execute contingency plans.	Accepted	30/11/2015	Low		High				Very Low		Very Low			

Risk ID	Risk Title	Risk Description	Risk Status	Planned Finish	Probability Potential risk	Consequence Potential risk Capex Cost	Schedule	Reputation	HSSE	Operability	Probability Residual risk	Consequence Residual risk Capex Cost	Schedule	Reputation	HSSE	Operability
D-0266	Serious local concerns emerge, leading to objections to the project	Cause: Gaps in information provision and inadequate/ineffective local consultation result in local people feeling disenfranchised and developing negative attitudes to the project, ultimately culminating in objections. Event: objections lodged by local residents groups when we submit our planning applications. This could also lead to an NGO campaign starting in opposition to the project. Consequence: regulators come under pressure from community to hold public inquiry, impose more stringent conditions. DECC cannot take FID on Shell project due to groundswell of public opinion against the project.	In Progress	30/11/2015	Low		High	High			Very Low		Very Low	Very Low		
D-0249	Safety regulations for CO_2 transportation are immature	Cause: Safety regulations are immature Event: Introductions of new HSE legislation that people are not aware of e.g. DSEAR - Dangerous Substances and Explosives Atmosphere Regulations. Consequence: Increased cost to rectify and ensure the plant complies with legislation retrospectively. The project is treating CO_2 as a Hazardous Substance. The H&SE have sufficient power under existing regulations to ensure that we do the right thing (i.e. demonstrate ALARP, BAT, etc.). A precautionary approach is, however, advised.	In Progress	30/11/2015	Low	High	High				Very Low	Very Low	Very Low			
D-0404	Poor condition of existing Goldeneye wells	Cause: There is a possibility that there may not be sufficient wall thickness (especially taking into account the CO_2 cooling effects) on the wall thickness of the conductor and/or surface casing for the 10 years operation period for PCCS project. Event: New wells will need to be drilled if the well integrity is deemed unsatisfactory over the lifetime of the project. Consequence: Schedule and costs impacts.	Accepted	30/06/2016	Low	High	High				Very Low	Medium	Medium			
D-0278	Scottish Independence referendum leads to change or cancellation of CCS Competition	Cause: Independence referendum in 2014. Event: Independence is taken as the decision Consequence: Scotland does not recognise the Energy Act and refuses to honour the CCS Competition and/or CfDs. Equally, there is a risk that HMG pays for the FEED in Scotland and Scotland benefits from the CCS plant; HMG then tries to claim the money back from a newly independent Scotland and Scotland refuses.	Proposed	01/10/2014	Low	High	High			High	Low	Medium	Medium			Medium
D-0224	Project is required to use novel technology that is still the subject of intellectual property rights, leading to potential litigation	Cause: Project is required to use novel technology that is still the subject of intellectual property rights. Event: Design implementation or operation of the project infringes a third party's intellectual property rights. Consequence: Shell is exposed to risk of litigation.	In Progress	30/11/2015	Low	High	High			Medium	Very Low	Medium	Medium			Low

A1.2. Risks At The End of FEED.

Risk ID	Risk Title	Risk Description	Risk Status	Planned risk closure date	Current severity/ Due Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE	Mitigation Action ID	Mitigation Action Title	Mitigation Action Status	Mitigation Action Due Date	After Action severity Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE
D-0209	Competition complexity causes project delay and budget over-run	Cause: The magnitude/scale and complexity of the overall project (i.e. the long chain from the operating power plant to inject in depleted gas reservoir) and complexity of DECC competitive bid process and potentially changing political landscape. Event: Do not have full control of cost and schedule due to DECC driven processes and timeline. Consequence: Project delay and budget overrun, leading to stakeholder concerns over deliverability of project	Taken	30/12/2019	C [H/H]	SCH [H/H]		REP [H/M]					A-0193	Shell/SSE Steering Group meetings	Closed	30/12/2019	C [M/M]	SCH [M/M]	OP [M/L]	REP [M/M]				
													A-0435	Actively engage UK Gas Advocacy network	Closed	26/03/2019								
D-0303	DECC and/or EU Commission impose onerous requirements as part of Permit award	Cause: Risk tolerance of regulators for early demonstration projects leads to the imposition of onerous conditions for awarding the storage permit. These could take the form of: onerous site closure obligations, issues with proposed transfer of responsibility, onerous monitoring regime and financial responsibility requirements. Event: Storage permit is granted with onerous conditions attached. Consequence: Potential requirement for significant level of additional monitoring, financial security and acceptance of more liability impacts costs and project schedule.	Active	31/03/2016	C [H/H]	SCH [H/M]	OP [H/H]						A-0316	Early and detailed engagement with regulators	In Progress	30/12/2015	C [M/L]	SCH [M/L]	OP [M/L]					
													A-0317	External Review of Permit and modelling of storage	Closed	31/08/2014								
D-0286	Surface release of CO_2 and reservoir fluids at well during workover/well intervention activities	Cause: Reservoir at high pressure full of CO_2 and some condensate + gas Event: High expansibility of CO_2 and operational issue during well operations (workover, well intervention activities) might lead to release scenario. This can be due to accidental damage to the tree/wellhead, or non-adherence to operational procedures during a CO_2 well workover Consequence: Well/Platform unavailable for injection, leading to loss of revenues	Active	30/12/2031	C [M/VH]	SCH [M/VH]	OP [M/VH]	REP [M/VH]	P (HSE) [C/5]				A-0303	CO_2 workover procedures rig / wireline operability under CO_2 conditions	In Progress	31/12/2015	C [VL/H]	SCH [VL/VH]	OP [VL/VH]	REP [VL/VH]	P (HSE) [A/3]			
													A-0361	Investigate how to qualify rigs for CO_2 intervention	In Progress	30/09/2017								
													A-0712	Prepare response to cover event of Hydrocarbons + coming to surface during any CO_2 leak	Proposed	24/01/2019								
													A-0724	Run workshop with Denbury and/or Occidental in USA	Closed	30/08/2015								
													A-0725	Recovery strategy - Blow Out Preventer on the beach etc.	Active	31/12/2015								
D-0309	Higher levels of solvent degradation than model based design	Cause: Degradation/ make-up rates can be calculated but not proven (no capture plant at this scale). Event: degradation and make-up rates could be higher than anticipated Consequence: OPEX increase from increased solvent, also increases the waste treatment requirements	Active	06/05/2019	C [M/VH]		OP [M/M]	REP [M/M]					A-0395	Consider additional testing of solvent	Closed	31/03/2015	C [VL/L]		OP [VL/L]	REP [VL/L]				
													A-0456	Relay results of testing back to project	Active	31/12/2015								

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D-0573	Unexpected increase in corrosion in wells owing to starting and stopping and the formation water + CO_2	Cause: Unexpected combination of ions in the water caused by CO_2 interactions and the possible occasional presence of oxygen and/or solvent degradation products could react with the metal and cause corrosion and failure of the well components. Event: Every time a well is turned off, there is a possibility that water will flow back into the well. Consequence: Increased corrosion in well, well could be permanently shut-in leading to requirement for new well to be drilled (cost/schedule impact)	Active	31/08/2030	C [M/VH] C [M/VH]	SCH [M/VH]							A-0632	Selection of well components to minimise corrosion risk, performing corrosion experiments, sparing strategy	Closed	31/08/2015	C [L/L]	SCH [L/L]						
													A-0633	Well Cat modelling	In Progress	30/12/2016								
													A-0634	Integrity logging during workover	In Progress	01/03/2020								
													A-0635	Reservoir section abandonment	In Progress	01/03/2020								
													A-0636	Spare well available (i.e. don't abandon 5th well)	In Progress	12/12/2015								
													A-0637	Book a rig slot when we are doing start up -to prevent us having to remobilise rig to drill new wells / execute corrective measures (e.g. tubing leak)	Closed									
													A-0638	Have rig on site while starting up (delay drilling to 2019)	Closed									
D-0223	Failure or significant delay by Authority to obtain State Aid clearance for Project contracts being the Project Contract with the Authority and the CfD Contract with LCCCL	Cause: CfD is considered to be a State Aid subsidy (also applies to the capital grant in the Project Contract with DECC) Event: Legal challenge may be made against the provision of all aid/funding from the state Consequence: Delay impacting Shell bid, or risk of project cancellation if State Aid case not approved.	Active	30/06/2016		SCH [M/H]	OP [M/VH]						A-0437	Discuss with DECC the implications that other State Aid cases will have on our application	Closed	30/05/2014		SCH [VL/VL]	OP [VL/VL]					
													A-0484	Ongoing dialogue to support HMG CCS State Aid application(s)	In Progress	30/06/2016								
D-0250	Emission of nitrosamines and other degradation products	Cause: Emission & other degradation products from the onshore CCP Event: Potential health impacts are not effectively communicated via public consultation (or fully understood by affected stakeholders), or Shell/3rd party emissions modelling is unacceptable to regulators. Consequence: Impact on design causing cost increase & schedule delay from additional regulatory requirements, stakeholder reputation damage & possible litigation), HSSE impacts	Active	31/12/2015	C [M/M]	SCH [M/M]	OP [M/M]	REP [M/H]	P (HSE) [C/3]				A-0250	Undertake Health Risk Assessment	Closed	01/09/2013	C [VL/VL]	SCH [VL/VL]	OP [VL/L]	REP [VL/L]	P (HSE) [A/1]			
													A-0251	Investigate inclusion of De-NO_x system to minimise the risk of nitrosamine formation	Closed									
													A-0252	Perform nitrosamines and nitramines formation emission dispersion modelling/ Environmental chemistry	Closed	31/03/2015								

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													A-0470	Develop clear messaging on nitrosamines and share this with the local community through public consultation events'	Closed	31/12/2015								
													A-0502	Secure Shell Occupational Health resource for amine toxicology expertise & prepare report in support of solvent use.	Closed	31/12/2014								
													A-0662	Investigation of nitrosamine risk	Closed	31/05/2015								
D-0614	Performance of WWTP based on FEED design	Cause: Regulator requirement for shared waste water treatment facility to be used by both SSE and Shell at the power station. Event: Ondeo FEED for shared WWTP for both PPS & CCP proposes a larger design than originally thought, and raised concerns over operability, discharge limits as well as construction cost/schedule. Consequence: Higher CAPEX cost & time to construct proposed WWTP, also potential impact on operability due to complex design	Active	31/12/2016	C [M/H]	SCH [M/VL]	OP [M/H]	REP [M/H]					A-0726	Seek assistance from water treatment experts including feedback on EPC tender proposals	In Progress	31/10/2015	C [L/L]	SCH [L/VL]	OP [L/L]	REP [L/L]				
													A-0730	Identify offsite disposal route & associated costs for acid wash effluent	In Progress	31/10/2015								
D-0220	Extended Post-Closeout Monitoring Requested by Regulator	Cause: Due to first of a kind nature of activity and uncertainty over CO_2 monitoring, regulator requests additional post closeout monitoring. Event: Monitoring is determined to require the platform to be left in place post cessation of injection. Consequence: Increased OPEX and greater safety and environmental monitoring requirements	Active	31/01/2016			OP [M/H]						A-0212	Address with DECC in the permit discussions	In Progress	31/12/2015			OP [VL/M]					
													A-0392	Employ enhanced monitoring	Closed	30/12/2014								
D-0464	Unavailable SSSV due to low temp requirements	Cause: Only 4 SSSVs are required for a very specific design specification, and concerns over whether this may be economically attractive or viable for valve suppliers Event: Vendors unwilling to provide bids for work, or delay in securing contract/valves Consequence: Delay in achieving first injection date	Active	31/03/2016		SCH [H/M]							A-0705	Vendor feasibility study to develop a SSSV valve suitable for low temperatures	Active	31/03/2016		SCH [VL/VL]						
D-0603	UK Government elected in 2015 chooses to not support the project	Cause: 2015 General Election could result in a revised political direction. Topics of potential concern include UK position within EU & relationship with EU Commission, as well as devo max powers passed to Scottish Government despite No vote in Scottish independence referendum. Event: UK Government spending review affects the amount of public funding available, UK referendum on EU relationship impacts State Aid case & increased Scottish government devolved powers impact the project. Consequence: Delay to project while political change or uncertainty is assessed	Active	31/05/2016		SCH [M/H]							A-0707	Monitor Scottish devolution proposals & their impact on project	In Progress	31/05/2016		SCH [L/L]						

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D-0257	Unplanned temporary / permanent technical unavailability of single GT	Cause: Gas turbine dedicated to CCS use breaks or lifetime is exceeded. Event: Gas turbine doesn't last until end of injection period Consequence: Requirement to connect a second turbine part way through the project leading to additional CAPEX requirement and loss of CfD revenue	Active	31/12/2015	C [L/VH]	SCH [L/VH]	OP [L/H]	REP [L/M]					A-0266	Estimate Cost for connecting second GT	Closed		C [VL/L]	SCH [VL/L]	OP [VL/H]	REP [VL/L]				
													A-0268	Establish Cost of Power at Peterhead	Closed									
													A-0269	Establish Cost of Power at St Fergus	Closed									
													A-0270	Establish Availability and Cost of Gas at Peterhead	Closed									
													A-0271	Establish Availability and Cost of Gas at St Fergus	Closed									
													A-0273	Commercial Treatment of PPS availability	In Progress	30/11/2015								
D-0396	Goldeneye integrity issues prior to first injection	Cause: Goldeneye infrastructure preserved since cessation of hydrocarbon production, in preparation for decommissioning. Event: Some sections of infrastructure inspected prior to injection & require upgrade for injection Consequence: Cost growth because of poor Goldeneye physical condition prior to first injection	Active	30/12/2017	C [L/VH]	SCH [L/VH]	OP [L/VL]	REP [L/M]					A-0429	Integrity survey assessment & status vs baseline	Proposed	31/12/2017	C [VL/VL]	SCH [VL/VL]	OP [VL/VL]	REP [VL/VL]				
													A-0430	Remediation plan vs timeline of project	In Progress	30/12/2015								
													A-0431	Opportunity to divest for non-required items	Closed	30/12/2017								
D-0218	3rd party indicates that there is a CO_2 leak	Cause: 3rd party performs survey of seabed near store Event: survey identifies elevated CO_2, hydrocarbon, or other issue near store Consequence: significant reputation/press attention, significant cost to execute contingency plans	Active	31/12/2042		SCH [L/VH]	OP [L/H]	REP [L/H]					A-0343	External review and verification of storage	Closed	31/08/2014		SCH [VL/M]	OP [VL/L]	REP [VL/L]				
													A-0344	Extensive monitoring plan	Closed	01/01/2050								
													A-0391	Inject tracer along with CO_2	Closed	01/01/2023								
													A-0712	Prepare response to cover event of Hydrocarbons + coming to surface during any CO_2 leak	Proposed	24/01/2019								
D-0575	Cansolv are not able to secure REACH registration	Cause: REACH chemical registration dossier (and associated documents e.g. eMSDS etc.) and the requirements to gain REACH authorisation are not properly documented and aligned with the PCCS timeframe to ensure that solvent is available for use within the project. Event: Cansolv are not able to secure REACH registration to allow the transportation of solvent. Consequence: Redesign of the capture plant (cost, schedule, operability impact)	Active	31/12/2016	C [L/H]	SCH [L/VH]		REP [L/H]					A-0643	Securing REACH certification as a requirement in the Cansolv Licence Agreement	In Progress	31/12/2016	C [VL/VL]	SCH [VL/VL]		REP [VL/VL]				
													A-0644	Support Cansolv in achieving registration of Cansolv solvent	In Progress	31/12/2016								
D-0272	Horizontal Directional Drilling (HDD) not possible for pipeline	Cause: Unfavourable geological ground conditions mean HDD proves difficult or impossible. Event: Pipeline hole not stable enough for preferred approach of HDD Consequence: Have to look at alternative construction i.e. Open cut, meaning offshore concept needs to be re-visited resulting in cost and schedule impact	Active	30/12/2017	C [L/VH]	SCH [L/VH]							A-0359	Perform geotechnical investigations	Closed	30/05/2014	C [L/M]	SCH [L/L]						
													A-0360	Engage with regulators on proposed pipeline landfall options	In Progress	31/12/2015								
													A-0409	Additional 3rd party review of technical feasibility and risks	Closed	31/12/2014								
													A-0498	3rd Party Review of	Closed	31/07/2014								

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														Drilling Contractor Results										
													A-0519	Drill Pilot hole	Closed	30/06/2015							
													A-0520	Offshore bore hole(s) at exit area and perhaps intermediate	Closed	30/09/2016							
													A-0521	HDD Scope to be implemented early	Closed	26/08/2014							
													A-0523	Develop a decision based contingency plan	Closed								
													A-0524	Develop alternative open cut as full FEED deliverable as part of the pipeline contractor FEED scope	Closed	30/03/2015							
													A-0525	Build sufficient flexibility in contract with Government & Manage expectations with Government to prevent termination of agreement	Active	31/12/2015							
													A-0526	Thorough Prequalification of HDD contractors	Active	30/10/2015							
													A-0527	Appropriate contract clauses with HDD contractor with respect to performance	Active	30/10/2015							
													A-0528	Thorough understanding of HDD Scope Of Work (by company but also FEED contractor)	In Progress	30/10/2015							
													A-0529	Application of lessons learned from previous projects	In Progress	31/12/2016							
													A-0530	Methodology (Break through at very end, potential Environmental spill)	Closed	31/01/2015							
													A-0531	Consultation with SNH prior to EIA submission	Closed	30/03/2015							
													A-0532	Should HDD not be possible - Consider additional actions to offset extension of construction time and its impact to the community	In Progress	30/12/2017							
													A-0533	Underground services survey	Closed	30/03/2015							

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													A-0713	Review the schedule against different outcomes for the onshore crossing (HDD or open-cut)	In Progress	30/10/2015								
D-0294	CO_2 migrates above primary seal via flow behind injection casing	Cause: Loss of cement bond Effect: Flow behind casing Consequence: forced to cease using injection well, leading to well intervention and abandonment of well. Possible license issues, increased monitoring costs	Active	30/12/2035	C [L/VH]		OP [L/VH]	REP [L/H]					A-0366	Cement quality logging	Proposed	01/04/2017	C [VL/L]		OP [VL/VH]	REP [VL/M]				
													A-0367	Monitoring for flow behind casing	Proposed	30/12/2031								
D-0342	Immature regulatory requirements around capture plant chemicals influences costs and schedule	Cause: Immature regulatory requirements around capture plant chemicals Event: Permits not in on time - regulatory requirements enforce change to plant Consequence: Cost and schedule impact	Active	01/01/2020	C [L/L]	SCH [L/VH]							A-0420	Engage with regulatory authorities	In Progress	31/12/2015	C [VL/VL]	SCH [VL/VL]						
D-0641	Seismic survey cost increases	Cause: Low oil price, market downturn Event: Scarcity of suitable seismic survey vessels to execute MMV plan Consequence: Unable to secure vessel for survey. Schedule slippage or cost increases from having to use over-specified vessels	Active	01/01/2018	C [L/VL]	SCH [L/VH]							A-0751	Secure vessel as early as possible	Proposed	30/03/2016	C [VL/VL]	SCH [VL/VL]						
D-0219	High public & regulator expectations around MMV	Cause: PCCS is a demonstration project and a case was made at one point for over monitoring the first few projects to address public concerns over CO_2 storage. There is uncertainty within regulatory parties regarding the monitoring and verification of CO_2. Event: Increased regulatory scrutiny and uncertainties delay permits and consents being issued by the regulator or lead to a requirement for more (or longer) monitoring than planned e.g. monitoring and verification plan, storage permit, monitoring facilities. Changes in academic/regulatory understanding of elements (like seasonal variability) might contribute to this risk. Consequence: Increased monitoring requirements leading to increased costs (CAPEX and OPEX). Delay in approval of storage permit.	Active	31/03/2016	C [M/VL]	SCH [M/M]	OP [M/M]						A-0210	Address in MMV Plan development	Closed	01/07/2015	C [M/VL]	SCH [M/L]	OP [M/L]					
													A-0246	Enhance baseline survey	Closed	29/08/2014								
													A-0343	External review and verification of storage	Closed	31/08/2014								
													A-0418	External review and verification of storage	Closed	31/07/2014								
													A-0434	Work with academics to measure benthic CO_2 variability	Active	31/12/2015								
D-0226	Operations Staff lack CO_2 operating experience	Cause: Operations staff has little or no CO_2 operating experience. Event: Lack of knowledge leads to poor operability. Consequence: Potential loss of containment, inefficient operations leading to higher cost	Active	31/12/2016			OP [M/M]	REP [M/M]					A-0219	Requirement for an Operations Philosophy	Closed	31/01/2014			OP [L/L]	REP [L/L]				
													A-0220	Develop a training and development plan for operations personnel	In Progress	31/12/2016								
													A-0497	Transition of Goldeneye competence from the asset to the project, or come up with a plan to develop such competence	In Progress	31/12/2015								

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D-0246	Restricted CCS supply chain due to lack of resources	Cause: CCS supply chain restrictions Event: Impacts supply chain due to material/human resource scarcity in the area Consequence: May impact cost during Concept Select, Define/FEED, Development and Construction of the project. Project stage gates not achieved & schedule delays experienced.	Active	30/12/2017	C [M/M]	SCH [M/M]							A-0243	Construct the contracting strategy matrix so as to maximise EPC synergies and minimise/identify the small packages of work	Closed		C [L/M]	SCH [L/M]						
													A-0412	Work with Scottish Enterprise	Closed									
													A-0413	Perform local content workshop	Closed	30/11/2014								
													A-0351	Develop an overall Local Value Proposition proposal for the project, get internal endorsement and budget and test with local communities	In Progress	31/12/2015								
													A-0464	Develop Local Content Strategy for the construction and operations phases of the project	In Progress	31/12/2015								
D-0553	Supply chain & schedule inefficiency between Shell, SSE & vendors due to multiple EPC contractors on site	Cause: There could potentially be 2 EPC contractors working at PPS during the construction phase. Site will be congested in terms of access/site management and complicated by the fact that existing permit/planning approval is based on historical SSE permits/planning. Specifically covers impact during execution phase due to SSE systems at site, permitry, access issues etc. Event: CDM - 1 principle contractor is typically identified for a single site. In the event of HSE incident and particularly for incidents in shared areas, the CDM compliance is complex where 2 contractors are involved. Permits - in the event of environmental discharges exceeding the allowed limits, the process of determining the main source of non-compliance is difficult and resolution may create substantial delay/standby to either or both parties. Consequence: cost and schedule delays, multiple EPC contractors creating complications in compliance to CDM, permits etc. and lack of clear accountabilities	Active	31/12/2015	C [M/M]	SCH [M/M]							A-0613	Investigate potential for single EPC contractor	Active	31/10/2015	C [VL/VL]	SCH [VL/VL]						

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D-0561	Offshore HDD is completed late, resulting in late release of the turf to the onshore EPC contractor	Cause: The current schedule allows for the HDD to start before the site preparation work associated with the compression facility commences. Both works are located within the same premise within PPS. Depending on the stage of the HDD work, the work can be quite disruptive in term of the work foot print requirement as the pipe stringing area is quite long and wide. Event: Delay in the HDD completion due to unfavourable soil conditions or other causes), impacts schedule & therefore cost of Onshore EPC workscope. Consequence: cost & schedule impact, also consider contingency execution planning to prepare the compression area (or progress some portion of the compression facility work) while the HDD work is on-going.	Active	31/12/2017	C [M/L]	SCH [M/M]							A-0612	Manage HDD delay within onshore EPC scope of work	In Progress	30/10/2015	C [VL/VL]	SCH [VL/VL]						
D-0306	Local communities do not feel benefit from CCS project	Cause: No dedicated strategy to maximise positive benefits; i.e. local content and Social Investment. Event: Local community feel aggrieved that balance of impacts and benefits is not right and they are taking on additional impacts for little benefit. Consequences: Conditions imposed by regulator as part of permit conditions, negative reputational impact.	Active	30/12/2020				REP [M/M]					A-0348	Implement public consultation plan fully and on time	Closed	31/12/2015				REP [L/L]				
													A-0351	Develop an overall Local Value Proposition proposal for the project, get internal endorsement and budget and test with local communities	In Progress	31/12/2015								
													A-0464	Develop Local Content Strategy for the construction and operations phases of the project	In Progress	31/12/2015								
D-0347	Late decisions by SSE may delay the schedule	Cause: Different governance processes/project drivers for Shell and SSE Event: Key SSE decisions/activities may not be made in line with the overall integrated schedule Consequence: Schedule delay	Active	31/12/2015		SCH [M/M]							A-0321	Agree integrated schedule with SSE	Closed			SCH [M/M]						
													A-0440	Align SSE with agreed DECC/SHELL Level 3 Schedule	Active	30/12/2015								
D-0351	DECC does not accept commercial deviations from the bid	Cause: DECC require that Shell adhere to the terms of the Bid, to the extent that such changes are unrelated to any changes made by DECC to the Bid submitted by Shell Event: DECC request changes to be made by Shell to its Bid Consequence: Reputational damage between DECC & the participants in the project	Active	31/03/2016				REP [M/M]					A-0324	Demonstrate bid updates are driven by DECC risk allocation	In Progress	31/12/2015				REP [M/M]				
D-0394	Lack of Operations/maintenance staff	Cause: Intention is to realise synergies with existing asset support team based at Shell's St Fergus gas plant,	Active	31/12/2016			OP [M/M]						A-0424	Secure Goldeneye competent staff from St Fergus	In Progress	31/12/2015			OP [L/L]					

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	being available from St Fergus Asset	Event: risk of unavailability of staff due to competing priorities or lack of resources to complete both scopes of work. Consequence: prolonged shutdowns and reduction in revenue											A-0425	Agree (SHELL internal) parent asset organisation for Peterhead CCS project to be incorporated	In Progress	31/12/2015								
D-0225	Unforeseen challenges occur during the commissioning phase	Cause: Lack of operating familiarity with CO_2 and Amine within the consortium Event: Unforeseen challenges occur during commissioning/operations. Consequence: Higher Operating Cost, Higher Commissioning Cost, Reputation Damage, Shutdowns.	Active	31/12/2018	C [L/M]	SCH [L/H]	OP [L/H]	REP [L/H]					A-0217	Train operators using Quest, CCPilot100+, Saskpower and Aberthaw experiences	In Progress	31/01/2018	C [L/L]	SCH [L/L]	OP [L/L]	REP [L/L]				
													A-0218	Apply Shell start-up readiness and flawless start-up	Proposed	31/01/2018								
													A-0411	Apply Quest/SASKPOWER commissioning experience	In Progress	30/06/2016								
D-0356	Major injection or monitoring well integrity related leak to platform	Cause: Loss of integrity in seals or casings Event: CO_2 released onto platform Consequence: Drilling rig (qualified for CO_2 service) required for well intervention, increased cost & schedule delay, reputational damage	Active	31/12/2017	C [VL/VH]	SCH [VL/VH]	OP [VL/VH]	REP [VL/VH]	P (HSE) [B/4]				A-0303	CO_2 workover procedures rig / wireline operability under CO_2 conditions	In Progress	31/12/2015	C [VL/VH]	SCH [VL/VH]	OP [VL/VH]	REP [VL/VH]				
													A-0361	Investigate how to qualify rigs for CO_2 intervention	In Progress	30/09/2017								
D-0230	Unforeseen issues with Goldeneye pipeline prior to commissioning	Cause: The reused portions of the goldeneye pipeline will be hydrocarbon freed then filled with water. The pipeline must be dried prior to commissioning with CO_2. Event: Drying for CO_2 export may not be successful. When CO_2 is added, severe corrosion could occur due to generation of carbonic acid. Consequence: Repair/replacement costs for the pipeline, subsequent delays to project and reputational damage	Active	31/12/2019	C [L/H]	SCH [L/H]		REP [L/H]					A-0225	Pipeline drying operations	Active	30/06/2019	C [L/M]	SCH [L/L]		REP [L/L]				
													A-0410	Pre-commissioning requirements to be included in EPC contract	Closed	30/09/2015								
D-0651	Competent Authority does not agree that COMAH requirements have been suitably addressed	Cause: Competent Authority does not agree that COMAH requirements have been suitably addressed in the project design. Event: Project required by the Competent Authority to modify design. Consequence: CAPEX, schedule, relationships, reputation	Active	31/12/2017	C [L/H]	SCH [L/H]		REP [L/H]					A-0752	Instruct EPC about the requirement to complete the COMAH report as part of their scope	Active	31/12/2015	C [L/M]	SCH [L/L]		REP [L/L]				
													A-0753	Complete exotoxicity assessments on solvent & associated degradation products	Active	31/12/2015								
													A-0754	Complete assessment on combustion products	Proposed	31/12/2015								
D-0543	Uncertainty around centralising clamps in well	Cause: PEC survey Jun 2014 revealed GYA05 centralising clamp dropped Event: Wellhead oscillates in low sea state and raises issues around the rest of the wells Consequence: Increased FEED costs to survey all wells, could lead to increased execution costs for remediation prior to full workover	Active	30/06/2016	C [VH/VL]	SCH [VH/VL]	OP [VH/VL]			A (HSE) [D/2]			A-0499	Consider requirement for stabilising chocks	Closed	31/03/2015	C [L/VL]	SCH [L/VL]	OP [L/VL]			A (HSE) [B/]		
													A-0500	Perform fatigue analysis	Active	31/03/2016								

Risk ID	Risk Title	Risk Description	Risk Status	Planned risk closure date	Current severity/ Due Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE	Mitigation Action ID	Mitigation Action Title	Mitigation Action Status	Mitigation Action Due Date	After Action severity Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE
D-0314	Adverse public and/or stakeholder reaction to Peterhead Power Station COMAH classification	Cause: Chemicals used at capture plant lead to reclassification of PPS for COMAH purposes Event: PPS re-classified as a COMAH Tier 1 site. Consequence: Public reaction or support to the classification change causes a reputational impact.	Active	31/12/2017		SCH [L/M]		REP [L/M]				R (HSE) [B/4]	A-0365	Develop full understanding COMAH requirements	Closed	31/12/2014		SCH [VL/VL]		REP [VL/VL]				R (HSE) [A/1]
													A-0513	Prepare for consequences of COMAH classification.	In Progress	31/12/2015								
D-0269	Lack of suitable & available jack-up rig for well workover campaign	Cause: A short duration rig contract is required in a market where there is only around a dozen suitable jack-up rigs - it addition to short duration, Goldeneye is in water depth which is the upper limit of jack ups and there are only a few capable rigs worldwide. Event: It may not be possible to procure a suitable jack-up rig at the desired time (drilling contractor interest levels could be low) Consequence: Delays to schedule and/or increased cost for rig hire.	Active	30/12/2018	C [L/H]	SCH [L/H]							A-0293	Rig market research - monitor prior to ITT	In Progress	31/03/2016	C [VL/L]	SCH [VL/L]						
D-0365	Failure of CO_2 gas detection	Cause: CO_2 detector failure due to temperature drop Event: Failure of CO_2 gas detection Consequence: HSSE exposure, unable to inject CO_2, potential health impact	Active	30/12/2029			OP [L/H]	REP [L/H]	P (HSE) [B/3]				A-0384	Review and testing of CO_2 technology	Closed	30/05/2015			OP [VL/H]	REP [VL/M]	P (HSE) [A/1]			
													A-0640	Engage suppliers on low temperature compatibility of components and connections	Active	31/12/2015								
D-0288	Novel Materials and Equipment on commercial scale	Cause: Materials and equipment - novel plant and reuse not previously used on commercial scale Event: Unforeseen operational issues/ premature degradation of plant and especially existing equipment Consequence: Additional OPEX costs and deferments of injection while the work is carried out.	Active	31/12/2016			OP [L/H]						A-0281	Conduct materials testing to validate need for oxygen removal unit for this specific project	In Progress	30/12/2015			OP [VL/H]					
													A-0326	Selection of new materials and equipment.	Closed	30/12/2014								
													A-0748	Ensure FFP modelling and detailed engineering by EPC	Proposed	30/12/2016								
													A-0749	Investigate way of checking concrete coating quality (given very large size of the column)	Proposed	30/12/2016								
													A-0750	Ensure Cansolv are there during CSU phase to support as required	Proposed	31/12/2015								
D-0222	Major legislative changes occur which affect the viability of the CCS Competition and/or the project	Cause: Project must comply with UK legislation and EU requirements Event: UK legislative changes/ EU requirements alter occur, impacting project Consequence: Cost impact, schedule delay or project is deemed unviable.	Active	31/12/2019	C [L/M]	SCH [L/L]	OP [L/M]	REP [L/L]					A-0215	Project Contract Risk Management	In Progress	31/12/2015	C [M/VL]	SCH [M/VL]	OP [M/VL]	REP [M/VL]				
													A-0571	Active Government relations (SEPA, SNH, Crown Estate, CCS directive, HS&E)	In Progress	30/12/2015								
													A-0572	Assess FOAK derogations (SEPA, SNH, Crown Estate, CCS directive, HS&E)	In Progress	30/12/2015								
													A-0573	Flexibility in EPC contracts (agreed rates etc.)	Active	30/12/2015								

Risk ID	Risk Title	Risk Description	Risk Status	Planned risk closure date	Current severity/ Due Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE	Mitigation Action ID	Mitigation Action Title	Mitigation Action Status	Mitigation Action Due Date	After Action severity Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE
													A-0574	Design ALARP. Anticipate. (Demonstrating ALARP and building to BAT)	Closed	30/06/2015								
													A-0575	External verification of design and specifications	Closed									
													A-0576	Precedent based standards (i.e. learn from legislation in other countries)	In Progress	31/03/2016								
													A-0577	Anticipate changes, manage expectations with stakeholders	Proposed	15/12/2015								
													A-0578	Flexibility in declaration window	In Progress	15/12/2015								
													A-0579	Ensure ability to call-off other expertise (i.e. Boundary Dam etc.)	Proposed	30/12/2023								
													A-0581	Contractual Provisions for call off (price, availability)	Active	30/12/2015								
													A-0582	Pre allocated contingency reflected in cost estimate	Active	30/12/2015								
													A-0583	Suspension mechanisms (SSE contract)	Active	31/12/2015								
D-0228	Elastomeric seals are unproven for high pressure CO_2 application	Cause: Seals are unproven with CO_2. CO_2 dissolves into the elastomer and as a result of a sudden change in pressure, bubbles form and damage the seal, leading to CO_2 leaks Event: Performance may be below expected standards Consequence: Loss of containment of CO_2, Increased OPEX	Active	31/12/2015	C [L/L]	SCH [L/M]	OP [L/L]	REP [L/M]					A-0223	Equipment refurbishment (subsea valves for CO_2 service)	Closed	31/12/2014	C [VL/VL]	SCH [VL/VL]	OP [VL/L]	REP [VL/L]				
													A-0388	Further elastomer verification and consultation with vendors	In Progress	30/11/2015								
													A-0592	rebasing mechanism with DECC (if CCS risk)	Closed									
													A-0639	Work with industry peers to gain their experience	Proposed	31/12/2016								
													A-0641	High pressure CO_2 factory acceptance testing (FATs) or in Statoil test well	Closed									
													A-0642	Plant operating mode to be modified (reduced)	Proposed	31/08/2020								

Risk ID	Risk Title	Risk Description	Risk Status	Planned risk closure date	Current severity/ Due Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE	Mitigation Action ID	Mitigation Action Title	Mitigation Action Status	Mitigation Action Due Date	After Action severity Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE
D-0432	Poorly managed demolition scope	Cause: Extensive demolition scope for execution during EPC. Shell assumes it is within SSE scope and thus SSE needs to review. From SSE perspective, the scope of demolition works are not yet clear within CTA and as far as they are concerned, it is up to Shell to review. Event: Poorly managed demolition scope. Consequence: Safety incidents, schedule delay, penalties, LTIs, cost increase.	Taken	31/12/2015	C [L/VL]	SCH [L/M]			P (HSE) [B/3]				A-0493	Minimise demolition scope as objective within FEED development & commercial agreements.	Closed	31/12/2015	C [VL/VL]	SCH [VL/VL]			P (HSE) [A/1]			
													A-0648	Undertake contamination study and demo, survey at FEED phase	Closed	30/11/2014								
D-0424	Disruption of the execution plan due to bad weather	Cause: The site is in northern Scotland and frequently experiences severe weather, especially during the winter months. Event: Disruption of the execution plan due to bad weather Consequence: Lost time also leading to cost increase, HSE impact on people	Active	31/12/2016	C [L/M]	SCH [L/M]			P (HSE) [B/3]				A-0492	Detailed Design needs to consider materials/construction method	In Progress	31/12/2016	C [VL/L]	SCH [VL/L]			P (HSE) [A/1]			
D-0292	Potential difficulty in procuring adequate level of insurance.	Cause: First of a kind, lack of market experience of CCS risks. Event: Difficult to obtain adequate level of asset or liability insurance Consequence: Project delay or cost escalation	Active	30/06/2016	C [L/M]	SCH [L/L]							A-0305	Shell Insurance Strategy paper drafted and Shell Risk & Insurance (RI) consulted	In Progress	31/12/2015	C [VL/L]	SCH [VL/VL]						
D-0621	Difficulty in identifying & securing suitable disposal route of thermal reclaimer waste on commercial terms	Cause: Waste from thermal reclaimer unit (TRU) will be transported offsite for disposal Event: Disposal route for thermal reclaimer waste not yet landed in FEED, limited amount of sites available Consequence: Possible increased cost for treatment & transportation	Active	28/12/2018			OP [L/M]	REP [L/L]					A-0728	Approach suitable disposal centres for handling TRU waste	In Progress	31/10/2015			OP [VL/VL]	REP [VL/VL]				
													A-0729	Plans for road tanker transportation arrangements to be in place by FID	In Progress	31/12/2015								
D-0253	Onshore venting results in inadequate CO_2 venting	Cause: Planned onshore CO_2 venting. Event: CO_2 dispersion modelling is inaccurate and so onshore venting leads to inadequate CO_2 dispersion Consequence: Negative impact on operations (injection levels, cost), plus reputational impact.	Active	31/12/2035			OP [L/VL]	REP [L/M]					A-0255	Carry out dynamic dispersion modelling	Proposed	31/12/2016			OP [VL/VL]	REP [VL/VL]				
													A-0256	Set operational parameters to minimise planned venting	In Progress	31/12/2016								
													A-0257	Define location of onshore venting exit point	Closed	30/01/2015								
													A-0258	Pipeline proximity distance for onshore pipelines? If so, no longer relevant due to selection of direct offshore transportation option.	Closed									
D-0446	Misaligned schedules for gas turbine control systems upgrades between project & SSE	Cause: SSE GT control systems defunct, CCS project upgrades control system for GT13 interfacing with GT11 & GT12 Event: SSE decide to upgrade control systems after project upgrades GT13 Consequence: Cost and schedule impact on project	Active	28/02/2020	C [L/VL]	SCH [L/M]							A-0466	Ongoing dialogue with SSE to establish GT control systems upgrade plans	Active	31/12/2015	C [L/VL]	SCH [L/L]						

Risk ID	Risk Title	Risk Description	Risk Status	Planned risk closure date	Current severity/ Due Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE	Mitigation Action ID	Mitigation Action Title	Mitigation Action Status	Mitigation Action Due Date	After Action severity Capex Cost	Schedule	Operability	Reputation	People-HSE	Assets-HSE	Environment-HSE	Reputation-HSE
D-0639	CAA request new helideck monitors on Goldeneye	Cause: Civil Aviation Authority is currently reviewing all North Sea installations with a view to making improvements to the helidecks. Event: There is a risk that the CAA may request Shell to make improvements to the helideck monitors on Goldeneye Consequence: increasing work scope impacting cost & schedule for project	Active	31/12/2015	C [L/VL]	SCH [L/M]							A-0747	Interface with asset focal point to get CAA feedback	In Progress	31/12/2015								
D-0302	Delay to EU Permit review	Cause: CCS Directive obliges DECC to consult EU Commission on decision to award CCS Permits. Event: EU takes longer than planned to issue opinion on submission of Carbon Storage Permit application Consequence: Potential schedule impact.	Active	31/03/2016		SCH [L/M]							A-0314	Early and detailed engagement with regulators	Closed	01/07/2015		SCH [L/L]						
													A-0315	Address potential for EU delay in permit/project schedule	Closed	01/07/2013								
													A-0316	Early and detailed engagement with regulators	In Progress	30/12/2015								
D-0358	Well cementations unsuitable for CO_2 injection	Cause: Cementation of existing GE wells is suitable for hydrocarbons however may not be for CO_2. Event: Once injecting, cement found to be unsuitable for CO_2 on multiple wells. - Potential leak to surface. Consequence: New wells will need to be drilled (or side-tracks), cost & schedule impact as well as loss of revenues	Active	30/09/2019	C [VL/VH]	SCH [VL/VH]	OP [VL/VH]	REP [VL/H]	P (HSE) [B/1]				A-0609	rebasing mechanism with DECC (if CCS risk)	Closed	31/12/2015								
													A-0610	Renegotiate rig contract (same rig or via long-term contract owner)	Proposed	31/12/2018								
													A-0611	Ability to suspend other execution contracts	Proposed	31/12/2018								
D-0354	Minor well leakage to surface of CO_2 or hydrocarbon	Cause: Loss of cementation or cement plugs or combination migration path or material fatigue Event: Small release of hydrocarbons or CO_2 to either platform (sustained casing pressure) or to seabed (bubbles). Consequence: Wireline intervention or possibly rig intervention.	Active	31/01/2017	C [VL/VH]	SCH [VL/VH]	OP [VL/VH]	REP [VL/VH]					A-0368	Midlife monitoring	Proposed	30/12/2024	C [VL/VH]	SCH [VL/VH]	OP [VL/H]	REP [VL/M]				
													A-0369	Well monitoring	Closed	30/12/2031								
													A-0712	Prepare response to cover event of Hydrocarbons + coming to surface during any CO_2 leak	Proposed	24/01/2019								
D-0259	Scaled up technology does not perform as expected	Cause: Scale up of the CO_2 capture technology has not been proven. Event: Absorber does not perform as well as modelled once scaled up. Capture technology does not perform as effectively as modelled. The cool/warm up time is excessive. Consequence: Reduced injection volumes, Operating Cost Increases, Potential Total failure, Level of contingency increases	Active	01/04/2019	C [VL/H]	SCH [VL/VH]	OP [VL/VH]	REP [VL/H]					A-0276	Design system to have sufficient margin to cover scale up issues	Closed	30/12/2014	C [VL/VL]	SCH [VL/VL]	OP [VL/VL]	REP [VL/VL]				
													A-0277	Apply lessons learnt from other projects	In Progress	31/12/2015								

A1.3. Top 15 Upside Risks At The End Of FEED

ID	Title	Description	Risk Progress Summary/ Notes	Manageability	Status	Next Review Date	Planned Finish Date	TECOP	Impact Phase (ORP)	Custom Tags	Current severity Probability, Project RAM	Cost/Benefit, Consequence	Schedule, Consequence	Operability, Consequence	Reputation, Consequence
U-0680	Hands on Tools	Explore 'Hands on Tools' for productivity analysis & improvement		Can Control	Active	2016-01-30	2019-12-30	Technical, Economic, Commercial, Organisational	Execute		4	4			
U-0638	Accelerate Shell Onshore CCC EPC contractor getting on site after SSE EPC scope complete	Current Execute integrated schedule with SSE only allows Shell EPC contractor on site after completion of SSE scope, due to CDM regulations. An opportunity exists to work with SSE to identify opportunities to reduce schedule time, save costs & eliminate complexity/inefficiency.	Workshops ongoing over summer 2015, final results not known until EPC contract award in October/November 2015.	Can Influence	Active	2015-12-31	2016-06-30	Technical, Economic, Commercial	Define, Execute	Capture Plant, Capture and Compression, SSE, SHELL , Treat	3	4	4		
U-0681	Maximise the synergies of Shell & SSE scope in EPC negotiations	Leverage SSE increased interest in project		Can Influence	Active	2016-01-30	2019-12-31	Economic, Commercial, Political	Execute		4	3			
U-0500	Technical collaboration with Statoil	TCM still talking, offshore stalled		Can Influence	Active	2015-12-31	2017-12-31	Technical	Define, Execute, Basis of Design Package, FEED	Pan Project	2	1	5		
U-0712	System integration test (SIT) on Wells	System integration test (SIT) on Wells		Can Control	Active	2016-01-10	2018-03-30	Technical, Economic, Commercial	Execute		5	2			
U-0716	Install N2 cushion in annulus	To be included in the intervention scope of work		Can Control	Active	2016-06-30	2016-12-31	Technical, Economic, Commercial	Execute		2	5			
U-0690	Remove Shell/Esso (SEGAL) facilities at PPS (Pipelines)	SEGAL facilities will be decommissioned imminently area could be used for CCS facilities		Can Influence	Active	2016-03-30	2016-12-31	Technical, Economic, Commercial	Execute		3	1		2	
U-0617	Reduction in planned Maintenance time by extending cycle to 4 years + moving to 24/7 turnarounds			Can Influence	Active	2015-11-30	2015-11-30	Technical, Economic, Commercial	Define	Capture Plant, Capture and Compression, SSE, SHELL , Treat	2			3	

ID	Title	Description	Risk Progress Summary/ Notes	Manageability	Status	Next Review Date	Planned Finish Date	TECOP	Impact Phase (ORP)	Custom Tags	Current severity Probability, Project RAM	Cost/Benefit, Consequence	Schedule, Consequence	Operability, Consequence	Reputation, Consequence
U-0623	Approach market early enough to maximise the chance of lowest rig cost	Jack-up rig market now showing clear signs of softening, consider how/when to approach the market and award the rig contract to maximise the chance of lowest rig cost. Full risk assessment of the opportunity to be completed within the coming weeks, including commercial angle with Goldeneye JV & also DECC. Possible for long lead item GIP for a rig to be fast-tracked, especially if accepted for Goldeneye decommissioning in the event of CCS cancellation.	Maersk Innovator confirmed free from February 2017 NORWAY: Maersk Drilling indicates jackup Maersk Innovator now has free-and-clear availability from February 2017 and that two one-year options with ConocoPhillips no longer exist. The 2002-delivered GustoMSC CJ-70 unit has been on contract with ConocoPhillips in the Ekofisk area since late 2004. Maersk Inspirer available in late 2016 NORWAY: Maersk Drilling now estimates that jackup Maersk Inspirer will next be available around November 2016 compared to previous indications of December 2017 as it's drilling and production contract covering the life of Statoil's Volve field continues.	Can Influence	Active	2016-12-31	2017-12-31	Technical, Economic, Commercial	Execute	Wells/Subsurface, SHELL , Treat	2	3			
U-0726	BOO Model for WWTP	Carve out the scope from the onshore EPC contract and set up a new contract for the WWTP.	Suggested by William, tender separately from EPC contract and tender for WWTP work under a BOO Model	Can Influence	Active	2016-01-30	2019-12-31	Technical, Economic, Commercial	Execute	Capture Plant, Capture and Compression, SSE, SHELL , Treat	1	1		3	
U-0722	Relocate Shell owners team to EPC or SSE offices	Move the Shell owner's team out of Tullos to reduce costs.			Active		2016-07-01	Economic, Commercial, Organisational	Execute	Capture Plant, Capture and Compression, SSE, SHELL , Treat	3	1			
U-0725	Explore SSE operatorship appetite	As SSE are the power station owners & more familiar with the industry, exploit possibilities for them to take over the operation/maintenance of the CCP from Shell to make the operation more efficient, less costly & also demonstrate full chain operation in the power station from within the industry.			Active	2015-12-31	2015-12-31	Technical, Economic, Commercial, Organisational, Political	Operate	Capture Plant, Capture and Compression, SSE, SHELL , Treat	1			3	
U-0398	OPP: Reduced costs by maximising use of WTW (walk-to-work) both in construction phase and Operations phase	OPP: Reduced costs by maximising use of WTW (walk-to-work) both in construction phase and Operations phase	Opportunity only realised really if SHELL UK adopt.	Can Control	Active	2016-01-03	2018-12-30	Technical, Economic, Commercial	Execute, Operate	Platform, SHELL , Treat	3	1			
U-0499	Potential cost and schedule savings from synergies with SSE, control room, warehouses etc	Synergies with SSE, control room, warehouses etc - potential cost and schedule savings		Can Influence	Active	2016-01-30	2019-12-31	Technical	Execute	Capture Plant, Capture and Compression	3	1			

ID	Title	Description	Risk Progress Summary/ Notes	Manageability	Status	Next Review Date	Planned Finish Date	TECOP	Impact Phase (ORP)	Custom Tags	Current severity Probability, Project RAM	Cost/Benefit, Consequence	Schedule, Consequence	Operability, Consequence	Reputation, Consequence
U-0727	Sharing vessel to support offshore mods scope (Buzzard, NAM vessel)	NAM currently employs 1 WTW vessel to support 21 Southern North Sea platforms and is considering contracting a 2nd vessel. Opportunity to timeshare 2nd vessel with NAM saving on demob costs.			Active	2016-03-01	2016-07-01		Execute	Platform, SHELL , Treat	3	1			

APPENDIX 2. Risk Assessment Matrix

Figure A-1: Project Risk Assessment Matrix

		Consequences/Severity Impact					Likelihood / Probability				
							1	2	3	4	5
		Capex Cost	Schedule (First Injection)	Operability	HSSE	Reputation	Never heard of in the Industry	Heard of in the industry	Has happened in the organisation or more than once per year in the industry	Has happened at the location or more than once per year in the industry	Has happened more than once per year at the location
							0-10%	11-25%	26-50%	51-80%	>80%
Very High	5	>£30Million	> 6 months	One off >350k t deferment Annual >170t/d deferment Opex increase >£5 Million/Year	More than 3 fatalities Massive Impact	Adverse international/ national media coverage Adverse international/ national political reaction Adverse reaction from regulator Organised protests					
High	4	£15 - £30 Million	<= 6 months	One off <350k t deferment Annual <170t/d deferment Opex increase <£5 Million/Year	PTD or up to 3 fatalities Major impact	Adverse national media Coverage Adverse national political reaction Adverse investor reaction Adverse reaction from regulator Organised protests					
Medium	3	£6-£15 Million	<= 4 months	One off <175k t deferment Annual <85 t/d deferment Opex increase <£2.5 Million/Year	Major Impact/injury	Adverse regional political reaction Local protesting					
Low	2	£3-£6 Million	<= 2 months	One off <70k t deferment Annual <35 t/d deferment Opex increase <£1 Million/Year	Minor Impact/injury	Adverse local media coverage Adverse Industry Press					
Very Low	1	<£3 Million	<= 1 month	One off <35k t deferment Annual <15 t/d deferment Opex increase <£0.5 Million/Year	Slight Impact/injury	Complaints from Neighbours					
		No Impact	No Impact	No Impact	No Impact	No Impact					

APPENDIX 3. Shell HSE Risk Assessment Matrix (RAM)

Figure A-2: Shell HSE Risk Assessment Matrix