Peterhead CCS Project

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Table of Contents

List of Tables

List of Figures

Executive Summary

This report is a template for the Annual Field Storage Report and Plan (ASRP); which will be completed near the end of each calendar year following the start of injection. It is expected that the release of the plan will be:

(a) Aligned with the Developers business plan cycle (the annual look-ahead of planned activities for the next five years).
(b) Issued to the Regulator as part of Shell's regulatory reporting cycle for the Goldeneye CO_2 store.

The report will be updated after the first data collection activities: (the pre-injection "baseline monitoring").

Amongst others, this plan contains the following elements:

- Discussion about the performance of the asset.
- Current reservoir pressure.
- Injection Forecasts.
- Amount of CO_2 stored.
- Remaining capacity.
- Results from the Monitoring, Metering and Verification (MMV) plan.

The scope of this document is limited to the following:

- Transport of CO_2 to the Goldeneye Platform.
- Injection and storage of up to 15 million tonnes of CO_2 in the Goldeneye reservoir.

A key purpose of the report and plan will be to record findings from the MMV plan which might indicate possible non-conformance. Such findings may lead to a requirement for additional monitoring activities and corrective measures if required.

This document should be seen as a snapshot of a live document, which itself will be updated annually. The first release of the document will contain the latest data from the pre-injection monitoring and seismic survey, and consequent baselines for pressure, non-injected CO_2 saturation and the benthic environment of the storage complex. Aside from the yearly updates, additional updates to the report and plan will be released should observation of potential irregularities cause the implementation of contingency monitoring and corrective measures.

The Peterhead Carbon Capture and Storage (CCS) Project is currently pre-construction. A Storage Development Plan (Key Knowledge Deliverable 11.128) (1) has been written prior to the start of injection. As a consequence, this current version of the Annual Field Storage Report and Plan describes the asset as it is currently constituted and uses headings and short descriptions as placeholders for the future operational data and analysis that will be collected /undertaken once injection has started.

1. Introduction

The Peterhead CCS Project aims to capture around one million tonnes of CO_2 per annum, over a period of 10 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 CO_2 capture, transport and offshore geological storage from a (post combustion) gas-fired power station.

Post cessation of production, the Goldeneye gas-condensate 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 (GT-13) 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, in order 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:

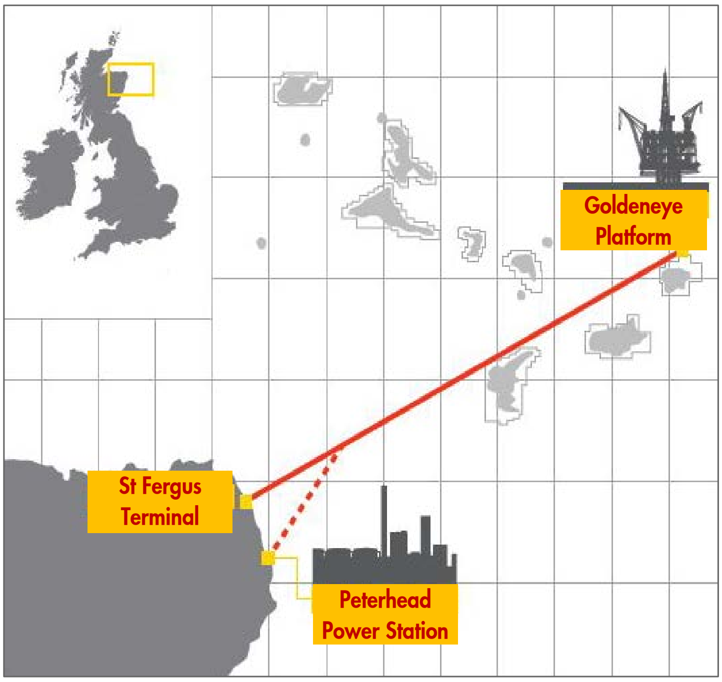

Figure 1-1: Project Location

The Goldeneye gas condensate field was shut-in after water production, from the final operational development well; this process began in December 2010. The field was finally shut-in on the 16th March 2011, after final production tests of the watered-out wells were conducted. A proposal has been submitted for re-use as a store for CO_2 as part of the Peterhead CCS Project, which is participating in the UK CCS Commercialisation Programme. Shell U.K. Limited has been granted the Carbon Storage Licence CS002 and is now applying for a permit to store up to 20 million tonnes of high purity CO_2 in a subsurface volume centred on the depleted Goldeneye hydrocarbon field.

The dense phase CO_2 will be metered prior to exporting directly offshore via a new short section of onshore pipeline which will incorporate the onshore pig launcher and pipeline landfall, and a new offshore pipeline which will be tied in subsea to the existing Goldeneye pipeline.

The current base case for the total quantity of CO_2 to be injected and stored is up to 15 million tonnes over a period of 15 years. The purpose of this document, once populated with actual data following start-up, is to demonstrate the performance of the storage asset during its lifetime and to highlight any threats to the successful completion of the project so that they may be mitigated. The document refers only to the scope of the project that falls under the purview of the offshore transport and storage operation and will be updated on a regular basis. The purpose is to assess changes to the risk profile of the project and include any updates required for the MMV plan for the field.

The figure below illustrates the overall block flow diagram, showing the power station, capture, compression, conditioning, pipeline and wells.

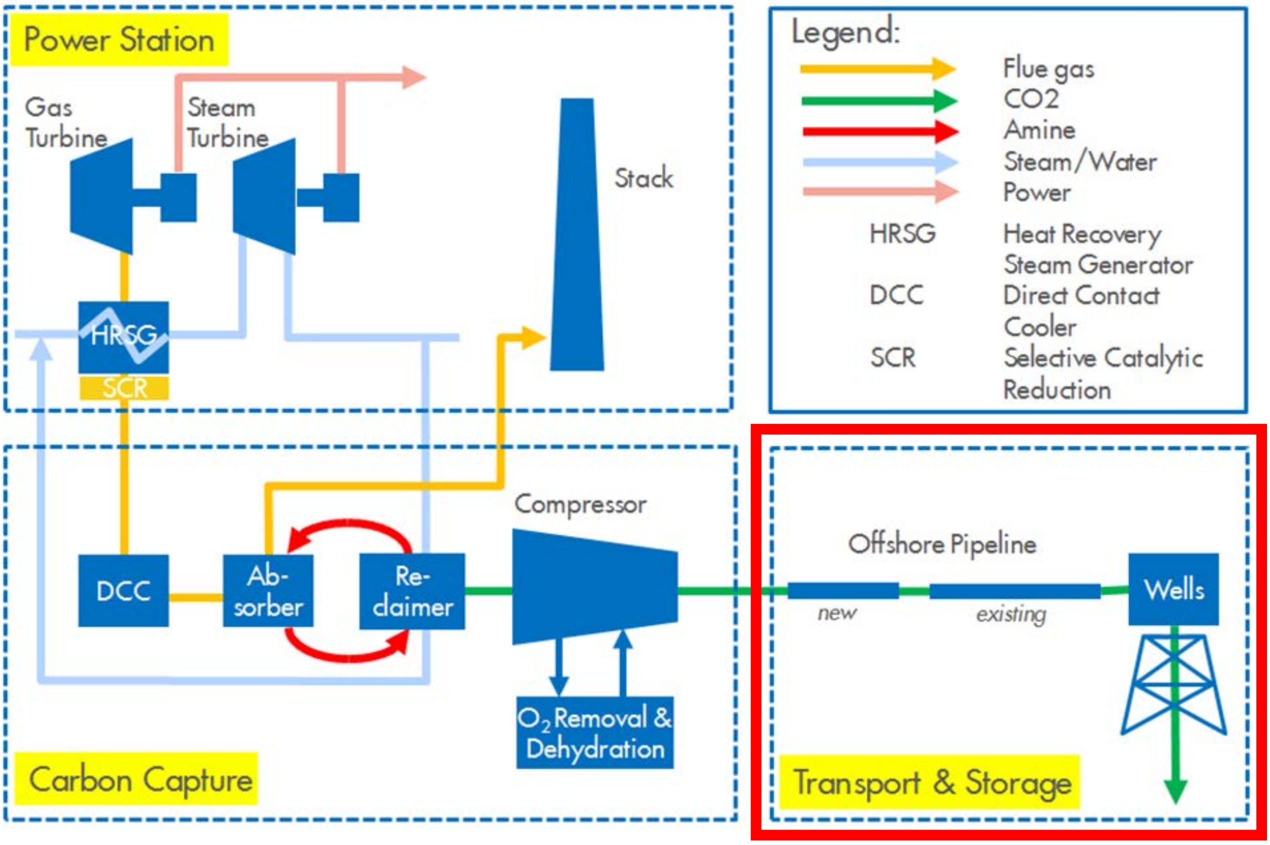

Figure 1-2: Overall CCS Block diagram. The focus of this report is shown in the red rectangle

2. Health, Safety, Security, Environment and Social Performance (HSSE-SP)

Data and discussion should be provided, at least yearly, under the following headings:

- Actual safety performance, referring to Goal Zero[1] or appropriate current Shell safety target.
- Results of inspections or audits by Shell and external auditors.
- Safety record during construction or platform modifications.
- Continuous monitoring throughout project lifecycle of potential chemical hazards in the Capture plant and reporting of any spills.
- Social Performance – including, in early years, reports on restoration of local environment e.g. after completion of beach crossing and communications with local residents.

[1] Goal Zero captures the belief that we can operate without fatalities or significant incidents despite the often difficult conditions in which we operate. To support this aim, we continue to roll out initiatives to strengthen our safety culture. This includes improving the safety leadership skills of staff, simplifying our requirements, and rewarding successful performance.

As stated above, the Annual Storage Report and Plan will be updated yearly. In 2015/16 the main activities and safety focus is on construction. In later years there will be greater focus on wellwork (replacing completions, installing and testing pressure gauges etc.). This will be in parallel with baseline monitoring activities including offshore seismic surveys, use of boats to deploy geochemical probes and seabed grab testers. Early monitoring will be primarily aimed at proving conformance, while later in the life of the store there will be more emphasis on verifying containment. The HSSE focus will shift accordingly.

3. Development Summary

3.1. Infrastructure

The planned offshore part of the Peterhead CCS development comprises two major parts:

- The pipeline connecting offshore and onshore facilities.
- The offshore platform facilities and wells.

3.2. Activities of Other Users of the Seabed and Subsurface

Any change in usage of the surrounding area should be documented and the implications for the CO_2 storage project should be noted. It is important for the security of the CO_2 storage complex that any activities which could compromise the Complex's seals are clearly communicated to Shell UK and to the U.K. Regulator.

The notification area, within which any plans including any intrusive activities, such as drilling new wells or entering existing ones or disturbing the benthic ecosystem, should be provided to the U.K. Regulator, covers the extent of the original Goldeneye hydrocarbon field plus an extended area which is considered to be hydraulically connected to the store. The notification area is therefore that already specified as the storage complex, illustrated in Figure 3-1. The vertical extent of the complex is illustrated in Figure 3-2. This figure shows the primary seal of the store – the Plenus Marl/Hidra Formation and the Rodby Formation above the Captain sand. If CO_2 can find any route to bypass this seal (most likely a man-made route though a well, existing or new), it will migrate upwards and be trapped by the secondary seals – the Lista and Dornoch shales. Therefore, any activity involving these mudstones or the chalk above Goldeneye must be done with the same requirement for notification as well work in the Captain aquifer. Notification of any disturbance to the seabed within the complex bounding box must also take place as monitoring could mistake such a disturbance as indication of a potential irregularity. This includes the laying of pipelines, dredging, drilling of shallow boreholes, or the placement of equipment on the seabed.

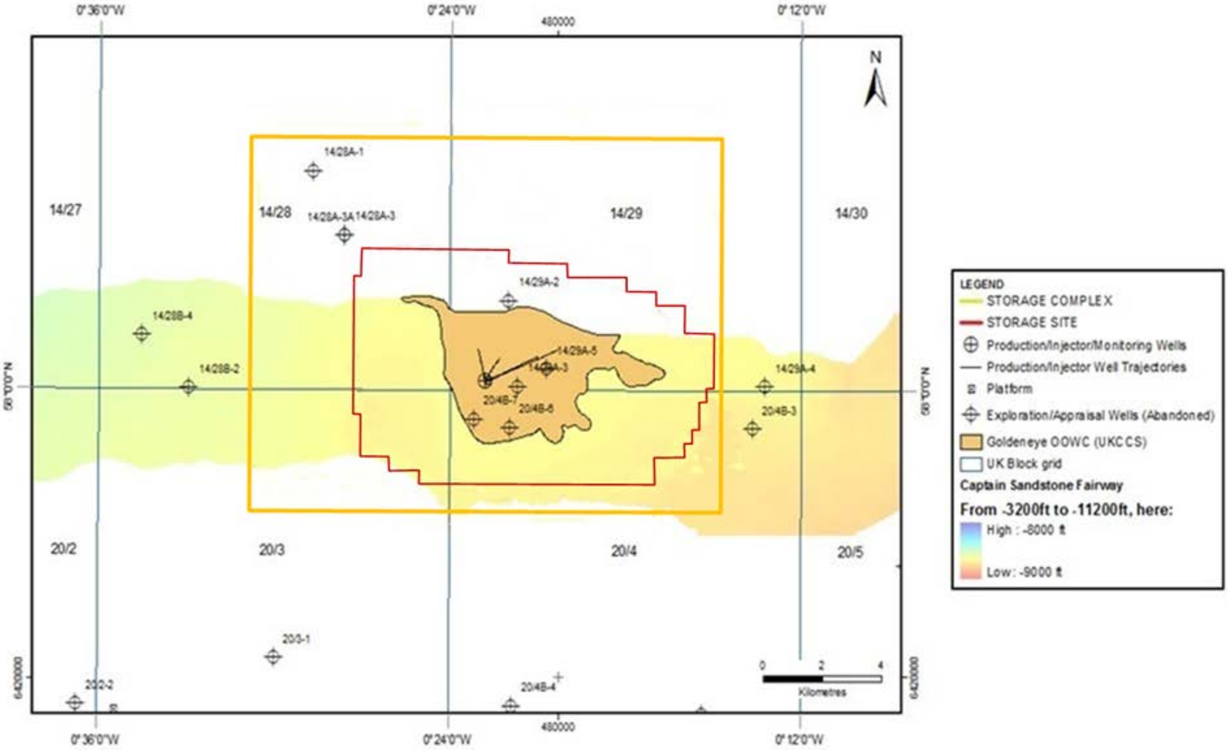

Figure 3-1: Geographical extent of the storage site and storage complex, with extent of Captain Sandstone Member aquifer indicated

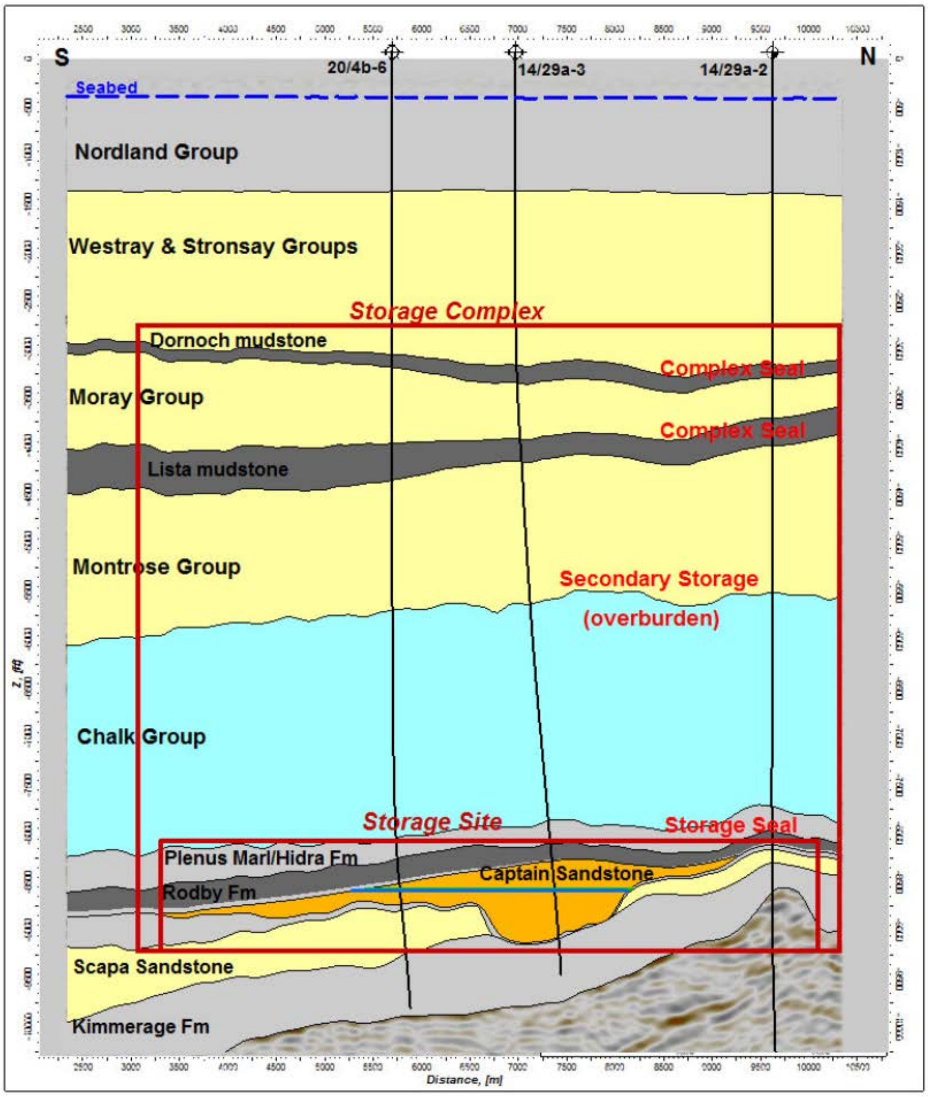

Figure 3-2: Schematic representation of the vertical extent of the storage site and complex

It has been determined by intensive study of the abandonment programmes of existing, non-injecting, wells in the site and complex that there is an extremely low likelihood of these wells forming a path through which injected CO_2 could leave the site or complex.

For Goldeneye's five former production wells, high quality components will be used to abandon or recomplete as CO_2 injectors. It is vital that any and all future well work in the storage complex, by Shell or a third party, can be assured to be of the same high standard. To this end, the U.K. Regulator should be notified of plans before work commences, they will consult Shell as the carbon store operator and Shell should have the right to express, with clear and robust reasons, disagreement with the plan. Ultimately the U.K. Regulator will provide final approval.

3.3. Changes in Legislative and Regulatory Environment

Although there is legislative and regulatory commitment in the UK to the future of CCS any changes in the relevant legislation should be noted.

3.4. Business Environment

3.4.1. Key Performance Indicators (KPI) and Value Drivers

The KPIs for the transport and injection system are given below:

- Safe operations with no harm to people in accordance with Shell's Goal Zero policy. No unplanned releases of CO_2 from facilities.
- Availability uptime of injection facilities as defined in the engineering design package.
- Monitoring systems perform as required to show conformance and containment. Specifically there will always be high confidence regular pressure monitoring of the reservoir pressure and the bottom hole injection pressure. The seismic surveys will be executed to a high quality without spatial gaps or high noise compared to best practice. Pipeline integrity monitoring will be frequent enough and effective enough to assure that there are no leaks.
- Delivery of monitoring results clearly and on time to the UK regulator, with prompt response to questions. Passing of UK regulator's periodic inspections as required under the Storage Directive.
- Effective dissemination of monitoring and performance data on the store to qualified academic institutions, via the Knowledge Transfer (KT) process.

Value drivers of the project include: Knowledge Transfer, effective demonstration of CO_2 transport, injection and storage; and the dissemination of learning from the project.

3.4.2. Risks

Risks currently identified for the project will be included under this section and their significance updated from monitoring results. The following are expected to be included:

- Risks to well integrity possibly encountered during initial workover – the highest risk factor in the discovery of a cementation that is deemed not suitable for CCS.
- Unexpected MMV results indicating non-conformance or leakage.
- Third party activity in the storage complex.

The risks section will be updated annually.

3.5. Injection History

After the start of injection an annotated graph (or graphs, if presented on a per well basis) of injection rate will be shown to demonstrate injection performance to-date. Comparison of the actual profile against forecasts will be part of the basis for revised monitoring activities.

The following injection rates are proposed. The capture plant is planned to be run at 130 tonnes/hour of CO_2 mass flow. Its maximum rate is expected to be 138 tonnes/hour (flow rate, not annual average). The steady state well head injection pressure is 116 bara. The average annual uptime is expected to be in excess of 80% equating to 1 million tonnes CO_2 per annum.

3.6. Field Characteristics

The Goldeneye field is a good candidate for CO_2 storage. It has a relatively simple structure (three-way dip closure, with additional stratigraphic trapping due to reservoir pinch-out) and has no evidence of fluid compartmentalisation. Its main reservoir – the 'D' Unit of the Captain Sandstone

Member – is a very clean (average net-to-gross = 94%) massive sandstone, with excellent reservoir properties (average porosity = 25% and average permeability is 790 mD). The injectivity index for CO_2 is expected to vary throughout the injection life cycle due to the pressure variation (hence physical properties of the CO_2). At low gas rates the change in drawdown between hydrocarbon producing gas and CO_2 injection is at a minimum; it will become larger at high gas rates.

It is important to note that the above is a synopsis of the reservoir characteristics as understood at the time of writing in April 2015. Any modifications to this understanding which arise as a result of monitoring activities and/or observations of unexpected performance during the project lifecycle, should be recorded.

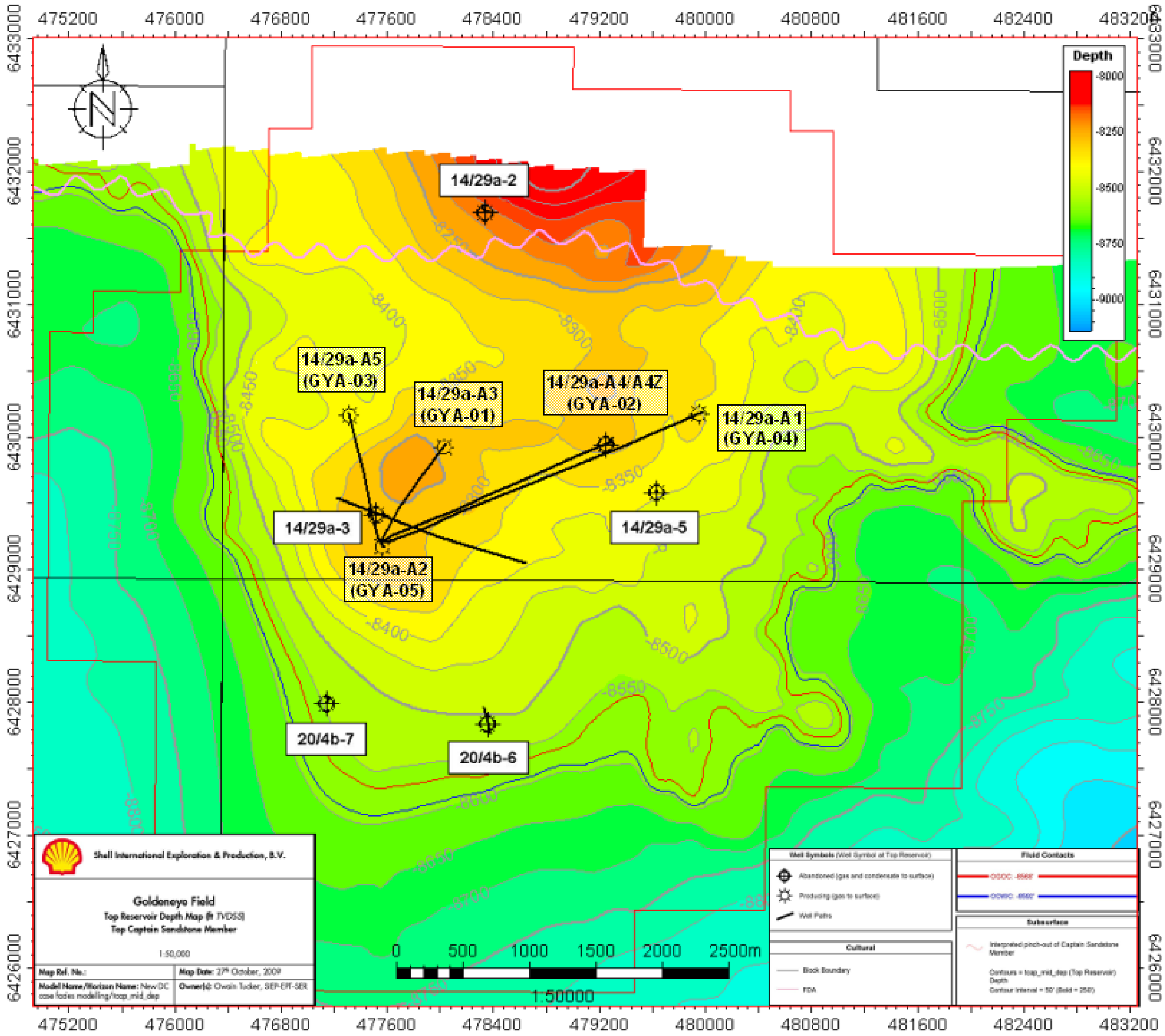

Figure 3-3: Goldeneye field top structure map showing well locations

A description of the updated understanding of reservoir properties will be included, with a clear comparison of expected and observed values and characteristics. Also included will be implications for expected future behaviour of the store and updates (including timing) to the monitoring plan.

When available, plots on a well-by-well and field basis, of injection rates achieved, compared against forecasted will be included in the ASRP.

3.6.1. Current Reservoir Pressure

The average reservoir pressure was calculated from measurements made from all five then working downhole pressure gauges at 0000 on 6th February, 2011, as 2114 psia (146 bara) at datum of 8400 ft (2560 m) TVDSS.

The depleted reservoir pressure at the time of commencement of injection (assumed for this forecast to be 1/1/2019), is expected to be in the range of 2800 to 3070 psia (190 to 212 bara) at datum of 8400 ft (2560 m) TVDSS, with a mid-case value of 2965 psia (204 bara). Injection of 15 Mt of CO_2 in 15 years is expected to cause a pressure increase to a value, at the end of injection, in the range 3303 to 3763 psia (228 bara to 260 bara) at datum and a mid-case value of 3595 psia (248 bara).

The latest pore pressure prediction report was completed in Q1 2015. It shall be updated before any well intervention takes place and will include:

a) Updated pore pressure predictions, in the form of tables and plots such as that shown, or if appropriate in the Shell approved format at the time of compilation.
b) Observed pressures with plots and tables for each well intervention. Discuss any notable discrepancies between predicted and actual pressure. Ensure that actual performance of neighbouring, hydraulically connected fields has been accounted for.
c) Identification of any data gaps from third party fields and describe implications for CO_2 injection and security of the store.

Table 3-1: Example pore pressure prediction table (Not valid for post 2017 well interventions)

Well Name	GYA01 (14/29a-A3)											
Date	01-Jan-15											
Valid to:	3.5 Years (July 2018)				Pressure (psia)							
Date	Formation top (ft)	Depth AHBDF ft	Depth TVDSS ft	Fluid	Abs Min	Poss. Real. Low	Expected	Poss. Real high	Abs High	Fluid gradient (psi/ft)		
										Gas	Oil	Water
01-Jan-18	Captain	9017	8265	Gas	2046	2847	2883	2960	3802	0.105	-	0.452
	TD	9166	8397		2060	2861	2897	2974	3816	0.105	-	0.452

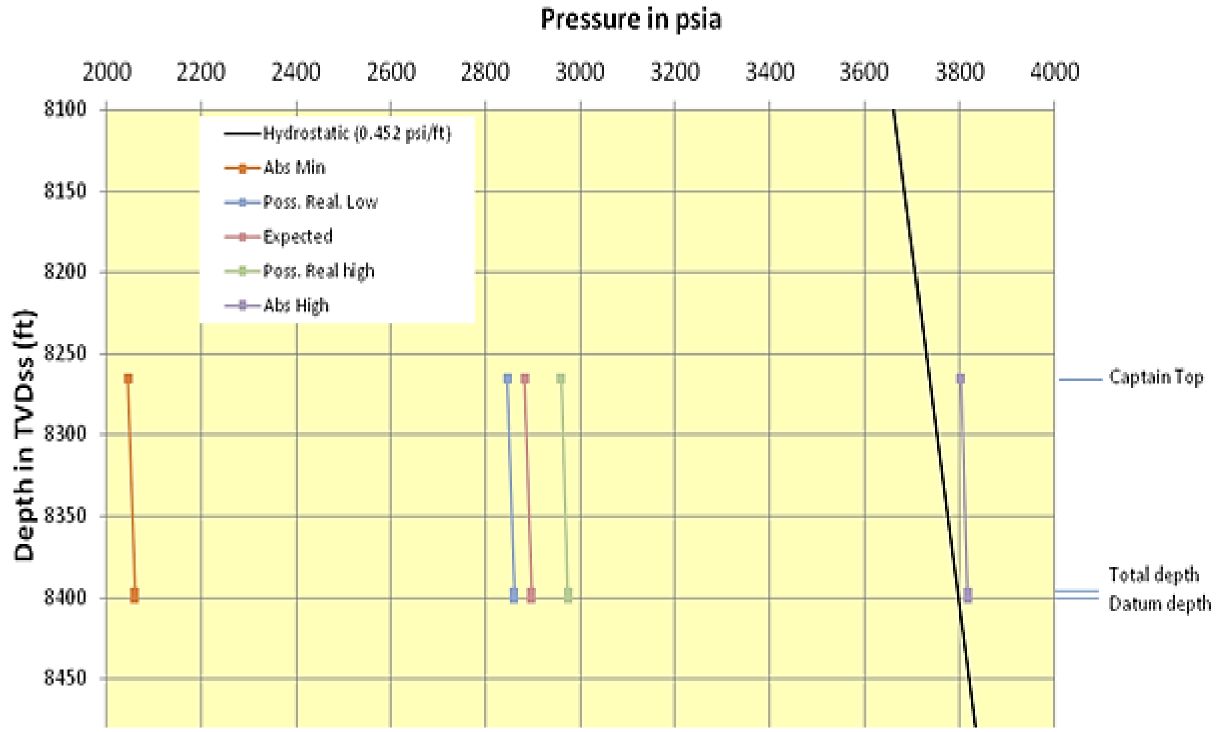

Figure 3-4: Example pore pressure prediction (PPP) for GYA01 valid for example date post 2016. Not to be used for post 2017 well interventions

4. Forecast and CO_2 Injection Efficiency

4.1. Injection Profiles

It is estimated that the CO_2 capture plant will run at a flow rate of 130 tph of CO_2 for up to 15 years, with an average availability in excess of 80%.

The total quantity that is planned to be injected and stored is up to 15 million tonnes over a period of 15 years. Predicted future injection profiles per well will be presented under this section. Existing injection pressures will be reported and compared to predicted values. The Storage Development Plan (1) has the most recent estimates of the profiles.

The measured composition of the delivered and injected CO_2 stream will be recorded and compared with the planned composition shown below.

Table 4-1: Composition, rates and pressure of CO_2

Parameter	Unit	Design
Planned flow rate to pipeline	tph	**130**
Operating pressure envelope (pipeline)[2]	bara	**85-120**
Pipeline diameter	inch	**20**
Temperature at discharge of aftercooler	°C	**25**
Composition mol%		
SO_2	mol %	**0.00**
CO_2	mol %	**99.98**
H_2O	ppmV	**≤50**
O_2	ppmV	**≤1**
N_2	ppm (mol)	**322**
H_2	ppm (mol)	**5**
Ar	mol %	**0.00**

4.2. Injection Performance (Dynamic)

The injection pressure vs total injected must also be plotted as must an analysis of fall off tests, and thermal decay tests when wells are shut in. The team might look at rate transient analysis in addition to pressure transient analysis.

Example of pressure data: (illustrative figures only as of time of writing, April 2015)

Table 4-2: Store Pressure from PDG in injectors

Injecting wells	Pressure from gauge psig	Pressure from gauge psig	Pressure from gauge psig	Forecast Store pressure
Date	GYA01	GYA02S1	GYA04	
1/1/2019	2967.74	2964.75	2967.79	2950
1/1/2020	3090.27	3099.49	3102.57	3074.9
1/1/2021	3114.93	3168.42	3168.42	3146.4
1/1/2022	3226.12	3226.12	3226.12	3203.7
1/1/2023	3217.59	3272.75	3282.56	3250

[2] Note: MAOP of the existing pipeline is 132 barg (133bara).

Table 4-3: Store Pressure from PDG in monitoring wells

Monitoring wells	Pressure from gauge psig	Pressure from gauge psig
Date	GYA03	GYA05
1/1/2019		
1/1/2020		
1/1/2021		
1/1/2022		

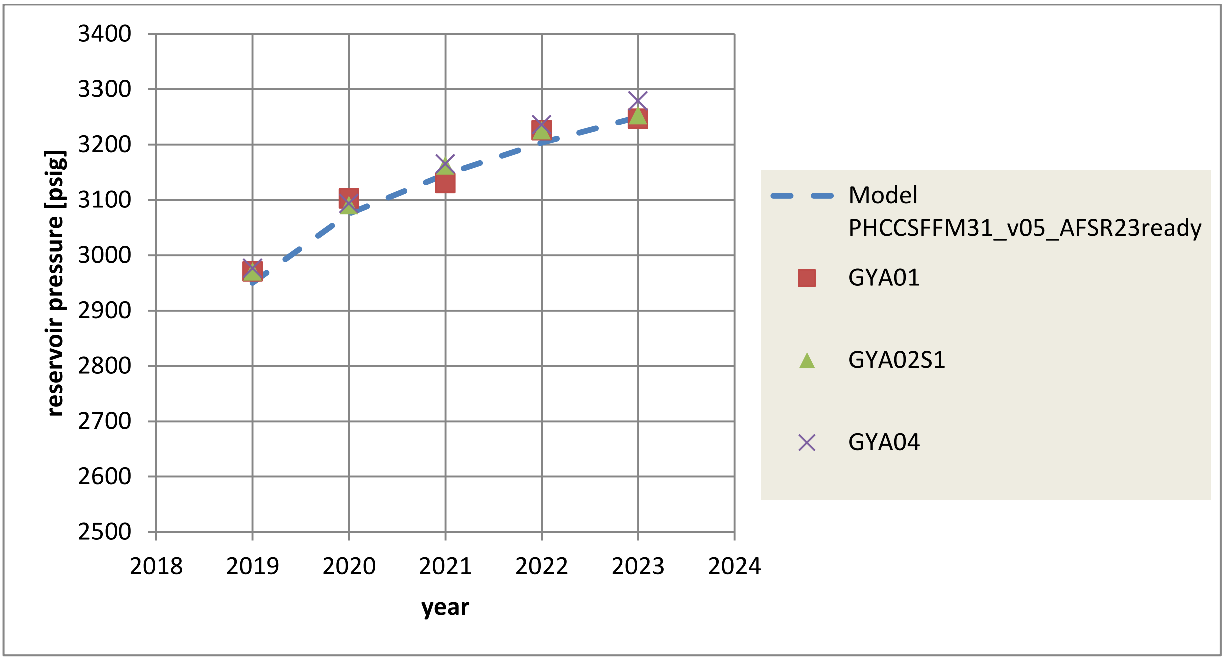

Figure 4-1: Example pressure plot (illustrative only)

4.3. Asset Integrity

A description of the performance of the facilities over the past year, outlining any issues that have affected availability over the period, plus plans for the coming year will be included. This will cover the pipelines, wells and platform facilities including monitoring equipment.

As shown in Figure 1-2, facilities covered in this report are:

a) The CO_2 transport pipeline, leading from the capture plant through a short section of onshore pipeline which will incorporate the onshore pig launcher and pipeline landfall, and a new offshore pipeline which will be tied in subsea to the existing Goldeneye pipeline.

b) The normally unmanned Goldeneye platform – modified to include additional filtration, metering and upgraded for CO_2 service. The vent system and all safety systems will have been upgraded for CO_2 operation.

c) Three of the former production wells will be recompleted as CO_2 injectors, the fourth will be used for monitoring and as a possible extra injector late in injection life (when the value of information from well monitoring reduces). The injection wells will consist of ^{13}Cr and Super 13 chrome (S13Cr) corrosion resistant tubing strings (and the existing sand screens), and carbon steel liners and casings. The fifth well will be a subsurface abandonment with downhole cement plugs at the primary seal level.

4.4. Reliability & Operations

A chart displaying actual reliability will be included along with a discussion on expected reliability for the following period.

Capture plant uptime, CO_2 rate to pipeline – to be recorded in first week of every month.

Table 4-4: CO_2 rate to pipeline table (illustrative example)

Date	CO_2 rate	Plant uptime	Total CO_2 delivered to wells	Forecast total CO_2 delivered
	Averaged over month tph	Daily % uptime, averaged over last month	Tonnes/day – averaged over month	Tonnes/day – averaged over month
Jan 2019				
Feb 2019				
Mar 2019				
Apr 2019				
May 2019				
Jun 2019				
Jul 2019				
Aug 2019				
Sep 2019				
Oct 2019				
Nov 2019				
Dec 2019				
	Annual total CO_2/tonnes	Annual average uptime percent	Total CO_2 delivered since 1.1 2019	
End 2019				

4.5. Storage Capacity Estimates

Injection performance per well and results from monitoring surveys will be incorporated into the full field simulation models (FFSM) of the reservoir. This will be used to compare actual performance versus modelled performance (conformance). Also presented in this section will be estimates of volume of CO_2 stored and an estimate of remaining capacity – supported by appropriate graphical output from the FFSM.

The remaining storage capacity should be referenced to the different storage resource classes:

- 1P – the high confidence volume that in this case is also the permitted volume, or 15Mt.
- 1C – the contingent resource volume, 20Mt, the volume technically de-risked.
- 2C – the expectation volume for the structural trap, 34Mt.

Storage resource volume classification is outlined in (3). An example of the capacity estimates is given in Table 4-6.

Individual well performance is also plotted and listed; examples are show in Table 4-5, Figure 4-5. While the latest forecasts of fluid and pressure distributions are shown from the updated history matches. Examples are in Figure 4-2 and Figure 4-3.

Example plots from FFSM:

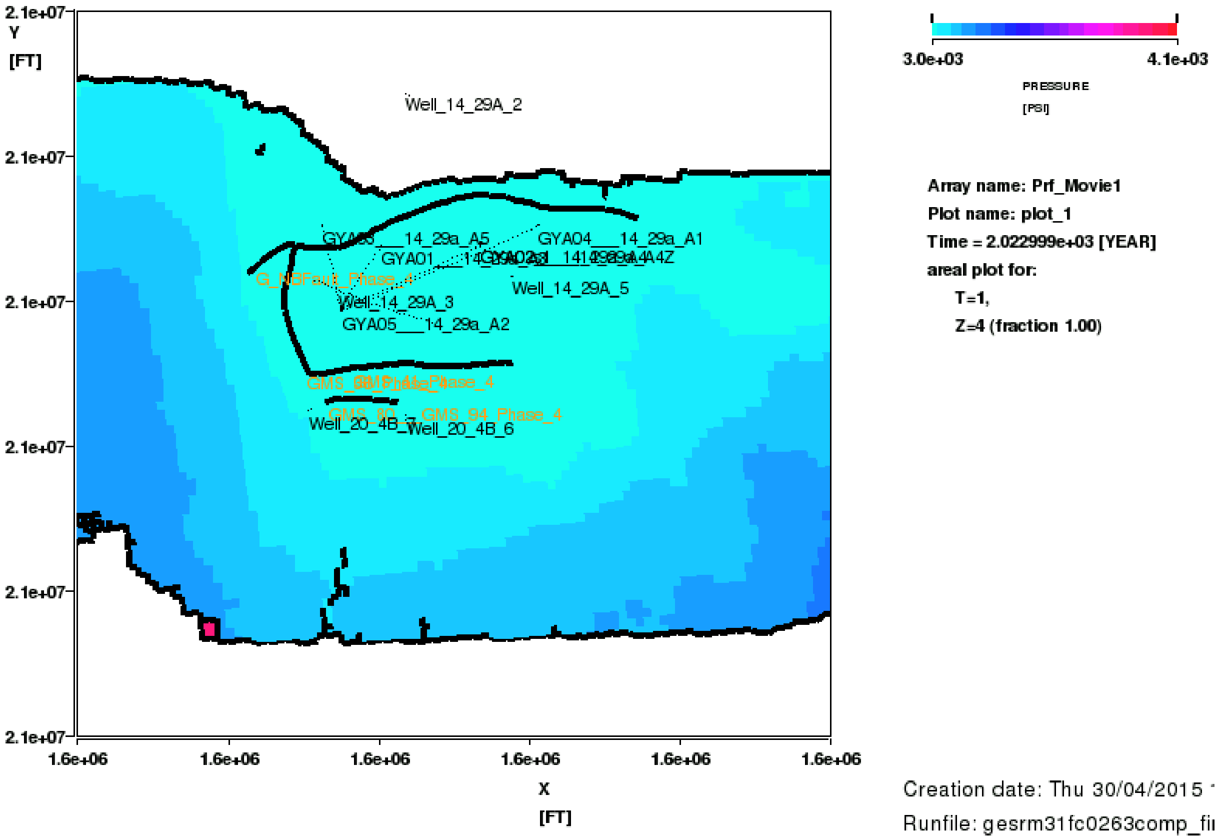

Figure 4-2: Forecast reservoir pressure at 1.1.2023, after injection of 3.05 Mt CO_2 in GYA02S1 only

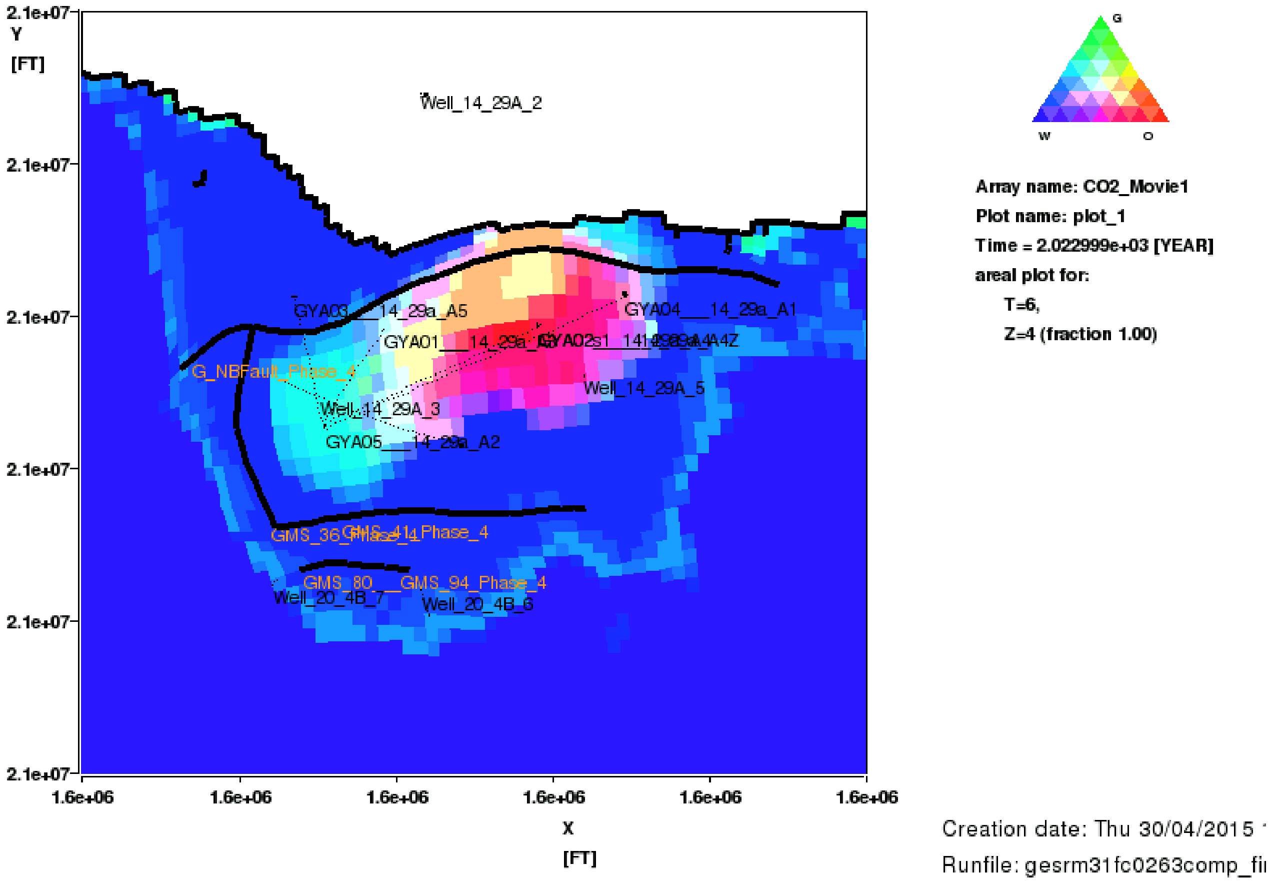

Figure 4-3: Forecast CO_2 saturation at 1.1.2023, after injection of 3.05 Mt CO_2 in GYA02S1 only

Table 4-5: Injection Performance Table (example for a single well)

	GYA02S1	Injecting well Actuals			Historical estimate (from last year)		
Date	Average annual CO_2 injection rate tph	Average annual CO_2 injection rate m^3/hour (to compare with simulator)	Total injected from well in last year Mt	Total injected from well Mt	Average annual CO_2 injection rate tph	Average annual CO_2 injection rate m^3/hour	Cumulative CO_2 Mt
1/1/2019	0.096	48813	0	0	0.096	48813	0
1/1/2020	0.120	61017	0.840	0.840	0.120	61017	0.840
1/1/2021	0.120	61017	1.050	1.891	0.120	61017	1.891
1/1/2022	0.120	61017	1.050	2.941	0.120	61017	2.941
1/1/2023	0.120	61017	1.050	3.99	0.120	61017	3.992

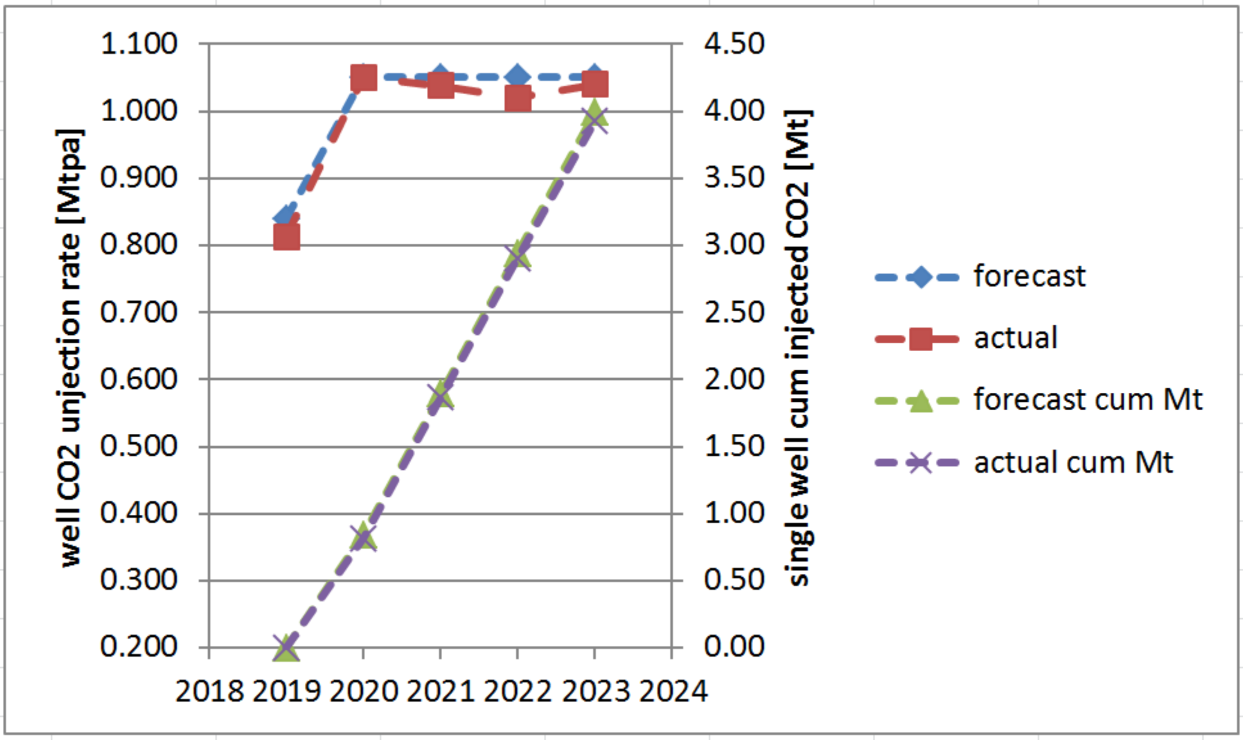

Figure 4-4: Single well GYA02S1 injection rate and cumulative injection since 1/1/2019

Table 4-6: Remaining storage capacity estimate (illustrative example)

Cumulative CO_2 injected well [millions of tonnes]						
1/1/2019	GYA01	GYA02S1	GYA04	Total injected	Remaining permitted capacity (1P)	Remaining expectation capacity (2U)
1/1/2019	0	0.000	0	0.000	15.0	34.0
1/1/2020	0	0.840	0	0.840	14.2	33.2
1/1/2021	0	1.891	0	1.891	13.1	32.1
1/1/2022	0	2.941	0	2.941	12.1	31.1
1/1/2023	0	3.991	0	3.991	11.0	30.0

5. Measurement, Monitoring and Verification (MMV)

A risk-based approach has been used to design a site-specific plan for MMV of the Goldeneye storage complex. The plan is based on a detailed understanding of the storage complex, taking into account the heterogeneity of the subsurface and all the potential leakage pathways present in the complex.

Monitoring activities planned for the year and results of previous year's monitoring will be reported under this section.

5.1. Summary of Results of Prior Monitoring

This section will include any implications and changes to the current year's monitoring as a result of the previous years.

5.2. Plans For this Year's Monitoring Activities

The monitoring plans for upcoming monitoring, and expected results which would demonstrate good conformance. Also, possible findings which would indicate the need for updates to longer term monitoring (including increased monitoring).

Indicative examples of what this section is likely to include (following consultation with the U.K. Regulator):

Immediate monitoring activity, baseline surveys to include:

- Seabed and water column under platform, seabed mapping over storage complex (pockmarks) for later leakage identification, baseline bubble surveys using remotely operated vehicle (ROV) under platform, GPS baseline for surface displacement monitoring.
- 3D streamer seismic over storage complex, Ocean Bottom Nodes (OBN) over storage site.

Pre-injection and start of workover activities:

- Installation of permanent downhole gauges.
- Cement Bond Logging (CBL) and casing integrity logging.
- Sigma and neutron logging for baseline fluid contacts.
- Delivery pipeline integrity.

Start injection and continued workover activity pre injection in additional well(s):

- Further CBL as required.
- Continual bubble monitoring.
- Pressure monitoring on start of injection (Hall plot baseline).
- Capture plant integrity, CO_2 stream composition.

One year post injection, pre-handover:

- Repeat baseline surveys: Seabed and water column under platform, GPS for evidence of any seabed movement.
- 3D streamer seismic over storage complex, Ocean Bottom Nodes (OBN) over storage site. For evidence of any CO_2 movement out of storage site.
- Continue bubble monitoring – for injection well integrity.
- Post-injection pressure monitoring in injection wells.
- Capture plant integrity, CO_2 stream composition.
- CO_2 transport pipeline – check for leakage.

Six years post injection – final check before handover:

- Repeat all baseline surveys of wells and complex.

5.3. Update to Storage Containment Risk Assessment

The monitoring programme will collect significant quantities of data. Some of this concentrates on validating conformance and on improving the 3D dynamic forecasting models, other data looks directly for evidence of significant irregularities.

The activities of other users of the subsurface and seabed have the potential to alter the performance of the storage site. Together, 3D dynamic modelling and containment monitoring serve to inform the risk assessment. This section will record any changes to the assessed risks.

6. Costs

Injection, capital expenditure (CAPEX) and operational expenditure (OPEX) profiles will be presented. The aim is to track the average cost of injection and the operating cost.

Table 6-1: Costs and injection volumes, £MOD, Mt

Year	Platform, subsea and monitoring capex	Monitoring opex (including onshore costs)	Other opex (including share of overheads)	Injected volume
2016				
2017				
2018				
2019				
2020				
2021				

7. References – Bibliography

1 PCCS-00-PT-AA-5726-00001, Storage Development Plan, 2015.

2 PCCS-05-PTD-ZP-9025-00003, Storage Permit Application Part III (Metering, Monitoring and Verification Plan), https://www.gov.uk/oil-and-gas-carbon-storage-public-register, 2015.

3 Gorecki, et.al. Development of Storage Coefficients for Carbon Dioxide Storage in Deep Saline Formations, IEAGHG 2009/13

8. Glossary of Terms

Term	Definition
ARP	Asset Reference Plan
CAPEX	Capital Expenditure
CCGT	Combined Cycle Gas Turbine
CO_2	Carbon Dioxide
CCS	Carbon, Capture and Storage
DECC	Department of Energy and Climate Change
FFSM	Full Field Simulation Model
FID	Final Investment Decision
GPS	Global Positioning System
HDD	Horizontal Directional Drill
HSSE	Health, Safety, Security and Environment
HSSE-SP	Health, Safety, Security, Environment and Social Performance
KKD	Key Knowledge Deliverable
KPI	Key Performance Indicator
KT	Knowledge Transfer
MMV	Measurement, Monitoring and Verification
OBN	Ocean Bottom Nodes
OPEX	Operational Expenditure
PDG	Permanent Downhole Gauge
PPP	Pore Pressure Prediction
ROV	Remotely Operated Vehicle
SP	Social Performance
TI	Technical Integrity
tph	Tonnes per hour
TVDSS	True Vertical Depth Subsea

9. Glossary of Well Names

In the text well names have been abbreviated to their operational form. The full well names are given in Table 10-1.

Table 9-1: Well name abbreviations

Full well name	Abbreviated well name
DTI 14/29a-A3	GYA01
DTI 14/29a-A4Z	GYA02S1
DTI 14/29a-A4	GYA02
DTI 14/29a-A5	GYA03
DTI 14/29a-A1	GYA04
DTI 14/29a-A2	GYA05

10. Glossary of Unit Conversions

For the provision of the SI metric conversion factor as applicable to all imperial units in the Deliverable.

Table 10-1: Unit Conversion Table

Function	Unit - Imperial to Metric conversion Factor
Length	1 Foot = 0.3048 metres 1 Inch = 25.4 millimetres
Pressure	1 Bara = 14.5psia
Temperature	°F=(1.8)(°C)+32 °R=(1.8)(K) (absolute scale)
Weight	1 Pound = 0.454 Kilogram