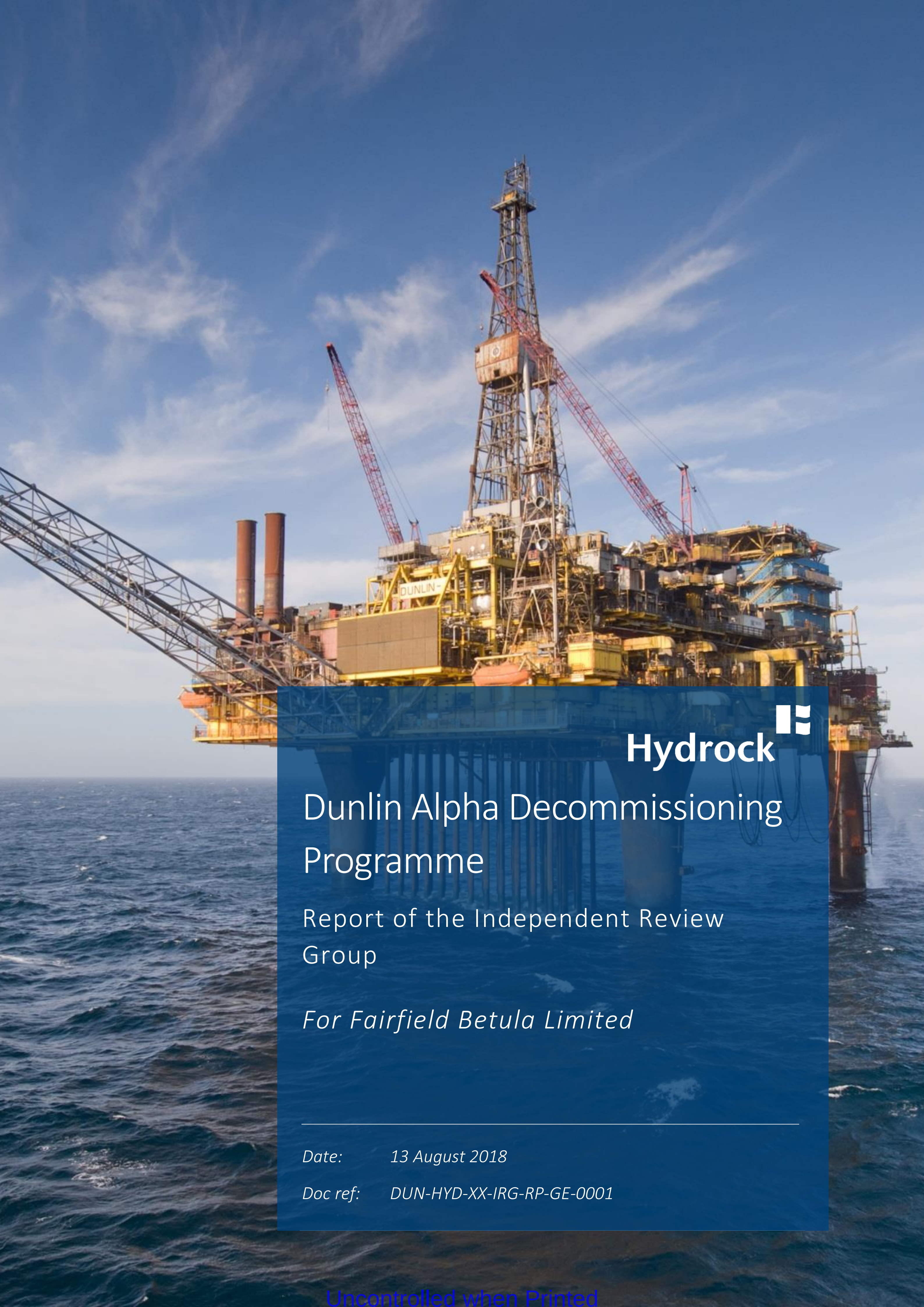

Hydrock

Dunlin Alpha Decommissioning Programme

Report of the Independent Review Group

For Fairfield Betula Limited

Date: *13 August 2018*

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ABBREVIATIONS

ALARP	As Low as Reasonably Practicable
AORP	Attic Oil Recovery Project
BEIS	Department for Business, Energy and Industrial Strategy
CA	Comparative Assessment
CGBS	Concrete Gravity Base Structure
CoP	Cessation of Production
CP	Cathodic Protection
CCTR	Cell Contents Technical Report
DBT	DiButyltin
DP	Decommissioning Programme
EA	Environmental Appraisal
EIA	Environmental Impact Assessment
ENVID	Environmental Impact Identification
FAR	Fatal Accident Rate
FBL	Fairfield Betula Limited
HLV	Heavy Lift Vessel
HSE	Health and Safety Executive
IMO	International Maritime Organisation
IRG	Independent Review Group
LAT	Lowest Astronomical Tide
MCDA	Multi Criteria Decision Analysis
MEMW	SINTEF Marine Environmental Modelling Workbench
MSF	Module Support Frame
ODU	Offshore Decommissioning Unit (of BEIS)
OGA	Oil & Gas Authority
OGUK	Oil & Gas UK
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Oslo-Paris Convention
PLL	Potential Loss of Life
ROV	Remotely Operated Vehicle
RPS	Risk Probability Score
S29	Section 29 of the Petroleum Act 1998
SEPA	Scottish Environmental Protection Agency
TBT	TriButyltin
THC	Total Hydrocarbon Content
ToR	Terms of Reference
TRL	Technology Readiness Level
TRS	Technical Risk Score

EXECUTIVE SUMMARY – PRINCIPAL FINDINGS OF THE IRG

Introduction

The Independent Review Group (IRG) was established in August 2017 by Fairfield Betula Limited (FBL) to independently review proposals for the decommissioning of the Dunlin Alpha Concrete Gravity Base Structure (CGBS). This report by the IRG presents the principal findings, conclusions, and recommendations of the IRG. The report, together with the Appendices, includes the Terms of Reference (ToR) of the IRG, a description of how the IRG worked and how it developed arguments to support the principal findings. It provides a complete reference list of documentation. The IRG reviewed documentation provided by FBL up until IRG Meeting #09 (17th June 2018). In relation to the review of FBL's Decommissioning Programme (DP) document, this review included up to and including revision A4. Any documentation issued to the IRG after this date was not reviewed for the purposes of this report.

The issue of this IRG report coincides with the publication of FBL's Pre-consultation DP document in August 2018.

Principal Findings

1. FBL has commissioned a considerable number of programmes of investigation and study work to evaluate options for the decommissioning of the Dunlin Alpha CGBS. During the period of the IRG's engagement, the IRG has reviewed in excess of 100 technical reports.
2. The IRG agrees with FBL that removal of the entire CGBS to leave a clean seabed (Option 4) is neither feasible nor desirable from an environmental, safety, technical or economic perspective.
3. Of the nine options considered, the IRG supports the early screening out of the following options ahead of the Comparative Assessment (CA) workshop, namely:
   a. Option 1 In-situ re-use;
   b. Option 2 Re-float and re-use;
   c. Option 3 Re-float and destruct; and,
   d. Option 8 Retain with the Module Support Frame (MSF) in place.
4. FBL did not take Option 7 (toppling the legs) beyond the screening stage because of advice from the Department for Business, Energy and Industrial Strategy (BEIS) that toppling would be regarded as being dumping at sea and not supportable.
5. Option 5 (shallow leg cut) and Option 6 (International Maritime Organisation (IMO) compliant leg cut) both entail underwater cutting of heavy wall thickness concrete on a scale never previously attempted. The IRG considers the risks of attempting such an operation to be very high.
6. The remaining option, Option 9 (leave in situ with the four steel transition pieces up and protected by an extended Cathodic Protection (CP) system, internal coating and navigational aid (navaid)), has been taken forward as the preferred decommissioning solution. The IRG agrees with the outcome of this assessment.
7. The IRG would have liked to have seen more consideration of the longer-term impacts, beyond 50 years, of Option 9 and believes that such consideration could have made some difference to the scoring outcome of the CA but would not change the overall conclusion. It should be noted that current legislation makes

provision for longer term monitoring and assigns liability to those served with notices under Section 29 (S29) of the 1998 Petroleum Act.

8. There is a considerable volume of oil-based mud drill cuttings lying on top of and around the base of the structure, typical of many North Sea platforms. The release of hydrocarbons from this cuttings pile has been assessed as being compliant with Oslo-Paris Convention (OSPAR) hydrocarbon release limits. However, the cuttings pile contains a number of potentially highly toxic components including heavy metals such as tin compounds. Disturbing this pile to relocate it would create a considerably more significant environmental impact than leaving it in place.
9. Despite the extensive Attic Oil Recovery Project (AORP) of cell contents in 2007, remnant hydrocarbons remain in the storage cells. The methodology used to estimate the volumes, locations and nature of material remaining within the cells represents a reasonable approach. The modelling, which follows good practice, indicates that even if this volume has been underestimated, given the nature of the concrete containment and its likely failure mechanism, any release of oil would have an insignificant impact on the environment.
10. The IRG opinion is that the environmental impact and safety risk created by trying to remove and dispose of any remaining oil and sediment in the storage cells outweighs the benefit of recovery. The IRG therefore accepts that leaving the cell contents in-place is the preferred option.
11. The IRG notes that the integrity of the piping and pumping systems in the structure legs and base has been compromised in a number of places. FBL is reluctant to penetrate the storage cells for sampling before removal of the topsides because of the potential water inflow, which they believe could compromise overall structural integrity. Whilst the IRG considers that this risk could have been managed if action had been taken earlier, it considers that there is not a compelling engineering argument for FBL to undertake further cell contents sampling or survey to validate the previous modelling. The IRG considers that such investigations may be required to validate theoretical modelling, to satisfy stakeholder concerns, enhance public perception, and manage the risk to the decommissioning programme and therefore should be kept open as an option.
12. The IRG is generally satisfied that FBL has followed BEIS and OSPAR guidance when running the CA exercise. The IRG considers the technical data to be reliable and the assessment process transparent. Throughout the project, FBL has engaged with a wide range of stakeholders. The IRG has sampled the outputs from these interactions and notes the views held and responses given by FBL to the questions raised. The CA workshops attended by key stakeholders were well run. Ahead of the workshops, FBL provided extensive pre-read material and offered stakeholders one to one briefing sessions. However, there was limited take-up of these briefings.

1. INTRODUCTION

1.1 Purpose of the Report

The purpose of this report is to present the findings of an Independent Review Group (IRG) constituted in August 2017 by Fairfield Betula Limited (FBL), to review FBL's proposals for the decommissioning of the Concrete Gravity Base Structure (CGBS) part of the Dunlin Alpha Platform installation.

The report provides a full account of the IRG's activities that enabled it to fulfil its duties set out in the Terms of Reference (ToR) (Appendix A) that were agreed between FBL and the IRG.

1.2 Legislative and Regulatory Context and Guidance

The decommissioning of offshore oil and gas installations on the UK Continental Shelf is governed by the 1998 Petroleum Act [1], as amended by the 2008 Energy Act [2] and the 2016 Energy Act [3]. In addition, the UK complies with the 1992 Oslo-Paris Convention (OSPAR) for the Protection of the Marine Environment of the North-East Atlantic [4]. Under the OSPAR regime, the presumption is for complete removal of offshore installations when they are decommissioned; OSPAR Decision 98/3 [5] provides for operators to apply for a derogation to allow CGBSs (such as Dunlin Alpha) and footings of large steel platforms to be left in place. Where derogation from full removal is sought, a Comparative Assessment (CA) of options is required to demonstrate how the preferred decommissioning solution has been arrived at.

The UK regulator responsible for decommissioning and ensuring that these legislative and international requirements are complied with is the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), which is part of the Department for Business, Energy and Industrial Strategy (BEIS). OPRED is the UK Competent Authority for OSPAR compliance; its Offshore Decommissioning Unit (ODU) has provided Guidance Notes for the Decommissioning of Offshore Installations [6].

The Energy Act 2016 established the Oil and Gas Authority (OGA) that is required to maximise economic recovery of offshore UK petroleum. The OGA must also be consulted for decommissioning.

BEIS requires that the CA process and conclusions are subject to independent expert verification. In the case of the Dunlin Alpha platform, the IRG was asked to review both the CA and the Decommissioning Programme (DP) Consultation document[1].

The decommissioning option selection and CA process is described in more detail in Section 2.1.

FBL's objective is to present decommissioning proposals for the Dunlin Alpha platform that are compliant with the BEIS guidance. The IRG has reviewed and commented on FBL's proposals and the technical basis on which they have been derived, especially in respect of:

- The supporting evidence and assumptions for decisions made; and,
- Implementation of the CA process.

More details are presented at Appendix B.

[1] More details of the IRG's remit and the approach that it took to arrive at its findings are presented in Appendix A and Appendix C

1.3 IRG Membership and Activities

IRG membership is listed in Table 1 below. Summary biographical details of members are presented in Appendix D as evidence of their expertise relevant to the decommissioning issues under review.

Table 1: Dunlin Alpha Decommissioning IRG Membership

IRG Member's Name	Role/Specialism	Affiliation
Graham McNeillie	Chairperson	Hydrock Consultants
Jenny Richards	Vice Chairperson; Stakeholder Engagement	Hydrock NMCL
George Fleming	Environmental Engineering - Marine Processes	Enviro Centre
Zoe Crutchfield[2]	Environmental Assessment	Arup
Andrew McNulty	Structural Engineering	Arup
Martin Muncer	Health & Safety	Independent Consultant
Stein Haugen[3]	Risk Analysis Specialist	Independent Consultant
Eric Cooper	Project Manager (for IRG activities)	Hydrock Consultants
Ruby Lowe	Secretariat (for IRG activities)	Hydrock NMCL

Over the period August 2017 to July 2018, the IRG:

- Met formally as a group on 10 occasions to discuss the proposals put forward by FBL;
- Discussed and clarified issues with FBL employees and technical consultants;
- Reviewed and provided written comment on FBL reports and proposals;
- Attended two stakeholder engagement meetings in Aberdeen in November 2017 and May 2018;
- Observed the CA Workshop in Aberdeen in March 2018; and,
- Met with BEIS ODU to confirm certain policy issues and clarify BEIS' expectations.

The IRG examined and commented on the FBL documents in order to understand and critically comment on the process used by FBL, and the underpinning evidence, which was used to make decisions. This review activity is presented in more detail later in this report. Members of the IRG expressed their views independently and did not necessarily always agree on all issues all of the time. However, this report does represent the collective views, conclusions and recommendations of the IRG.

More details of IRG activities are presented at Appendix C.

[2] Zoe Crutchfield left the IRG in May 2018 and thereafter her involvement with the IRG ceased

[3] After March 2018, Stein Haugen did not attend IRG meetings but was involved in group activities by correspondence. He reviewed and commented on sections of the final report

1.4 Description of the Dunlin Alpha Platform Facility

The Dunlin Alpha installation is a CGBS, located in UK Block 211/23a in the North Sea. It was installed in 1977 and stands in 151m of water. As shown by Figure 1, the installation consists of a concrete base caisson, topsides and four concrete legs, with steel transition pieces connecting to the topside and horizontal guide frames supporting the well conductors. The IRG's remit for review covers the decommissioning of the CGBS and does not include the decommissioning of the topside or any other ancillary aspects of the platform.

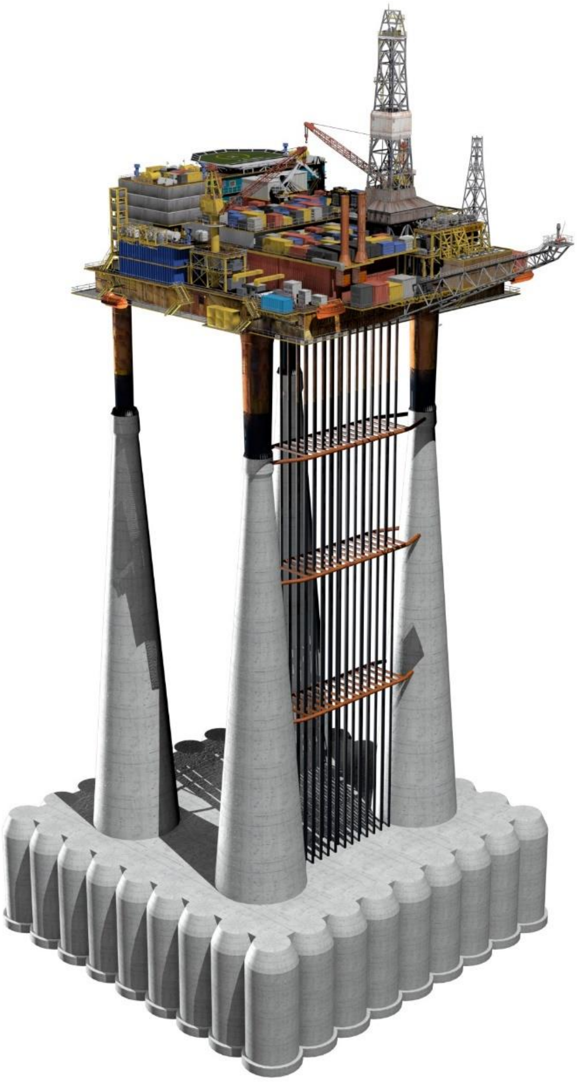

Figure 1: The Dunlin Alpha platform

The substructure was originally designed to provide oil and water separation prior to oil export and consists of 81 individual cells in the base of the structure. All use of the oil storage cells ceased in 2004, and an oil recovery project was undertaken in 2007 to remove mobile oil from the cells and roof spaces. Cessation of Production (CoP) occurred in June 2015.

Further details relating to the platform, including its location, its relationship with adjacent facilities and a description of the items to be decommissioned can be found in FBL's DP [7]. The substructure is within the criteria allowed for potential derogation under OSPAR Decision 98/3.

2. IRG FINDINGS

FBL commissioned a considerable number of programmes of investigation and study work to evaluate options for the decommissioning of the Dunlin Alpha CGBS. During the period of the IRG's engagement, the IRG has reviewed in excess of 100 technical reports; the complete list is provided in Appendix E to this report. This documentation supported FBL's CA process and considered the established BEIS criteria of safety, environment, technical feasibility, societal impact and cost [6].

The following sections describe the findings of the IRG and its opinion on important aspects of the DP.

2.1 Option Selection and the Comparative Assessment Process

2.1.1 OSPAR Decision 98/3

OSPAR Decision 98/3 [5] states that 'the dumping, and the leaving wholly or partly in place, of disused offshore installations within the maritime area is prohibited'. However, the OSPAR 98/3 decision recognises that, for gravity based concrete installations (excluding their topsides), if the competent authority of the relevant Contracting Party is satisfied there are significant reasons why an alternative disposal method is preferable to reuse or recycling or final disposal on land, it may issue a permit for the installation to be left wholly or partly in place. This is known as a derogation case.

The Dunlin Alpha CGBS complies with the set of criteria stipulated by OSPAR 98/3 in order to qualify for derogation. However, sufficient reasoning and assessment must be provided by the relevant Contracting Party to OSPAR (in this case the UK government) in order to justify their preferred decommissioning option for the platform. OSPAR 98/3 sets out a framework for the assessment of disposal options for disused offshore installations. It requires a range of options to be considered, via a CA process, including re-use, recycling, disposal on land and other options for disposal at sea. It requires the assessment to be sufficiently comprehensive for a reasoned judgement on the practicability of each of the disposal options to be made, and to allow for an authoritative comparative evaluation.

BEIS Guidance Notes on the Decommissioning of Offshore Oil and Gas Installations and Pipelines [6] provide general guidance on regulatory requirements for the decommissioning process, including guidance on the CA process. However, they provide little detailed prescription for substructures, other than that decisions must be transparent. Oil & Gas UK (OGUK) has also produced guidelines for CA [8] which give further background to the process for comparing decommissioning options.

2.1.2 Decommissioning Options

Initially FBL considered the following decommissioning options (Table 2) for the Dunlin Alpha CGBS, as per FBL's pre-consultation DP [7]:

Table 2: Set of decommissioning options considered by FBL

Option 1.	Re-use of the installation at the current location
Option 2.	Re-float the installation for reuse at another location
Option 3.	Re-float the substructure for deconstruction at an inshore location
Option 4.	Total deconstruction of the substructure at the current location (full removal)
Option 5.	Partial removal of the substructure legs to -8m Lowest Astronomical Tide (LAT) approx. (i.e. below the sea surface) and installation of a navigational aid (navaid) tower (shallow cut)
Option 6.	Partial removal of the substructure to LAT -55m (International Maritime Organisation (IMO) cut)
Option 7.	Collapsing legs through controlled demolition
Option 8.	Retain the Module Support Frame (MSF) on the substructure and install navaid
Option 9.	Leave the substructure in-situ[4] and install navaid on one transition

2.1.3 Option Screening

In accordance with BEIS and OGUK guidelines [6] [8] a screening phase was used by FBL to screen out the unrealistic options or those likely to be unacceptable to the regulators. Table 3 below shows which options were either taken forward to the CA or screened out. Within the table, the IRG has provided an overview of FBL's reasoning behind screening out an option, along with any additional points it thought were important to note.

[4] The IRG understanding is that a combination of coatings and cathodic protection would be applied only to the transition piece accommodating the navaid.

Table 3: An overview of decommissioning options

Decommissioning Option	Screened out/taken forward to CA	Reasoning (if screened out)
1. Re-use	Screened out	Re-use would postpone, but not prevent, the eventual decommissioning of the ageing structure; however, no re-use (including the case examined for carbon sequestration) was identified and Option 1 was screened out. While it may be unlikely that a potential purchaser for a different use exists, it is understood that FBL has not yet advertised the opportunity in the Official Journal of the European Union.
2. Re-float for use at another location	Screened out	Dunlin Alpha had not been designed or constructed with removal in mind and a range of technical issues renders the re-float removal method extremely challenging. Option 2 and Option 3 were therefore screened out on the basis of technical feasibility.
3. Re-float for inshore deconstruction	Screened out	
4. Full removal	Taken forward to CA[5]	
5. Shallow cut	Taken forward to CA	
6. IMO cut	Taken forward to CA	
7. Toppling of the legs	Screened out	BEIS has confirmed that deliberate toppling of the legs is considered by UK Government as dumping and is currently not acceptable based on previous ministerial commitments. Option 7, while potentially feasible, was therefore screened out.
8. Retaining MSF	Screened out	Retaining the MSF with the concrete substructure and steelwork transitions was shown to provide little structural benefit to the concrete legs. Significant maintenance for the MSF was likely to be required and it was not clear that regulators would accept this option as suitable for derogation, with the MSF being explicitly part of the topside structure that OSPAR 98/3 would require returning to shore. Option 8 was therefore screened out.
9. Transitions up	Taken forward to CA	

The IRG supports the early screening out of Options 1, 2, 3, 7 and 8 ahead of the CA Workshop.

Although taken forward to the next CA stage, there are a number of technical challenges recognised by the IRG associated with the remaining four options, as shown in Table 4.

[5] BEIS guidance [6] states that the Comparative Assessment should include a full removal option

Table 4: An overview of the technical challenges associated with options taken forward for CA

Decommissioning Option	Remaining technical challenges
4. Full removal	• Requires extensive tool and method development and the deconstruction programme is likely to take several decades; and, • This is the only substructure decommissioning option requiring removal of drill cuttings (drill cuttings are discussed in Section 2.5) and removal of all of the cell contents (Section 2.2).
5. Shallow cut 6. IMO cut	• There are safety issues related to working in the legs (to clear obstructions prior to undertaking the cuts); • Currently, no cutting tools of the scale required have been developed to undertake the cuts and cutting of sub-sea concrete legs on this scale has never been previously attempted. Extensive works in the dangerous environment of the legs to remove and support appurtenances is also required. The IRG considers the risks associated with such operations to be very high; • There are difficulties in Heavy Lift Vessel (HLV) dynamic support of the shafts being cut; and, • Connection of a new concrete navigation aid tower to a cut post-stressed reinforced concrete leg as Option 5 also presents a major technical challenge.
9. Transitions up	• FBL proposes to extend the life of the steel transitions with internal coating, external Cathodic Protection (CP) on the basis that this will allow the anticipated life of the transitions to better match that of the upper concrete legs. A navaid would also be installed on one transition.

2.1.4 Comparative Assessment Process

FBL carried out a CA of the four remaining decommissioning options. Given the nature of Dunlin Alpha CGBS, FBL recognised the need for this CA process to be applied from an early stage in the project planning and so has satisfied this requirement. The objective of the IRG throughout the CA process was to consider, at a strategic level, the scope, quality and application of the work undertaken by FBL. The IRG was not a verifier of the data used within the assessment but observed the general process and how the CA was conducted.

There are a number of different approaches that can be applied when undertaking a CA; these are described in the OGUK Guidelines [8]. FBL chose to use Multi Criteria Decision Analysis (MCDA) 'pairwise' software. Although the IRG was not constituted at the time this approach was selected, the group has witnessed its application and is satisfied that it enabled FBL to assess a number of different decommissioning options objectively and transparently. In addition, the studies commissioned by FBL to support the CA process have been organised in accordance with Annex A of the BEIS guidance [6], which follows the requirements of Annexes to OSPAR 98/3 [5]. The BEIS framework consists of five assessment criteria, of which some are split into a number of sub-criteria. The proposed decommissioning options that underwent CA were assessed against each of these criteria, which are suggested by BEIS as follows:

- Safety (split into 3 sub-criteria):
  - » Risk to personnel;
  - » Risk to other users of the sea; and,

    - Risk to those on land.
- Environmental (split into 4 sub-criteria):
    - Marine impacts;
    - Other environmental compartments (including emissions to the atmosphere);
    - Energy/resource consumption; and,
    - Other environmental consequences (including cumulative effects).
- Technical
- Societal (split into 3 sub-criteria):
    - Fisheries impacts;
    - Amenities; and,
    - Communities.
- Economic

FBL initially compared Options 5, 6 and 9 using the above criteria. The preferred option identified from this assessment was then compared, again using the same criteria shown above, with Option 4. In terms of the CA process, the IRG is generally satisfied that FBL has followed regulatory and industry guidance.

In addition, FBL also proposed to undertake a CA for the cell contents. The need for this cell contents CA was dependent on the outcome of the CGBS CA; a cell contents CA was only required if either Option 5, 6 or 9 was identified as the preferred option. This is because, in the case of Option 4, the cell contents would be decommissioned along with the remainder of the CGBS. Four cell contents management options were proposed:

1. High oil and sediment recovery;
2. Mid oil and sediment recovery;
3. Mid oil recovery; and,
4. Leave in situ.

2.1.5 Comparative Assessment Workshop

Comparative Assessment of the four remaining options was undertaken using safety, environmental, technical, economic and societal criteria at a workshop in March 2018. A number of stakeholders was invited to attend this workshop and contribute to the assessment; a proportion of these attended and the full list of attendees can be found in the CA Report [9]. A more detailed description of the Comparative Assessment process, including the methodology and emerging recommendations, is provided in the CA Report [9].

Option 4 was regarded as the base case (requiring no derogation) that the preferred alternative should be assessed against. Initially, the remaining three derogation options (Options 5, 6 and 9) were mutually compared before the selected Option 9 was assessed against Option 4.

Option 9 was assessed by FBL as significantly preferred overall in the comparison between Options 9 and Option 4 and preferred individually in relation to safety, environmental, technical and economic criteria. The IRG supports the outcome that the remaining option, Option 9, has been taken forward as the preferred decommissioning solution.

As described in Section 2.1.3, as Option 9 was identified by FBL as the preferred option, FBL subsequently conducted a cell contents CA at the same CA workshop in March 2018. This cell contents

CA evaluated four cell contents management options that had been identified by FBL[6] as alternatives to be considered as a result of proposing to derogate the structure. The four management options to be compared were:

1. High oil and sediment recovery;
2. Mid oil and sediment recovery;
3. Mid oil recovery; and,
4. Leave in situ.

FBL concluded as a result of this cell contents CA exercise (which was run in the same manner as the CGBS CA and as explained further in the CA report [9]) that the preferred management option was Option 4 (leave the cell contents in situ). The IRG considers the CA process for the cell contents was comprehensive and reached the level of detail appropriate for a decision of this importance. The IRG also considers that the supporting evidence for this option is comprehensive and thorough and agrees with the conclusion of this assessment.

Prior to the March 2018 CA workshop, a significant amount of information (consisting of technical reports and a CA Briefing Document [10]) was made available to the workshop participants; the IRG notes that this may have been difficult for stakeholders to absorb. After the CA workshop, stakeholders were then given the opportunity to question and discuss further the emerging recommendations from the CA at a stakeholder workshop held in May 2018 [11]; subsequent attendance at the emerging recommendations workshop will have been helpful in improving the robustness of the CA conclusions.

The IRG had some concerns about the CA process that were not considered fully addressed in the CA and stakeholder workshops to date. The IRG has commented and challenged detailed aspects of various CA criteria; some criteria modifications would increase the relative preference for the emerging recommendation while some would diminish it; these criteria are summarised below. However, it should be noted that the IRG does not believe that any such modifications to the criteria would impact the choice of Option 9 as the emerging recommendation.

Safety Selection Criteria

Safety criteria are split into 3 equally weighted sub-criteria:

1. The first sub-criterion, for operations personnel, is based on Potential for Loss of Life (PLL) calculated from the estimated man hours and a Fatal Accident Rate (FAR) derived from a 2005 SAFETEC report titled 'Risk Analysis of Decommissioning Activities' [12].
2. The second sub-criterion, other users (which are principally attendant and passing vessels), are measured in terms of vessel days only.
3. The third sub-criterion, legacy risk for other users of the sea, is based on lifetime PLL estimated for the duration of the risk.

The IRG notes that the all the safety selection criteria will favour the options of lowest duration as manhour estimates are a major input.

Use of the SAFETEC report [12] can be expected to give a good estimate of the FAR for most deconstruction activities. However, the IRG considers that the FAR for the topside (in legs) work of 7.2

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[6] The screening process undertaken by FBL in order to arrive at these four chosen CA options is described in more detail in the Cell Contents Technical Report (CCTR) [16]

(fatalities per 100 million man-hours) is underestimated; this is relevant as it may impact on option selection. The reasoning for this is given below:

FBL has previously made the case that it prefers not to perform work inside the legs unless this is unavoidable. FBL is mindful of the hazardous location and the safety risks involved of performing work inside the legs.

The CGBS Safety Summary report [13] shows that the FAR of 7.2 is an average of the values for rope access (10.3) and for deconstruction operations – offshore work tasks (4.1) that are contained in the SAFETEC report [12]. The IRG considers that it would be more reasonable to take the average of rope access work and of lifting operations – platform cranes (26.8) as this would be more representative of the activity expected in the legs. This would result in a FAR of 18.5. It should be noted also that the SAFETEC report [12] states that 'the average experienced FAR value in decommissioning projects in the North Sea is 26.' The IRG therefore believes that the FAR of 7.2 for work inside the legs is an underestimate.

The IRG draws FBL's attention to the effect of an increased FAR for topside (in leg) work for the CA. The IRG considers that it would potentially change the gap between Option 9 and Option 6 and that it would have no influence on the emerging recommendation.

The IRG is satisfied that a measure of vessel days is sufficient to compare the safety risks to other users.

The Legacy risk used in the CA is shown to be dominated by the hazard of fishing gear snagging, which produces PLL values which are an order of magnitude greater than that for vessel collision risk. There is also an anomaly in that a lifetime PLL is calculated over differing lifetime estimates, whereas the IRG believes that an annual PLL is more appropriate for the purposes of CA. Finally, Option 6 appears as the least favoured option in the CA which is counter-intuitive for an option which has eliminated the vessel collision hazard.

FBL has assumed that there is no snagging risk for Option 9 whilst the columns remain visible above the sea surface. The IRG considers that it is possible for fishing gear to snag on the column structure whilst a vessel is close to but clear of the columns. A sensitivity study [9] examined the influence of a safety zone, both in the circumstance where a safety zone is in place for all options, and where there is no safety zone put in place for any of the options. It has been shown that there are increased vessel movements near the structure when a safety zone is not defined. However, in both instances, "these adjustments are insufficient to alter the outcome of the original evaluation i.e. Option 9 being the most preferred of the CGBS derogation options" [9].

The IRG considers that, because of the order of magnitude difference in PLL for fishing gear snagging and vessel collision, the snagging risk and the collision risk could be treated separately in the CA. If this approach is adopted, then the result is that there is little difference in the snagging risk between Options 5, 6, and 9; whereas Option 6 has no collision risk and Options 9 and 5 have a small risk of collision.

The effect of the approach considered by the IRG would slightly reduce the advantage given to Option 9 in the Legacy risk, but the overall preference for Option 9 in the Safety Selection Criteria would remain.

Environmental Selection Criteria

The environmental criteria for CA are also split into three sub-criteria [10].

1. The first sub-criterion considers the operational phase. It considers leg cutting and lifting operations (when applicable) together with potential for dropped objects and the effect on drill cuttings.
2. The second sub-criterion assesses the overall atmospheric emissions from the project measured in CO_2 released and in fuel consumed.
3. The third sub-criterion considers the potential for long term releases. These are not considered to be a differentiator for any of the derogation options. However, Option 4 will clearly have no long term marine impact but it will have significant effect on material returned to shore for disposal or re-processing, which has not been assessed.

The environmental selection criteria gave a preference for Option 9 over the other derogation options.

Technical Selection Criteria

The technical selection criteria are described fully in the 'Comparative Assessment – Technical Risk Assessment' report [14].

In this assessment, the risk of Technical Project Failure is considered. Technical Project Failure is defined as "an unplanned or accidental event from which would require the re-submission of the approved decommissioning programme". This is a reasonable definition as it covers anything that means the chosen method of decommissioning must be abandoned and a new method found.

A Technical Risk Score (TRS) is assigned to elements of the project workscope. This score is a product of the 'Technology Readiness Level' (TRL) and the 'Risk Probability Score' (RPS). The TRL has values ranging between 1 and 10. The RPS has values ranging between 0.001 and 2 i.e. a factor of 2000 between highest and lowest, or 200 times the range of the TRL score. This then means that the combined score is more sensitive to probability (RPS) than it is to TRL.

The IRG commented that the method of scoring may have had an unintended influence on the overall CA. The CA Report [9] shows that the technical risk criteria and the safety criteria are the main criteria (in addition to economic criteria) that influence the choice of Option 9 as the preferred option. The IRG is further concerned at the relatively narrow range in TRS over the derogation Options 5, 6 & 9, in comparison with the extreme value shown for Option 4.

Furthermore, in the Technical Risk Assessment [14], it is stated that legacy risks were not considered in this risk assessment and that the options were assessed for technical risks up to completion of project execution only. It also states that there are a number of technical legacy risks associated with the decommissioning options that leave part of the substructure in place and "it is recommended that legacy risks for options for derogation are considered elsewhere". The IRG agrees with this comment.

The legacy risk for safety in terms of collision and fishing risk has been considered – but is subject to comments as mentioned earlier within the 'Safety Selection Criteria' section above. Legacy risk in terms of technical selection criteria can be taken to be 'what could happen after 50 years?'. For example:

- Option 9 – it is possible that coating protection and CP may fail earlier than predicted and that a transition may fail at some time after 50 years. The IRG believes that the TRS, taken over the longer term, should take account of the difficulty in providing adequate marking of a navigational hazard if the transitions are inadequate.
- Option 5 – there is technical uncertainty about the integrity of the connection of the supporting column for the navaid tower. The IRG believes that this is likely to result in increased TRSs when a wider timeframe than 50 years is considered. The IRG also considers that the challenges of

extending the technology for cutting concrete for this option may have been underestimated and that a higher TRS is appropriate.

- In Option 6 – there is no need for provision of a navaid. However, the IRG considers that the technical challenges of cutting the concrete columns are understated and that a higher TRS is appropriate.

The IRG raised the clarity of assessment of time periods, including the application of a 50-year timeframe for economic assessment. In the IRG's opinion, the assumption of a 50-year timeframe disadvantages Option 4 and Option 6 because, in the immediate and longer term, they do not present a navigational or a significant fishing hazard, whereas Option 5 and Option 9 will incur continuing legacy liabilities, monitoring, and maintenance costs [10]. However, this was not felt to affect the emerging recommendation for Option 9 because the other factors in the CA outweigh the effect of using this timeframe.

The IRG considers that there are some inconsistencies in the calculation of PLL in the safety criteria. These figures are unlikely to affect the emerging recommendation for Option 9 (for the same reason as stated above), but would narrow the gap between options, particularly in terms of Legacy risk. [10].

The IRG would have liked to have seen more consideration of the longer-term impacts beyond 50 years of Option 9 and believe that such consideration could have made some difference to the scoring outcome of the CA but would not change the overall conclusion.

The IRG has made its own assessment of the revised risk scores for Options 5, 6, & 9. The IRG's opinion is that the amendments and revisions do not change the emerging recommendation for Option 9 but they narrow slightly the advantage of this option over Options 5 and 6.

Societal Selection Criteria

In this assessment, the fishing industry and other groups are treated in separate sub-criteria using narrative text for comparison. In the case of the fishing industry, the existing legal position is understood by the IRG to be that a decommissioned offshore installation that remains above sea level retains the definition of an offshore installation and therefore a safety zone is applied under the Petroleum Act. This means that a safety zone for fishing has been applied in Option 5 and Option 9. The Scottish Fishermen's Federation has expressed a preference to treat the decommissioned offshore installation as a lighthouse and further study has been undertaken to look at the effect of removing the safety zone [15]. This study looked only at PLL, but the existence of a safety zone, or not, would also influence the benefit to fishermen.

The Health and Safety Executive (HSE) is understood to be consulting with other interested parties on possible changes to the requirement for safety zones around decommissioned offshore installations. However, any changes in regulations are unlikely to be implemented in the near future.

The societal benefit to other groups is considered in narrative text with some estimated quantities of returned steel and scrap material for recycling and for concrete for landfill, together with some manhour estimates of onshore work generated for Option 5 and Option 6.

The IRG notes that consideration of the return of materials onshore in this manner would also significantly benefit Option 4. However, the benefit of job creation and reuse/recycling of material has been offset against the requirement to transport large quantities of material onshore for processing and disposal. Option 4 and Option 9 have been considered equal in terms of societal risk to Other Groups in the CA Report [9].

The IRG observes that the societal criteria for other groups has little influence in the CA. The issue of the safety zone needs to be clarified with the regulators.

Economic Selection Criteria

The economic selection criteria give a clear preference for Option 9 over the other derogation options, and a significant advantage over Option 4. The IRG supports this conclusion.

A sensitivity analysis undertaken by FBL [9] removing the economic criterion for the evaluation of Option 4 versus Option 9 resulted in no change in the preferred option.

2.1.6 Output from Comparative Assessment Workshops - FBL Recommended Option

The output from the MCDA process adopted by FBL indicates that overall, Option 9 has a clear advantage over the other derogation options considered. Option 9 scored considerably higher than Options 5 and 6, which broadly scored the same. It is interesting to note that Option 6 scores only marginally worse than the shallow cut but the scores for both of these Options fall well behind Option 9. When Option 9 is then scored against Option 4, there is a clear difference with Option 9 scoring significantly higher than Option 4 [9].

Once the CCBS has been removed, the clean seabed site will present little or no environmental impact. However, the impact of removing the structure to achieve the clean sea bed will have a considerable impact due to:

- Disturbance of the drill cuttings pile exposing the surrounding water and seabed;
- The requirement for massive onshore landfill to accommodate the concrete;
- Extended period of offshore activity over many years whilst the structure is de-constructed; and
- The potential release of any remaining hydrocarbons from the cells, sediment in the cells and trapped hydrocarbons in the ballast.

FBL has therefore selected Option 9 as its recommended option for derogation.

The IRG agrees that removal of the entire CGBS to leave a clean seabed (Option 4) is neither feasible nor desirable from an environmental, safety, technical or economic perspective.

2.1.7 IRG Opinion

There are many ways to conduct CA assessments. The MCDA process was the chosen method. If other methods had been utilised or indeed adjustments made to the selection criteria in this MCDA, then this could change the differences in scores between the Options, however, the IRG does not believe that these differences would alter the selection of Option 9 as the recommended case to take forward for Derogation.

The IRG is generally satisfied that FBL has followed BEIS and OSPAR guidance when running the CA exercise. The IRG considers the technical data to be reliable and the assessment process to be transparent. Throughout the project, FBL has engaged with a wide range of stakeholders. The IRG has sampled the outputs from these interactions and notes the views held and responses given by FBL to the questions raised. The CA workshops attended by key stakeholders were well run. Ahead of the workshops, FBL provided extensive pre-read material and offered stakeholders one-to-one briefing sessions. However, there was limited take-up of these briefings.

Overall, the IRG:

- supports the early screening out of certain options ahead of the CA Workshop, namely Options 1, 2, 3, 7 and 8;
- considers that, for Options 5 and 6, the risk associated with the operations to cut heavy wall thickness sub-sea concrete legs on a scale never previously seen is very high;
- agrees that removal of the entire CGBS to leave a clean seabed (Option 4) is neither feasible nor desirable from a safety, technical, environmental (see reasoning in Section 2.1.6 above) or economic perspective;
- supports the outcome that the remaining option, Option 9, has been taken forward as the preferred decommissioning solution;
- considers the CA process for the cell contents to be comprehensive and has reached the level of detail appropriate for a decision of this importance. The IRG agrees with the conclusions of this assessment;
- considers the supporting evidence for the selected option, i.e. to leave the cell contents in situ, is comprehensive and thorough. The IRG agrees with the conclusions of this assessment; and,
- has commented and challenged detailed aspects of various CA criteria; some criteria modifications would increase the relative preference for the emerging recommendation while some would diminish it. However, overall these are considered not to change the result of an emerging recommendation for Option 9.

2.2 Cell Contents

FBL has undertaken a best-estimate assessment of the contents of the base caisson cells and their estimated distribution. This assessment [16] is based on production history and operational data, computer modelling and analogous data.

The base of the Dunlin Alpha CGBS comprises 81 cells of which 75 were oil storage cells. Each is arranged in a matrix with each having a height of 32 m. The base is 104 metres wide and by 104 long. The cell walls range in thickness from 400 mm to 1040 mm. The domed roofs range in thickness from 800 mm to 2500 mm.

The cells are divided into five groups; four of these groups were used for cyclic storage of production fluids and one for cooling of conductors by circulation of seawater.

In 2004 it was decided that the cells would no longer be used for production fluid storage and separation. In 2007 the cells were subject to an Attic Oil Recovery Project (AORP), intended to recover stored oil and attic oil from the cells. The project was undertaken by Shell and reported by SIGMA[3] in 2008 [17]. The project indicated the recovery of 30000 m^3 of stored oil and 11000 m^3 of attic oil. The total volume of the cells to store all components is 236,906 m^3.

2.2.1 Cell Contents Verification

FBL has carried out a detailed review into the effectiveness of the AORP. In its Cell Contents Technical Report (CCTR) [16], FBL concluded that the AORP had been very effective and only a very thin layer of oil is likely to reside in the top attic space of each cell. This review was based on the data reported as part of the AORP [17] and on theoretical evidence consisting of desktop modelling and analogous data. Contents surveying and sampling have not been undertaken as part of the CCTR [16].

The key findings in the CCTR [16] were reported as follows:

- "There are a number of potentially feasible options to obtain survey and sampling information from within the cells via the existing pipework;
- The CO_2 displacement was successful in pushing the oil into a layer that would have been accessible by the normal export route;
- Any residual oil will be evenly distributed throughout the cells in a very thin layer that now resides in the cell top domed areas;
- The analogous data review revealed a number of gaps in the compositional base data, mainly for the water phase;
- Similarly, there is likely to be variation in the sediment profiles within each cell….;"

The desk top evaluations verified a base case estimate inventory for the cell contents. These are summarised in Table 5, as reported in the Environmental Appraisal (EA) [18].

Table 5: Base Case Cell Contents Estimate

Inventory phase	Volume
Water (seawater and water in sediment layer)	233,994 m^3
Hydrocarbons (mobile oil, oil in sediment layer and in wax)	1,928 m^3
Sediment (sand/clay and scale (including heavy metals))	522 m^3
Wax (wall residues)	462 m^3
Total	236,906 m^3

By way of context, a typical shuttle tanker used in the North Sea would carry of the order of 150,000 m^3 of oil. The Dunlin CGBS is estimated to contain a total volume of hydrocarbons of 1,928 m^3 (mobile oil, oil in sediment and in wax); this is equivalent to 1.3% of the crude oil carried by a typical tanker.

Validation of the inventory estimates by theoretical studies, modelling and analogous data, was considered important in order to have confidence in the inventory estimates before considering the management options for the cell contents.

2.2.2 *Issues to Consider*

The cell contents are contained within the CGBS. The cell contents need to be understood in relation to the options considered for the decommissioning of the Dunlin Alpha CGBS. The thickness of the reinforced concrete walls varies between 400-2500 mm.

The fate of the cell contents was considered for the four CGBS decommissioning options taken forward for CA. In the case of Option 4 the cell contents would be decommissioned along with the remainder of the CGBS and the associated impacts were assessed. In the case of Options 5, 6 and 9 the cell contents were assessed for four management options [16]. These included removal, bioremediation, capping and leave in situ. Of those options, further assessment based on further studies removed bioremediation [19] and capping due to their limited effectiveness and further considered issues associated with removal or leave in situ [16].

Issues were considered relating to the options, including:

- the presence of drill cuttings (full removal and minimal/moderate/substantial disturbance);
- direct/indirect cell penetration (direct penetration was later ruled out);
- the volume of waste created;

- the duration of operations; and
- the degree of contamination management efficiency.

The IRG notes that the integrity of the piping and pumping systems in the structure legs and base have been compromised in a number of places. FBL is reluctant to penetrate the storage cells for sampling before removal of the topsides because of the potential water inflow which they believe could compromise overall structural integrity.

However, IRG considers that this risk could have been managed if action had been taken earlier. IRG considers that, although there is not a compelling engineering or environmental argument for FBL to undertake further cell contents sampling or survey to validate the previous modelling, such investigations may be required in the future to satisfy stakeholder concerns, enhance public perception, and manage the risk to the decommissioning programme; it should therefore be kept open as an option.

2.2.3 Studies Undertaken

A number of theoretical studies, including the CCTR [16] and EA [18], were based on best practice and were undertaken to support the understanding of the cell contents and the impacts they may have on the surrounding environment. The fate of the cell contents, if these were accidently released, was a topic assessed in these studies. This assessment included modelling the fate of oil and sediment being released [18] using a deterministic model known as 'SINTEF Marine Environmental Modelling Workbench' (MEMW). The modelled fate of the envisaged worst-case instantaneous release of about 50 m^3 of oil from four cells was predicted not to reach the shore on the East Coast of Shetland and the quantities would be so small that they may not be detectable. The fate of any sediment release (estimated by FBL to be a maximum of 522 m^3) was predicted to be to the benthic environment which is already impacted by drill cuttings. It was shown in the documentation [16] that the cell sediments are similar to the drill cuttings, which satisfy the OSPAR criteria on oil release. Hence the reports concluded that release of the cell sediments and oil content would not cause a significant environmental impact.

2.2.4 IRG Opinion

Despite the extensive AORP of cell contents in 2007, remnant hydrocarbons remain in the storage cells. The methodology used to estimate the volumes, locations and nature of material remaining within the cells represents a reasonable approach. The modelling, which follows good practice, indicates that even if this volume has been underestimated, given the nature of the concrete containment and its likely failure mechanism, any release of oil would have an insignificant impact on the environment.

The IRG opinion is that the environmental impact and safety risk created by trying to remove and dispose of any remaining oil in the storage cells outweighs the benefit of recovery. The IRG therefore accepts that leaving the cell contents in-place is the preferred option.

The IRG is of the opinion that there is not a compelling engineering or environmental argument for FBL to undertake further cell contents sampling by direct penetration to validate the previous theoretical studies, modelling and analogous data. This opinion is based on the following factors:

1. The quantity of sediment present in the cells (estimated by FBL to be 522 m^3) is small and any release from the CGBS would be limited and would be to the adjacent sea bed already impacted by the contaminated drill cuttings (estimated by FBL to be 19555 m^3);

2. The impact of the envisaged worst case, instantaneous release of oil is shown by modelling to be environmentally insignificant;
3. The drill cuttings are contaminated but pass OSPAR criteria to be allowed to remain in situ. The cell sediments are estimated to be similar to the drill cuttings; and,
4. The containment provided by the cell base structure is robust with thick reinforced concrete providing a high level of confinement until structural deterioration has reached an advanced stage.

Notwithstanding the above, the IRG recognises that sampling and/or survey of the cells at some point in the future to support the evidential argument may be a condition of the derogation approval.

2.3 Waste Streams

The definition of waste is given in the Waste Framework Directive (75/442/EEC) [20] which states:

'Any substance or object in the categories set out in Annex1 which the holder discards or intends or is required to discard'

The Scottish Environmental Protection Agency (SEPA) is responsible for regulating waste in Scotland and the Environment Agency is responsible for waste regulation in England. There are similar agencies in Norway and the rest of Europe.

The UK government supports the principle of a Waste Hierarchy which is contained in the national waste strategies for Scotland, England and Wales. This hierarchy lists waste prevention or minimisation where the generation of waste is reduced or minimised as the preferred waste management option. The hierarchy includes, in order of preference; preparation for reuse; recycling; other recovery; and the least preferred option disposal to landfill, or any operation which is not recovery.

It should be noted that the forward waste strategy [21] includes a policy to aim for zero waste and this also involves reducing the dependence on landfill facilities and the available capacity.

Also contained in the Waste Framework Directive [20] is consideration of the destination of the waste. This issue also includes trans-boundary shipments and importantly the Proximity Principle where it is stated waste should in general be treated and disposed of close to where it is produced.

The location of where waste is produced would normally be the premises or site where the waste is generated. It can reside on those premises or site without becoming waste, but if discarded then it becomes waste subject to waste regulations. For example, a developer of a housing project will have sought a planning application and the area of development is defined by the planning boundary. If material is generated and used within the planning boundary e.g. soils or demolition then it is not waste, but if discarded it becomes waste and subject to the waste regulations.

2.3.1 Issues to Consider

In the case of decommissioning the Dunlin Alpha platform, SEPA's guidance [22] states that "offshore structures subject to decommissioning are waste. Recovery in most cases will be through dismantling and recovery of component materials".

Before waste can be transferred to shore, FBL needs to have produced a preliminary materials inventory. This is the first step in waste identification and lists all categories of materials and their likely waste classification (i.e. hazardous or non-hazardous together with the potential to reuse or recycle). This inventory is required at the start of the DP.

The materials inventory is required prior to the CA process in order that each option can include consideration of the amount of waste generated and the eventual fate of the materials (i.e. landfill or recycling).

In accordance with the outcome of the CA, it is FBL's intention to apply for a derogation to leave the CGBS in situ. Some of the ancillary structural steel and piping of the CGBS will be removed and, on removal and shipment, these parts will become waste.

The party responsible for the Dunlin Alpha installation has a Duty of Care under waste regulations; it is stated that "anyone who imports, produces, carries, keeps, treats, or disposes of waste is subject to a Duty of Care". This is to ensure that producers of waste accept legal responsibility for their waste streams. The Duty of Care extends through the complete waste management process and remains with FBL until the final recovery or disposal of all wastes generated from decommissioning activities.

Once the decommissioning contractor is selected, waste management plans need to be developed to ensure all project requirements and legal obligations are met.

2.3.2 Assessments Undertaken

A preliminary materials inventory [23] was undertaken early in the process to identify the quantity and type of material to be decommissioned, and an FBL Waste Management Strategy [24] was produced. This strategy document clearly demonstrated a comprehensive understanding of the waste management process and the legal obligations involved.

In support of the CA and DP, an EA [18] was undertaken. This included the environmental impacts of the waste generated from the various options.

The CGBS CA [9] took into account the quantities of waste generated by each option. The preferred option was Option 9. This option produces the least waste and therefore satisfies the waste hierarchy. The drill cuttings were not subject to a CA as they satisfy the OSPAR criteria to leave in situ. Waste will only be generated from the parts of the CGBS that are proposed for removal. The Dunlin Alpha DP [7] contains the estimated inventories for the topsides, CGBS, and cell contents.

2.3.3 IRG Opinion

The management of waste as part of an oil platform decommissioning project is an important consideration in terms of safety, environmental, technical, societal and economic criteria. The IRG considers the assessments undertaken by FBL to demonstrate a clear understanding of the issues involved and the legal responsibilities incurred.

The IRG considers that Option 9 best satisfies the UK Government Waste Hierarchy by preventing or minimising the generation of waste.

2.4 Environmental Appraisals

The extraction of oil and gas from the North Sea has taken place for 40 years and has involved the installation of infrastructure in the form of wells, pipelines, steel and concrete support structures and topsides. The installation of the Dunlin Alpha infrastructure caused a level of environmental impact that was not assessed at that time to the rigor and standards required by current environmental legislation.

The Town and Country Planning Act (Assessment of Environmental Effects) Regulations 1988 [25] was the earliest legislation to outline the Environmental Impact Assessment (EIA) requirements.

The Environmental Protection Act (1990) [26] defined the structure and authority for waste management and emissions to the environment.

The Environment Act (1995) [27] created new standards for environmental management and set up the Environment Agency and the SEPA.

As the oil and gas activities reduce in the North Sea, there comes a need to decommission this infrastructure.

The evaluation of the impact of the proposed decommissioning activity requires an environmental assessment process to be applied. However, there is no statutory requirement for an EIA that satisfies the EIA Directive for decommissioning activities. Guidance on the environmental considerations for offshore decommissioning has been produced by BEIS [6]. An EIA must now be documented in an EA. EA guidelines have been prepared by Decom North Sea for offshore oil and gas decommissioning [28].

FBL's EA supports its selection of a preferred decommissioning option and its case for derogation.

2.4.1 Environmental Assessment Process

The EA was used in support of the CA and the DP. It is based on an extensive set of documentation that reports on surveys and modelling described elsewhere in the report.

FBL had commissioned a number of studies to assess the environmental impact of decommissioning the Dunlin Alpha CGBS prior to the introduction of the use of an EA.

An EIA and environmental statement was reported by FBL in 2012 [29]. This was undertaken as a requirement at the time in order to assess the short term and long term environmental impacts associated with the decommissioning of the Dunlin Alpha CGBS.

The EIA process has a number of steps, including the production of a Screening Report, which determines if an EIA is required. In the case of Dunlin Alpha, although there is no statutory requirement for an EIA, the early guidance made an EIA a requirement; a screening opinion had already concluded that an EIA was a requirement. The next step in the process was to undertake a scoping report to determine which environmental issues should form the scope of an EIA. It should be noted that new guidance relating to the production of an EIA changed in 2017 (during the period FBL was preparing its DP). The guidance requested the production of an EA rather than an EIA; FBL therefore produced an EA to comply with the new guidance. A scoping report was produced by FBL in 2016 [30]. This report identified the following potential impacts that may be associated with decommissioning activities:

- seabed disturbance;
- underwater noise;
- discharge to sea;
- atmospheric emissions;
- physical presence;
- accidental events;
- waste generation; and
- cumulative and transboundary impacts.

The environmental scoping report requirement has now been superseded by an Environmental Impact Identification (ENVID) scoping process. FBL has undertaken an ENVID [31] which identified a number of issues to be assessed and reported in the EA. They included:

- cell contents – gradual release over time;
- cell contents – instantaneous release;
- drill cuttings disturbance;
- physical presence; and
- waste.

It should be noted that BEIS guidance requires that the environmental descriptions should only be for the current environment at the project location such that the EA should be for the preferred decommissioning option, Option 9, which involves leaving the CGBS, transition pieces, drill cuttings and cell contents in situ. The transition piece supporting the navaid would have CP and internal coating added. The IRG's understanding is that in the CA workshop Option 9 had CP and internal coating on all transition pieces, whereas the DP implies that the additional protection will only be applied to the transition piece supporting the navaid.

An EA [18] was undertaken in line with BEIS guidance which requires a description relating to sediment characterisation; chemical contamination; benthic organisms; seabirds; marine mammals; fish; protected habitats and other users of the sea. The report also included the issues identified in the ENVID process.

2.4.2 Conclusions of the Environmental Appraisal

The EA concluded that the preferred Option 9 for decommissioning the Dunlin Alpha CGBS would have the following impacts:

- there is expected to be no significant impact on receptors;
- cumulative and transboundary impacts have been assessed as not significant;
- there is not expected to be a significant impact on protected sites;
- the proposed decommissioning activities are in broad alignment with marine planning policies; and
- the information used to undertake the assessments is evidence based.

2.4.3 IRG Opinion

In the IRG's opinion, consideration of the environmental issues associated with the decommissioning of the Dunlin Alpha CBGS and the associated drill cuttings and cell contents has followed the guidance available and has been updated as the guidance has been revised. The EA conforms to BEIS guidance and the current environmental legislation.

The process has been evidence-based. In the case of the drill cuttings this evidence is based on surveys and data collection which provided comprehensive information to adequately characterise the drill cuttings.

In the case of the cell contents, the evidence was based on analogous data from other oil platform surveys, together with data obtained from desktop modelling and operational data. Cell contents sampling was not undertaken. The IRG is satisfied that the EA addressed all the environmental issues identified in the Scoping process and the ENVID.

2.5 Drill Cuttings Pile

During the Dunlin Alpha installation operating period from 1977 to 2001, drilling cuttings were discharged to the sea and resulted in an accumulation of drill cuttings. Detailed information relating to the volumes and depth of the drill cuttings pile can be found in Dunlin Alpha Pre-decommissioning Cuttings Assessment Survey Report [32] and the Dunlin Alpha Drill Cuttings Technical Report [33].

2.5.1 Issues to Consider

The drill cuttings represent a deposit containing oil and heavy metal contaminants which will have an impact on the environment if they are disturbed or left in situ.

If left in situ, they must satisfy the following OSPAR screening criteria values:

- rate of oil loss to water column - less than 10 tonnes/yr; and,
- persistence of area of seabed contaminated - less than 500 km^2/yr.

There are no OSPAR criteria regarding heavy metals.

A number of the options taken forward to CGBS CA would involve the removal or disturbance of the drill cuttings and the environmental impact of this removal or disturbance needs to be assessed. Furthermore, all four of the options taken forward to the CA will involve of debris removal to some extent; this issue also needs to be assessed.

In a recent Norwegian Oil and Gas Association report [34] it is noted that “In several past OSPAR derogation cases, the cuttings piles have been approved to be left on the sea bed together with the jacket footing, allowing for natural degradation. The OSPAR derogation processes have generally not received any significant comments or objections, proving the general acceptance of this management option". This applies to jacket footings when the OSPAR screening criteria values have been met. Dunlin Alpha is a CGBS and the options for decommissioning require a CA including consideration of the relevant issues relating to drill cuttings.

2.5.2 Studies Undertaken

According to BEIS Guidance [6], the environmental description of the platform should address the current environment at the Dunlin Alpha location. The description needs to be informed by all available data, and gaps in that understanding require to be augmented by surveys to determine the physical, chemical and biological character of the benthic environment around the Dunlin Alpha platform.

In addition, assessments are required in order to understand the environmental impact of the drill cuttings, either disturbed or undisturbed.

A number of studies have been commissioned by FBL to provide the technical data to allow assessment of the environmental condition of the seabed, including the drill cuttings area [32] [35] [36] [37] [38].

The various studies were comprehensive and followed industry best practice in sampling and analysis. The knowledge gained provided a good understanding of the drill cuttings and the surrounding sea bed as follows:

Physical Characteristics

The surface sediments on the drill cuttings both on the sea bed and the top of the cells consisted of predominantly poorly-sorted, medium to coarse, silts, whereas the sediments on the sea bed surrounding the drill cuttings consisted of a range between very fine to coarse sand. Generally, the drill cuttings are finer than the surrounding sea bed; core samples from the drill cuttings confirm that the poorly sorted medium to coarse silts are present with depth.

Chemical Characteristics

The samples from the drill cuttings when analysed by FBL confirmed the presence of oil contamination with Total Hydrocarbon Concentrations (THC) ranging between 300 – 146000 µgg-1 [38]. These results are considerably higher than the results from previous studies recorded 250-650 metres from the platform with results of 62.6 μgg^{-1} [38]. This exceeds the OSPAR "ecological effect" threshold of 50 μgg^{-1} above which, the hydrocarbons will have a negative impact on faunal communities. However, the OSPAR screening criteria mentioned earlier, when applied to the Dunlin Alpha drill cuttings, indicated from two tests that oil release was calculated to be in the range 0.46-1.75 tonnes/yr and the persistence of area of seabed contaminated was calculated to be 47.4 km^2/yr. Hence the Dunlin Alpha drill cuttings are within the OSPAR screening criteria for being permitted to be left in situ.

The sample analysis of the chemical characteristics of the drill cuttings also found the presence of a range of heavy metals including TriButyltin (TBT), DiButyltin (DBT), mercury, lead and zinc. The levels of heavy metals were within the ranges recorded in other North Sea drill cuttings but were generally above the relevant assessment criteria including expected toxicity levels associated with biological effects. It is also noted that the presence of DBT indicates that oxidation of the TBT could be taking place in the surface sediments of the drill cuttings. The drill cuttings are generally aerobic on the surface and becoming anaerobic with depth.

The presence of naturally occurring radionuclides including radium 226 was found to be comparable to the range found occurring naturally in marine sediments.

The OSPAR screening criteria do not consider heavy metals, therefore their presence in the drill cuttings does not affect the conclusion to leave them in situ.

Biological Characteristics

Surveys commissioned by FBL indicated a diverse range of species across the area with a limited range of species across the site of the drill cuttings [32] [35] [36]. This is due to the organic enrichment and heavy metal concentrations of the cuttings pile. Early research carried out by Pearson [39], before the discharge of organic contaminants to the sea bed, correctly predicted the change in diversity of taxa due to the presence of organic contamination. The benthos found on the drill cuttings represents a recovery and is indicative of species of taxa that thrive on contaminated sediments and in turn contribute to their recovery. This is similar to the recovery of vegetation on terrestrial sites which have experienced contamination from hydrocarbons and heavy metals.

Cuttings Pile management

Studies were undertaken [32] [37] [38] to consider a number of options associated with the removal of the pile cuttings compared to the option of leaving in situ. Each option considered the environmental, societal, safety and technical impacts and issues relating to the management of the drill cuttings.

The options included suction pumping, mechanical dredging, grab excavation, suction pumping to the platform, suction pumping to sea bed dispersal and the leave in situ option.

Of all the options for managing drill cuttings, the pumping for sea bed dispersal had the worst impact on fisheries while the overall best option was to leave in situ.

Debris removal

As part of the Dunlin CA studies, consideration was given to the removal of debris from the drill cuttings and sea bed surface. The resulting study [40] identified the presence of debris scattered over an area of the sea bed and drill cuttings. The OSPAR Convention [5] requires the removal of such debris. If undertaken then this operation must ensure no disturbance of the drill cuttings and release of contaminants.

2.5.3 Selected Option

Taking into account the various studies and assessments the FBL recommendation was to select the 'leave in situ' option for the drill cuttings.

2.5.4 IRG Opinion

There is a considerable volume of oil-based mud drill cuttings lying on top of and around the base of the structure, typical of many North Sea platforms. The release of hydrocarbons from this cuttings pile has been assessed as being compliant with OSPAR hydrocarbon release limits. The IRG opinion is that the leave in situ option for the drill cuttings has been demonstrated to satisfy the OSPAR screening criteria. In addition, the cuttings pile contains a number of potentially highly toxic components including heavy metals and tin compounds. Disturbing this pile to relocate it, in the IRG's view, would create a considerably more significant environmental impact than leaving it in place.

2.6 Longevity

Option 9 will inevitably result in very long-term deterioration of the CGBS structure. The pace of deterioration is uncertain but it is clearly considerably longer than 50 years, a period which has been applied in a number of situations throughout the CA process.

The Comparative Assessment exercise, as discussed in Section 2.1, restricted consideration to a 50-year horizon from the date of decommissioning. While the IRG is not of the opinion that a longer time scale would likely have altered the preferred option arising from the Comparative Assessment, there are other longevity issues to consider as discussed below.

2.6.1 Predicted Life

FBL has assessed the likely effective life before collapse commences for various parts of the structure [41] as:

- transitions: around 75 years - legs C and D, with thicker transition plate, are likely to have longer lives than legs A and B;
- upper concrete leg: around 250 years at the critical location;
- lower concrete leg: around 1250 years (but governed by the base caisson); and
- base caisson: around 1000 years.

FBL proposed to add external CP to the steel transitions (though since recognising no CP benefit accrues to the zone above the water line, the upper splash zone is likely to be the critical transition section), together with an internal surface coating, to extend their life towards that of the upper concrete shaft.

Collapse will occur through a complex interaction of various processes and there is significant uncertainty in these estimates, which should be regarded as an order of magnitude only [41]. One failure scenario sequence that could be envisaged might be:

1. Failure and collapse of one or more of the steel transition pieces at perhaps 75 years;
2. A gradual deterioration of the concrete cover to the legs in say the upper 20m where the legs are subjected to more significant wave action and higher oxygen levels. This would be followed by corrosion of the reinforcing steel leading to concrete spalling and gradual collapse of the upper sections of the concrete legs occurring over perhaps 250 plus years;
3. Deterioration of concrete and reinforcement and eventual collapse of the concrete section progressing down the legs towards the cell roofs over perhaps 1000 - 2000 years. The deeper the water, the more benign the corrosion environment will be with reducing wave / current action, lower levels of dissolved oxygen and lower and more constant water temperatures, these all tending to reduce the rate of deterioration with depth; and,
4. Progressive failure of cell structure in the longer term (likely more than 1,000 years).

2.6.2 Monitoring, Inspection, and Maintenance

The current legislation governing North Sea oil platforms, ensures through Section 29 (S29) of the Petroleum Act 1998 [1] as amended by the 2008 Energy Act 2008 [2], that liability for the platform rests jointly and severally with the current owner and all previous owners.

Decommissioning obligations arise when the Secretary of State serves a S29 notice to an operator of a platform. Ignoring an S29 notice is a criminal offence.

OPRED will expect long term monitoring up to ten years and a risk-based period of monitoring thereafter.

FBL proposes to undertake visual inspection of the structure, from marine vessel or drone, at intervals and for a period that FBL will agree with OPRED. The most recent Remotely Operated Vehicle (ROV) survey showed no unexpected deterioration [7] and neither future subsea inspection nor any physical monitoring is proposed for more detailed information. Collapse of a transition, for example, may therefore occur with little warning if extensive corrosion and/or fatigue crack propagation has occurred that was not apparent from above sea surface visual inspection.

A single transition will carry a navaid, for the purpose of warning to shipping, with a spare mount and navaid available [42]. FBL assumes that no maintenance or repair will be required for the substructure, other than for the navaid. However, as a result of inspection conclusions or an untoward incident, OPRED may require the S29 notice holder(s) to undertake any particular measure which it sees fit to specify. The assumption of no offshore work scope, other than navaid maintenance and above surface visual inspection, may not satisfy OPRED.

FBL's opinion is that as positioning technology develops and becomes more ubiquitous, the requirement for such a navaid system will diminish until it is not required, dependent on the Regulator's view pertaining at the time. The presence of the steel transitions to support the navaid would then also not be required. However, any remains at shallow or moderate depth below the surface would present a hazard for shipping and fishing, notwithstanding the 500m safety zone which currently applies to decommissioned facilities.

Periodic subsea inspection would be agreed with OPRED in the future to provide clarity as to any ongoing structure deterioration, though little damage would be expected to be visually apparent over the initial period (i.e. a few decades).

2.6.3 IRG Opinion

In the IRG's opinion, FBL has demonstrated that it understands these post-decommissioning issues that by law are required to reach agreement with OPRED on monitoring and management in the long term.

The IRG considers that subsea ROV inspection, at appropriately lengthy intervals, would better inform the S29 notice holders and OPRED as to the structure status and would reduce the probability of unexpected events. FBL should provide a succinct summary report of its plans for managing the structure over the longer term as it inevitably deteriorates.

2.7 Stakeholder Engagement

2.7.1 Issues Considered

Engaging with stakeholders in a proportionate and appropriate way throughout the decommissioning planning stage is encouraged through both regulatory and industry guidance and through the experience of other major projects within the oil and gas sector. BEIS Guidance [6] states that:

'Experience shows that performing appropriate scenario analysis can greatly enhance confidence in a decision in terms of demonstrating the robustness of the weights chosen and in terms of the stakeholder 'journey'. Simply demonstrating what would result if weights chosen by people with different points of view were applied can increase buy-in and alleviate future challenges'.

Following this guidance, FBL has been engaging with interested parties for a number of years. In its documentation, FBL has generally listed those interested parties who have been consulted, along with issues raised. The list of stakeholders associated with the project is extensive and is not repeated here.

There have been two distinct phases of stakeholder consultation and engagement during the project planning. The first phase, during 2010-2012, included an initial workshop, followed by a number of targeted meetings with those stakeholders who could not attend. The workshop raised a number of issues which, at that stage, were seen as important in the overall decommissioning planning. These issues included:

- Inventory of the subsea structures;
- Degradation and erosion of the remaining CGBS structures if left in place;
- On-going monitoring; and
- Long term liability/residual liability fund etc.

A full list of issues can be found in FBL's 2012 Stakeholder Engagement Summary Report [43]. It was recognised that the planning was at an early stage, but the IRG noted with interest that many of the issues which were raised at this preliminary stage were also of interest in the second, more recent phase of engagement.

The second phase, described in FBL's 2018 Stakeholder Engagement Report [42], from 2016 onwards and following cessation of production, refreshed the stakeholder base and brought a wide range of stakeholders (over 100) up to date with FBL strategy and more recent technical studies. In particular, stakeholders were involved with the CA process both before the CA evaluation workshop and afterwards in terms of outcome of the CA.

Two significant stakeholder workshops were convened during 2017/18. These were observed by representatives from the IRG and were regarded as best practice in stakeholder engagement. A detailed and comprehensive report was produced following both events [44] [45]. The issues raised were similar in nature to those raised in the first phase and included questions relating to the monitoring over time of the structures, the eventual release of the cell contents and other long-term liability considerations. A further key question related to the verification of the cell contents through survey or sampling.

The stakeholder report [42] states that:

'However, it is worth highlighting that the principal questions related to monitoring over time and long-term liability, and the potential environmental impacts from the eventual release of cell contents. These are addressed in both the Decommissioning Programme and in the supporting Environmental Appraisal Report.

A further key question related to the verification of cell contents through sampling to validate modelling. Fairfield is currently attempting (with some difficulty) to obtain samples of the contents from the topsides via internal pipework. External entry to the cells cannot be attempted until the topsides of the platform have been removed because of the risk of destabilisation of the legs that this would cause and the potentially fatal consequences for personnel on board the platform. Nevertheless, external entry remains an option post-topsides removal should efforts to obtain samples internally before topsides removal prove unsuccessful.'

Both workshops presented a large amount of technical data and information which, although previously circulated to stakeholders, may have been a challenge to those stakeholders less familiar with the project and with the available information.

2.7.2 IRG Opinion

FBL has engaged with a wide range of stakeholders during the two phases of the interactions, as described above. Engagement has been in line with regulatory and industry guidance which recognises the importance of good stakeholder involvement. Both the CGBS and the cell contents have been subject to a CA process to which key stakeholders were invited. A number of stakeholders participated in these processes (a full list of CA workshop attendees can be found in the CA Report [9]).

The IRG has witnessed at first-hand the latter phases of stakeholder engagement on a number of occasions, including the CA process and two significant workshops, referred to above. These were seen as demonstrating good stakeholder engagement. However, IRG members noted the large volume of technical information shared before and at these meetings. On the whole, issues raised accorded with previous stakeholder concerns and remain as key points for consideration by FBL in their decommissioning activities.

2.8 Decommissioning Programme Pre-Consultation Draft Document

The IRG has reviewed the DP Pre-Consultation Draft Document (issue A4) prepared by FBL [7] and considers that it presents the arguments in the supporting documentation and that it complies with the requirements of the BEIS guidance for the preparation of such a programme.

The above statement is not made on the basis of review of the DP report alone but follows a review by the IRG of key supporting documents that are referenced therein together with those listed at Appendix E to this report.

2.8.1 IRG Opinion

For Option 9, it is not clear if the intention is to extend the CP system and internally coat all four of the transition legs or for only the transition supporting the navaid. If the intention is to protect one transition leg only, then management of the future situation as the unprotected transition legs progressively fail needs to be considered.

Within the issue A4 of the DP, Section 6.6 (Post-Decommissioning Monitoring and Evaluation) of the document recognises that, in approximately 250 years, the steel transitions will have collapsed leaving nothing above the water line. It is suggested that by then navigation technology will be sufficiently advanced to enable avoidance of submerged structures. The IRG agrees that this is likely to be the case.

The IRG is however, somewhat surprised that the regulations are not clearer, with regard to maintaining a safety zone once the structure has ceased operation and is free of hydrocarbons. Furthermore, the IRG is surprised that the requirements for ongoing inspection and maintenance are not more clearly defined. Whilst under S29 of the 1998 Petroleum Act obligations are made in perpetuity, the IRG questions the long-term feasibility of such an obligation.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

1. FBL has evaluated a range of decommissioning options from complete removal, leaving a "clean sea-bed", to removal of the topsides and MSF only, leaving the CGBS and steel transition legs in place. The IRG believes that the range of options considered is both comprehensive and appropriate.
2. The IRG support the selection of Option 9 as the preferred decommissioning solution.
3. The IRG concludes that the environmental impact that would be incurred by attempting to remove either the drill cuttings pile or any materials remaining in the storage cells would be more severe than leaving the cuttings and the storage cell contents undisturbed in situ.
4. The IRG notes that, following the 2007 AORP, for a variety of reasons, FBL has been unable to access the storage cells for physical verification of cell contents. On completion of the AORP, Shell declared the storage cell mobile oil contents to be at ALARP levels. The IRG considers that there is not a compelling engineering or environmental argument for FBL to undertake further cell contents sampling or survey to validate previous theoretical studies, modelling and analogous data. However, it also recognises that sampling and or survey of the cells at some point in the future to support the evidential argument, may be a condition of the derogation approval.
5. The IRG would have liked to have seen more consideration of the longer-term impacts (i.e. beyond 50 years) of Option 9 and believe that such consideration could have made some difference to the scoring outcome of the CA. However, the IRG does not believe that any such differences would have altered the selection of Option 9 as the preferred option.

3.2 Recommendations

1. FBL should work actively with government, the regulator, other operators and the service industry to promote the development of more effective decommissioning technologies, monitoring requirements and management agreements, specifically in the area of remotely accessing submerged facilities. The issue of post-decommissioning the safety zones requires to be clarified with the regulators.
2. FBL should provide a succinct summary report of its plans for managing the structure over the longer term as it inevitably deteriorates.
3. Appropriate research should be commissioned to increase the understanding of the longer-term impacts of leaving the contaminated drill cuttings on the seabed. This research should include an assessment of the potential future disturbance of the drill cuttings and the resulting impact together with an understanding of the change in contamination over time.

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Appendix A Terms of Reference

Background

Terms of Reference (ToR) for the IRG were agreed between FBL and the IRG membership.

It may be noted that the primary role of the IRG was to assess the evidence on which the decommissioning proposals are based and to provide comment accordingly. The IRG had no responsibility for stating its approval of the options selected by FBL or otherwise, or to provide a verification service.

It is also of note that the remit of the IRG did not include the decommissioning of the 'topsides' elements of the Dunlin Alpha platform nor the connecting subsea infrastructure such as pipelines. The IRG was only concerned with the decommissioning of the Concrete Gravity Base Structure (CGBS) part of the platform.

Terms of Reference

Agreed ToR were as follows:

- The IRG comprises of a group of senior professionals selected as having experience and expertise covering all aspects of the Dunlin Alpha decommissioning project. The IRG will perform its duties and provide reports independent from the views of FBL;
- be constituted in August 2017 and remain in operation until the submission of the Decommissioning Programme for Dunlin Alpha;
- review issues relating to decommissioning options for the Concrete Gravity Base (CGB) Structure;
- read and review relevant project documentation to ensure an understanding of the relevant issues for the comparative assessment process[7];
- read and review relevant study work made available to the IRG which provides the evidence base to support the comparative assessment;
- provide comments to the project on the above in respect of the scope, clarity, completeness, data, methodology, relevance and objectivity of conclusions;
- review FBL responses to IRG comments and record close out, including any further actions;
- when invited and where considered appropriate by the IRG, observe at external stakeholder meetings and similar events;
- attend meetings with Fairfield Energy Limited when requested to do so;
- advise on any further research or actions to address identified gaps that would otherwise prevent an informed decision;
- make recommendations for additional work as necessary which should be practicable and achievable which may be within the timeframe for the decommissioning programme submission or may require to be undertaken subsequently;
- confirm that relevant stakeholder comments have been addressed within the scope of studies which the IRG have been invited to review; and,

normally provide any input within 10 working days of a request from the Project Manager.

[7] Note: the IRG would expect to see only finalised and approved documents

Appendix B Regulatory Background

General

The decommissioning of offshore oil and gas installations that are located on the UK Continental Shelf is governed by the Petroleum Act of 1968, as amended by the Energy Acts of 2008 and 2016. In addition, the United Kingdom complies with the 1992 Oslo/Paris Convention for the Protection of the Marine Environment of the North East Atlantic (known as the OSPAR Convention).

A meeting of the OSPAR Commission in July 1998 agreed the regime to be applied to decommissioning of off-shore installations. The presumption is for complete removal of offshore installations when they are decommissioned but OSPAR Decision 98/3 provides for operators to apply for a derogation to allow Gravity Based Structures and the footings of large steel platforms to be left in place.

In the UK, the regulator responsible for decommissioning and ensuring that the requirements of the Petroleum Act and OSPAR obligations are complied with is the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) which is part of the Department for Business, Energy and Industrial Strategy (BEIS), formerly the Department of Energy and Climate Change (DECC). With respect to OSPAR policy on decommissioning, OPRED is the Competent Authority and its specialist department, the Offshore Decommissioning Unit (ODU) has provided Guidance Notes for the Decommissioning of Offshore Installations (the Guidance).

The Energy Act 2016 established the Oil and Gas Authority (OGA) that is required to maximise economic recovery of offshore UK petroleum. The OGA must also be consulted for decommissioning and has a specific remit to advise the Secretary of State.

As described in the Guidance, where derogation from full removal is sought, a Comparative Assessment of options is required to demonstrate how the preferred decommissioning solution has been arrived at. Compliance with this mandatory requirement for Comparative Assessment ensures that different decommissioning options are assessed objectively. As part of encouraging transparency in the assessment process, BEIS also encourages the engagement of stakeholders in the form of other government departments and agencies, Non-Governmental Organisations (NGOs), and members of the public.

BEIS also requires that the decommissioning proposals are subject to independent scrutiny and in the case of the Dunlin Alpha platform, independent review of the Comparative Assessment process, and of the resulting Decommissioning Programme, are the primary functions of the IRG.

Guidance and Compliance Requirements

Framework

As noted above, the following overall framework applies:

- The Offshore Decommissioning Unit of OPRED has issued guidance on the Decommissioning of Oil and Gas Installations.
- Under OSPAR 98/3, FBL is entitled to derogation from complete removal in respect of the decommissioning of the Concrete Gravity Base element of the Dunlin Alpha platform.
- To comply with the Guidance, FBL is required to implement a Comparative Assessment process in which a preferred decommissioning option emerges from an objective assessment of all relevant issues.
- The preferred option is then taken forward in a Decommissioning Programme that is presented to OPRED for approval.

FBL's objective is to present decommissioning proposals for the Dunlin Alpha platform that are compliant with the current BEIS guidance in respect of derogation. The role of the IRG is to review and comment on such proposals and the technical basis on which they have been derived, especially in respect of:

- the supporting evidence and assumptions for decisions made; and
- implementation of the Comparative Assessment process.

BEIS Guidance on the Decommissioning of Oil and Gas Installations

Overview

The Guidance was first prepared by the ODU of OPRED, part of DECC, and more recently by the equivalent technical team within BEIS. Sequential versions are available, the most recent dated May 2018.

BEIS states that the guidance notes have been 'prepared to provide operators, licensees and contractors with guidance on the regulatory requirements for decommissioning offshore oil and gas installations and pipelines in accordance with obligations set out in the Petroleum Act'.

The Guidance confirms that, in respect of OSPAR Decision 98/3: ' the Decision recognises that there may be difficulty in removing the 'footings' of large steel jackets weighing more than 10,000 tonnes and in removing concrete installations. As a result, there is a facility for derogation from the main prohibition for such installations'.

It follows that 'Potential derogation cases will be considered individually to see whether it may be appropriate to leave the footings of large steel installations or concrete structures in place. Derogations will only be granted if there are significant reasons why an alternative disposal option is preferable to re-use or recycling or final disposal on land, as assessed in accordance with the comparative assessment and consultation procedure, set out in the OSPAR Decision'.

BEIS Guidance on Comparative Assessment

General Requirements

Annex A to the BEIS Guidance confirms that:

- A comparative assessment is a mandatory requirement for any potential OSPAR derogation candidate;
- The comparative assessment process enables Operators to assess objectively and transparently a number of different decommissioning options; and
- Where an Operator identifies a decommissioning option that will see infrastructure remain in the marine environment a comparative assessment of a reasonable number of options must be provided to demonstrate how the preferred decommissioning solution has been identified.

Comparative Assessment Framework

Annex A to the BEIS Guidance identifies five Assessment Criteria and the matters to be considered within each, these being the issues of:

- Safety
- Environmental
- Technical
- Societal; and

- Economic

The studies commissioned by FBL to support the Comparative Assessment process have been organised in accordance with this framework, which echoes the requirements of Annexes to OSPAR 98/3, especially that of Items 8(e) to 8(m) of Annex 2.

Verification

Under the heading 'Verification', Annex A of the BEIS Guidance notes that 'it is important that the studies and the assessment process that supports the decommissioning option are subject to independent expert verification. The purpose of this verification is to confirm that the assessments are reliable...' Further, it is stated that ' This may involve the establishment of an independent review process to evaluate the scope, quality, and application of the work undertaken. Experts in particular fields may be engaged to evaluate and confirm specific aspects of the project'. This is the requirement in the guidance that underpins the need for this IRG.

OSPAR 98/3

The wording of OSPAR Decision 98/3 [5] is presented in full at Annex B to the BEIS Guidance on the Decommissioning of Oil and Gas Installations, [6]. It comprises main provisions and a series of explanatory annexes. In the 2018 BEIS Guidance, the main features of OSPAR 98/3 are summarised and at Chapter 7 the impact of OSPAR 98/3 (i.e. its implications for decommissioning operators) is reviewed.

The key outcomes relevant to Dunlin Alpha are that Gravity Based Concrete Installations may be allowed to remain wholly or partly in place under a derogation from a baseline condition of complete removal, subject to assessment in accordance with Annexes 1 and 2 of the 98/3 Decision, where:

- Annex 1 lists the categories of disused offshore installations where derogations may be considered, of which 'gravity based concrete installations' is one; and
- Annex 2 provides a framework for the assessment of proposals for the disposal at sea of disused offshore platforms, that is, a requirement for a detailed comparative assessment of the alternative disposal options.

Appendix C IRG Activities

Introduction

This Appendix provides details of IRG activities from its initial inception in August 2017 through to issue of its Final Report in August 2018.

IRG Meetings

The IRG met on 10 occasions during the period August 2017 – July 2018. The date, duration and location of the meetings are shown in Table 1.

Table 1: Date, duration and location of IRG meetings held to date

IRG Meeting #	Date of Meeting	Duration (days)	Location
01	30-31 August 2017	2	Aberdeen
02	26 September 2017	1	Solihull
03	02 November 2017	1	Aberdeen
04	06 December 2017	1	London
05	10 January 2018	1	Bristol
06	21-22 February 2018	2	Aberdeen
07	27 March 2018	1	Glasgow
08	05-06 June 2018	2	Aberdeen
09	17 July 2018	1	London
10	27 July 2018	1	London

Minutes of each meeting have been retained as a project record.

Meeting #1 was the first meeting of the full IRG and was an opportunity for FBL to brief IRG members regarding the Dunlin Alpha platform characteristics, the main decommissioning options, and the Comparative Assessment process. The methods by which the IRG would work were agreed as were issues such as lines of communication. Thereafter, the meetings mainly involved tracking progress with regard to reports issued by FBL relevant to the Comparative Assessment process. Where deemed necessary, the IRH had the opportunity to engage in face-to-face discussions with FBL technical staff and its advisers. IRG meetings #8 - #10 had an emphasis on IRG Final Report content and issue.

On 05 June 2018, as part of the IRG meeting #08, the IRG met with Ms Audrey Banner, Head of Policy in the ODU of BEIS, at FBLs offices in Aberdeen. This meeting was an opportunity for the IRG to gain an understanding BEIS's position on a number of topics relating to the decommissioning of Dunlin Alpha. This session was not attended by representatives of FBL.

IRG Review of FBL Reports

Technical reports prepared by, or on the behalf of, FBL that underpin the process of choosing a preferred decommissioning option for the Dunlin Alpha CGBS were reviewed in detail by the IRG. A full list of the reports sent to the IRG for review is provided in Appendix E of the IRG report; each report was given an 'IRG number' by FBL, ranging from IRG001 to IRG127. The review of each document was assigned to IRG specialists by the IRG Chairman.

Records of comments made by the IRG and FBL responses to those comments were systematically recorded and retained as a project record.

Stakeholder Engagement Meetings

Since August 2017, IRG members have attended two stakeholder engagement meetings as observers. The meetings attended were as follows:

8th November 2017 – A formal stakeholder engagement workshop to inform stakeholders about the current status of the planning and the future steps in the Dunlin Alpha decommissioning process. A workshop report was produced [44] by the workshop facilitators and circulated to attendees; and

3rd May 2018 – A second formal stakeholder engagement workshop to update stakeholders on the progress of the development of decommissioning proposals for the Dunlin Alpha installation, and on the emerging recommendations from the comparative assessment of options. It was also an opportunity to identify whether there are any areas of outstanding concern. Again, a workshop report was produced [45] and circulated with attendees.

Comparative Assessment (CA) Workshop

As observers, members of the IRG attended the external CA workshop held on 9th March 2018. A Comparative Assessment Report was subsequently produced [9]

Appendix D IRG Membership

Hydrock

Introduction

This Appendix provides more details of the IRG membership, which is listed in Table 1 below.

Table 1: Dunlin Alpha Decommissioning IRG Membership

IRG Member's Name	Role/Specialism	Affiliation
Graham McNeillie	Chairperson	Hydrock Consultants
Jenny Richards	Vice Chairperson; Stakeholder Engagement	Hydrock NMCL
George Fleming	Environmental Engineering - Marine Processes	Enviro Centre
Zoe Crutchfield	Environmental Assessment	Arup
Andrew McNulty	Structural Engineering	Arup
Martin Muncer	Health & Safety	Independent Consultant
Stein Haugen	Risk Analysis Specialist	Independent Consultant
Eric Cooper	Project Manager (for IRG activities)	Hydrock Consultants
Ruby Lowe	Secretariat (for IRG activities)	Hydrock NMCL

The following may be noted:

1. Having taken up a new position with a regulatory body, Zoe Crutchfield left the IRG in May 2018 and thereafter her involvement with the IRG ceased. Zoe made no written contribution to the Final Report.
2. Due to the responsibilities of a new position, after March 2018, Stein Haugen was unable to attend IRG meetings but continued to be involved in group activities as a corresponding member. Although Stein made no written contribution to the Final Report, he was able to review and comment on sections relevant to his specialist expertise.

Biographical Details of The IRG Membership

Graham McNeillie

Role	IRG Chairperson	Affiliation	Independent Consultant
Academic and Professional Qualifications		BSc Eng Hons FICE CEng	
Since retiring from BP where he was Chief Engineer for BP Exploration and Production Ltd, the upstream division of BP, Graham has worked as an independent consultant advising oil and gas companies around the world on Project and Risk Management. He has acted as an Expert Witness for the International Court of Arbitration and is an advisor to the UK Government Cabinet Office on Project Management. He was a senior Advisor to Schlumberger Business Consulting and more recently to the Boston Consulting Group.			

Jennifer Richards

Role	Vice Chairperson, Stakeholder Engagement Specialist	Affiliation	Hydrock NMCL
Academic and Professional Qualifications		BSc MSc FIOP Chartered Physicist	
Jennifer Richards is a Director with Hydrock and has 40 years' experience in the nuclear industry. She is a Fellow and past Vice President of the Institute of Physics. Jenny has extensive experience of the complexities of stakeholder management in large and complex nuclear projects, particularly with respect to safety and environmental issues. She is expert in nuclear regulation and has worked with both operators and regulators to inform policies and standards within the industry. She is an independent member of a number of senior safety committees and involved in the peer review of complex safety submissions within the nuclear industry.			

George Fleming

Role	Environmental Engineering - Marine Processes Specialist	Affiliation	Enviro Centre
Academic and Professional Qualifications		PhD FREng FRSE FICE FCIWM CEnv	

George Fleming is a civil engineer and environmental manager with over 45 years professional experience in all aspects of environmental management. Particular skills include the application of mathematical models to surface water, groundwater, hydrogeological studies generally, coastal processes, sediment movement, river restoration, and the development of ports and harbours. He also has extensive expertise in landfill, brownfield land management, and remediation. From 1984 to 2003 he was Professor of Civil Engineering at the University of Strathclyde and from 1999-2000 he was President of the Institution of Civil Engineers.

Zoe Crutchfield

Role	Environmental Asessment Specialist	Affiliation	Arup
Academic and Professional Qualifications		BSc (Hons)	

Zoe has over 20 years' experience advising on marine environmental issues in North Sea oil and gas and offshore (O&G) industries. Zoe's industry leading experience has been gained working for industry and the regulator, having held key roles with O&G operators and the Joint Nature Conservation Committee (JNCC). For over nine years Zoe was an active member of the Offshore Energy Strategic Environmental Assessment Steering Group, and worked closely with DECC (now BEIS) assessing and reviewing on all oil and gas applications. Zoe has participated in the review of a number of major oil and gas decommissioning activities including the Maureen Platform, Frigg and MCP01 providing DECC (BEIS) with advising on the Comparative Assessments, decommissioning methodologies and potential impacts included within Decommissioning Programmes. She has a broad expertise on impacts on key receptors including commercial fisheries, shipping, marine ecology among others.

Martin Muncer

Role	Health & Safety Specialist	Affiliation	Independent Consultant
Academic and Professional Qualifications		C Eng	

Martin is a recently retired Principal Inspector of Offshore Safety with Health & Safety Executive. He is a Chartered Engineer and Naval Architect with past roles in Safety Management and Project Management. He has a total of 42 years post-graduate experience in the marine and offshore industries, which comprises 14 years as a shipyard naval architect, 6 years working with a vessel operator, 6 years in marine and offshore consultancy, and 16 years as an offshore industry regulator.

Andrew McNulty

Role	Structural Engineering Specialist	Affiliation	Arup
Academic and Professional Qualifications		MA MSc DIC CEng MICE	

Andrew McNulty has extensive experience in design and construction of major industrial and infrastructure projects with particular emphasis on offshore oil and gas structures including various concrete gravity substructures. Prior to his thirty years at Arup he spent seven years with civil engineering contractor George Wimpey.

He retired from Arup in 2017 as Associate Director but is retained by Arup as a consultant.

Stein Haugen

Role	Marine Engineering Specialist	Affiliation	Independent Consultant
Academic and Professional Qualifications		MSc PhD	
Stein Haugen is a professor in risk analysis at the Marine Technology Department at the Norwegian University of Science and Technology. Stein has a PhD in marine risk analysis and worked more than 25 years with safety and reliability consultants Safetec before joining the university. In Safetec, he mainly worked for the oil and gas industry, with risk analysis and safety management. This also included extensive work with decommissioning, among other several Joint Industry Projects aimed at developing data and methods for quantitative risk analysis of decommissioning operations. He has published a large number of papers in international research journals and at peer-reviewed conferences.			

Eric Cooper

Role	Project Manager for IRG Activities	Affiliation	Hydrock
Academic and Professional Qualifications		BSc MSc FGS CGeol SiLC	
Eric Cooper is Technical Director for Contaminated Land and Groundwater in Hydrock. From a background in hydrogeology, Eric has acquired over 45 years professional experience in the UK and in many countries overseas, most recently managing technical aspects of major projects. He has a familiarity with the oil and gas industry from work in connection with UK onshore oil & gas exploration, where is interests relate to environmental protection, as well as work on a large-scale liquified natural gas production in the Far East. Eric currently provides senior level ground-related technical direction to Hydrock projects in the UK, with an emphasis on protection against adverse change.			

Ruby Lowe

Role	Secretariat	Affiliation	Hydrock
Academic and Professional Qualifications		MSci	
Ruby graduated from the University of Bristol in July 2015 with a First-Class Masters' Degree in Chemistry. Ruby is an experienced Consultant at Hydrock NMCL and her work focuses on the facilitation of the independent review of companies' decommissioning programmes, including stakeholder engagement. Her other specialist work involves providing advice on the management of higher activity radioactive waste and associated governance arrangements and supporting organisations to develop suitable and robust organisational capability arrangements to satisfy regulatory requirements.			

Appendix E List of reports provided to the IRG

Table 1 below gives a complete list of documentation provided to the IRG by FBL. Documents IRG123 onward were provided after substantial parts of this IRG report had already been completed and no consideration of their content is included.

Table 1: Complete list of documentation sent by FBL to the IRG

IRG001.	Dunlin Alpha CGB Re-use Report
IRG002.	Dunlin Alpha CGB Refloat Report
IRG003.	Dunlin CGBS In Situ Deconstruction Report
IRG004.	Dunlin CGBS In-Situ Decommissioning Report
IRG005.	Stakeholder Engagement Summary Report
IRG006.	Environmental Impact Assessment 2012
IRG007.	Dunlin CGBS Decommissioning Screening Study
IRG008.	Attic Oil Recovery Close Out Report
IRG009.	Application of Bioremediation to Dunlin CGBS
IRG010.	Leg Internal Remedial Workscope A01
IRG011.	Dunlin Seabird Colonisation Study A01
IRG012.	Dunlin Transition Piece Study A03
IRG013.	Transition Piece Refined Longevity Study A02
IRG014.	Aids for Navigation A03
IRG015.	Concrete Cutting & Removal A04
IRG016.	Subsea Cut Methodology
IRG017.	Leg Failure A03
IRG018.	Dunlin Marine Growth Assessment
IRG019.	Dunlin Alpha Drill Cuttings Study
IRG020.	Dunlin Cell Top Debris Study
IRG021.	Transition Cathodic Protection Study
IRG022.	Fishing Risk Study (Subsea Facilities)
IRG023.	Dunlin Transition Internal Coating Study
IRG024.	OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations
IRG025.	OSPAR Implementation report on Recommendation 2006/5 on a management regime for offshore cutting piles
IRG026.	Guidance Notes Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998
IRG027.	Guidelines for Comparative Assessment in Decommissioning Programmes
IRG028.	OGP Decommissioning of offshore concrete gravity based structures (CGBS) in the OSPAR maritime area/other global regions
IRG029.	Photos volume 1
IRG030.	Photos volume 2
IRG031.	Dunlin Project Execution Plan Rev 4
IRG032.	CGB Cells Contents Impact Assessment
IRG033.	DA Access to Legs and Cells
IRG034.	DA Decom Options Assessment and Selection

IRG035.	XODUS Expert Verification Statement Dunlin Alpha - Concrete Gravity Base Decommissioning
IRG036.	XODUS Independent Expert Verification Statement Dunlin Alpha DP
IRG037.	Independent Expert Verification Statement Dunlin Alpha Decommissioning Environmental Statement
IRG038.	Dunlin Alpha DP 2012
IRG039.	Greater Dunlin Area DPs Bridging document
IRG040.	Interactive graphic of Dunlin Alpha Platform
IRG041.	Dunlin Alpha Comparative Assessment Strategy
IRG042.	Dunlin Alpha Stakeholder Engagement Strategy & Action Plan
IRG043.	Dunlin Alpha Option Screening for Comparative Assessment email from ODU
IRG044.	Fairfield Waste Management Strategy
IRG045.	Dunlin Alpha DP (DP3) (Derogation case) Pre-Consultation Draft 2016
IRG046.	Dunlin Alpha Pre-decommissioning Cuttings Assessment Survey
IRG047.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Technical Risk Assessment A2 2017
IRG048.	Shipping and Fishing Decommissioning Risk Assessment Dunlin Alpha (Block 211/23) Rev02
IRG049.	Fairfield Dunlin Alpha Decommissioning Review of Technologies and Conceptual Methods for Cutting of Dunlin A Concrete Legs Rev00
IRG050.	Methodology for Separation of Dunlin Platform Transition Columns A01 2017
IRG051.	Dunlin Wave Radar Airgap Analysis
IRG052.	Dunlin CA Studies - Seabird Colonisation Study A02
IRG053.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 4 - Transition Piece A05 2017
IRG054.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Transition Pieces Refined Longevity Study A04 2017
IRG055.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 5 - Aids for Navigation A04 2017
IRG056.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 6 - Concrete Cutting & Removal A05 2017
IRG057.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 8 - Leg Failure A04 2017
IRG058.	Studies and Transfer Register
IRG059.	Dunlin Alpha CGBS CA Study 1 Leg Internals remedial workscope A04 2017
IRG060.	Dunlin CA Studies - Study 12: Cell Top and Seabed Debris Study A03 2017
IRG061.	Dunlin Alpha CGBS Cell Contents Technical Report (DRAFT) R3 2017
IRG062.	Dunlin Alpha Decommissioning: Dunlin Alpha Drill Cuttings A03 2017
IRG063.	Methodology and Cost Estimates for Coating Application to Leg A, B, C, & D Transition Piece Internals, EL +143m to EL +150m 2017
IRG064.	Dunlin Alpha Decommissioning: Option 4 – Full Removal Vessel Collision Risk Assessment Rev 02 2017
IRG065.	A) CA Facilitation - CA Briefing Document R01 2018
IRG065.	B) Dunlin Alpha CGBS CA Study 1 Leg Internals remedial workshop
IRG066.	Dunlin CA Studies - Seabird Colonisation Study A02 2017
IRG067.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 4 - Transition Piece A05 2017
IRG068.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Transition Pieces Refined Longevity Study A05 2017
IRG069.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 5 - Aids for Navigation A05 2017

IRG070.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 6 - Concrete Cutting & Removal A06 2017
IRG071.	Dunlin Alpha Platform Decommissioning – CGBS Studies for CA Study 8 - Leg Failure A04 2017
IRG072.	Dunlin CA Studies - Marine Growth Assessment A01 2017
IRG073.	Dunlin CA Studies - Cell Contents: Marine Impacts Associated with Decommissioning of the Dunlin Alpha CGBS – Full Removal (Option 4) A02 2017
IRG074.	Dunlin CA Studies - Study 12: Cell Top and Seabed Debris Study A03 2017
IRG075.	CA CGBS Safety Summary A01 2018
IRG076.	Dunlin Alpha Transition Piece Corrosion Protection – High Level Options Study (Issue 2) 2017
IRG077.	Dunlin Alpha Decommissioning Cells Contents Impact Assessment June 2011
IRG078.	Dunlin Alpha CGBS Cell Contents Technical Report A02 2018
IRG079.	Dunlin Alpha Decommissioning Dunlin Alpha Drill Cuttings Technical Report A05 2018
IRG080.	Dunlin Alpha Pre-decommissioning Cuttings Assessment Survey UKCS Block 211/23 A05 2017
IRG081.	Shipping and Fishing Decommissioning Risk Assessment Dunlin Alpha (Block 211/23) Rev02 2017
IRG082.	Methodology and Cost Estimates for Coating Application to Leg A, B, C, & D Transition Piece Rev02 2017 Internals, EL +143m to EL +150m
IRG083.	Dunlin Alpha Decommissioning Review of Technologies and Conceptual Methods for Cutting of Dunlin A Concrete Legs Rev00 2017
IRG084.	Methodology for Separation of Dunlin Platform Transition Columns A01 2017
IRG085.	Dunlin Alpha Platform Decommissioning – CGBS Studies for Comparative Assessment Study 26 - Wave Radar Airgap Analysis A01 2017
IRG086.	Dunlin Alpha Platform Decommissioning – CGBS Studies for Comparative Assessment Technical Risk Assessment A02 2017
IRG087.	Provision of Environmental Consultancy Services Energy and Emissions Assessment (Study 28) A05 2018
IRG088.	Dunlin Alpha Decommissioning: Option 4 – Full Removal Vessel Collision Risk Assessment Rev02 2017
IRG089.	Fairfield Pre-decommissioning Habitat Survey: Dunlin Field Rev03 2017
IRG090.	Dunlin Alpha Pre-decommissioning Environmental Survey UKCS Block 211/23 Rev03 2017
IRG091.	Macrobenthic succession in relation to organic enrichment and pollution of the marine environment (T.H Pearson and R. Rosenburg) 1978
IRG092.	Dunlin Decommissioning - CGB Derogation Independent Verification Process A02 2012
IRG093.	Dunlin Decommissioning - Final Reports Review: EIA/ES Review Methodology A01 2012
IRG094.	Dunlin Decommissioning - Final Reports Review: Decommissioning Plan Review Method Statement A01 2012
IRG095.	Review of Dunlin Cell Contents Release Assessment: Dunlin Cell Contents Release Assessment A01 2016
IRG096.	Comparative Assessment Facilitation - CA Facilitation Support: Comparative Assessment Briefing Document A01 2018
IRG097.	Dunlin Alpha – Principal Studies in support of Comparative Assessment
IRG098.	Dunlin Alpha Platform Decommissioning – CGBS Studies for Comparative Assessment Study 8 - Leg Failure A05 2018
IRG099.	Dunlin Alpha CGBS Cell Contents Technical Report A03 2018
IRG100.	Shipping and Fishing Decommissioning Risk Assessment Dunlin Alpha (Block 211/23) Safety Zone Sensitivity Analysis Rev00 2018
IRG101.	Dunlin Alpha Platform Decommissioning – CGBS Studies for Comparative Assessment Technical Risk Assessment A04 2018

IRG102.	Dunlin Alpha Decommissioning Comparative Assessment Report Emerging Recommendations A01 2018
IRG103.	Dunlin Alpha EIA Scoping Report A07 2016
IRG104.	ENVID Workshop Output Matrix 2018
IRG105.	Dunlin Alpha Decommissioning Environmental Appraisal Report Rev02 2018
IRG106.	–
IRG107.	Study 5 Data Table (1 of 3): Installation of Lighthouse & Navaid A07 2017
IRG108.	Study 5 Data Table (2 of 3): Maintenance and Monitoring of the Navaid A08 2017
IRG109.	Study 5 Data Table (3 of 3): -12m cut & removal of Steel Transitions & Concrete A7 2017
IRG110.	Option 9 Data Table (1 of 3): Transition Piece Internal Coating A05 2017
IRG111.	Option 9 Data Table (2 of 3): Transition Piece Cathodic Protection A04 2017
IRG112.	Option 9 Data Table (3 of 3): Leg Capping - Steel Caps A03 2017
IRG113.	Study 6 Data Table (1 of 3): -55m cut and removal of concrete A9 2017
IRG114.	Study 6 Data Table (2 of 3): -119m cut and removal of concrete A9 2017
IRG115.	Study 6 Data Table (3 of 3): Concrete Cutting A7 2017
IRG116.	Dunlin Alpha Decommissioning Programme Pre-Consultation Draft A03 2018
IRG117.	Dunlin Alpha Decommissioning Environmental Appraisal Report A02 2018
IRG118.	Dunlin Alpha Decommissioning Comparative Assessment Report A02 2018
IRG119.	Dunlin Alpha CGBS Cell Contents Technical Report A04 2018
IRG120.	Dunlin Alpha Decommissioning Stakeholder Workshop 3rd May 2018 Rev02 2018
IRG121.	Dunlin Alpha Decommissioning Programme Pre-Consultation Draft A04 2018
IRG122.	Dunlin Alpha Decommissioning Stakeholder Engagement Report A01 2018
IRG123.	Dunlin Alpha Decommissioning: Dunlin Alpha Drill Cuttings Technical Report A06 2018
IRG124.	Dunlin Alpha Decommissioning Comparative Assessment Report A03 2018
IRG125.	Dunlin Alpha Decommissioning Environmental Appraisal Report A03 2018
IRG126.	Dunlin Alpha Decommissioning Programme Pre-Consultation Draft A05 2018
IRG127.	BEIS comments on A02 Pre-Consultation DP