Fairfield Energy Limited, Dunlin Alpha Decommissioning Stakeholder Workshop, 8 November 2017
REPORT

This report forms a record of the 8 November 2017 stakeholder workshop for those who attended the event. It is also intended to help inform other interested organisations and their representatives about the developing decommissioning plans for Dunlin Alpha, and its stakeholder engagement.

If you have any questions or issues about Dunlin Alpha decommissioning that you would like to raise with Fairfield Energy, please contact Carol Barbone by Monday 18 December 2017 at carol.barbone@fairfield-energy.com . Thank you.

This report has been produced by Resources for Change, a socially responsible consultancy, which independently facilitated the stakeholder workshop on behalf of Fairfield Energy Limited. Additional information has been provided by Fairfield Energy where it is believed that this will enhance understanding of the report content.

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1. Introduction

1.1 Background

The decommissioning of the Dunlin Alpha oil production platform is part of a multi-year, multi-phase decommissioning project being carried out by Fairfield Energy Limited in the greater Dunlin area. The project follows Cessation of Production (COP) from the area in June 2015, after achievement of maximum economic recovery from the Dunlin oilfields. The 8 November 2017 stakeholder workshop forms part of the stakeholder engagement to inform the decommissioning planning for Dunlin Alpha. Further information about the decommissioning of Dunlin Alpha and its associated facilities can be viewed on the Fairfield Energy website http://www.fairfield-energy.com/operations/greater-dunlin-area

1.2 Workshop Purpose

The purpose of the workshop, as set out in advance of the meeting, was as follows:

- To inform stakeholders (organisations with an interest or stake in the Dunlin Alpha decommissioning project) about the current status of the planning and the future steps in the decommissioning process.
- To facilitate stakeholder understanding and acceptance of Fairfield Energy's preparations, reasoning and foundation for the eventual proposals, which will be set out in an application to the UK government authorities for permission to decommission.
- For stakeholders to understand the decommissioning challenge being considered by Fairfield Energy and to consider and discuss these challenges with other stakeholders and company representatives.
- For stakeholders to provide feedback on any issues raised from their perspective, so that these can either be addressed on the day, or understand the process by which these will be responded to by Fairfield at a later point.
- To help Fairfield Energy to better understand stakeholder issues and concerns about the planning for Dunlin Alpha Decommissioning and to use this knowledge to inform the comparative assessment of options for decommissioning.
- To capture stakeholder perspectives which may usefully inform Fairfield Energy's exploration and assessment of decommissioning options more broadly.

1.3 Workshop Participation

A list of the stakeholders and the Fairfield Energy decommissioning team who participated in the workshop, along with a list of invited organisations, can be viewed at appendix 1. The design and facilitation of the workshop was carried out on behalf of Fairfield Energy by Resources for Change, a socially responsible consultancy which specialises in stakeholder engagement.

1.4 Workshop Agenda and Format

The agenda for the workshop can be viewed at appendix 2. Fairfield Energy provided presentations on the main topics concerning the decommissioning of Dunlin Alpha which are listed below. Key points from the presentations have been summarised in section 2 of this report. A copy of the slides used with the presentations can be viewed at appendix 3.

- Dunlin Alpha Decommissioning Challenges
- Comparative Assessment
- Topsides
- Drill Cuttings
- Cell Contents
- Concrete Gravity Base Structure (Legs and Cells)

The first two topic presentations were followed by small group discussions (seven tables of 10-11 people). The remaining four topics presented were followed by four carousel 'stations', which stakeholders could visit in turn. The small group format was used to encourage participation and give more opportunity for people to make contributions. Stakeholders were invited to raise any questions and issues from their perspective, and Fairfield Energy provided responses to these. There was also an opportunity for points raised within the small groups and carousel stations to be shared with other participants. The questions, answers and stakeholder comments made during the course of the day are captured within this report.

1.5 Supporting Materials

In advance of the workshop at the time of invitation, stakeholders were directed to an online video, which provided an overview of the decommissioning challenge. A link was also provided to further details of the decommissioning programme preparations to date at http://www.fairfield-energy.com/ .

Stakeholders were later provided with a copy of the draft scoping report for Dunlin Alpha's Environmental Impact Assessment (EIA), in order to provide further background information in advance of the workshop. This had previously been circulated to organisations with an environmental interest for comment. The EIA was circulated with the agenda for the meeting to all stakeholders, including those who were not planning to attend. Those stakeholder who could not attend were able to put forward written questions which could be raised during the workshop. Three written questions were received and were read out to the participants during the event by the workshop facilitators Resources for Change, and given a response by Fairfield Energy.

At the workshop itself, further materials were made available to support the understanding and participation of attendees:

- A series of background documents was available for reference, comprising 23 of the studies that have been carried out to date on the various aspects of the structure in order to inform the decommissioning planning and comparative assessment for Dunlin Alpha. A list of these is provided at appendix 4.
- A briefing sheet entitled *Dunlin Alpha Fast Facts*, which shows an annotated diagram of Dunlin Alpha's structure and the range of decommissioning options that have been examined. The options include those that have been screened out, and the current candidates for comparative assessment. Readers of this report may find the briefing sheet a useful point of reference to better understand the questions and comments reported in this document. Please see appendix 5.
- An acronym or *Jargon Buster* handout. This can be referenced at appendix 6.
- Posters that illustrate the various structural and decommissioning elements of Dunlin Alpha in more detail. These include information on the topsides, drill cuttings, cell contents, and the concrete gravity base structure which comprises cells and legs. Please see appendix 7.

Copies of the slides used to illustrate the presentations at the workshop were circulated to participants the following day to stimulate further comment (see appendix 3).

1.6 Outputs of the Workshop Sessions

Summaries of the questions, comments and issues raised by stakeholders and the corresponding answers from Fairfield Energy, were made by the Resources for Change team during the workshop. These have been collated without attribution and are set out in sections 3-8 of this report. Additional information from Fairfield in response to the points raised has also been added into the report where it may help to enhance understanding.

1.7 Evaluation of the Workshop

The experience of participation in this workshop was evaluated by the stakeholders via a written questionnaire, which was circulated at the end of the event. The feedback has been collated without attribution and can be viewed at appendix 8.

1.8 Future Engagement

Stakeholders will be contacted again once Fairfield has addressed any outstanding questions, and also with the output of the Comparative Assessment and any issues that it raises. Stakeholders are also invited to add any further comments to this report, though are asked to do so by 18 December 2017, as Fairfield Energy will need to make progress with the decommissioning planning. Please see the front of this report for further information and contact details.

2. Presentations

This section contains a summary of the information presented on the key topics for Dunlin Alpha decommissioning. Further detail has been added by Fairfield Energy where it may help to enhance understanding. These topics were introduced to participants at the workshop by Fairfield Energy and their technical consultants Xodus Group and Atkins. The accompanying presentation slides can be viewed at appendix 2. Please refer to these slides for further detail on each of the presentation summaries in this section.

2.1 Decommissioning Challenge

Initial studies were carried out 2010-2012 for the purpose of producing a reference case decommissioning programme to understand the costs, what the options were, and what might be a credible outcome. These studies included reports on: reuse, refloat, in situ deconstruction, derogation options (in case full removal was not possible), cells and cell entry, and leg entry, all of which fed into an options screening exercise in 2011. Note that these studies were available in hard copy for participants to review at the 8 November 2017 stakeholder workshop.

Stakeholder engagement was also carried out at this stage, and a draft decommissioning programme was produced and shared with the regulator, but not formally submitted. A series of workshops with stakeholders were held, which included a cell contents discussion group. Refloat reports were revised based on stakeholder input. Stakeholder meeting reports can be viewed on the Fairfield website http://www.fairfield-energy.com/operations/greater-dunlin-area/stakeholder-engagement/events-workshops . Meetings were also carried out with OSPAR Contracting Parties.

The reference case options at this stage included reuse Options 1 and 2, destruct Options 3 and 4, and below lowest astronomical tide (LAT) Options 5, 6 and 7. Further illustration of these decommissioning options can be viewed in the *Dunlin Alpha Fast Facts* briefing sheet at appendix 5.

Reuse was not considered viable either in situ or elsewhere. Refloat was not considered viable due to the integrity of the structure and also the suction of the base, with no certainty that this could be jetted out. The technical challenges were insurmountable. For destruct in situ the technical challenges were also insurmountable and all these options were screened out. There were three derogation cases: remove all of the legs, remove to the legs to -55m below LAT, and a shallow cut to -20m with a tower added for navigation. Toppling was rejected due to the regulatory position on dumping at sea. Thus the original reference case for decommissioning was derogation with a shallow cut to -8m with a navigation tower.

There has been further study since the cessation of production in 2015, which has more recently included involvement of an Independent Review Group (IRG). Additional options have also been introduced. A review of the previous work in light of technological developments has been undertaken, and with no assumption that the reference case is a given. The outcome of this work is that the reuse Options 1 and 2 are still considered not to be viable. The destruct Options 3 and 4 were reviewed and the in situ destruct option was studied in some depth. The below LAT Options 5, 6, and 7 were looked at afresh, though toppling (Option 7) was thought of as dumping. The -55m deep cut (Option 6) and shallow cut (Option 5) which is now assumed to be between -8m and -20m, were given further consideration.

The additional options introduced were Options 8 and 9, which are above LAT. These involve the retention of the topsides' module support frame (MSF) and/or the steel transitions (which support the MSF) respectively. Appendix 5 provides an illustration of these additional options.

Note that the concrete structure of the legs does not reach above sea level due to their construction, so that if the steel transitions are removed, this leaves the legs at -8m below LAT. Option 8, which includes MSF retention, was discounted due to the fatigue of the frame and the consequent care and maintenance requirement. It did not improve longevity of structure, nor help the legs survive longer. Option 5 involves a -8m cut plus concrete navigation tower. Option 9 maintains the steel transition structure through the splash zone. The lower part of guide frames and supports would remain. Diamond wire in conjunction with remotely operated vehicles (ROVs) would be used to cut the legs.

Additional studies carried out since the cessation of production are those on risk, environment, the structure, cell contents, and drill cuttings. The remaining options now going forward for comparative assessment are:
- Option 4: Full Removal
- Option 5: Shallow Cut and Navaid Tower
- Option 6: International Maritime Organisation (IMO) Cut –55m LAT
- Option 9: Transitions Up

2.2 Comparative Assessment Overview

Various options are being compared for the decommissioning to get the optimum outcome. Regulations dictate that comparative assessment (CA) is a requirement whenever there is a derogation case, for example for the concrete gravity base structure (CGBS). OSPAR decision 98-3 and the DECC guidelines[1] have made CA a requirement. Comparative assessment enables options to be compared in a formal and detailed way. It uses scientific evidence-based, auditable information. All potential options must be looked at, including reuse and recycling. There are seven steps: scoping, screening, preparation, evaluation, recommendation, review and decommissioning programme submission. Comparative assessment involves stakeholders from the start. Information is shared and feedback gained. The 8 November 2017 stakeholder workshop forms part of this process.

The scoping and screening stages gather enough detail about the options to establish whether they are viable, in order to narrow down a set of options to explore in more detail. The preparation stage identifies the studies, detail and information needed to do the evaluation of the remaining options. The evaluation stage involves the detailed CA elements. A Multi-Criteria Decision Analysis (MCDA) is undertaken. This looks at the elements (economic, environmental, safety, societal, technical) in isolation which are then drawn back together. The CA process is carried out in alignment with industry guidance. A stakeholder workshop is usually included to ensure that all views are considered and that proper processes have been adhered to. All these stages can be subject to iteration, i.e. Fairfield Energy can go back and review again if that is indicated. At the recommendations stage, the outcome is then put out for review and to ensure that nothing pertinent has been missed prior to formal submission.

[1] Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998

The Concrete Gravity Base Structure CA from 2011 was re-evaluated in 2015. Fairfield Energy want to find out from stakeholders whether there are additional information or studies needed and would appreciate feedback on that. Fairfield Energy currently estimate that they may move into the recommendations phase in 2018.

The criteria for the CA as required by OSPAR (Decision 98-3[2] on the disposal of disused offshore installations) are: 1. Safety, 2. Environment, 3. Technical, 4. Societal, and 5. Economic. Fairfield Energy has identified the sub-criteria shown below within each of these high level criteria, and would like feedback on the sub-criteria from stakeholders.

The following sub-criteria can change or be adapted as required:

1. Safety: Personnel offshore, personnel onshore, other users, high consequence events, residual risk including legacy
2. Environment: Marine impacts, emissions, consumption, disturbance, protections including legacy
3. Technical: Technical risk
4. Societal: Fishing, other users
5. Economic: Operational costs, legacy costs.

Both quantitative and qualitative methods are used to carry out the CA.

2.3 Topsides

The topsides are characterised as approximately 19,535t dry weight. At installation, the Module Support Frame (MSF) was floated and lowered onto the steel leg transitions with some modules already in place and some installed afterwards. Plug and Abandonment (P&A) of the wells has to be completed, and infrastructure connections to other offshore installations have to be disconnected before the topsides can be removed.

A brief overview of the main methodologies for removal are:

- **Piece Small:** This entails a small-scale deconstruction operation, on a module by module basis, followed by an MSF heavy lift or float off of the MSF, which is highly weather dependent.
- **Single Lift:** Minimal offshore preparation is required. However, the Dunlin platform is too wide for the Pioneering Spirit vessel to perform a conventional single lift operation. Fairfield Energy is exploring alternative removal solutions with the vessel owner Allseas, to look at possibilities.
- **Reverse installation:** This method would be executed via the use of a heavy lift vessel (HLV) to reverse the installation process and take apart the platform, module by module. All the pipework, cables, and other facilities between modules have to be disconnected first. All this is done offshore. There will be some piece-small removal to enable access for the main HLV cranes required. The MSF can be removed in a single lift.
- **Hybrid Solution:** This would involve the use of a heavy lift vessel, plus an MSF lift/float off. Fairfield Energy is looking for the best elements of all the three main methods above to tailor a safe, efficient and cost effective solution.

Fairfield Energy is evaluating supply chain capability with a view to broadening competition for the Dunlin decommissioning project. This includes conventional heavy lift vessels; single lift or improved lift vessels; and new entrants, e.g. vessels currently under construction or that currently operate in different regions of the world. The reduction of time spent at the Dunlin offshore location and the number of trips back and forth to disposal yards are both considered advantageous.

[2] OSPAR Decision 98-3 – OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic – The Disposal of Disused Offshore Installations

2.4 Drill Cuttings

Drill cuttings are generated during the drilling of a wellbore, and are the produced formation 'chippings' that are removed by the drill bit. Dunlin Alpha started drilling in 1977 with 45 original wells drilled, some of which have been reworked multiple times. This has amounted to a total length of 223km of drilling.

Drilling muds perform essential functions in well drilling, including wellbore stability, lubricating and cooling the drill bit, and transporting cuttings back to the surface. The returned mud and cuttings are cleaned and separated, with the mud being reused. The types of mud used can be broadly categorised as water based mud, and two types of oil based mud, the latter being typically used for the deeper well sections. Until 2001, cuttings and any adherent mud that remained following cleaning could be discharged to sea. At Dunlin Alpha this was via a discharge chute. The Dunlin drill cuttings landed on top of the concrete gravity base structure and spilt onto the seabed as they built up. A volume of 31, 431m^3 of cuttings was generated, of which 99% was discharged to the sea.

Surveys of the drill cuttings were carried out from November 2015 to April 2016. Fairfield, Xodus and Fugro and the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) have been involved in devising and executing this programme of work. These surveys fulfil decommissioning guidance and comply with the latest (2017) OSPAR requirements[3]. The sampling included both detailed bathymetry using high resolution acoustic methods, and the collection of sediment samples by ROV-operated cores or vibrocores.

A total of 12 sample stations were located across the cuttings pile on the seabed, and sediment samples collected for analysis of several determinands, including sediment particle size, metals and hydrocarbon content. Samples for macrofaunal analysis were collected at four stations. Long vibrocore samples (up to 4m) were taken from three locations for sectioning, subsampling and analysis of determinands at different depths. For the cuttings pile on the CGBS roof, ROV core samples were taken from three locations for physico-chemical analyses. It was not possible to obtain long core samples from the pile on the CGBS roof or from the steeper parts of the cuttings pile on the seabed due to access limitations imposed by the platform legs and topsides and the difficulties of deploying the coring device on steep slopes.

Overall there is high confidence that the data gathered is sufficient to describe the key characteristics of the drill cuttings pile. In total, including both parts of the pile on the CGBS roof, and on the seabed, the pile has an area of 9,184m^2 and a volume of 19,555m^3. Both the pile on the seabed and the pile on the CGBS roof have a maximum height of almost 13m. From the ROV core samples, total hydrocarbon content (THC) concentrations in surface sediments were up to 146,000 $\mu g.g^{-1}$ in the seabed pile, and up to 73,400 $\mu g.g^{-1}$ in the pile on the CGBS roof. High concentrations of hydrocarbon-based drilling fluids were recorded in samples collected from the surface or near surface sediment layers, and down to a maximum depth of 150cm. In the sectioned core samples, highest THC levels were recorded in subsurface layers (compared with surface layers) at some stations, particularly those from the pile on the CGBS roof. In samples from the sediment surface, hydrocarbon degradation was evident, while deeper within the pile the oil traces were fresher.

In the pile on the seabed, the lower hydrocarbon concentrations found at deeper levels were thought to be due to water based muds being encountered or the natural sea bed. Regarding the different types of oil based mud used, results indicated the presence of synthetic fluids in the upper layers of the pile and closer to the discharge source, low toxicity oil based mud (LTOBM) to be deeper or further out, and diesel based muds to be at the deepest level or furthest out. Levels of contaminants, including oil, are above natural background concentrations, and typically also above the concentrations at which ecological effects might be expected. However, they are consistent with other cuttings piles found in the North Sea. Calculations based on survey data indicate that the cuttings pile is below the oil loss and persistence thresholds of the OSPAR 2006-5 Recommendation which implies that no Best Environmental Practice (BEP) review is required for management of the pile.

[3] OSPAR 2017-03 Guidelines for the Sampling and Analysis of Cuttings Piles

A debris recovery study is ongoing. The survey data gathered is being used to inform other studies (including modelling), that look at how different decommissioning options could affect the drill cuttings pile. This information is also being used in the CA process, and will inform the Environmental Impact Assessment, together with the design of post-decommissioning surveys.

2.5 Cell Contents

Cells are the compartments in the bottom of the concrete gravity base structure. These were used to separate production fluids, and for storage. Their historical use means that it is possible that a number of different contaminants have accumulated over time.

An attic oil recovery project (AORP) was carried out by Shell UK Limited in 2007 to capture the inaccessible oil above the pipework geometry of the cells. The oil was displaced to the level of the export pipework using carbon dioxide (CO_2) which was generated via the chemical reaction between hydrochloric acid and sodium bicarbonate. It took a year to execute, and required 27,000 tonnes of chemicals, 700 road tankers and 9 round-trip vessels.

The aim of the recent cell inventory assessment undertaken by Fairfield Energy has been to understand both what is inside the cells and where it is located. This has proved challenging due to the way in which the cells were used and operated.

The findings of various theoretical desktop studies and dynamic modelling have resulted in the following being established:

- The sediment layer in the cells is unlikely to be evenly distributed. Based on the expected particulate distribution, the sediment layer per cell is predicted to range from 10s of centimetres to a maximum of 1 metre. Deposition is likely to be highest in 8 of the 75 cells used for oil storage. The total sediment volume within the CGBS is estimated to be approximately 1,248m^3.
- Over the operating life of the cells, changes in temperature profiles may have led to a solid wax residue forming on the surfaces within the cells. Thermal modelling has been done to understand the waxy hydrocarbons on the walls and ceilings of the cells. The modelling showed that there is a layer of approximately 12cm on walls and ceilings. This equates to a total wax residue volume of approximately 306m^3.
- The presence of mobile oil products is being investigated in order to calculate how much could be left in the cells. The original inventory assumed that an oil layer thickness of 10cm would be left upon completion of the AORP. This equates to an inventory of approximately 1620m^3. However, recent dynamic simulation findings suggest that this was highly conservative and that the true residual oil content may be less than half of the initial estimate.

The cell contents inventory carried out by Fairfield Energy has been done on a cell by cell basis. As mentioned earlier, validation of the inventory has been performed using various theoretical methods, including dynamic modelling. This has confirmed that the CO_2 displacement and oil extraction was very effective, and that approximately 97% of the mobile oil has been recovered. However, Fairfield Energy are currently exploring various physical validation methods, which include gaining cell access via the existing rundown lines, and riser and J-tubes.

In preparation for the CA of the cell contents management options, an options identification exercise has been used to highlight the various removal and/or treatment concepts applicable to the storage cells at Dunlin Alpha.

The broad options for management that are being examined include:

- Removal and subsequent treatment/disposal;
- In situ treatment using bioremediation;
- In situ capping to provide an additional environmental barrier; and
- Leave contents in situ without intervention/treatment.

Cell access for removal, treatment or capping purposes would require external access via the cell domes. The current waste-management base case assumes that any resulting hydrocarbon, solid and water waste will be shipped onshore for treatment and disposal.

There are 70 options currently under review, which Fairfield hope to screen to get to a manageable number for the next step of the CA by considering the following parameters:

- Presence of drill cuttings (full removal, minimal/moderate disturbance);
- Direct/indirect penetrations (technical feasibility of running hoses to access fluids (oil / water) in neighbouring, leg and triangle cells;
- Volume of waste created;
- Duration of operations;
- Degree of wax contamination and removal/treatment efficiency;
- Degree of mobile oil contamination and removal/treatment efficiency; and
- Degree of sediment contamination and removal/treatment efficiency.

2.6 Concrete Gravity Base Structure (Legs and Cells)

The concrete gravity base structure (comprises concrete legs topped with steel transition columns, which extend from a concrete base. The steel reinforcement in the legs helps them to withstand the North Sea. There is pipework in the legs, with access to/from the platform. There are 45 well conductors. The steel skirts of the base penetrate into the sea bed, along with grout which extends into the sea bed to an unknown depth.

The function of the steel transition columns is to extend the concrete legs through the water surface. Construction constraints meant that the concrete legs are shorter and span from below the water surface to cells. The transition columns are constructed from carbon steel which corrodes, although it was constructed with a coating and sacrificial wall. The steel transitions are connected to the top of concrete legs with bolts, which cannot be inspected. The steel transition columns are unique to Dunlin and add to the complexity of the structure.

The four legs measure 111m from the steel transition columns to the cells at the base of the CGBS. The top of legs contain a ring beam. The ring beam provides the connection to the steel transition columns, and tension steel cables in the legs are dependent on the ring beam. There is a draw-down system whereby the level of water internally is lower than that externally. This provides compression which is beneficial to the integrity of the legs.

The 81 concrete cells that form the base of the structure are each 11m length x 11m breadth x 32m height. The cells have an iron ore ballast that itself weighs 88,000t. The volume of grout beneath the cells is unknown. The steel skirts weigh 728t, and the cells 202,600t.

Structural integrity study work has been carried out by Fairfield Energy. This technical work has drawn on wide range of long-term expertise, which includes one of the engineers involved in the original Dunlin Alpha installation.

There are considerable technical challenges for decommissioning the CGBS. For full removal (Option 4), the requirement is for three separate cuts for each of the legs. These cuts are: a shallow cut to remove the steel transitions, a cut at -55m to remove the upper portion, and then removal of the lower portion. This would be followed by removal of the concrete cells. The scale of full CGBS removal, which is a total weight of 336,000t, has never been attempted before. Extensive trials would be required, including how the leg cuts could be achieved. The cutting process has never done before offshore. The uplift required in order to release the suction at the base is another challenge.

Option 6, which involves a cut to -55m has similar difficulties. The integrity of the transition bolts is unknown. Separate shallow water cuts need to be made to separate the transitions for this reason. Operational restriction in the North Sea due to the weather means that work might not be completed but have to stop.

For Option 5, the shallow cut, the ring beam needs to be maintained in order to enable the navlight to be installed. A shallow cut above the ring beam might compromise it. Connecting the lighthouse to the leg would be a challenge. In the long term there may be damage to the cell tops as the legs start to degrade.

Option 9 is to leave the CGBS in place with the concrete legs and steel transitions. Corrosion of the steel and degradation of the concrete may cause the legs to fail and eventually damage the cells.

Further illustration of these decommissioning options can be viewed in the *Dunlin Alpha Fast Facts* briefing sheet at appendix 5.

A summary of the questions, comments and issues raised by stakeholders, and the corresponding responses from Fairfield Energy are set out in the remainder of this report (sections 3-8). Please note that in some instances responses were given by other stakeholders and this has been indicated where it occurs.

The summary was noted by the facilitation team, Resources for Change, during the workshop, and has been collated according to topic and without attribution. Additional information provided by Fairfield Energy in response to the points raised has also been added into the report where it may help to enhance understanding.

Please note that subsequent sections of this report are presented in a tabular, landscape format to improve readability.

3. Dunlin Decommissioning Project Overview

This section contains outputs from the workshop sessions that relate to the decommissioning of the Dunlin facilities as a whole. A summary of the questions (Q.), comments and issues raised by stakeholders, and the corresponding answers (A.) from Fairfield Energy, and also other stakeholders, has been collated without attribution. Additional information from Fairfield in response to the points raised has also been added into the report where it might help to enhance understanding.

3.1 Physical Environment

Stakeholder Question	Fairfield Response
Q. How high energy is the seabed environment at Dunlin Alpha?	A. The environment at Dunlin Alpha is a low energy system of muds, sands and clays with very little current.

3.2 Interaction with Other Facilities

Stakeholder Question	Fairfield Response
Q. Who are the other operator partners in decommissioning plan? Will they all decommission at different times, or will things happen at the same time? How is it co-ordinated?	A. The Thistle Alpha platform operated by EnQuest will be supported until 2019. After that the platform may be bypassed and Thistle supported separately to allow decommissioning to start.

3.3 Cessation of Production (CoP)

Stakeholder Question	Fairfield Response
Q. The decommissioning planning started in 2010; what was the view of cessation of production at that time?	A. During 2013-14 it was anticipated that production would continue to 2025. The aim was to extend production life, but falling oil prices and integrity concerns about the structure and the investment needed to address this led to the decision to cease production. The timescale of that decision meant that work on plugging and abandonment of the 45 wells had not yet been done.

3.4 Well Plug and Abandonment

Stakeholder Question	Fairfield Response
Q. What is your target for the Plug and Abandonment (P&A) programme?	A. We have 45 wells to plug and abandon. We have not been able to do this in advance or to survey either. Some of the wells are straightforward others might take longer than expected. We think we have another 2-3 years to go, but it is too early to say.

3.5 Subsea Structures

Stakeholder Question	Fairfield Response
Q. What is the current status of the subsea structures?	A. Subsea infrastructure decommissioning is the subject of separate draft decommissioning programmes, submitted for statutory and public consultation earlier this year. *For further information please see: https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines*.
Q. Are the platform pipelines on the inside or outside of the concrete gravity base structure (CGBS)?	A. The pipelines are on the outside of the CGBS, while the risers and umbilicals are inside.
Q. Were the conductors flushed and are they clean?	A. The carrier pipe, and the space between it and the casing, are programmed to be circulated clear. With the plugging and abandonment of wells, cement barriers are put in place at three levels of depth, which is done to industry standard guidelines.
Q. Where will you cut the oil line?	A. It will be cut above the mud mound and the lower guide frame will be left in place to avoid disturbing the drill cuttings pile.
Question put to stakeholder: What are the issues concerning rock-dump?	**Answer from stakeholder:** Currently we are looking in to this in terms of its significance across the North Sea. The issue is the specification of the grain size (compared to the surrounding substrates), more than the actual rock type.
Q. It would be very helpful to have more information on any rock-dumping likely to be included as part of the decommissioning.	**Additional information provided post-workshop by Fairfield Energy:** Specifications for rock cover required for the subsea decommissioning programmes will be discussed with the SFF prior to execution.

3.6 Dunlin Alpha Stakeholder Workshop

Stakeholder Question	Fairfield Response
Q. Of all the Dunlin facilities, is it just the platform being covered in the workshop today or is it other elements such as subsea pipelines as well?	A. The workshop focus is on Dunlin Alpha. There are five decommissioning programmes for Dunlin in total. Three of the decommissioning programmes, which cover most of the subsea infrastructure, have already gone through to the formal consultation phase and post-consultation drafts are now being prepared. A further decommissioning programme is being prepared for the export pipeline, which will be in service until 2019.

4. Comparative Assessment

This section contains outputs from the workshop sessions that relate to the technical studies and research, the screening of options, and the comparative assessment (CA) for Dunlin Alpha. This includes matters encompassed by the main CA criteria which are: safety, environment, technical, societal and economic. A summary of the questions (Q.), comments and issues raised by stakeholders, and the corresponding answers (A.) from Fairfield Energy, has been collated without attribution. Additional information from Fairfield in response to the points raised has also been added into the report where it might help to enhance understanding.

4.1 Initial Studies (2010-12)

Stakeholder Question	Fairfield Response
Q. What prompted the re-evaluation (the work done in 2010-12, and then revisited in 2016), and does this continuing review mean potential ongoing delays in reaching conclusions and decisions?	A. The original studies (2010-12) were a solid piece of work but not sufficient for the decommissioning programme, so further work was needed. In addition, legislative changes, learning from other fields, and changes in position from the regulator all mean that further work may or will need to be done. However, there is no intention to delay, but to make decisions based on the best and most current information at the time.

4.2 Decommissioning Timeline

Stakeholder Question	Fairfield Response
Q. What is the timetable for the decommissioning?	A. The exact timetable for execution is still to be determined and will depend on the outcome of the CA process and regulatory approvals.
Q. When will the decommissioning studies be reported / concluded?	A. The studies are expected to conclude in the first quarter of 2018.
Q. How does the conclusion of the studies relate to submission of the decommissioning programme timetable?	A. The studies help us to identify uncertainties and create a decision-making tool to test assumptions through the CA process.
Q. How far are we down the road of making a decision?	A. The only decisions to date are those which have narrowed the options down. Options 1,2,3,7 and 8 have been screened out and Options 4, 5, 6 and 9 have been identified as candidates for the comparative assessment.
Q. The detail on the timeline for the decommissioning is not clear and it would be useful to know this.	A. Fairfield will advise on this as soon as the way ahead is clearer.
Q. Can we decommission in a phased way, so that we can do some of it, have the opportunity to take learning from others, and then come back to it?	A. While the execution can be phased, plans need to be clearly defined in the decommissioning programme which is submitted for regulatory approval.

4.3 Comparative Assessment Process

Stakeholder Question	Fairfield Response
Q. Comparative assessment can be done in a number of ways, e.g. very quantitative or very narrative assessments. What approach will Fairfield take?	A. A multi-criteria decision analysis (MCDA) tool will be used for the comparative assessment. This tool is standardised across the entire suite of Dunlin Alpha decommissioning elements and their comparative assessments. Depending on the level of definition of data required, a mixture of qualitative and quantitative inputs may be used.
Q. The comparative assessment sounds like a very complex process. Will the stakeholders understand it?	A. The comparative assessment uses the studies as an evidence base. **Stakeholder comment:** The decommissioning is a very complex subject, with a number of elements that are all important.
Q. The comparative assessment weightings are all 20%; it seems odd that fishermen and safety are all the same. Why is this? **Stakeholder issue:** It sounds like Fairfield is starting with a preferred option. **Stakeholder issue:** Cost and safety intuitively would be the two highest weightings.	A. The 20% weightings are the starting point for the assessment, from which you can then do sensitivity analysis.

4.4 Options Screening

Stakeholder Question	Fairfield Response
Q. The options chosen seem to be the 'obvious' ones; has sufficient work been done on those rejected?	A. All options were considered seriously in the options screening before any were discounted.
Q. Are the screened-out options out of the picture completely, or can other information be fed into the screened-out options for further consideration? **Stakeholder issue:** Five options have been screened out, but with new technology, or regulatory changes, it might be possible to bring these back in.	A. As things currently stand this is unlikely unless significant new evidence arises.
Q. Can the option of reuse by other industries outside the energy industry be given further consideration?	A. Full consideration of other potential opportunities for the facilities has already been undertaken and is a prerequisite of the regulatory guidance before considering decommissioning and removal of the facilities.
Q. Can the option to topple the legs be reintroduced?	A. This was considered to be dumping at sea in 2011/2 so that is why it was discounted.

4.5 Candidate Options for Comparative Assessment

Stakeholder Question	Fairfield Response
Q. Does Fairfield Energy have a preferred option?	A. Not at present, all feasible options (as presented) are being considered through the CA process.

4.6 Studies and Technical Work

Stakeholder Question	Fairfield Response
Q. When comments such as…"It's too difficult to…" are made, where is the evidence?	A. The evidence is presented in the screening documents. If someone feels something is missing, please get in touch.
Q. On Options 5, 6 and 9, has a full feasibility study been done?	A. There has been feasibility work undertaken, but as there is no precedent for some of the options, it is not possible to base this on published evidence. The technical modelling for some parts of the options has been completed.
Q. Are there any studies or research still to finish for the decommissioning planning, and have there been any information gaps identified that will require further studies, research or investigations to be done by Fairfield?	A. A number of studies are currently being completed to inform consideration of the options. The Independent Review Group will be responsible for auditing the completeness of these.
Q. Has there been sufficient involvement with contractors to inform the inputs to the project?	A. We believe so, yes; for example liaison has been undertaken with HLV operators, as well as with engineering contractors currently engaged in topsides removal works, in order to ensure robust inputs.

4.7 Learning from Other Operators

Stakeholder Question	Fairfield Response
Q. Has Fairfield Energy been able to benefit from other previous decommissioning CA's, such as for the Brent field, in the Dunlin Alpha CA? **Stakeholder comment:** There is a real value in unlocking the knowledge and lessons learned from previous decommissioning work.	A. Yes, we have looked at the experiences of and approaches to other similar projects to help inform our understanding, although consideration of feasible options for Dunlin needs to be tailored to the specific requirements of the installation.

4.8 Learning from Other Industries

Stakeholder Question	Fairfield Response
Q. How much liaison happens with the nuclear industry especially with regard to future liability? **Stakeholder comment:** I was at a decommissioning event in Cumbria recently and there are lots of similar issues.	A. The cell contents studies are looking at various technology across all industries and sectors to survey and sample the cells via the pipework. For example, a robot has been created by Toshiba, which has been used at Fukushima to take samples and footage of the reactor cores. There is more we can do.
Q. Does the regulator in the nuclear industry have the same function as in the oil and gas industry? If you have a CA process in the nuclear industry, the nuclear regulator signs up to it. There is a difference.	A. There are separate regulatory processes for each industry; for offshore decommissioning, the principles are set out in regulatory guidance which have been developed into industry-standard guidance by Oil and Gas UK.

4.9 Technological Advance and Innovation

Stakeholder Question	Fairfield Response
Q. Is it likely that changes in technology would make things safer? Q. Technology is making huge advances. It is a challenge, but can we stretch to innovate more, for example as was done on Brent Delta? **Stakeholder issue:** We need to have more understanding of whether we can provide breathing space for future technologies to set up.	A. Potentially and in time, but for Dunlin there are lots of immediate challenges: for example, there is a 13m width of leg at -55m, with steel-reinforced concrete, and we are aiming for an orbital cut. We have been working with a company to look at this; it has never been done before so it would need to be the subject of a research project. We do not want to use explosives to take down the legs because of the noise impact to the marine environment.

4.10 Requirement for Studies and Comparative Assessment

Stakeholder Question	Fairfield Response
Q. Surely not every CGBS needs to go through the same process of examination. We are just repeating the studies instead of learning. Why cannot some of the work inform further decommissioning?	A. DECC guidance notes are very clear on the requirement for preparing a decommissioning programme and must be adhered to.
Q. There are 12 CGBSs in the UK North Sea. Is there a need for bespoke studies? This may not be the best use of resources. Is there enough transparency of the costs and benefit of studies? At what point have we got an acceptable solution?	A. The UK must meet the OSPAR requirements, we must be respectful of our international obligations which we are signed up to.

4.11 OSPAR

Stakeholder Question	Fairfield Response
Q. How might the OSPAR talks in 2018 affect the Dunlin decommissioning planning?	A. OSPAR Decision 98-3 is reviewed every five years. The next review is due in 2018. Fairfield will feed into the debate and process via the International Association of Oil & Gas Producers (IOGP) which has a CGBS owners' forum which meets twice a year, but most of the dialogue is through the UK Government Department for Business Energy and Industrial Strategy (BEIS), via OPRED. Brexit is also happening within the same time frame, which could also have some bearing. It is a recognised project risk.
Q. What happens if there is an approved decommissioning programme and then OSPAR rules change? **Stakeholder comment:** Proposals may be put forward for the July 2018 OSPAR Commission that toppling in situ is not dumping, nor is leaving them in situ as an artificial reef.	A. OSPAR rules could change. But the Dunlin decommissioning timeframe would allow for any change because it is a process that is taking place over a number of years. It is a project risk that is recognised along with Brexit.
Q. Is there another European Community body trying to get similar powers to OSPAR and how would that fit with European Community non-members? The Commission is developing a body to look after the environmental matters around the coastlines of the European Community because there is a political view that OSPAR is becoming too soft.	**Answer from stakeholder:** The discussions that I am having with regulators around the basin suggest that some of them are starting to harden their view. There is a suggestion that we should challenge OSPAR more. At the moment no one is willing to do this, especially with the review on the horizon, as the object of OSPAR will be to maintain the status quo. I do not think anything will change this time round.

4.12 Regulator Guidance and Requirements

Stakeholder Question	Fairfield Response
Q. Would your findings from the studies and modelling expectations on longevity guide the regulator on the condition of the derogation, or would the regulator set the condition, or is there negotiation between the two? In the nuclear industry for example, the regulator sets the condition.	A. We would not expect the regulator to specify a timescale for the structure's longevity. This is not a credible or relevant approach in an offshore oil and gas context. We do have expertise from other industries, including nuclear, within the Independent Review Group to give that perspective to the project. We have not been asked by the regulator to meet a specific timescale for longevity. However we will have to provide a documented legacy management plan and this requires an understanding of the likely longevity of the structure and how it will degrade. These are estimates and some of it is speculative. Then beyond a 1000 year period it is difficult to credibly make predictions. As part of the

Stakeholder Question	Fairfield Response
	Comparative Assessment, the legacy and liability management planning for Dunlin Alpha includes cost estimates. Beyond 50 years it is very difficult to make cost projections, though the legacy planning and company responsibility extends beyond this. Who does this legacy management and how, in that longer term beyond 50 years, is an industry-wide question and one for the Oil and Gas Authority (OGA) and BEIS.
Q. Is the regulatory position likely to change?	A. Guidelines from BEIS are being refreshed, and these will come into force in 2018. We do not know yet what is in them. We understand that BEIS is trying to simplify the guidance to make it more flexible.

4.13 Safety and Decision-Making

Stakeholder Question	Fairfield Response
Q. Is safety being used as an excuse not to act?	A. No, but safety is a huge part of all considerations, and in its broadest sense covers risk to people at sea, to those on land, and to the environment. Knowing that an act cannot be carried out safely should merit serious consideration and a decision not to proceed. Much time is spent on assessing and seeking ways to reduce risk to an acceptable level to multiple audiences.

4.14 Fishing and Options Preference

Stakeholder Question	Fairfield Response
Q. What residual structure will there be? Fishermen's feedback says being able to see the structure is less hazardous than a submerged structure. Q. Options 9 and 5 were preferred by fishermen, what were their reactions to Option 6? Q. There has been a preference expressed previously, if CGBS is left in situ, for being able to see the legs and therefore not cutting them.	A. We are still looking at Options 4, 5, 6 and 9, so this is not determined yet. A. Decommissioning Option 6 (cut to -55m) complies with the International Maritime Organisation's (IMO) requirements and has less of the residual liability issues. **Stakeholder response:** The SFF policy has changed. The preference for fishing industry with the CGBS left in place is to remove the legs to -55m below LAT. Vessels could transit over the top of it with a safety awareness zone. HSE are the only ones who can implement it but do not have a tool to do it, aside from

Stakeholder Question	Fairfield Response
	the 500m safety zone. If the legs are left up at Dunlin, the 500m statutory safety zone would stay in place and vessels could not transit. **Stakeholder response:** The fishing industry is currently developing its own decommissioning policy which is due for release in late 2017/ early 2018. **Additional information provided post-workshop by Fairfield Energy:** The SFF have advised that their guidance notes regarding offshore structure derogation will be published next year. The guidance will state that should full removal not be a viable solution, the preferred option is the -55m IMO cut (at a minimum) to allow fishing vessels to navigate over the remaining structure should the 500m safety zone be removed. This is a change in the opinion of the SFF who were consulted earlier in the decommissioning process (originally 'legs up' was the preferred solution).

4.15 Exclusion Zones and Fisheries

Stakeholder Question	Fairfield Response
Q. If infrastructure is left in place, how will it be marked for fishermen. There is currently a safety zone, will this be reduced or remain the same? Q. I am not sure that it has been agreed yet what the safety/exclusion zone would be in future? **Stakeholder issue:** The issue of safety/exclusion zones needs to be resolved.	A. This is still to be determined, but the fishing industry will be part of the consultation on options at that stage, should it arise (full removal would not require any marking). Normal practice is for post-decommissioning trawl sweeps to take place to indicate that the seabed is hazard-free, at which point safety certification would be made for the area around the structure if left in situ, with any remaining elements of the structure itself marked on Admiralty Charts and the FishSAFE system, when guard vessels would be removed. **Stakeholder response:** There is no law that would currently allow an exclusion zone around a decommissioned installation. The hazard would be marked on maps in the same way as wrecks.
Stakeholder issue: The fishing industry was promised a clean seabed at the end of the process. If there are 750 exclusion zones, this would be a massive impact.	**Stakeholder response:** There is commitment from the oil and gas industry to create a fund for the fisheries industry and it is party to the UK Fisheries Offshore Oil and Gas Legacy Trust Fund Limited (FLTC) which enables maintenance of the FishSAFE system to mitigate risk to the fishing industry.

4.16 Environmental Impact

Stakeholder Question	Fairfield Response
Q. Regarding the environmental impact, do we need the seabed to go back to what it was before or do we need to address life as it is today? It may be the case that toppling is less environmentally damaging.	A. There are risks of damaging the cell structure by toppling the legs, plus there is increased risk by using explosives and perhaps creating more hazards where they do not currently exist. We are as an industry moving to a strong focus on the carbon footprint impact of decommissioning and the energy required to undertake it.

4.17 Environmental Impact Assessment (EIA)

Stakeholder Question	Fairfield Response
Q. Potential environmental risks for removal were covered in the draft scoping report for the EIA, but were not covered for in situ options. Will these be addressed in the EIA?	A. Both execution impact and legacy impact will be investigated via the comparative assessment process. The CA sub-criteria address both the execution and legacy challenges. The EIA scoping report was issued to 20 interested parties, and valuable feedback was received in response. Once the emerging recommendation is in place via the CA, a next-level EIA will be done, and that will include the impacts of execution for anything to be removed and the legacy for anything to be left behind.

4.18 Waste Management

Stakeholder Question	Fairfield Response
Q. What plans are there for materials disposal and recycling?	A. We have a risk management strategy in terms of scoping the decommissioning programme. We have done a hazardous material survey and have a full inventory of what is on board. We have good understanding of that and where it is located, and we have a waste management strategy. Operationally, we have well-established management practices and we will build waste management principles into the decommissioning scopes. Contracts have not yet been awarded for waste management, so the disposal routes and handling will all be established via the eventual contractual arrangements.
Q. Do you have detailed asset register for every piece of equipment?	A. Yes we have a detailed inventory.

4.19 Marine Growth

Stakeholder Question	Fairfield Response
Q. Is there much marine growth on the structure? Is there any survey of what is there?	A. Yes. Studies are carried out by ROV with probes which are used to measure the growth thickness. The species present varies with this and the depth.
Q. Is cold water coral *Lophelia pertusa* around the area or only on the infrastructure?	A. It grows on the structure but there are some areas also where it has fallen off and survived on the seabed substrate. If it is off the structure then it is not clear as to its status under the regulations.
Q. Do we have baseline information about what is living out there, as this might support the option decisions, i.e. the marine growth on the structure, for example the cold-water coral, *Lophelia pertusa,* is uncommon in the North Sea, but has been found on similar structures? **Stakeholder issue:** If there is an ecosystem of significance out there, it should be considered that bringing the structure onshore has a considerable environmental impact, which includes emissions generated through the process of moving it. **Stakeholder issue:** There is potential to use the site as a massive sanctuary; are we therefore taking away an opportunity for a positive subsea environment and instead pushing the environmental problems onto land, e.g. by bringing marine life onshore and in the process also causing environmental problems through the creation of emissions?	A. The matter of marine growth on the structure has not been covered in detail, however the focus of environmental impact has been on the negatives, but the presence of marine growth could be considered to be positive. A. Reuse as an artificial reef creation can benefit other industries such as fishing, but this option is not feasible under current legislation.
Q. If the platform is left in place and the structure monitored, will marine life also be included as part of the monitoring?	A. Yes. There is some information coming from other decommissioned structures. There is also some useful knowledge that can be learnt from windfarms in the Netherlands. **Stakeholder comment:** NERC and industry studies, plus the INSITE North Sea website are useful references for current monitoring information and knowledge generally.

4.20 Clean Seabed

Stakeholder Question	Fairfield Response
Stakeholder issue: If everything was cleared you would not have a legacy or perpetuity issue. Dunlin Alpha was a great feat of engineering from finding the field in 1974 and delivering oil five years later. I find it really frustrating and hard to believe that the technology was available to build it 50 years ago but not available 50 years later to remove it. It has to be down to cost that it is not feasible to remove it. **Stakeholder comment:** The law has forced the industry down the removal route. There is now a requirement for new facilities to be designed to be removable. **Stakeholder comment:** The obligation for removal never goes away, so that if technology advances, you can be required to revisit what is left.	A. There should not be any hiding from that. The rush to get the oil meant that there was no thought of removal. One of the Fairfield team is involved in a joint industry project: Design for Decommissioning, which takes lessons learned from past decommissioning projects worldwide to inform future development. A. Yes, the obligation is there for removal for new structures. When you submit a plan for a new structure it has to come with a removal solution.

4.21 Liability and Legacy

Stakeholder Question	Fairfield Response
Q. Regarding long-term liability, we are making technical decisions now, for example cutting the leg and perhaps taking the option that's relatively simple to do, but are we really just delaying the real technical challenge to 500 years' time when we are then having to deal with a structure that's partially collapsed? Q. Yes, and the different options will have different long-term liability issues as well.	A. Primarily this is dealt with through the CA process. It is a balance between doing things now at the current cost and minimising your future liability, and monitoring now and waiting for technology to improve. There is some cynicism about this, but Allseas' vessel Pioneering Spirit and single lift removal is one example of a recent technological step change.
Stakeholder issue: There is a need to understand the legacy impact if facilities are left in place.	A. Agree that we need to understand the impact. A lot of work has been done previously and we now have a coherent strategy. There have been jointly-funded studies on the impact on concrete and steel over time.
Q. The legacy arrangements are very vague. There needs to be clarification about how what is left will be inspected.	A. Anything left behind would be marked on Admiralty charts.
Stakeholder issue: Who is going to do the maintenance for hundreds of years? Are we just kicking the can down the road?	A. There will be maintenance requirements (and navaid requirements if the legs are left above sea level). This could potentially be the subject of a joint industry initiative (with neighbouring facilities) to improve cost efficiency.

Stakeholder Question	Fairfield Response
Stakeholder issue: We need to have more understanding of who is responsible for the legacy. Q. If Fairfield Energy leave something behind, something will remain. Someone then has to take ownership of that. What will happen for long-term residual liability? Indemnity will have to be passed on. Q. At what point in time will the company have fulfilled its requirements, and would 50 years be a fair ask of the operator in that respect, and thereafter it becomes a liability for the state?	 A. The liability rests jointly and severally in perpetuity with all section 29 notice holders if Fairfield or its joint venture partners are unable to meet its commitments.
Q. To what extent has the monitoring and residual liability issue been taken into account because these could be different? **Stakeholder comment:** There is no common industry view on dealing with the in perpetuity issue, and this is long overdue.	A. The CA has residual risk legacy management as one of the criteria so it is something that is taken account of for each option as part of the CA process. Although the regulations might change, Fairfield can go through the comparative assessment process again if this happens. We can go back at any stage and review the process if we need to.
Q. There has been some thinking done in the past about financial institutions buying out such liabilities? **Stakeholder comment:** There is an overall industry issue and desire to do something different.	A. There are some industry discussions ongoing with the financial and insurance market about what approaches might be developed to deal with decommissioning liabilities. However, it is one thing to insure against a risk within a defined period such as plug and abandonment of wells, but insurance in perpetuity is not a viable prospect. **Stakeholder response:** The government would have to be satisfied with any scheme. **Stakeholder response:** There are insurance companies out there that are willing to provide products to insure against work on wells over a defined period. **Stakeholder response:** Another difficulty in progressing a financial approach to liability is that the guidelines on monitoring are not clear, including for how many years it needs to be carried out by the owner. The guidelines would need to be clear. **Stakeholder response:** Every owner will have slightly different drivers and views so this is not something that the industry can resolve by itself.

Stakeholder Question	Fairfield Response
	A. It could be informed by longevity studies to understand the likely length of structural integrity and the window of opportunity for removal. This is currently better understood for subsea infrastructure than for CGBS.
Stakeholder Comment: There was some thought about CGBS operators coming together to have a fund for CGBS decommissioning because they are the only ones with that particular problem.	

4.22 Economics

Stakeholder Question	Fairfield Response
Q. The more you leave in situ, the cheaper the removal will be and there was an original commitment to remove the entire structure. Therefore, are the options driven by cost concerns?	A. The starting point for the CA is full removal and consideration of all feasible options. It will consider the pros and cons associated with each removal option in terms of many factors across the following areas: Safety; Environment; Technical; Societal; and Economic. Each of these criteria is given equal weighting in the CA (i.e. 5 x 20%) therefore the recommended option cannot be determined by cost alone. OSPAR Decision 98-3 also emphasises that cost can only be a differentiator where other options are equal and cannot drive the outcome.
Q. What about the financial cost differences between options?	A. The costs of the options are defined as part of the CA process.
Q. Is it more expensive to remove the platform than to leave it in place?	A. Not necessarily as it depends on the legacy implications.
Stakeholder question: Are people here aware how decommissioning is funded; that companies are given tax relief for decommissioning costs, it is not just the company's money it is public money?	*This question was not responded to directly but prompted the discussion on financial institutions buying out liabilities summarised in section 4.20 above.*

4.23 Reuse

Stakeholder Question	Fairfield Response
Q. Have other uses for the structure been considered outside the energy industry, for example other types of extraction, offshore agriculture and / or observatories? Q. Option 9 has the potential to be used as a fish farm. Is there reuse potential for the other options too? Q. Could what is there be made useful?	A. Yes, these were considered before decommissioning planning commenced, as required by the regulator. A. No feasible reuse options exist. Note that the maintenance and indemnity requirements for reuse would be a challenge for alternative uses. **Stakeholder comment:** Would people want to do it so far away?

4.24 Derogation

Stakeholder Question	Fairfield Response
Q. Could the derogation option have options?	A. It is not possible to offer more than one option for derogation, however, it may be possible to offer options within the selected option for derogation.
Q. At what stage can the derogation request be made? **Stakeholder issue:** It would be helpful if the regulators could be minded to give an indicator at an earlier stage, as a refusal at the decommissioning programme stage could result in both additional delays and potential unnecessary costs.	A. This can only be considered when the decommissioning programme is underway, and following the statutory consultation element of the decommissioning programme. This forms part of the (UK) legislation and cannot be changed in Scotland.

5. Topsides

This section contains outputs from the workshop sessions that relate to the topsides of Dunlin Alpha. A summary of the questions (Q.), comments and issues raised by stakeholders, and the corresponding answers (A.) from Fairfield Energy, has been collated without attribution. Additional information from Fairfield in response to the points raised has also been added into the report where it might help to enhance understanding.

Information on the decommissioning options for topsides was provided at the workshop in the presentation slides, which can be viewed at appendix 3. Further detail about the removal concepts being considered was also displayed on a poster at the workshop, and a copy of this can be viewed at appendix 7.

5.1 Dunlin Specific Issues for Topsides Removal

Stakeholder Question	Fairfield Response
Q. Is there anything unique about the Dunlin topsides and which affects the decommissioning?	A. The unique part of the Dunlin installation is the steel transition columns. It does not affect the topsides removal base scope of work, but may add to it, should removal of the transition columns be required. The transitions may be removed separately or with the MSF. MSF removal complete with leg sections may not then enable the use of a barge but could possibly be transported via the HLV hooks to the disposal yard. However, use of this methodology has potential problems associated with fatigue or vessel motion which might transfer to the structure.

5.2 Removal methods - Single Lift Vessel

Stakeholder Question	Fairfield Response
Q. What is the capability of a vessel like the Pioneering Spirit to remove the topsides at Dunlin?	A. The Dunlin platform is too wide for the Pioneering Spirit, however theoretically it may still be possible to use it and this is being investigated with Allseas. One such concept involves removal of lift beams from one hull of the Pioneering Spirit and use of a grillage system to remove the platform topsides. The vessel would approach the platform, position one hull through the legs, and then de-ballast to lift the topside. However, the amount of adaptation required, and the time taken to do this may then compromise the vessel's availability for other work and therefore considerably increase cost.

5.3 Removal methods - Crane Barge

Fairfield Energy offered further information one of the removal vessels being considered: The ZOMC-owned crane-vessel, the Zhen Hua 30 has a capacity to lift 10,000 tonnes and has a huge deck space (see appendix 7 for illustration). The Dunlin MSF is approximately 7,000 tonnes, so there is the potential to use this vessel with the possible advantage that it could remove the topsides in fewer round trips to a disposal yard, which reduces the amount of vessel hire time required.

Stakeholder Question	Fairfield Response
Q. Would you transport the MSF on a barge or put it on the deck of the vessel?	A. Both options are possible for the topsides modules. Due to the weight of the MSF, it is likely that either a transportation barge would be used or that the MSF would be transported to the disposal yard using the vessel cranes. The tandem crane lift requirement prevents use of the HLV's own deck.
Q. Is the height of the Zhen Hua 30 vessel capable of lifting the upper modules or would you have to take away the cranes, the drilling derrick, etc. to access the hook height?	A. Yes, the ZOMC Zhen Hua 30 crane-vessel is capable of removing all the Dunlin topsides modules.
Q. Is there an optimum use of deck space in removing the modules so that you don't upset the centre of gravity?	A. Fairfield have developed a Dunlin structural model which will be used to provide project assurance that any lift sequences proposed by removal contractors can be safely accommodated by the existing Dunlin asset configuration.

5.4 Removal Methods – Heavy Lift Vessels

Stakeholder Question	Fairfield Response
Q. Are there other heavy lift vessels that could do these removal lifts?	A. Yes there are other vessels which could do modular removal but none of these would be capable of single lift removal of the MSF. One of the challenges will be evaluation of removal methodologies to ensure the best solution for the Dunlin project is identified. Other factors, such as the need for transferring materials from vessel to vessel, and the required weather conditions are significant considerations.

5.5 Removal Methods – Float-Off

Fairfield Energy offered further information on the float-off removal method being considered: The float-off concept uses a barge with a pre-designed grillage or support frames, that enables connection of the barge with the underside of the platform topsides, prior to de-ballast of the barge to remove or 'float off' the MSF. The main disadvantage of this option is the need for a flat calm sea to use it, which is not compatible with the Dunlin location in the northern North Sea. Further illustration of this method can be viewed at appendix 7.

5.6 Removal Methods - Piece Small

Fairfield Energy offered further information on the piece small removal method also being considered: There are several issues with the use of piece small methodology as the main removal method for Dunlin. The location of Dunlin means that challenging weather conditions exist for the majority of the year. There is finite deck space to work within for dismantling, and efficient work is therefore dependent on the ability to continually offload material to vessels using cranes. While most of the modules can be removed in this way, there is a need to regularly reconfigure support utilities, i.e. power, lighting, and heating ventilation and air conditioning (HVAC), therefore involving additional work. At a certain point, temporary accommodation will be required and the helideck would need to be repositioned. The configuration of the MSF does not allow piece small removal, hence it would still need to be removed using an alternative solution. There is also more impact on the well-being of personnel living on Dunlin with the duration of activity e.g. 24-hour noise.

Stakeholder Question	Fairfield Response
Q. Are you saying that piece small is not considered to be viable option?	A. Piece small could work within the hybrid options as a more efficient way to remove some of the smaller elements than heavy lift, with use of heavy-lift techniques for larger elements only in order to minimise the time that a HLV is required and the number of round trips which the vessel would be required to make.
Stakeholder comment: Some lateral learnings to offer: we successfully dismantled several entire drilling modules (Total Alwyn North) in the Northern	A. Some of the Dunlin modules do lend themselves to piece small. To examine the options we have done a combination of study work and gone out to piece

Stakeholder Question	Fairfield Response
North Sea. Must be done in summer months, cannot be done in winter. The derrick was removed piece-by-piece using a specialist team without the need for a heavy lift vessel. One rig was removed with a small team using high-pressure water cutting techniques, which can cut through steel efficiently. It was cut into in 10 foot blocks, and each removed by making a hole in the block and shackling without use of heavy lift gear. I would encourage you to think about these techniques as possibilities.	small contractors to understand the possibilities. The Dunlin derrick doesn't particularly lend itself to piece small. Dunlin CoP was a reactive decision in response to falling oil price and happened quickly, so none of the well P&A activity was done in advance of CoP as is more usual. This means P&A is on the critical path for the project timeline. We want to minimise time between P&A finishing and topside removal starting, in order to minimise cost.
Q. How do timescales compare between carrying out a single lift removal which is a full season and piece small removal or reverse installation?	A. Piece small removal would take more than a year to complete. There is limited down-time work that you can do on piece small over winter because you run out of deck space quickly. Conventional single lift removal of Dunlin is not possible, due to the platform's width. We consider that here are alternative methodologies that would enable Dunlin topsides removal to be completed in one summer season, with the overall object of achieving a safe, efficient and cost effective solution.

5.7 Options Assessment - Keeping Onshore Supply Chain Options Open

Stakeholder Question	Fairfield Response
Stakeholder issue: What kind of quayside draught does the vessel need [single lift vessel /crane barge]? The implication being whether this restricts where the topsides can be taken back to.	**Additional information provided post-workshop by Fairfield Energy:** We will evaluate the solutions proposed by topsides removal contractors in a number of areas, with onshore disposal being one of the criteria. Quayside draught is linked to vessel selection but there are alternative solutions, such as vessel-to-vessel transfer in sheltered waters, which may be proposed to enable a variety of disposal yards of varying water depth to be proposed.

5.8 Options Assessment – Financial Modelling and Criteria

Stakeholder Question	Fairfield Response
Q. Has any financial modelling been done to examine the differences between the options? And what about using existing platform supply vessels (PSVs) in the area for piece small removal compared with the Pioneering Spirit? For example, the larger draft of the Pioneering Spirt is restrictive in relation to the geography of this area. Has the cost/ benefit taken account of?	A. Cost modelling has been done but running an accurate cost model is hard to do in practice. Market supply and demand is subject to frequent change and contractors tend to prefer to provide lump sum proposals, so it is hard to get a vessel day-rate for comparison. PSVs could be used but the piece small option has a number of restrictions, as previously discussed. Weather is an issue,

Stakeholder Question	Fairfield Response
	cranes need to be available at all times, down time needs to be factored in, and costs can mount up quickly as a result.
Q. What about the ability to negotiate on price with contractors as this would influence a financial model?	The topsides removal work scope will be subject to a competitive tendering process. There are many dynamic factors, such as oil price, exchange rates, vessel supply and demand, that will influence the price tendered by the removal contractors.

5.9 Contracting Strategy

Stakeholder Question	Fairfield Response
Q. What is the contracting strategy? How much of the work is going to be done in-house and how much will be contracted out? Or will you invite the supply chain to contribute ideas to get the best of what they can offer?	A. We have already done that in using in-house capacity and reaching out where we needed specialist help. For example, the transition columns which are unique to Dunlin may need to be cut. We went out and shared our problem with the supply chain via an OGUK Share Fair where approximately 20 companies expressed initial interest. We then requested proposals and received three responses. This process led us to one solution. Another example is the Dunlin telecoms tower which had an integrity issue, and which (in consultation with the regulator) we reduced in height with a piece small approach. This used in-house expertise. As a company we have not done decommissioning before so are reaching out to companies with regard to the topsides removal. Unfortunately there is no UK heavy lift capability in the market, only for piece small, so there are limits to the supply chain's capabilities.

5.10 Onshore Environmental Considerations

Stakeholder Question	Fairfield Response
Stakeholder issue: Related to contracts, we are hearing that the biggest environmental impact is bringing the topsides onshore and the yards not having the capacity to deal with the waste.	A. It seems that the amount coming onshore has historically been underestimated, but there are some new yards in development, including Cromarty Firth and Dundee. We have previously engaged with bodies such as Scottish Enterprise, highlighting the issues and needs that Dunlin has and thereby trying to give UK plc (and Scotland) a fair chance.
Q. Given that you will be bringing waste ashore, do you consider the onshore facilities' environmental licensing to be the criteria for contracting them and what audit do you carry out of them?	A. We have done a hazardous material inventory of the topsides so we understand what there is to deal with and will share that information with the supply chain so they know what they would be accepting. The contract process

Stakeholder Question	Fairfield Response
	is that the supply chain will propose yards, we then have these independently audited. Pollution Prevention and Control (PPC) and Radioactive Substances Act (RSA) licences are the two main ones that we look for. One issue is that some of the yards are nearly at capacity. This is another factor to consider. There are new yards in development. These may not yet have permits, but if the process to obtain those is mature, and they are companies with a track record behind them, then they would be considered.

5.11 Operational Risk

Stakeholder Question	Fairfield Response
Q. If any of the components were dropped onto the seabed, could they all be retrieved by the vessels used in the decommissioning operations, or would they be too large to be retrieved?	A. Yes, they could all be retrieved. However, we will aim to ensure that such a risk is mitigated to As Low As Reasonably Practicable (ALARP) through our project assurance process.
Q. There are 250 tonnes of toxic material in the topsides. To what extent does the management of that material influence the choice of the removal option?	A. A piece-small removal solution potentially requires a lot more exposure to those materials at the offshore site, although the personnel that would do it would be well-trained and fully competent, so it would be possible. With modular removal, there is the issue of how you would safely separate the modules, so you would need to ensure the hazardous materials were safely treated, as required, within the module, before being disconnected and lifted, and adequately fastened on their onward journey. The single lift method is the least intrusive onshore, but then the material would still need to be dealt with onshore.
Q. Has the risk associated with dropping a toxic material in the marine environment and again with the material coming into port been taken account of with the overall consideration of options?	A. Yes, absolutely. Conversations with potential contractors cover these issues and assurances on these points are required of them.
Stakeholder comment: It seems apparent that if you are going to dismantle onshore, choosing an option that involves less travel distance and trips will reduce the risk.	

6. Drill Cuttings

This section contains outputs from the workshop sessions that relate to the drill cuttings pile at Dunlin Alpha. A summary of the questions (Q.), comments and issues raised by stakeholders, and the corresponding answers (A.) from Fairfield Energy, has been collated without attribution. Additional information from Fairfield in response to the points raised has also been added into the report where it might help to enhance understanding.

6.1 Background Information

Stakeholder Question	Fairfield Response
Q. Can you explain a bit more about the drill cuttings?	A. Many facilities used for exploration have historical drill cuttings piles. These are dealt with within each individual decommissioning plan.
Q. How far out does the pile extend?	A. The radius of the bathymetrically visible pile on the seabed against the south face of the CGBS is approximately 60m. OSPAR also defines a zone of wider contamination or within which an 'ecological effect' might be expected (the zone within which total hydrocarbon concentrations in sediments are ≥50 $\mu g.g^{-1)}$. This has been calculated from survey data to be an area of roughly 0.671km^2 centred on the platform, i.e. lying within the 500m safety exclusion zone.
Q. What sort of material is it?	A. Very fine sediment (silt-sized particles), compared to the surrounding natural seabed of muddy sand.

6.2 Sampling Process

Stakeholder Question	Fairfield Response
Q. The piles are up to 13m, have you got any cores right the way through? If not, why not?	A. No, not through the deepest part of the pile. There are technical difficulties associated with obtaining that deep a core. This is due to the types of sampling equipment available, and also the limitations of deploying it on the steeply sloping sides of the pile (where it is deepest) and beneath the topsides in between the platform legs. The 4m cores used in the last survey will have been used on the outer edges of the seabed pile, and some of these may have gone through into the natural seabed below. The forthcoming drill cuttings reports will have more detail.

Stakeholder Question	Fairfield Response
	Stakeholder response: This appears to be a common issue.
Q. When sampling, the oldest cuttings are deepest; have you just sampled the newest?	**Stakeholder response:** Fairfield have sampled the oil-based cuttings which are the worst, so I am somewhat reassured.
Q. What's the benefit of sampling to 4m? **Stakeholder issue:** I am concerned that if you expose cuttings at depth and repeat current OSPAR procedure to determine if those cuttings can remain in situ, you may find that the concentration at depth is much higher than the concentration at the surface, which is not in line with OSPAR regulations. There is a problem of re-exposure of total hydrocarbons at depth.	**Stakeholder response:** Sampling to 4m meets OSPAR 2006 regulations. **Stakeholder response:** You don't want to disturb the pile. A. Sampling to 4m was the longest feasible core. If you consider the decommissioning options, there may be a need for access points to cells at 4m depth or more. If you need to remove the whole pile, need to know what's in there. **Additional information provided post-workshop by Fairfield Energy:** For clarity, no vibrocore samples were taken on the cell tops, only ROV push cores. Core lengths were restricted entirely by current technology, the gradient of the seabed cuttings pile and the presence of the topsides. It is not feasible to swing an 8m long, 3t vibrocorer onto the cells from the surface (although whether anyone would advocate using a vibrocorer on top of the CGBS, regardless of the whether or not the topsides were present, is another matter altogether).
Q. Is total hydrocarbon content decreasing with depth a factor of the sampling conducted? Are the samples comparing like for like?	A. High levels of hydrocarbons were not recorded below 150cm. In most core samples where sectioning and sampling at different depths was performed, hydrocarbon concentrations did decrease with depth; it is assumed that these results are from cores located around the edge of the seabed cuttings pile (and had gone through into the seabed beneath the pile) or had penetrated into lower layers of water based mud cuttings. However, at two stations on the seabed cuttings pile, and in all three cores from the pile on the CGBS roof, evidence of total hydrocarbon concentrations (THC) concentrations being higher in subsurface layers than at the surface was seen. Nevertheless, in all of the three 4m cores from the seabed pile, THC concentrations had dropped off to near background levels by 150cm depth. In the three small cores from the pile on the CGBS roof, these were sectioned at three levels (down to just over 70cm) - the concentrations at each level were similar to or in some cases higher than those recorded at the surface. Therefore, for the pile on the CGBS roof, the possibility of higher THC concentrations being present at depths below 70cm remains. There will be more detail in the forthcoming drill cuttings report.

6.3 Composition and Characterisation

Stakeholder Question	Fairfield Response
Q. Can you explain why the drill cuttings are considered to be uncontaminated deeper than 150cm?	A. They are less contaminated, rather than uncontaminated. There are two possible reasons: a) because the 4m cores punched through the edge of the pile to the seabed below; or b) if the 4m core didn't punch through to the seabed below, it could have simply gone through into water based mud cuttings.
Q. When was diesel mud first used?	A. Diesel in oil based mud was first used in 1978.
Q. I am thrown slightly by the total hydrocarbon content decreasing with depth.	A. This was referring to the pile on the seabed, mostly on the periphery not at the core of the pile. The assumption is that surface layer hydrocarbons are relatively degraded, and much fresher when deeper. Then there are water based mud cuttings beneath, so the hydrocarbon levels drop off. *See further details in section 6.2 above.* **Stakeholder response:** Cumulative cuttings on CGBS maybe lead to later water-based cuttings sliding off onto seabed, therefore the lower levels on the seabed.
Stakeholder issue: [As per my offer on cell contents], I would be happy to offer comments … on [plans] for characterisation of the chemistry of the drill cuttings piles also, should the information become available. Without such detailed considerations of the overall inventory of wastes associated with the platform, both within and on top of the CGB and in the surrounding sediments, any decommissioning proposal would be lacking in critical detail, and therefore any longer-term stakeholder engagement would be of very limited value.	*This has been noted by Fairfield and will be discussed further with the stakeholder concerned.*

6.4 Environmental Impact Assessment

Stakeholder Question	Fairfield Response
Q. Has a macrofaunal assessment been done?	A. Yes.
Q. You only do the EIA on the final option. So does this mean that you have not done an EIA on all cuttings options?	A. We have carried out an EIA for removal of all cuttings and for other options but the Environmental Statement for the final option would be fully mature. We have enough information at the moment for the comparative assessment.

6.5 Interaction with Cell Tops

Stakeholder Question	Fairfield Response
Q. Drill cuttings give a protective cushioning to the cells. Has Fairfield any thoughts on any other covering?	A. If we did apply additional covering the might cause more disturbance to the cuttings. Some stakeholders would have concerns because of introducing more foreign material. **Additional information provided post-workshop by Fairfield Energy:** We have considered at a conceptual level the option of further protection for cell tops. Atkins have performed calculations looking at the impact energies of falling parts of the CGBS (namely the transition pieces) which show that penetration of the cell tops is highly unlikely.

6.6 Interaction with Debris

Stakeholder Question	Fairfield Response
Q. What are Fairfield's intentions for debris in the cuttings pile? **Stakeholder comment:** Debris is a problem only for interfaces; there would not be fishing over the cells.	A. Consideration of debris removal forms part of the comparative assessment. It is impacted by the various options but broadly speaking we are looking to remove all accessible objects.

6.7 Interaction with the Options

Stakeholder Question	Fairfield Response
Q: What is the impact of the drill cuttings and how do you protect against it in the four decommissioning options for Dunlin Alpha? Full removal would obviously disturb the pile. Would the IMO (-55m) cut also disturb the pile? **Stakeholder comment:** Full removal of the structure would need cuttings pile removal. If the concrete is left, there is more chance of leaving the pile.	A: The impact of disturbance of the drill cuttings for the full removal option has been assessed, including the impact on the water column and how the material would be distributed. The recovery of drill cuttings for this option through dredging (the chosen method) and its associated environmental impact has been assessed. [**Post-workshop clarification from Fairfield:** Current study work leans towards use of grab excavation as the preferred means of cuttings recovery rather than dredging as stated in the response.] The three derogation options would not involve disturbance of the cuttings pile; the lowest section of conductors and the lowest guide frame would stay in place, to avoid interaction

Stakeholder Question	Fairfield Response
	with the drill cuttings. There is no advantage in removing the lower conductors and guide frame and there is a lot of marine growth there.
Q. What options are there for removal of conductors? Would this be through the drill cuttings or not?	A. There are various options, from leaving in situ to taking out. For example a -55m cut would still be quite a distance from the cuttings pile.
Stakeholder comment: If you do something inside the base, you will need to remove the cuttings pile.	A. The options for managing the cell contents will evaluate the impact on the drill cuttings pile, and where it would require to be disturbed to gain access to the cells.

6.8 Decommissioning Options for Drill Cuttings

Stakeholder Question	Fairfield Response
Q. What are the preferred options?	A. There are various options where drill cuttings need to be disturbed or removed. It comes down to how long the operation would take and therefore potential disturbance. Studies are being undertaken to model the impacts of the options.
Q. Have many participants suggested removal?	A. There have been no suggestions for removal of drill cuttings, but there have been questions from stakeholders about what happens if they are removed.
Q. Why is there no industry position on removal?	A. The OSPAR Recommendation 2006/5 on drill cuttings was the result of a joint industry project and concluded that cuttings piles are in general best left in situ without disturbance. **Stakeholder comment:** There is the example of a 1989 removal at BP Magnus around a steel structure. It took 2-3 years' planning. It was done in a summer season. I do not know whether a report is available.
Stakeholder comment: The best options are to leave or remove totally. **Stakeholder comment:** The consensus at other events on decommissioning has been to leave the drill cuttings pile in situ. It is likely to have least damage, and would have dispersed over time.	

6.9 Removal Methods

Stakeholder Question	Fairfield Response
Q. Do you have a methodology for removal of drill cuttings without releasing a plume?	A. There are various options for removal, e.g. using a suction dredge pipe. However, none appear to totally remove the possibility of plumes being released. Removal leads to issues then of what to do with the recovered water and material. **Stakeholder response:** There is no previous experience of doing this. **Stakeholder response:** Most of the impact would stay within the area already impacted.

6.10 Disturbance

Stakeholder Question	Fairfield Response
Q. Why be scared of disturbing the cuttings pile?	A. OSPAR Recommendation 2006/5 seeks to avoid unnecessary disturbance of cuttings where they are within certain thresholds. Where disturbance will occur, modelling of the various options will help inform the solution.
Q. Could you give more information about the drill cuttings modelling?	A. It simulates the impact of disturbance to cuttings and their eventual fate in the context of different removal or relocation options.
Q. I thought it was accepted knowledge to minimise disruption to piles to minimise environmental impact. Why is this not stated?	A. That is correct, but we have to look at the potential effects of disturbance in the context of the full removal option for the CGBS as well as for potential access to the cells, both of which will be considered within the comparative assessment process.
Q. If you remove the cuttings, will the impact be higher?	A. Yes.
Q. The example of where dredging releases PCBs, is it similar for drill cuttings?	**Stakeholder response:** Yes. **Stakeholder response:** The question becomes, how much of an environmental impact it is. **Stakeholder response:** It possibly becomes an issue when considering all decommissioning: the cumulative effect.

6.11 Fishing Safety

Stakeholder Question	Fairfield Response
Q. How will you keep fishermen from operating by the cuttings? This is a safety issue. It is also an environmental issue. Could there be contamination of gear or catch? **Stakeholder issue:** There's a need to keep fishermen clear; this is an issue for post-decommissioning.	**Stakeholder response:** Yes, the drill cuttings would contaminate gear and catch, if towed through. A. Environmental impact is being modelled, including fisheries interactions.

7. Cell Contents

This section contains outputs from the workshop sessions that relate to the residual content of the cells of Dunlin Alpha's concrete gravity base structure. A summary of the questions (Q.), comments and issues raised by stakeholders, and the corresponding answers (A.) from Fairfield Energy, has been collated without attribution. Additional information from Fairfield in response to the points raised has also been added into the report where it might help to enhance understanding.

7.1 Attic Oil Removal

Stakeholder Question	Fairfield Response
Q. How can you calculate how much attic oil is still present?	A. Initially, a 'best estimate' attic oil inventory was set using the assumption of a 10cm residual layer across each production group. This equated to an attic oil volume of circa 1634m^3 across the entire CGBS. We sought to validate this inventory using theoretical means. Using the Attic Oil Recovery Project (AORP) pumping logs as a basis, a dynamic model was created by Xodus Group to better understand the offshore operations. The model simulates the addition of the acid and alkaline chemicals, the chemical reaction to produce carbon dioxide (CO_2), and the removal of attic oil. The model showed that the method used during the AORP would have been able to remove the majority of the attic oil from the cells to within a few centimetres of a residual oil layer. This proved the 'best estimate' inventory to be highly conservative. The technical report detailing the simulation basis and findings is available if required.

Stakeholder Question	Fairfield Response
	Fairfield is currently investigating how this inventory basis can be further validated using physical means i.e. accessing one or more of the CGBS storage cells for contents surveying / sampling purposes.
Q. Can you get more of the attic oil out of the cells?	A. Fairfield is currently reviewing the various attic oil removal / treatment options as part of the CA. In theory, it may be possible to remove more attic oil from the CGBS however the effectiveness of the recovery is dependent on several factors (relative thinness of oil layer, oil location within the cell domes, ease of external cell access, etc.). The operations would need to be performed on a cell-by-cell basis, as no further recovery is achievable using a methodology similar to the original AORP. The 'value' of the removal / treatment options will ultimately be determined using the CA process. **Stakeholder comment:** The presentation [video infographic] from Fairfield stated that all oil had been removed, if this is not the case, it needs to be changed.
Q. What chemicals were used to extract the attic oil?	A. Hydrochloric acid and sodium bicarbonate (alkaline) were added individually to produce carbon dioxide within the production cells. Recent dynamic modelling has showed that there is likely residual acid within the Dunlin A CGBS as this reactant was added in excess.
Q. Is the CO_2 still in cells?	A. Most of the CO_2 was scavenged in all bar one cell group (Group A). This will have naturally depleted and the CO_2 will have dissolved into the oil and water phases.

7.2 Cell Contents Inventory

Stakeholder Question	Fairfield Response
Q. When will information on cell contents be available, as this is likely to have an effect on what you are going to do with the structure as a whole, and would also tie in with drill cuttings?	A. The full evaluation of the cell contents is being collated in an overarching technical document that will be published alongside the decommissioning programme. As stated, there is an interaction between these different elements to be considered. *The current cell contents inventory basis is outlined in the presentation slides given in appendix 3.* The residual or 'mobile' oil in the cells has been validated based on dynamic modelling carried out by

Stakeholder Question	Fairfield Response
	Xodus Group. *The theoretical validation is described in more detail in section 7.1*. Fairfield is currently investigating how this inventory can be further validated through surveying / sampling (physical validation).
Q: What is in the cells? Has this been determined? Are there any concerns?	A. Work was carried out by Shell to remove the attic oil that remained in the cells, i.e. that which was above the reach of the export pipework. The attic oil was displaced with carbon dioxide. The process used by Shell has been reviewed by Fairfield and assessed, theoretically, as having been as effective as it could have been. However, there may be some residual free oil left. There are also probably some waxy deposits on the cell walls and ceilings, and sediment at the bottom of the cells. The volume of sediment is quite low, especially compared to that of the Brent field. There was no reservoir depressurisation operating phase (as with the Brent platforms) on Dunlin Alpha so much less sediment was created by the well operations. The main sediment deposition occurred during the very early years of production when the wells were newly drilled. We have made an assessment of what we think the contaminants are. *For details of the cell contents inventory basis, please refer to the presentation slides in appendix 3.*
Q. There is not just attic oil but other sediments too to be dealt with?	A. Yes. The sediment phase within the CGBS is considered to be made up of: • Sand and clays; • Hydrocarbons in the form of oils and waxes; • Small quantities of natural occurring contaminants such as heavy metals and low specific activity (LSA) naturally occurring radioactive materials (NORM); and • Water (could contain fluids drain fluids and residual quantities of production chemicals).
Q. Does Fairfield have any feel for the amount of sediment?	A. The overall volume of sediment within the CGBS is estimated to be 1248m^3. Based on the ability of the solids to travel through the communication ports between cells. The greatest proportion of sediment is in the base of 8 cells across the structure (the inlet cell and next adjacent cell in each of the 4 production groups). The volume of sediment across the Dunlin Alpha CGBS is much less than the Shell Brent Platforms (circa 1000m^3 per cell).
Q. How do the cell contents compare with others, for example Brent's?	A. There is less sediment at Dunlin due to a difference in production history.

Stakeholder Question	Fairfield Response
Q. Are there heavy metals in the cells?	A. Yes, we have estimated levels and are now validating our findings.
Q. It would be useful to have information about how high the hydrocarbons, PAHs etc. are compared to the background natural levels as this comparison could help visualise the issue.	A. The contaminants within the cells have been estimated to create a base case inventory, the assessment has also looked at potential upper bound quantities of contaminants, in order to assess the worst case environmental impact should there be a release of contents, or should they become exposed to the outside environment.
Q. From the written information that is available, I suspect that the sentence … "In 2008, trapped oil in the top of the cells (called attic oil) was removed during the Attic Oil Recovery Project making the cells oil free to as low as reasonably practical (ALARP)." … is something of an over simplification; I understand that it was not just attic oil that was initially left in the cell; but also a mix of solid materials … and if that is the case, then I imagine that those are still there and would be expected to remain there if a decision was taken to leave the CGB in place. If those wastes do exist and have been characterises to any degree already, then it would be extremely useful to see the data for those. If there are plans for further investigation of these materials, which (on the basis of experience with other platforms) could contain a complex mix of contaminants, then it would be interesting to see the plans for those investigations. Would be happy to offer comments on those plans, and on those for characterisation of the chemistry of the drill cuttings piles also, should the information become available. Without such detailed considerations of the overall inventory of wastes associated with the platform, both within and on top of the CGB and in the surrounding sediments, any decommissioning proposal would be lacking in critical detail, and therefore any longer-term stakeholder engagement would be of very limited value.	These are good questions and we have been looking to address, both characterisation of the existing CGBS cell inventory and the options available to manage the inventory (further recovery and/or treatment), recognising that recovering or treating all of the inventory may be constrained due to the configuration of the structure and how the inventory is distributed. We have identified that the cells will contain an inventory of sediment covering the cell floor and waxy residues covering the walls and ceiling. Sediment contamination is likely to be highest in 8 of the 75 oil storage cells and wall residues will be thickest in the cells with externally facing walls in contact with the ambient sea. A great deal of work has been performed to understand the efficiency of the previously executed attic oil recovery project to understand whether there is appreciable mobile oil left within the structure and where it is located. From our work, which has included a detailed dynamic model of one of the cell groups (20 out of the 75 oil storage cells), this has shown that the CO_2 displacement technique would have been very effective, but would have left a very thin evenly distributed layer of oil that will now reside in the top attic space of every cell.

7.3 Cell Contents Modelling

Stakeholder Question	Fairfield Response
Q. Who has verified the cell contents modelling? Q. How are you getting the modelling process verified?	A. Currently the modelling has not been independently reviewed, but was performed completely independently to the other cell inventory assessments. We have an Independent Review Group for the project to provide feedback on

Stakeholder Question	Fairfield Response
	our methodologies and decision-making processes and they will technically review supporting study work.

7.4 Impact of Contents Release

Stakeholder Question	Fairfield Response
Q. If there was a catastrophic event that damaged the concrete cells would there be an environmental disaster?	A. The structure will contribute to preventing this, through absorption of the impact energies, although it is acknowledged that a loss of containment would eventually occur if the structure and contents were left in situ. The contents are 99% water but there are other elements as well. The impact of the release of any residual contents will be analysed as part of the environmental impact assessment which has yet to be completed for the cell contents. The volumes of any potentially hazardous phases are considered to be low and the impact of any release would not result in a major environmental incident.
Q: Would the cell contents still be an environmental concern in the case of derogation?	A: We do not think it is a significant environmental hazard, though that point is subject to further assessment. The environmental impact of any contents left in situ will be considered during the cell contents CA and the Environmental Impact Assessment.
Q. Have you estimated the level of hydrocarbons that would be dispersed if the cells were left in place and degraded over time?	A. The hydrocarbons that are left in situ would not be released all at once. We are looking at defining a series of credible release scenarios (i.e. number of cells and where within the structure) but have not performed any updated environmental modelling yet.

7.5 Capping

Stakeholder Question	Fairfield Response
Q. Why would you have a capping option?	A. In situ capping would be applied to the sediment phase only. It involves an inert material such as cement, sand, clay, grout, etc. to contain the solid material. The main benefits of capping are: • Minimise the uncontrolled release of sediments to the environment when the CGBS integrity becomes compromised; and • Minimise the migration of contaminants from the cell sediments into the cell water phase and eventual accumulation as a distinct phase in the cell roof space.

Stakeholder Question	Fairfield Response
	Capping essentially acts as a secondary barrier between the sediment materials and the environment (the first barrier being the CGBS itself) but does not reduce the quantity of material left in situ. Sediment removal is therefore viewed as a more attractive management option.

7.6 Bioremediation

Stakeholder Question	Fairfield Response
Q. What about the bio-remedial option? Q. Has bio-remediation this been considered?	A. Although the technology has been used in other situations, bioremediation of the CGBS cell contents has many technical challenges including: • Any treatment would have no impact on the in-situ heavy metal components. • Biological reaction will be hampered by the closed environment of the CGBS, where light and oxygen is minimal and the ambient temperature as low. Effectiveness tests in this environment have not been done. • The time for any significant results to be apparent would be several decades (50-60 years). • The reaction results in several intermediate products prior to completion, meaning that quantifying and characterising the environmental impact of any eventual release is very difficult. • Penetration of the organisms into the deeper layers of the sediment may be limited. • Future intervention would be required to assess the process effectiveness and deliver more nutrients, reactants, etc. • The dynamic modelling carried out by Xodus Group has shown that the AORP resulted in an excess of acid being left within the CGBS, which could negatively impact the biological organisms used in bioremediation. In order to neutralise the pH, more chemicals will need to be added to the cells. Due to the several uncertainties and feasibility concerns, bioremediation is not considered to be a viable option for treatment of the Dunlin Alpha CGBS cell contents.
Q. Why are we trying to remediate what are small amounts of oil?	A. As mentioned previously, bioremediation is not considered to be a viable option for the Dunlin Alpha CGBS cell contents.

Stakeholder Question	Fairfield Response
	Any management options further evaluated as part of the CA would involve contents removal. Even though the mobile oil (and other phases) quantities within the CGBS are relatively low, the project needs to understand the impact of a release on the environment. There is also a need to consider the environmental, cost, safety, societal impact and technical implications of removal operations. We are currently narrowing down options to compare removal with the leave in place option. No decision has yet been made on whether the contents will undergo further management.
Q. How clean is clean?	A. The project are looking to take a pragmatic approach to demonstrate reasonable endeavours. This requires that a measurable improvement is made to reduce the inventory and its environmental impact, but that should be balanced against the level of effort required to execute the work. Importantly, reasonable endeavours should also look to execute the work in a predictable and manageable timeframe. It is likely that any further intervention to recover contents will experience a law of diminishing returns, where the benefit achieved reduces with increasing effort or time. The results will be monitored during the activity to demonstrate when no further improvement is practical.

7.7 Cell Access

Stakeholder Question	Fairfield Response
Q. Can you do any cell access other than through the pipework?	A. Fairfield Energy is currently investigating ways of accessing the cell contents within the CGBS for surveying and / or sampling purposes. A review of various access options have highlighted the following routes: • Via existing pipework (rundown lines and / or existing riser / J-tubes); and • Externally via cell top penetrations (as performed by Shell during the Brent cell sampling campaign).
Q. Does obtaining cell contents samples impact on the integrity of cells?	A. Not if we use current pipe work. External cell penetrations would have a higher risk in terms of CGBS integrity, but we will endeavour to keep any impact to a minimum. This integrity risk of externally penetrating the cells means that we would not be executing this until post-completion of the well P&A campaign and removal of the topsides. Should there be a loss of containment this would result in flooding of Leg A in the CGBS, and according to platform operating

Stakeholder Question	Fairfield Response
	procedures this would require the remaining legs to be flooded and the facility down-manned.

7.8 Interaction with Drill Cuttings Options

Stakeholder Question	Fairfield Response
Stakeholder issue: There is the issue of disturbing the drill cuttings to be taken account of. This may have bigger impact than any benefits gained from cell contents removal. **Stakeholder comment:** In order to compare options, the values of contaminants from the slow degradation of cells and release of contents should be compared with the sudden release of contaminants caused by removal of the cuttings pile (which would be required if the cell contents were to be removed as a decommissioning option).	A. The distribution of the drill cuttings has been mapped and this shows that a large proportion of the cells are covered. This will be taken into account when considering options.
Q. Could drill cuttings also be beneficial as they can reduce the impact of debris falling on the cell surface?	A. Yes, they could potentially reduce the impact of falling objects on the cell surface. The pros and cons of drill cutting disturbance / removal will be considered as part of the CA.

7.9 Learning from other Operators

Stakeholder Question	Fairfield Response
Q. Have other decommissioning projects had these cells?	A. Brent does, and we are looking at what has been done by others to help us formulate our options. We have been working to build-in best practice and learning from elsewhere.
Q. Has Fairfield spoken to Shell about their cell penetration studies and technologies, for example Geoprober? **Stakeholder comment:** Fairfield should show how they have learnt from previous cells issues e.g. Brent, to work towards best practice.	A. Yes, Fairfield and Shell have held discussions and are considering wider collaboration with other operators in a bid to share lessons learned and information.

7.10 Other Issues

Stakeholder Question	Fairfield Response
Q. On the basis that AORP has already demonstrated diminishing returns for managing the oil inventory, so should you not consider opening all the cells now and potentially controlling that environmental impact? **Stakeholder comment:** It is hard to differentiate at fine scale what the environmental impacts are and to assess impacts and benefits.	A. This approach is currently being examined.

8. Concrete Gravity Base Structure (Legs and Cells)

This section contains outputs from the workshop sessions that relate to the legs and cells of the concrete gravity base structure of the Dunlin Alpha platform. A summary of the questions (Q.), comments and issues raised by stakeholders, and the corresponding answers (A.) from Fairfield Energy, has been collated without attribution. Additional information from Fairfield in response to the points raised has also been added into the report where it might help to enhance understanding.

8.1 Shared Learning

Stakeholder Question	Fairfield Response
Q. How many platforms are there like this in the North Sea? Could the technology for decommissioning be shared? **Stakeholder comment:** More could be done to develop and share learning from all decommissioning.	A. There are 53 like this is the world, 27 of which are in OSPAR area including 13 in UK waters. There are some design differences however, and whilst some concrete cutting and other technology can be shared, there will be specific issues to each.

8.2 Structural Integrity and Degradation

Stakeholder Question	Fairfield Response
Q. What is known about the integrity of the legs?	A. The legs being concrete are much more resilient than steel. The steel supports would probably need to be supported to allow for their shorter life (resulting from future corrosion) and a retrofit kit is currently being tested for this.
Q. When you assess integrity, do you look at all eventualities including seismic?	A. We look at a range, but, seismic eventualities is not currently one of them

Stakeholder Question	Fairfield Response
Q. How confident can we be in the integrity estimates? As pieces are lost, won't there be a further loss of integrity?	A. It is an imprecise science and the long-term integrity of the concrete within this environment can only be estimated.
Q. Has the removal of topsides been modelled, as it alters the overall platform integrity?	A. Yes, a dynamic assessment has been done.
Q. If structure is left without the topsides will it be more prone to the energy of the waves?	A. No. This has been fully analysed.
Q. What about the integrity of the bolts?	A. It is hard to know the integrity of bolts, cables, etc. as they are often encased and cannot be seen. This is less of an issue than corrosion. They have been grouted. Retrofit and coatings have been designed for trial.
Q. What is the impact of losing the ring beam's integrity during cutting / removal of the metal of the legs?	A. The removal of the steel part of the structure does alter the loading significantly.
Q. Is it the intention to cap the legs?	A. This is not yet clear. If the legs are left, then there will be a transition with a pressure boundary excluding water. However, this will break down over time and the legs will eventually fill with seawater.
Q. If the concrete is flooded, is it an issue?	A. There would be a loss of compression and therefore a loss of 40% of the environmental loading. However, there are a number of other factors relating to how the decommissioning happens.
Stakeholder comment: The build life of Dunlin Alpha was for 30 years but it's already 40 years old.	A. Fatigue is assessed outside the installation's current design life.
Stakeholder comment: I previously worked for Atkins on modelling of reinforced concrete in deep water. The modelling explored whether corrosion of concrete could occur in a low oxygen environment, which it can. However, we did not have any detailed characterisation of concrete to support the modelling; no cores were available. I would very much like to revisit that modelling of corrosion rates, which was speculative, with the benefit of characterisation. I would like to better understand the timescales of concrete degradation more accurately. It would be helpful to have more guidance from the regulator about their requirements for the timescale for the modelling, whether this is say, 1000 years or infinite. This would help those undertaking modelling and could also benefit other industries, including nuclear. The work being done by Fairfield could help others. Other aspects of interest are the different behaviour of the steel and concrete, and the biological effects on concrete, for example there may be potential to seed and grow bio-forms on the surface to enhance the longevity of concrete, especially at depth.	*Fairfield was able to share a concrete core sample from Dunlin for the participant to examine at the workshop.*

Stakeholder Question	Fairfield Response
Q. Do you need more information on the lifetime of different components, and associated timings?	A. No. This has already been explored using modelling, and there is some uncertainty over prediction. Best current knowledge about what might happen is in the hundreds of years, rather than the thousand. This information is available (hard copies were provided for reference at the workshop). It is not planned to be included as part of the workshop presentations, because of the complexity/ other priorities, but is available for those who wish to examine it.
Q: Several of the decommissioning options involve leaving the concrete there for a long time. What do you expect to happen to the concrete over tens of hundreds of years? Q. What is the impact on the integrity of the concrete of the legs over a long time? What is the failure mode? And what impact will it have on the cells.	A. Although we do know that concrete strengthens over time, some of that expectation will be speculative in that we do not have long-term experience as an industry, or in fact as civilisation, over such a long time period. We have done failure studies to understand the longevity of the concrete and how the structure would fail over time. We think that the upper portions of legs would stay as they are for around 250 years. Further in the future, at around 1000 years, which is where the expectation is more speculative, we anticipate that there would be progressive failure of the base and the legs would collapse. The nature of the leg failure is chloride attack on the rebar and it would start spalling pieces of concrete. However the base is very thick so that would stay intact for longer. There is also the question of whether we should treat the steel transitions the same as the concrete, if they are able to last as long. Option 5 has the challenge to cut the transitions off and for technical reasons, this needs to be done at a point lower down the concrete leg than originally envisaged. However this may not be viable since it could undermine the longevity of legs as the ring-beam would be lost. We are therefore now looking to see whether we can we make transitions last longer and may have some solutions for this.
Q. People will want to know if the failure mechanisms on the cells have been modelled. Could a piece of significant size break a cell?	A. It is highly unlikely that a falling object would breach the cell tops. The largest object is the transition pieces, which due to their size and orientation could penetrate the cell roof, but given that a fall would be because of corrosion, the entire transition is unlikely to fall. A basis for credible release scenarios is still being evaluated.
Q. What is spalling?	A. Signs of stress or cracking in the concrete. This can result in chunks of the concrete falling away from the structure.
Stakeholder comment: If the legs fall down on their own, it is the same effect as toppling it now.	A. This is not the case. The legs would degrade gradually from the top down, rather than from the bottom of the legs at depth.

Stakeholder Question	Fairfield Response
Q. Have CGBS owners undertaking any initiatives to look at longevity of the concrete structures?	A. Yes, two post-doctorate concrete longevity studies (both sponsored by Fairfield among others) have been carried out by Dundee and Leeds Universities and there has been some collaboration via the IOGP working group. We have carried out some studies ourselves on leg failure. Atkins have also looked at a number of structural studies for the CGBS to see how the concrete would react if left in place.
Q. Is there any structural data about the current state of the CGBS?	A. Yes, based on a regular visual inspection including external ROV footage. There are also a number of leg internal cameras to support this. Any evidence of concrete spalling would trigger a more detailed assessment.
Q. Do you have data from the previous operator on the CGBS?	A. Yes, this was provided when the asset was acquired.
Q. Will you monitor stresses to the CGBS beyond decommissioning?	A. This will depend on the proposed way forward, and the fact that early failure (i.e. within 100 years) is not expected. Potentially, however, technologies could be installed to monitor the structure at a later stage.
Q. Has the seabed subsided as a result of the platform weight?	A. The CGBS has slightly subsided since installation, although not the surrounding seabed.
Q. What impact will iron ore ballast have on degradation?	A. The steel has all been coated so we do not believe it will be much affected.

8.3 Recycling Potential

Stakeholder Question	Fairfield Response
Q. What percentage of the materials can be recycled?	A. Topsides are usually easy to recycle and some have been sold on for re-use. Past experience suggests more than 95% can be recycled or re-used. For concrete structures, however, it is harder to say, and will depend how it can be broken down, and what it can then be used for other than rubble. Obviously the presence of reinforced steel within the concrete makes this harder. It should be noted that any concrete that is contaminated with low specific activity (LSA) or NORM would have limited reuse potential. Marine growth also presents difficulties for recycling or disposal because of limited availability of onshore facilities.

8.4 Environmental Impact of Removal

Stakeholder Question	Fairfield Response
Q. What about the environmental impact of bringing it to land? **Stakeholder comment:** There is a concern about the presumption to remove structures in terms of environmental impact. **Stakeholder issue**: There are concerns around the time required to remove all the CGBS, the environmental impact of removal, and the impact on land of that volume of concrete and other materials coming to shore.	A. There are likely to be implications, and these must be considered; however, the regulatory starting point is for all structures should be removed except in certain limited cases.

8.5 Legs Background Information

Stakeholder Question	Fairfield Response
Q. What is the diameter of the legs?	A. The diameter is 22.65m at the widest part of the legs at the base, and 6.7m at the top. It is 13m at -55m. The concrete itself is approximately 0.7m thick all the way through.
Q. What is in the concrete legs? I would like further detail.	A. Contents include process pipework, HVAC, instrumentation.

8.6 Legs Removal Options

Stakeholder Question	Fairfield Response
Q. Are we to assume the conductor guides will be removed?	A. This hasn't been decided yet although it is possible that the cut depths would correlate with leg cuts in the event of a partial removal solution.
Stakeholder comment: Referring to the steel transition columns; if they are left this will increase the overall weight left in situ.	A. Under these circumstances, overall weight would not be affected.
Q. Why the choice of - 55m depth for cutting the legs?	A. This relates to the IMO depth requirement for shipping clearance.
Q. If cutting to -55m then why not cut the legs off at the base and just leave the cells. Q. A cut at -55m is an acceptable clearance, but can we remove the legs at the top of the caisson (i.e. immediately above the cells)?	A. The technical challenge associated with cutting at the base is an order of magnitude more difficult that the IMO -55m cut.
Stakeholder comment: The concrete legs are the biggest decommissioning challenge.	A. In size, yes.

Stakeholder Question	Fairfield Response
Q. What are the challenges of reducing the length of the leg?	A. A major challenge is the diameter of the legs. The concrete is approximately 0.7m thick. Coupled with the steel reinforcements, the cutting challenge would be enormous. There is no evidence of cutting/removing concrete structures of such diameter and depth.
Q. What is the feasibility of leg cutting at different depths?	A. Cutting concrete subsea at any depth has not been proven to date.
Q. Are there any previous lessons learnt? Are there any previous examples of Option 6 the IMO cut?	A. No, it has never been done before, so there are currently no lessons to share.
Q. For the shallow cut Option 5 (i.e. -8m and -20m), have you considered making a structure to enable the cut to be made in dry conditions like a cofferdam; if not, could this be a workable solution where there is no water inside the legs?	A. Yes. If we did this, however, we would need to consider the inherent safety and other risks, as well as the longer-term implications of an additional structure, including regulatory.
Q. Is there the potential for more joint-industry working to test out some procedures (for leg cutting)?	A. Yes this might be a way forward for other projects.
Q: Considering the issue of the longevity of concrete and the company's liability in perpetuity, why was toppling ruled out, including the use of explosives to accomplish that?	A: In 2011 the project team were advised that toppling would be viewed as dumping at sea, and that it would be subject to challenge from the regulator and OSPAR. More recently this was checked with BEIS, and that position was confirmed in writing. Use of explosives is considered technically difficult, and while there is experience of their use with concrete, there is no experience in the case of concrete rebar subsea. (A study for the Dunlin Alpha project showed that the use of explosives would be mainly ineffective on reinforced concrete of this thickness.)
Stakeholder comment: Although toppling is currently seen as falling within the legislation relating to dumping at sea, this is currently being considered and reviewed by the regulators. **Stakeholder issue:** Given that toppling may be reviewed by the regulator, more work needs to be done on this. **Stakeholder issue:** Toppling is another option, as a possible artificial reef.	A. Acknowledged.

8.7 Legs Removal Timescale

Stakeholder Question	Fairfield Response
Q. How long would it take to remove the legs to 55m?	A. Probably 4-5 years. This allows 1 year per leg, allowing for sufficient weather windows. Cutting would probably be with a submersible using a diamond wire cutter, with the leg then being lifted up and away, probably in sections.

8.8 Cells Background Information

Stakeholder Question	Fairfield Response
Q. Why weren't all the cells used for storage?	A. Six of the cells were used for conductors to pass through.
Q. What is in the cells?	A. Mainly sea water (99%) but also residual mobile oil, waxy residues and sediment.
Q. What pressure are the cells at, and what happens if they are exposed to hydrostatic (external sea) pressure?	A. The cells are already exposed to hydrostatic pressure (7 bar internally and 15 bar externally). This is controlled by a pressure standpipe within Leg A, currently at around 70m. Should there be communication between the external sea and the internal cells this would cause Leg A to flood.
Q. Is there any access to the cells?	A. Potentially yes but this is currently under study for viability. *See also section 7.7.*

8.9 Concrete Gravity Base Structure Removal

Stakeholder Question	Fairfield Response
Q. Is the technology available to refloat the concrete structure and bring it to shore?	A. A key challenge to refloat is the suction created by the base on the seabed. The CGBS has been bedded in and sealed with grout and a 12m skirt system, so there is now a vacuum holding it in place. Currently, the technology available to remove the CGBS is very limited.
Q. There is also the issue of what to do with the CGBS once removed.	A. It may be an issue, but this cannot be assumed to be a reason for not following OSPAR requirements for decommissioning.
Stakeholder comment: When considering the options we should think about what we want to be left on the seabed in the future.	
Stakeholder comment: We should consider not only the existing technologies but also those that may be around in 50 years' time. We should not be afraid of envisioning what we would like to see and then inviting technology to achieve it.	A. Agreed, but current regulations require timely decommissioning of facilities. Note that the provisions of OSPAR Decision 98-3 can require revisiting of derogation cases at a later date should technology advance.

Stakeholder Question	Fairfield Response
Stakeholder comment: What should be done now to enable us to take advantage of the options that are likely to be available to be realised in say 50 years?	

8.10 Concrete Gravity Base Structure Removal Timescale

Stakeholder Question	Fairfield Response
Q. How long would complete removal actually take?	A. Approximately 40 years to get rid of the cells. This would require circa 250,000 tons of diesel for ships to support the process and collect concrete to shore.
Q. If cells cannot be entered until the topsides are removed, does this delay decommissioning?	A. No.

8.11 Explosives as a Removal Method

Stakeholder Question	Fairfield Response
Q. Is there, or could there be destructive technology (e.g. explosives) used to remove the structure?	**Answer from stakeholder:** The impact of such technology could be reduced by it being carried out inside a large boom, otherwise the negative impact on marine life from the destruction, the dust etc. would be very significant. **Stakeholder comment:** Explosives do not work well where there is rebar. **Stakeholder comment:** I have not had great experiences with explosives; I have had to go back and make a further intervention.
Q. Can a shaped charge be used to just blow the legs up and drop them?	A. Yes, this is potentially feasible, but based on current regulations this would be breaking the law as it would be treated as dumping at sea. **Stakeholder response:** This is being or should be reviewed by the regulators.
Q. Is a single big noise is worse than ongoing noises over time, e.g. from engines or tooling?	**Stakeholder comment:** I have not looked at noise density i.e. over 1 day or 10 years. **Stakeholder comment:** Noise is currently over-rated, e.g. shape chargers do not make noises.

Stakeholder Question	Fairfield Response
	Stakeholder comment: You could take a managed approach to noise, e.g. timing it.

8.12 Navaids on Legs

Stakeholder Question	Fairfield Response
Q. Why add a lighthouse to legs if left, why not just mark with a buoy?	A. The lighthouse approach is designed to protect others of the sea. Use of a buoy is not without issues however. A buoy could break free in a storm and result in no warning system at the site, as well as posing a hazard to shipping lanes; it is also extremely maintenance intensive.
Q. Is one navigation aid enough, given that the legs are a long way apart? Q. Would a single marker be an issue for fisheries?	A. One marker is regarded as sufficient by the regulator. There would of course also be markings on Admiralty charts and on the FishSAFE system.
Q. What is the longevity of the navigation lighthouse? Is there not a potential to use buoys or separate markers for the entire structure and to put it onto GPS charts?	A. Four years, after which the unit would need to be refurbished.
Q. Who has the liability for the lighthouse?	A. The operator licenses it from the Northern Lighthouse Board.

8.13 Fishing Safety

Stakeholder Question	Fairfield Response
Q. Is there a safety exclusion zone around Dunlin Alpha?	A. Yes, a 500m safety zone to exclude all vessels, other than those serving the platform, is in place to minimise collision risk. Post decommissioning, the safety zone would remain in place should the structure break the surface, but would not be enforced. It would normally be removed following certification where a subsea cut or full removal is undertaken.
Q. What difference is there in risk for fishermen if the structure is left in place, with or without a safety zone?	**Stakeholder comments:** • One factor is whether there is an exclusion zone post decommissioning. Currently the regulators do not want to have exclusion zones post decommissioning. • Even with an exclusion zone and / or good permanent markers, there could be an issue if a ship loses power and drifts onto the structure. • If there was an exclusion zone, would have to consider the distance of falling debris in the event of collapse.

Stakeholder Question	Fairfield Response
	• What if the structure is left in place and eventually collapses. There would be a need to maintain an exclusion zone to stop fishing ships going in to the area of the collapsed structure and nets getting snagged. • The structure will be there a very long time and this needs to be considered. • Fishing nets are often a long way behind the ship and so any exclusion or danger zone needs to consider this. • Pipelines are often more of an issue for fishermen as they cover a much wider area and are more likely catch nets, etc. • Any breach of the structure's integrity is likely to happen during a storm and so there is unlikely to be fishing in the area when a collapse actually happens (if it does).

8.14 Fisheries

Stakeholder Question	Fairfield Response
Q. Is the platform within a large fishery area?	A. A lot of consultation has been undertaken with fishing representatives. The wider area is not a major fishing ground at this time, although this reflects its status within the Cod Recovery Plan and so could change. Most of the fish landed from this area are pelagic species.

8.15 Platform Biodiversity

Stakeholder Question	Fairfield Response
Q. What is the biodiversity impact of the platform?	A. This depends to some extent on whether or not the platform is operational because of the variation in temperature associated with this. When it is decommissioned and 'cold', for example, then it will support a different biodiversity compared with during operations, although the extent to which it contributes in the cold state is not clear. After decommissioning, the platform structure would still provide shelter and a physical structure for marine life which would be different from the surrounding habitats. **Stakeholder comments:** There are a range of views about how this temperature transition and its effects on marine life on the structure is assessed and the knowledge about it.

Stakeholder Question	Fairfield Response
Stakeholder issue: The platform biodiversity should be monitored prior to and during decommissioning to provide data for others.	A. A pre-decommissioning environmental baseline survey was undertaken prior to commencement of decommissioning pre-planning. Two follow-up environmental surveys to examine recovery will be conducted post decommissioning, with further survey requirements determined in discussion with the regulator.

Appendix 1: Attendees and Invitees

FAIRFIELD ENERGY
DUNLIN ALPHA DECOMMISSIONING - STAKEHOLDER WORKSHOP – 8 November 2017

ATTENDED

ORGANISATION	PARTICIPANT
ABERDEEN CITY COUNCIL	Andrew Stephen, Team Leader, Economic & Business Development
ABERDEEN HARBOUR BOARD	John McGuigan, Operations Manager
ABERDEENSHIRE COUNCIL	Alistair Reid, Economic Development Team Manager
ATKINS	Philip Walker, Chief Engineer
BEIS – OPRED (OFFSHORE PETROLEUM REGULATOR FOR ENVIRONMENT & DECOMMISSIONING)	Ben Bryant, Environmental Manager
	Mark Bayman, Senior Decommissioning Manager (Technical)
	Derek Saward, Head of Environmental Management Team
	Amy Stubbs, Decommissioning Manager
CAPTURING THE ENERGY	Joe Chapman, Project Development Officer
CNR INTERNATIONAL	Roy Aspden, Decommissioning Project Manager
	Mark Raistrick, Projects Lead – Developments and Decommissioning
DANISH CENTRE FOR MARINE RESEARCH	Dennis Lisberg, Head of Maritime Service
DECOM NORTH SEA	Roger Esson, Chief Executive
DUNLIN ALPHA PLATFORM	Alan Reid, Offshore Installation Manager
	Liam Robinson, Offshore Installation Manager
EDINBURGH UNIVERSITY	Alan Fox, Post-Doctoral Research Associated, ANCHOR project
	Fiona Murray, Post-Doctoral Research Associated, ANCHOR project
ENQUEST	David Madill, Senior Commercial Adviser Northern North Sea
FAIRFIELD ENERGY LIMITED	Rebecca Allan, Process Engineer
	Carol Barbone, Stakeholder Relations
	Jonathan Bird, Regulatory Approvals Lead
	Jeff Burns, Environmental Advisor
	Gary Farquhar, Platform & Infrastructure Decommissioning Manager
	Caroline Laurenson, Senior Consultant - Process Engineer
	Peter Lee, Manager, HSE, Regulatory & Stakeholder Engagement
	Alexander MacQueen, Drilling Engineer
	John Wiseman, Managing Director
FORTH PORTS	Callum Falconer, Chief Executive, Dundeecom
GLOBAL MARINE SYSTEMS	Alex Riddell, Service Support Officer
HEALTH AND SAFETY EXECUTIVE	Stewart Millar, Decommissioning Focal Point
INDEPENDENT REVIEW GROUP	George Fleming, Chair, EnviroCentre Ltd., IRG Member
	Graham McNeillie Managing Director, McNeillie Consulting Engineers Ltd., and IRG Chair
	Ruby Lowe, Consultant, Hydrock, and IRG Secretariat
	Jennifer Richards, Director, Hydrock, and IRG Member
JNCC	Becky Hitchin, Offshore Industries Advice Manager
LERWICK PORT AUTHORITY	Calum Grains, Deputy Chief Executive
MARINE ALLIANCE FOR SCIENCE & TECHNOLOGY, and SAMS	Sally Rouse, Postdoctoral Researcher in Oil & Gas Decommissioning,
MARINE SCOTLAND SCIENCE	Peter Hayes, Offshore Energy Environmental Advice Group Leader
NEWGATE COMMUNICATIONS	Craig Harrow, Partner
NORTHERN LIGHTHOUSE BOARD	Archie Johnstone, Navigation Officer
OIL AND GAS AUTHORITY (SUPPLY CHAIN)	Bill Cattanach, Head of Supply Chain

OIL AND GAS AUTHORITY (DECOMMISSIONING)	Nils Cohrs, Head of Decommissioning
	Alan Ransom, Senior Decommissioning Engineer
OIL AND GAS UK	Richard Heard, Decommissioning Lead
PORT OF CROMARTY FIRTH	Zeina Sawaya-Melville
RESOURCES FOR CHANGE FACILITATION TEAM	Emma Cranidge
	Alison Davies
	Irene Evison
	Steve Evison
	Mike King
	Erica Sutton
	Cerys Thomas
SCOTTISH ASSOCIATION FOR MARINE SCIENCE	Michael Redford, PhD Student
	Elise Depauw, PhD Student
SCOTTISH ENTERPRISE	Karen Craig, Senior Executive, Oil and Gas Team – Energy
SCOTTISH FISHERMEN'S FEDERATION	Steven Alexander, Managing Director/Offshore Liaison
	Raymond Hall, Industry Advisor
	Peter West, Marine Assurance Officer/Industry Advisor
SEPA	Brian Blagden, PPC and COMAH Specialist
	Michael Buchan, Environmental Protection Officer - Waste
SCOTTISH WILDLIFE TRUST	Sam Collin, Marine Planning Officer
SICCAR POINT ENERGY	Alex Back, Developments Manager
SOTEAG (SHETLAND OIL TERMINAL ENVIRONMENTAL ADVISORY GROUP)	Rebecca Kinnear, Executive Officer
	Heather Runnacles-Goodridge, Engagement Officer
TAQA BRATANI	Mike Bayley, SIM Project Engineering Manager
	Alan Campbell, Decommissioning Manager
THE OIL & GAS INNOVATION CENTRE	Ian Phillips (also SPE Aberdeen Chairman)
THE OIL & GAS INSTITUTE, RGU	Bryan Atchison, Wells Engineering Manager
THE OIL & GAS TECHNOLOGY CENTRE	Brian Nixon, Interim Decom Solutions Centre Manager
	Susi Wiseman, Project Manager
UK FISHERIES OFFSHORE OIL AND GAS LEGACY TRUST FUND LIMITED	Charles Scott, Executive Chairman
UNITE THE UNION	John Boland, Regional Officer
UNIVERSITY OF ABERDEEN	Alex Kemp, Director of Aberdeen Centre for Research in Energy, Economics and Finance
	Astley Hastings, Senior Research Fellow, School of Biological Sciences
	Richard Neilson, Dean for Research and Knowledge Exchange (Physical Sciences and Engineering)
UNIVERSITY OF DUNDEE	Rod Jones, Professor of Civil Engineering and Director, Concrete Technology Unit, School of Science and Engineering
UNIVERSITY OF STRATHCLYDE	Selda Oterkus, Lecturer – Fluid Structure Interaction, Dept. of Naval Architecture, Ocean & Marine Engineering
WDC (WHALE & DOLPHIN CONSERVATION)	Fiona Read, Policy Officer
XODUS GROUP	Iain Dixon, Seabed Ecology Specialist
	John Foreman, CA Facilitator and Senior Consultant

<u>ALSO INVITED</u>

ABERDEEN GRAMPIAN CHAMBER OF COMMERCE
ASSOCIACION DE ARMADORES (SPANISH FISHERMEN'S ASSOCIATION)
BELLONA FOUNDATION
BRITISH GEOLOGICAL SURVEY

BRITISH PORTS ASSOCIATION
CENTRE FOR ENVIRONMENTAL AND MARINE SCIENCES, HULL
CETACEAN RESEARCH AND RESCUE UNIT
COMITE NATIONAL DES PECHES (FRENCH FISHERMEN'S ORGANISATION)
DANISH FISH PRODUCERS ORGANISATION
EAST OF ENGLAND ENERGY GROUP
EXXONMOBIL
FRIENDS OF THE EARTH SCOTLAND
FOROYA FISKIMANNAFELAG (FAROESE FISHERMEN'S ASSOCIATION)
GMB SCOTLAND
GREENPEACE INTERNATIONAL RESEARCH LABORATORIES (separate meeting being held)
HERIOT WATT UNIVERSITY (separate meeting being held)
HIGHLANDS & ISLANDS ENTERPRISE
HISTORIC SCOTLAND
INDUSTRY TECHNOLOGY FACILITOR
INTERNATIONAL ASSOCIATION OF OIL AND GAS PRODUCERS
INTERNATIONAL MARINE CONTRACTORS ASSOCIATION
INTERNATIONAL MARITIME ORGANISATION
KIMO
MARITIME AND COASTGUARD AGENCY (separate meeting being held)
MARINE CONSERVATION SOCIETY
NATIONAL OCEANOGRAPHIC CENTRE
NATIONAL FEDERATION OF FISHERMEN'S ORGANISATIONS
NATIONAL UNION OF RAIL, MARITIME AND TRANSPORT WORKERS (RMT) OFFSHORE INDUSTRY LIAISON COMMITTEE)
NEWCASTLE UNIVERSITY
NOF ENERGY
NORGES FISKARLAG (NORWEGIAN FISHERMEN'S ORGANISATION)
NORTH SEA COMMISSION
NORTHERN IRELAND FISHERMEN'S FEDERATION
NORTH SEA REGIONAL ADVISORY COUNCIL
NORWEGIAN ENVIRONMENT AGENCY
NORWEGIAN PETROLEUM DIRECTORATE
OFFSHORE CONTRACTORS ASSOCIATION
OPITO
PETERSHEAD PORT AUTHORITY
REDERSCENTRALE (BELGIAN FISHERMEN'S ASSOCIATION)
RSPB SCOTLAND
ROYAL YACHTING ASSOCIATION SCOTLAND
SCOTTISH OCEANS INSTITUTE
SEAS AT RISK
SEA SOURCE (EX-ANIFPO, NORTHERN IRELAND FISH PRODUCERS ORGANISATION)
SHELL UK
SKILLS DEVELOPMENT SCOTLAND
SOCIETY FOR UNDERWATER TECHNOLOGY
SOCIETY OF MARITIME INDUSTRIES
STATOIL UK LIMITED
THE EIC
UNIVERSITY OF WEST SCOTLAND
VISNED (NETHERLANDS FISHERMEN'S FEDERATION)
WWF

Dunlin Alpha Decommissioning Workshop

8 November 2017
Aberdeen Exhibition and Conference Centre

Aims for the event:

- To inform stakeholders of the Dunlin Alpha decommissioning project, the current state of play and the future steps in the decommissioning process. This is part of the strategy to facilitate stakeholder understanding and acceptance of the company's preparations, reasoning and foundation for the eventual proposals which will be set out in applications to the UK government authorities for permission to decommission.

Outcomes (for Fairfield Energy):

- To help the project team to better understand stakeholder issues and concerns and to use this to inform the comparative assessment of options for decommissioning.
- To capture stakeholder perspectives which may usefully inform the exploration and assessment of decommissioning options more broadly.

Outcomes for Participants:

- Organisations with a stake or interest in the issues can understand the decommissioning challenge being considered by Fairfield, consider and discuss them with other stakeholders and company representatives and provide feedback on any issues raised from their perspective so that these can either be addressed on the day, or understand the process by which these will be responded to by Fairfield at a later point.

Dunlin Alpha Decommissioning Workshop

8 November 2017
Aberdeen Exhibition and Conference Centre

Agenda

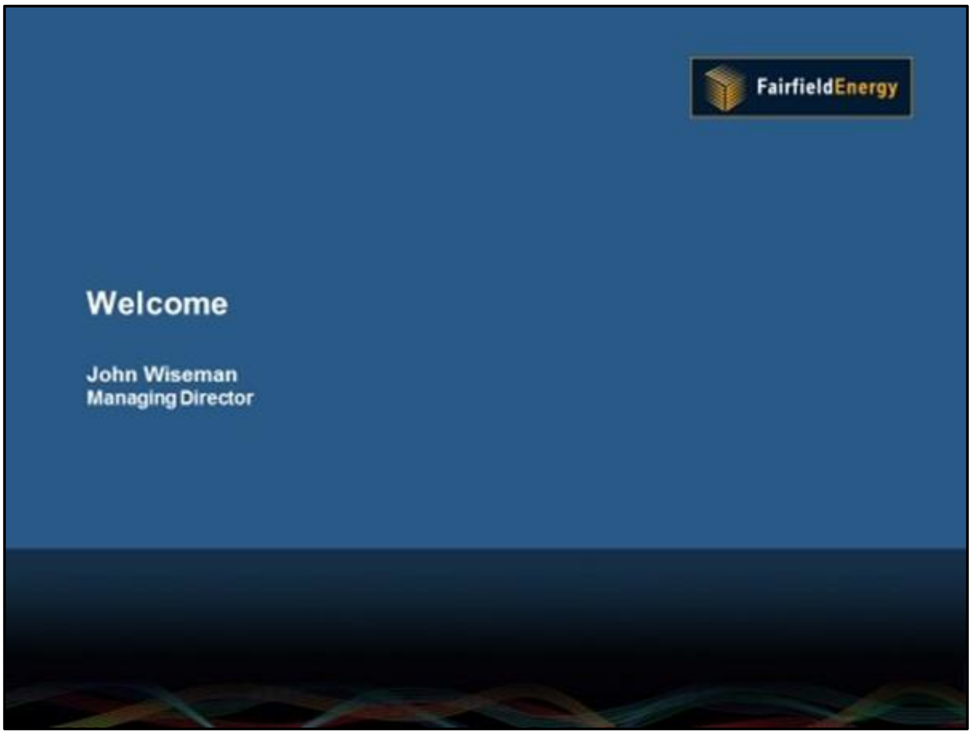
09:00	**Registration, coffee and refreshments**
09:30	**Safety briefing**
	Welcome – John Wiseman, Managing Director, Fairfield Energy
	Format for the day – Mike King, Lead Facilitator, Resources for Change
09:45	**Decommissioning challenges: project overview** – Peter Lee, Manager, HSE, Regulatory & Stakeholder Engagement
	Questions of clarification
10:35	*Tea/coffee*
10:55	**Comparative Assessment** – John Foreman, CA Facilitator and Senior Consultant, Xodus Group
11:10	**Small group facilitated discussion (by table)** on questions, knowledge gaps and key issues
11:50	**Feedback** from tables to plenary session
12:10	*Lunch*
12:55	**Exploring the key issues in more detail:**
	Topsides – Gary Farquhar, Platform & Infrastructure Decommissioning Manager, Fairfield Energy
	Drill cuttings – Iain Dixon, Seabed Ecology Specialist, Xodus Group
	Cell contents – Caroline Laurenson, Senior Consultant – Process Engineer, Fairfield Energy
	Legs and cells – Philip Walker, Chief Engineer, Atkins
13:55	**Discussion carousel** for facilitated topic discussions *(with tea and coffee 'on the go')*
14:55	**Plenary discussion** on carousel sessions
15:20	**Stakeholder engagement** – Carol Barbone, Stakeholder Relations, Fairfield Energy
	Plenary discussion on future engagement
15:40	**Next steps and evaluation** – Mike King, Lead Facilitator, Resources for Change
	Feedback forms
15:45	**Reflections and Close** – John Wiseman, Managing Director, Fairfield Energy
16:00	*Ends*

Appendix 3: Presentation Slides

The presentation slide topics shown in this section and their respective presenters are listed below:

- Overview: Peter Lee, Manager – HSE, Regulatory, & Stakeholder Engagement
- Decommissioning Challenges: Peter Lee, Manager – HSE, Regulatory & Stakeholder Engagement
    - Initial Studies and Cost Provisioning
    - Study Development since Cessation of Production
    - Specific Decommissioning Topics
- Comparative Assessment Overview: John Foreman, Xodus Group
- Topsides: Gary Farquhar, Platform & Infrastructure Decommissioning Manager, Fairfield Energy
- Drill Cuttings: Iain Dixon, Seabed Ecology Specialist, Xodus
- Cell Contents: Caroline Laurenson, Senior Consultant/ Process Engineer, Fairfield Energy
- Legs and Cells: Philip Walker, Chief Engineer, Atkins


FairfieldEnergy
Fairfield Energy
Dunlin Alpha Decommissioning
Stakeholder Workshop
8th November 2017


FairfieldEnergy
Welcome
John Wiseman
Managing Director

Facilitated by Mike King

- Resources for Change (R4C)
  - Creating constructive interactions between people and places
- Facilitators role is to:
  - Help you have the conversations you need to have
  - Manage the process – to time and topic
  - Independent – no stake in the outcome
- Supported by 6 other R4C facilitators

www.r4c.org.uk

Stakeholder Dialogue:

"Its not about winning an argument but creating a better outcome"

www.r4c.org.uk

Process

- Input from Fairfield – decommissioning challenges
- Discussion
- Lunch
- Input from Fairfield – exploring key issues
- Discussion
- Future engagement

www.r4c.org.uk

Working Agreements

- ✓ Chatham House rules
- ✓ Observers
- ✓ There is no such thing as a silly idea – please be respectful of all contributions
- ✓ One person speaks at the time
- ✓ Leave the day job till the breaks
- ✓ Please help us keep to time
- ✓ Recording, photo's & reporting
- ✓ Excuse the facilitators for being bossy!

www.r4c.org.uk

Outcomes

Outcomes for Participants:

- Develop an understanding of the decommissioning challenges
- Consider and discuss them with others
- Provide feedback from your perspective

Outcomes for Fairfield:

- Help the project team to better understand stakeholder issues and concerns
- Use this to inform the comparative assessment and the development of the decommissioning plan.

www.r4c.org.uk

FairfieldEnergy

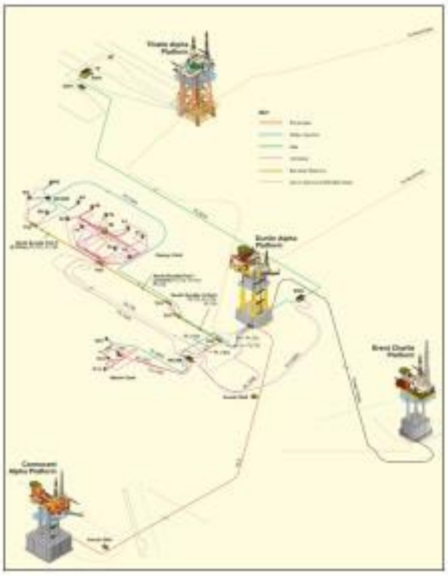
Overview

Peter Lee
Manager – HSE, Regulatory & Stakeholder Engagement

Overview

- Decommissioning Video [see http://www.fairfield-energy.com/ 'Watch the Movie']
- Dunlin Cluster of Facilities
  - Dunlin Alpha
  - Dunlin Subsea Infrastructure (Dunlin Power Import & Dunlin Fuel Gas Import)
  - Osprey & Merlin Fields
  - Export Pipeline to Cormorant Alpha
- Status of Facilities
  - Cessation of Production
  - Current Inventory & Manning Levels
  - Platform Well P&A
  - Export Service (until 2019)
  - Subsea Well P&A (by Transocean 712)
- Regulatory Status
  - Subsea Infrastructure DPs @ Post Consultation Stage
  - Dunlin Alpha nearing Comparative Assessment Stage
  - Export Pipeline @ Screening Stage
  - Safety Case (Transition Case followed by Dismantling Case)

Field Overview



Overview

- Decommissioning Video
- Dunlin Cluster of Facilities
  - Dunlin Alpha
  - Dunlin Subsea Infrastructure (DPI/DFGI)
  - Osprey & Merlin Fields
  - Export Pipeline to Cormorant Alpha
- Status of Facilities
  - Cessation of Production
  - Current Inventory & Manning Levels
  - Platform Well P&A
  - Export Service (until 2019)
  - Subsea Well P&A (by Transocean 712)
- Regulatory Status
  - Subsea Infrastructure DPs @ Post Consultation Stage
  - Dunlin Alpha nearing Comparative Assessment Stage
  - Export Pipeline @ Screening Stage
  - Safety Case (Transition Case followed by Dismantling Case)

Decommissioning Challenges

FairfieldEnergy

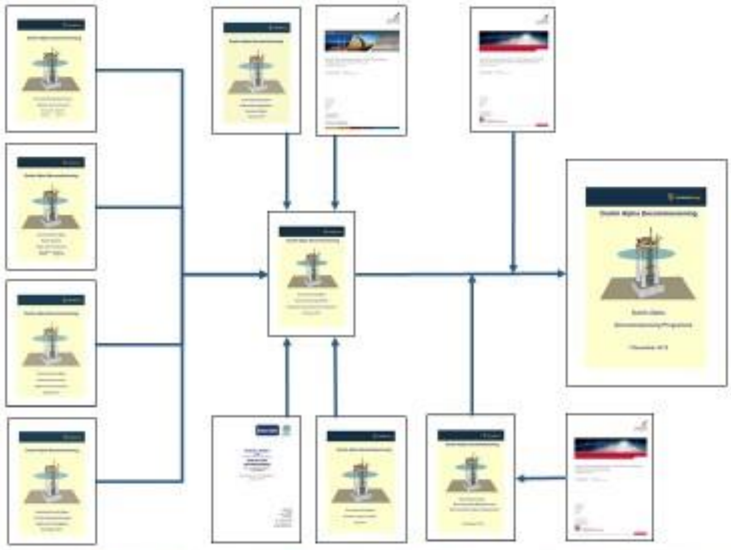
Decommissioning Challenges

- Initial Studies & Cost Provisioning
  - 2010-2012 Studies
  - Early Stakeholder Engagement
  - Reference Case Decommissioning Program
- Study Development since Cessation of Production
  - Refresh of Scoping & Screening
  - CGBS Options for Comparative Assessment
  - Additional Studies
  - Appointment of an Independent Review Group
- Specific Decommissioning Topics
  - Topsides Removal
  - Drill Cuttings
  - Residual Cell Contents
  - Concrete Gravity Based Structure

FairfieldEnergy

Initial Studies & Cost Provisioning

Initial Studies 2010-2012



Early Stakeholder Engagement

- Initial stakeholder engagement commenced in January 2010
- A series of workshops, reports and meetings took place over the following 24 months:
  - Jan 2010 Workshop
  - May 2010 Reuse Report
  - Jul 2010 Refloat Report
  - Sep 2010 Expert Discussion Group
  - Nov 2010 Norwegian OSPAR Meeting
  - Jan 2011 French OSPAR Meeting
  - Mar 2011 Netherlands OSPAR Meeting
  - May 2011 UK OSPAR Meeting
  - Jun 2011 Cell Contents Impact Assessment Report
  - Jul 2011 German OSPAR Meeting
  - Aug 2011 Second Refloat Report
  - Oct 2011 In Situ Deconstruction Report
  - Nov 2011 In Situ Decommissioning Report
  - Jan 2012 Stakeholder Engagement Summary Report

- Total of 26 stakeholders engaged – drawn from Government Authorities, Industry Interest Groups, NGO's, Scientific Organisations and the Supply Chain

Reference Case Decommissioning Programme

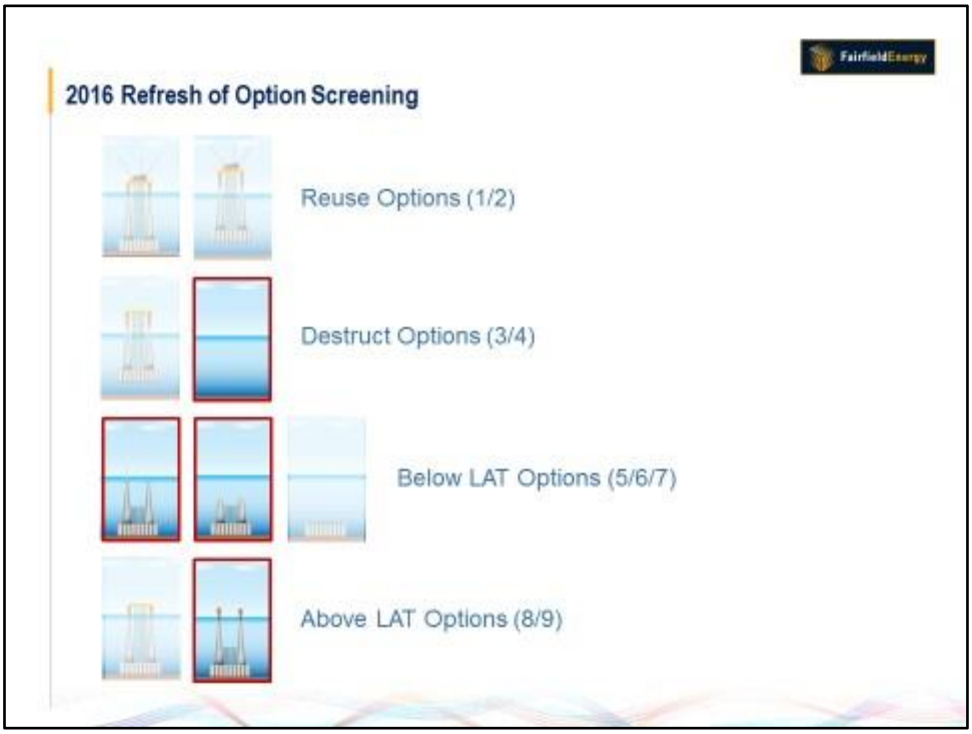
Reuse Options (1/2)

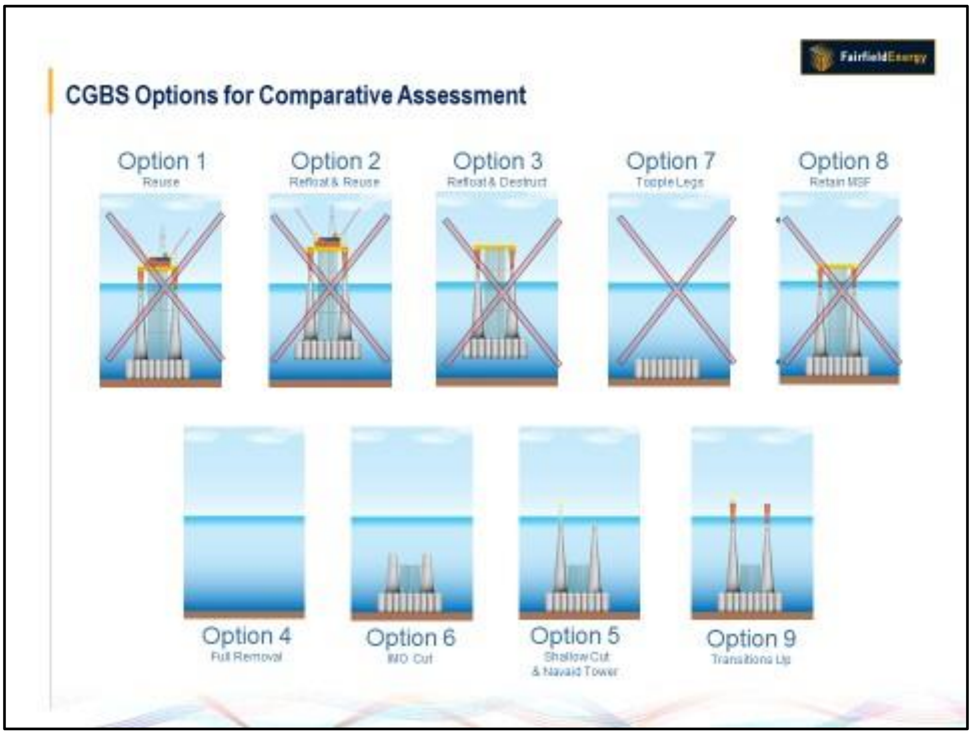
Destruct Options (3/4)

Below LAT Options (5/6/7)

Reference Case: Basis for Decommissioning Cost Provision

Study Development since Cessation of Production


FairfieldEnergy
2016 Refresh of Option Screening
Reuse Options (1/2)
Destruct Options (3/4)
Below LAT Options (5/6/7)
Above LAT Options (8/9)


FairfieldEnergy
CGBS Options for Comparative Assessment
Option 1
Reuse
Option 2
Refloat & Reuse
Option 3
Refloat & Destruct
Option 7
Topple Legs
Option 8
Retain MSF
Option 4
Full Removal
Option 6
IMO Cut
Option 5
Shallow Cut
& Navaid Tower
Option 9
Transitions Up

Additional Studies

Independent Review Group

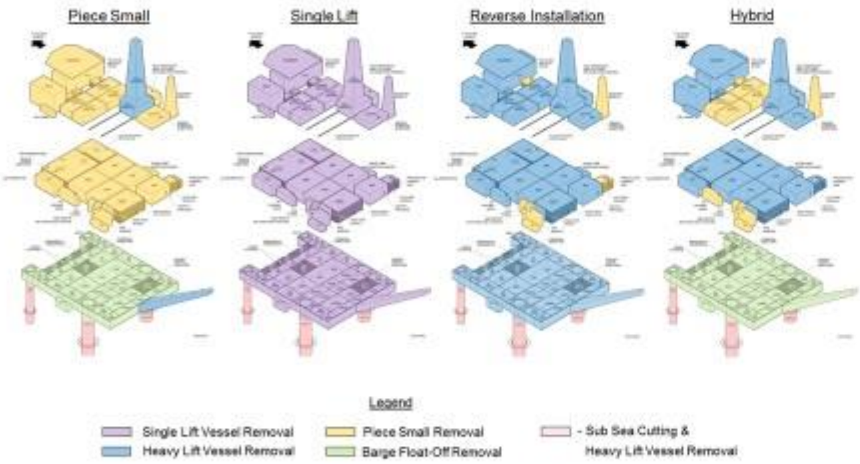
- Membership of the Dunlin Alpha IRG covers the following roles & disciplines:

Chairman	Graham McNeillie
Project Manager	Eric Cooper
Secretariat	Ruby Lowe
Stakeholder Engagement	Jenny Richards
Marine Biology	Zoe Crutchfield
Environmental Sciences	George Fleming
Structural Engineering	Andrew McNulty
Process & Chemical Engineering	Stein Haugen
HSE and Safety Assurance	Martin Muncer

- It is believed that these core disciplines cover the scope of the Dunlin Alpha DP
- Other experts may be co-opted if significant issues make this necessary
- IRG is administered by a Chair, PM and Secretariat and Terms of Reference include:
  - Review project documentation to ensure an understanding of the relevant issues
  - Review all study work which provides the evidence base for the comparative assessment
  - Provide views study scope, clarity, completeness, methodology, relevance and objectivity
  - Provide representation at external stakeholder meetings and similar events as requested
  - Advise on any actions to address identified gaps that might prevent an informed decision

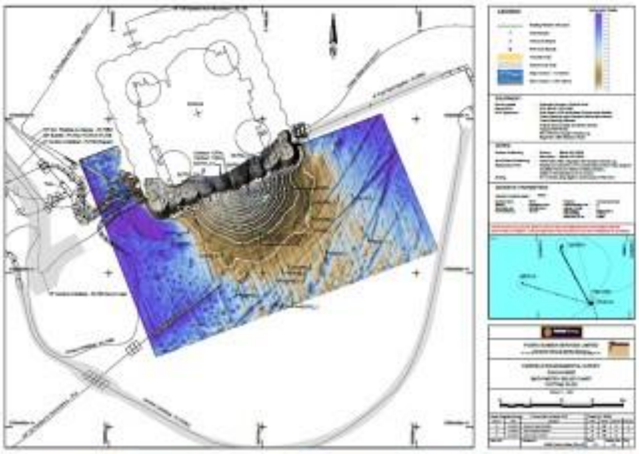
Specific Decommissioning Topics

Topside Removal Options



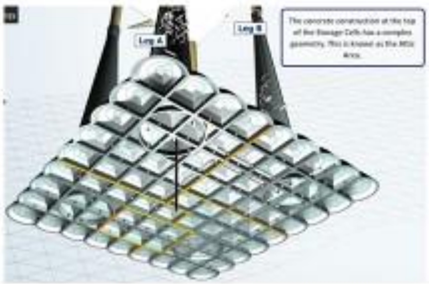
Drill Cuttings

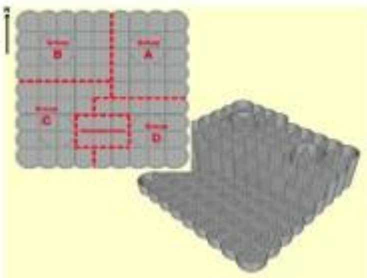
- Water Based, Invert Oil Emulsion and Low Toxicity Oil Based Muds all used and discharged
- Cuttings have been surveyed, sampled, characterised and assessed against thresholds
- Cuttings management options are currently being considered



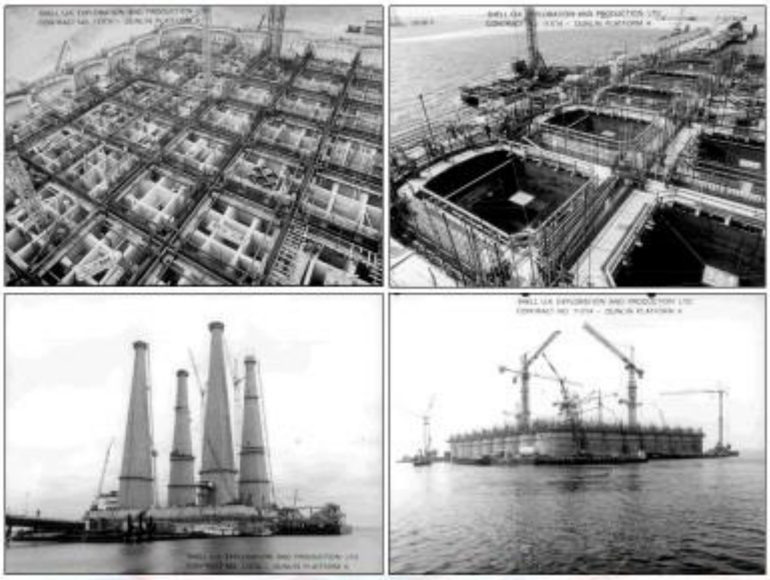
Residual Cell Contents

- 75 of the 81 cells of the CGBS were used for storage of produced oil
- Cells used continuously from 1978 until 1995 and then intermittently until 2004
- Total volume of these cell groups is approximately 215,000m3
- Of this volume, approximately 10,000m3 is in the attic area of the cells
- Following bulk de-oiling, an Attic Oil Recovery Project was completed in 2007
- Assessment of remaining inventories of oil, water & sediment is ongoing
- Future cells management options are currently being considered





Concrete Gravity Base Structure



Questions for Clarification

Comparative Assessment Overview

John Foreman
Xodus Group

Introduction – Regulatory Context for Comparative Assessment

Used for derogation candidates under OSPAR Decision 98/3

- The footings of "Steel Structures weighing more than 10,000 tonnes in air which were installed before February 1999"
- **The structure is of a "Gravity-based Concrete Installation" design**
- "Any other disused offshore structure, which has suffered unforeseen structural damage or deterioration to an extent that its removal presents equivalent difficulties"

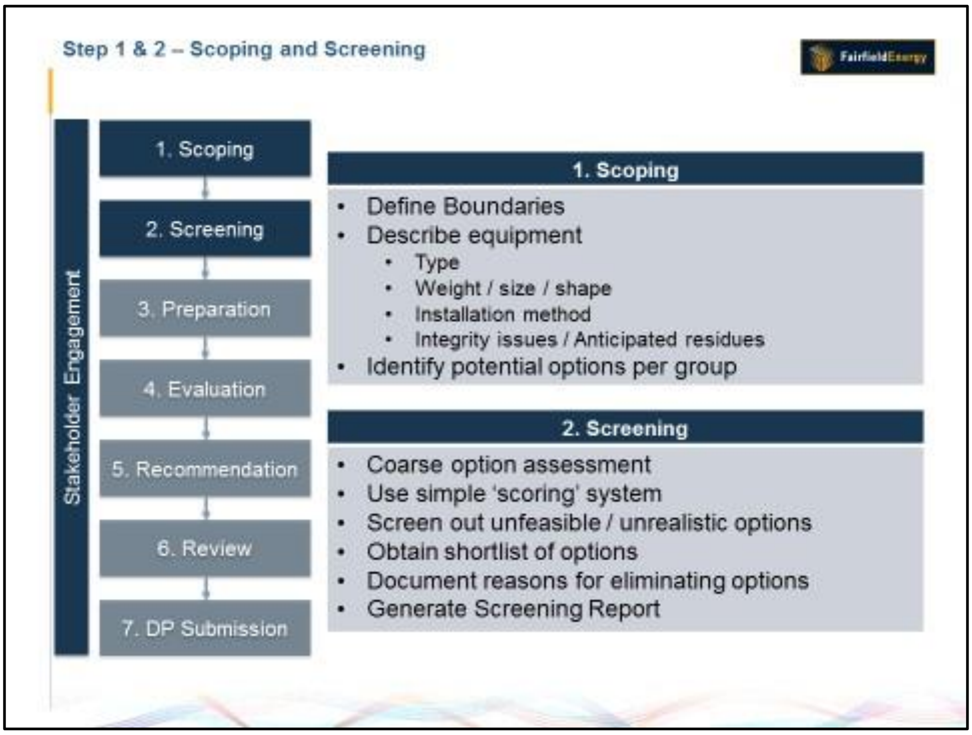
Requirements for Comparative Assessment are outlined in

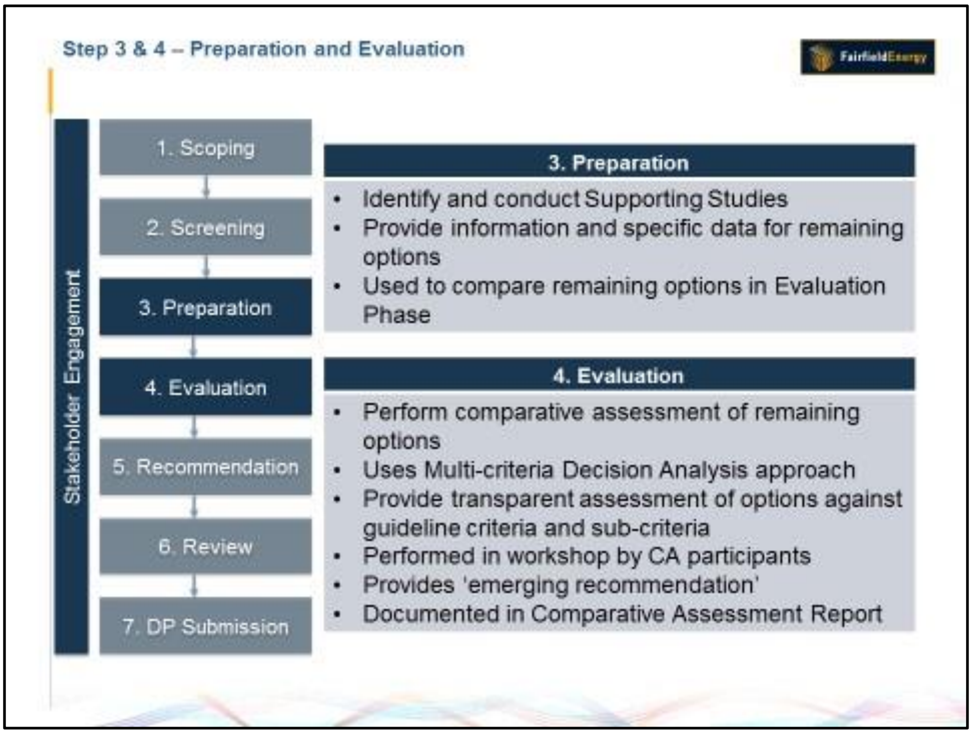
- OSPAR Decision 98/3
- DECC Guidance Notes 'Decommissioning of Offshore Oil and Gas Installations and Pipeline under the Petroleum Act 1998" (March 2011)
- 'Guidelines for Comparative Assessment in Decommissioning Programmes' (Oil & Gas UK, June 2015)

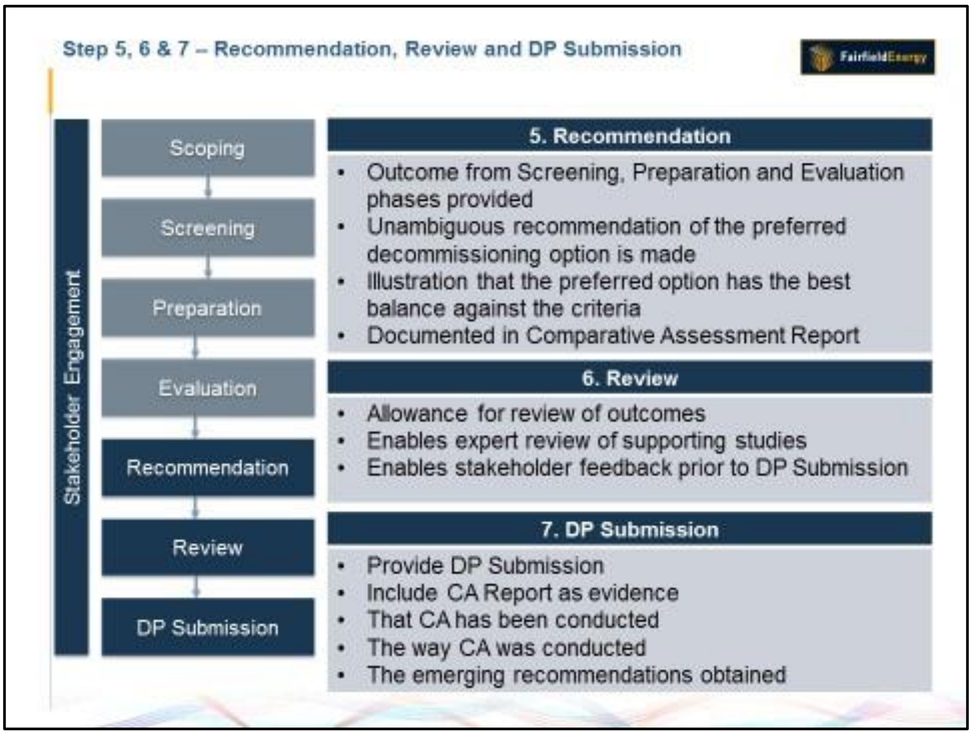
Comparative Assessment is used in the development of Decommissioning Programmes to

- Compare options
- Examine differences
- Identify the optimal option


7 Steps of the Comparative Assessment Process
FairfieldEnergy
1. Scoping
2. Screening
3. Preparation
4. Evaluation
5. Recommendation
6. Review
7. DP Submission


Step 1 & 2 – Scoping and Screening
FairfieldEnergy
Stakeholder Engagement
1. Scoping
2. Screening
3. Preparation
4. Evaluation
5. Recommendation
6. Review
7. DP Submission
1. Scoping
• Define Boundaries
• Describe equipment
• Type
• Weight / size / shape
• Installation method
• Integrity issues / Anticipated residues
• Identify potential options per group
2. Screening
• Coarse option assessment
• Use simple 'scoring' system
• Screen out unfeasible / unrealistic options
• Obtain shortlist of options
• Document reasons for eliminating options
• Generate Screening Report


Step 3 & 4 – Preparation and Evaluation
FairfieldEnergy
Stakeholder Engagement
1. Scoping
2. Screening
3. Preparation
4. Evaluation
5. Recommendation
6. Review
7. DP Submission
3. Preparation
• Identify and conduct Supporting Studies
• Provide information and specific data for remaining options
• Used to compare remaining options in Evaluation Phase
4. Evaluation
• Perform comparative assessment of remaining options
• Uses Multi-criteria Decision Analysis approach
• Provide transparent assessment of options against guideline criteria and sub-criteria
• Performed in workshop by CA participants
• Provides 'emerging recommendation'
• Documented in Comparative Assessment Report


Step 5, 6 & 7 – Recommendation, Review and DP Submission
FairfieldEnergy
Stakeholder Engagement
Scoping
Screening
Preparation
Evaluation
Recommendation
Review
DP Submission
5. Recommendation
• Outcome from Screening, Preparation and Evaluation phases provided
• Unambiguous recommendation of the preferred decommissioning option is made
• Illustration that the preferred option has the best balance against the criteria
• Documented in Comparative Assessment Report
6. Review
• Allowance for review of outcomes
• Enables expert review of supporting studies
• Enables stakeholder feedback prior to DP Submission
7. DP Submission
• Provide DP Submission
• Include CA Report as evidence
• That CA has been conducted
• The way CA was conducted
• The emerging recommendations obtained

Comparative Assessment – Summary of Current Status

FairfieldEnergy

Scoping	✓	Completed 2011
Screening	✓	Completed 2011 – Re-evaluated 2015
Preparation	✓	Ongoing since 2012 – Increased focus in 2015
Evaluation	✓	Ongoing since early 2017
Recommendation		Planned for 2018
Review		Planned for 2018
DP Submission		Planned for 2018

Criteria & Weighting

FairfieldEnergy

1 Safety [20%]
- 1.1 Personnel Offshore
- 1.2 Personnel Onshore
- 1.3 Other Users
- 1.4 High Consequence Events
- 1.5 Residual Risk inc. Legacy

2 Environment [20%]
- 2.1 Marine Impacts
- 2.2 Emissions
- 2.3 Consumption
- 2.4 Disturbance
- 2.5 Protections inc. Legacy

3 Technical [20%]
- 3.1 Technical Risk

4 Societal [20%]
- 4.1 Fishing
- 4.2 Other Users

5 Economics [20%]
- 5.1 Operational Costs
- 5.2 Legacy Costs

Note: Sub-criteria to be adapted where where required, e.g. following Stakeholder Input

FairfieldEnergy

Questions for Clarification

FairfieldEnergy

Exploring the key issues in more detail

1. Topsides: Gary Farquhar, Platform & Infrastructure Decommissioning Manager, Fairfield Energy
2. Drill Cuttings: Iain Dixon, Seabed Ecology Specialist, Xodus
3. Cell Contents: Caroline Laurenson, Senior Consultant/ Process Engineer, Fairfield Energy
4. Legs & Cells: Philip Walker, Chief Engineer, Atkins

Dunlin Alpha Topsides

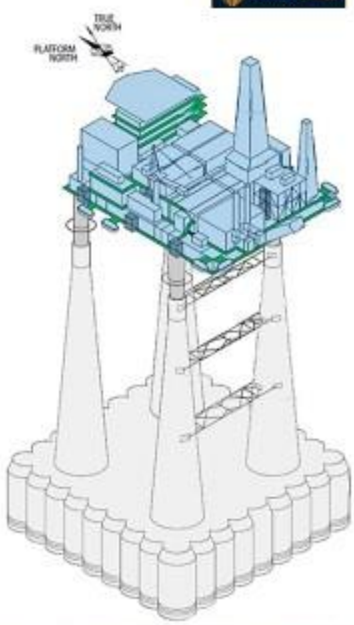
Gary Farquhar
Platform & Infrastructure Decommissioning Manager

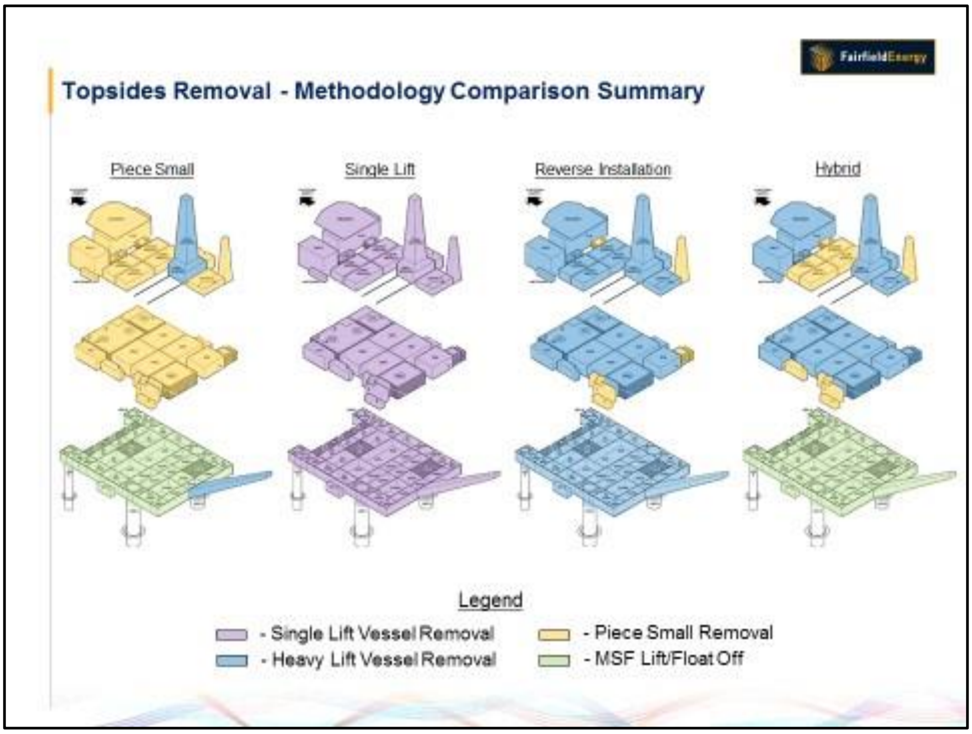
Dunlin Asset Configuration

The Dunlin structure consists of;

- A four leg Concrete Gravity Base (CGB), weighing approx. 320,000mT
- Modular "Topsides" design, supported by a steel box-girder frame, which hosts production facilities & 48 well slots

Total Topsides dry weight of approx. 19,500 mT




FairfieldEnergy
Topsides Removal - Methodology Comparison Summary
Piece Small
Single Lift
Reverse Installation
Hybrid
Legend
- Single Lift Vessel Removal
- Heavy Lift Vessel Removal
- Piece Small Removal
- MSF Lift/Float Off


FairfieldEnergy
Topsides Removal – Supply Chain Summary
Established Solutions
Emergent Technology
New Entrants
Conventional HLVs
Single Lift / Improved Lift Capability
Increased Competition & Capacity

FairfieldEnergy

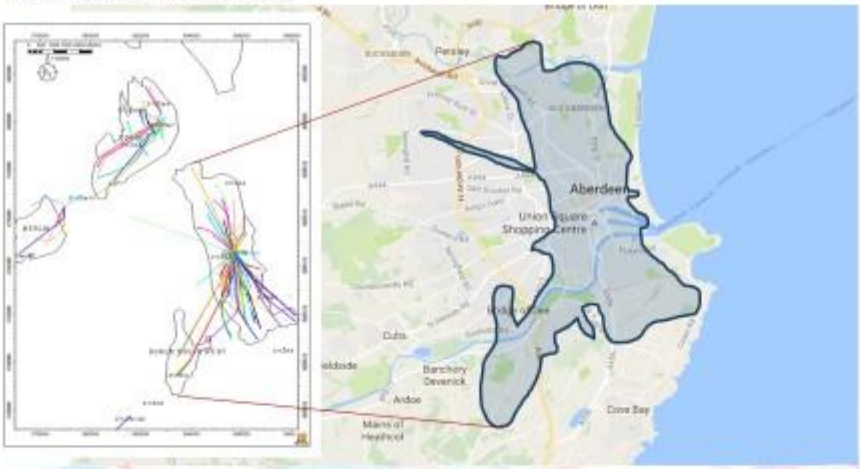
Dunlin Alpha Drill Cuttings Pile

Iain Dixon
Xodus Group

FairfieldEnergy

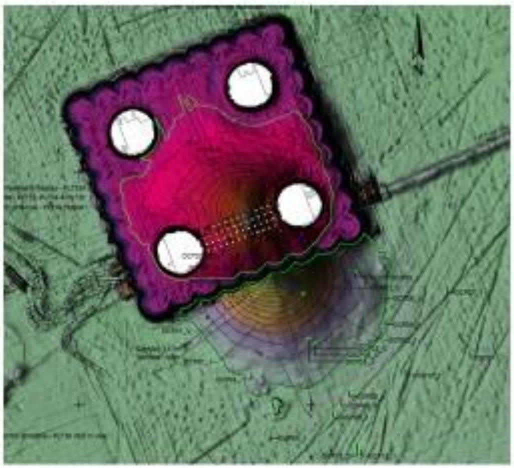
Drilling History

- Platform drilling commenced in **1977**
- **45** platform wells
  - ➢modified by further drilling **56** times
- **223,450 m** of formation drilled



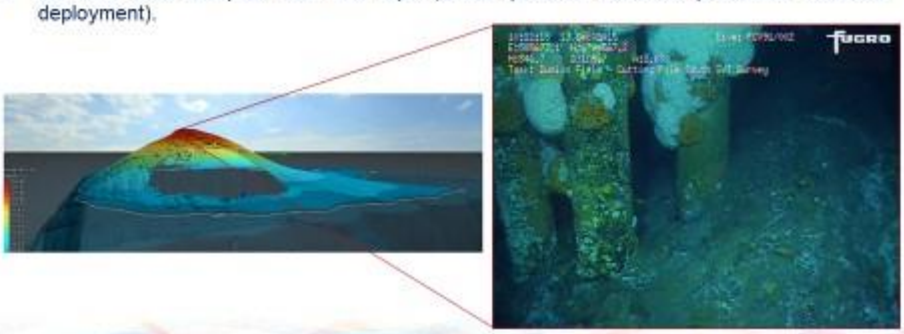
Drilling History

- Water Based Mud (**WBM**), Invert Oil Emulsion Mud (**IOEM**) and Low Toxicity Oil Based Mud (**LTOBM**) all used and discharged
- Pre-2001, cuttings were discharged to the top of CGBS and over spilled to seabed
- Post-2001, **5x** 8½" sections and **1x** 6" section were drilled (<**1%** of total cuttings generated)
- **31,431 m³ / 79,795 tonnes** of cuttings generated
    - >99% discharged to sea



Survey and Sampling Campaign

- Surveyed and sampled between November 2015 – April 2016.
    - Strategy compiled collaboratively by Fairfield, Fugro and Xodus Group;
    - In consultation with OPRED, and;
    - Fulfilling requirements of the DECC and the OLF Guidelines.
- Detailed bathymetric survey.
- **12x** seabed sample stations within cuttings pile footprint.
- **3x** 4 m vibrocore samples collected from seabed.
- **1x** ROV core sample from seabed (where pile gradient prohibited vibrocore deployment).
- **3x** ROV core samples from cell tops (where platform structure prohibited vibrocore deployment).



Drill Cuttings Pile Characterisation

	CGBS	Seabed	Combined
Area (m^2)	5,100	4,084	9,184
Volume (m^3)	10,200	9,355	19,555
Max Height (m)	12.9	12.83	-
Min. THC (µg/g)	16,100	6.3	6.3
Max. THC (µg/g)	73,400	146,000	146,000
THC Leachate Concentration ($\mu g l^{-1}$)	192	262	227
THC Leaching Rate ($mg/m^2/day$)	124	170	147
Below OSPAR Oil Loss Threshold	✓	✓	✓
Below OSPAR Persistence Threshold	✓	✓	✓
Estimated Debris (Identified Targets)	-	-	440

Status of Dunlin Alpha Cuttings Pile Work

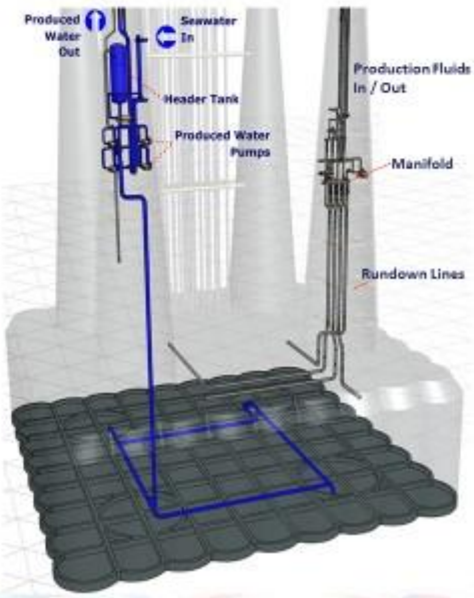
- Work undertaken / complete
  - Pre-decommissioning Environmental Baseline and Habitat Assessments surveys, analyses and reporting
  - Field-wide and cell top Debris Surveys
  - Pre-decommissioning cuttings pile MBES surveys
  - Pre-decommissioning cuttings pile sampling, analyses, reporting
  - Assessment against OSPAR Oil Loss and Persistence Thresholds
- Work ongoing
  - Debris recoverability study work
  - Drill Cuttings technical document
    - Including pile management options and associated modelling
  - Further stakeholder engagement
- Future Work
  - Inclusion in Dunlin Alpha Comparative Assessment / Environmental Impact Assessment / Decommissioning Plan process and deliverables
  - Post-decommissioning surveys

Dunlin Alpha – Cell Contents

Caroline Laurenson
Process Engineer

Dunlin Alpha Structure – Cell Contents Key Facts

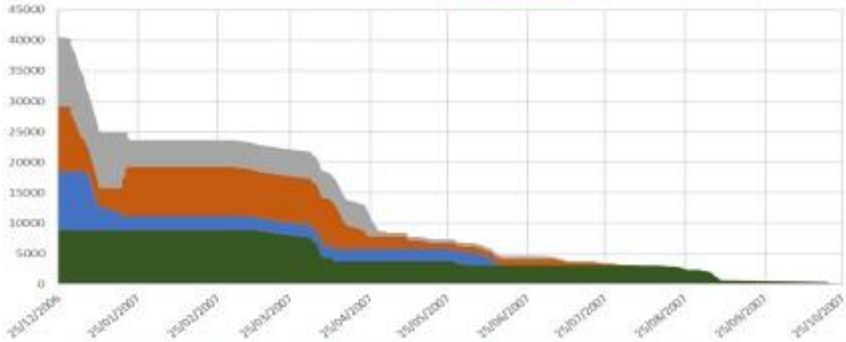
- Cell storage system:
  - 104 m square and 32 m high
  - 81 Cells
    - 75 for Storage
    - 6 for Conductor Cooling
- Total cell storage internal volume:
  - Approx. 240,000 m^3
- Total throughput:
  - More than 54 million m^3 of oil
  - Almost 85 million m^3 of water



Attic Oil Recovery Project (AORP)

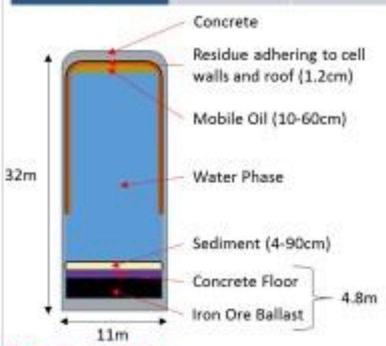
- Carbon Dioxide displacement
- Offshore execution works lasted approx. 1 year
- Resources utilised:
  - 27,000 tonnes of bulk chemicals
  - 700 road tanker movements
  - 9 round trip supply vessel sailings

Cell Group	Completion Date	Oil Recovery (m^3)
B	27/06/07	9733
D	06/08/07	11081
C	08/08/07	10614
A	02/11/07	8862



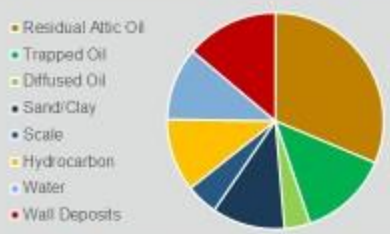
Cell Contents – Re-evaluation and Enhanced Understanding for Cell Contents Management Options

Typical Cell	Volume (m^3)	
	Minimum	Maximum
Mobile Oil	15	58
Sediment	3.6	100
Wall Residue	1.4	4.5
Water Phase	2600	3500



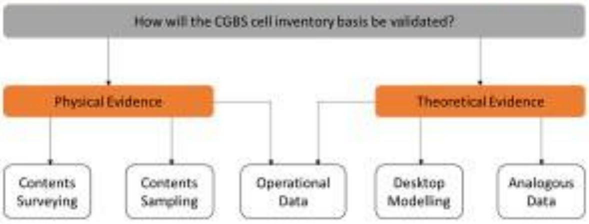
Note: not to scale

Total Inventory	%	Volume (m^3)
Residual Attic Oil	0.44	1,043
Trapped Oil	0.19	449
Diffused Oil	0.05	128
Total Mobile Oil	0.69	1,620
Sand / Clay	0.15	363
Scale	0.07	159
Hydrocarbon	0.15	363
Water	0.15	363
Total Sediment	0.53	1,248
Wall Deposits	0.19	462
Water Phase	98.6	233,576



Cell Contents Inventory Validation – Key Questions

1. How to verify or reduce uncertainty?
2. How can cells be accessed?
3. Which cells will be surveyed/sampled?
4. Where in the cell to survey/sample (i.e. which phase/s, at what depth, etc.)?

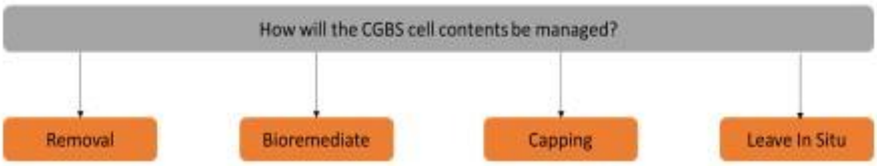


Key Findings:

- 11 cell access options, two topsides-based options remain which are being further investigated:
    1. Survey/sample via the rundown lines – utilising micro/nano ROV technology
    2. Survey via riser/j-tube pipework – utilising gamma scanning or neutron backscatter technology
- Dynamic modelling confirmed CO_2 displacement and oil extraction would have been effective, leaving behind a thin layer of oil between the CO_2 and water phases

Cell Contents Management Options – Key Questions

1. How will the cell contents be managed (mobile oil, sediment, wall residue, water)?
2. What physically can be achieved in terms of content treatment/recovery?
3. How will cells be accessed?
4. How will waste be managed?



Key Findings (to date):

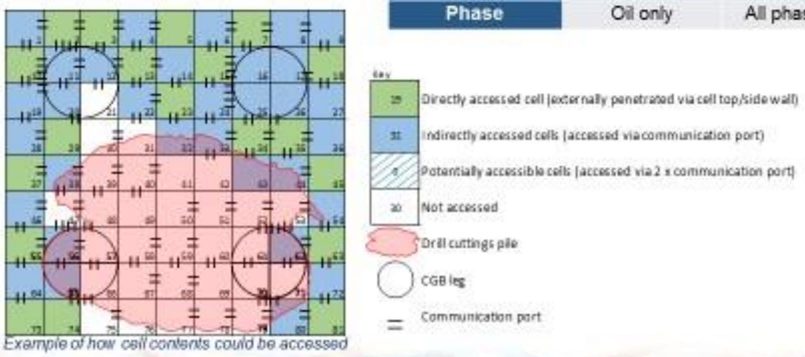
- New external penetrations are required for access
- Base case is that waste created will be shipped to shore
- Options are technically challenging (structure design / location/properties of contents)

Cell Contents – Management Options CA Screening

Reviewing 70 options, considerations include:

- Presence of drill cuttings
- Direct/indirect cell penetrations
- Volume of waste
- Duration of operations
- Degree of contamination
- Management option efficiency

Considerations	Option Scale	
	Minimum	Maximum
Drill Cuttings	Minimal removal	Full removal
Cell Penetrations	4	59
Waste	32 m^3	820,000 m^3
Duration	3-4 months	+40 years
Phase	Oil only	All phases

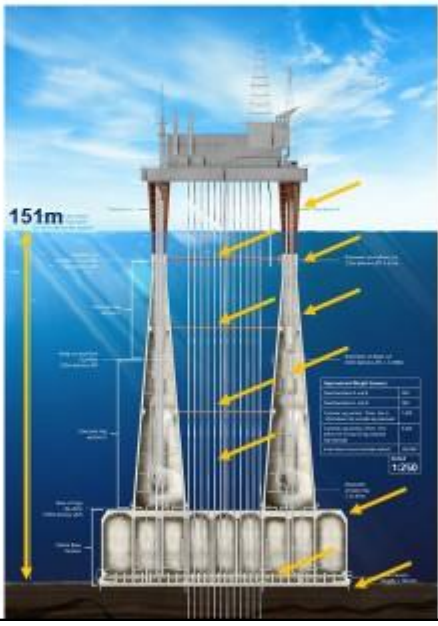


Example of how cell contents could be accessed

Dunlin Alpha Legs and Cells

Philip Walker
Chief Engineer, Atkins

Structural Overview



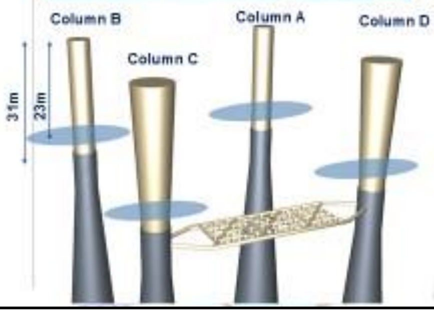
- Steel Transitions
- Reinforced Concrete Legs
  - Leg Internals
  - Ring Beam
- 45 x conductors

  Conductor Guide Frames at 3 Levels
- Reinforced Concrete Cells

Item	Weight (te)
Cells (9 x 9 = 81)	202,600
Iron Ore Ballast	88,000
Steel Skirts	728
Grout	unknown

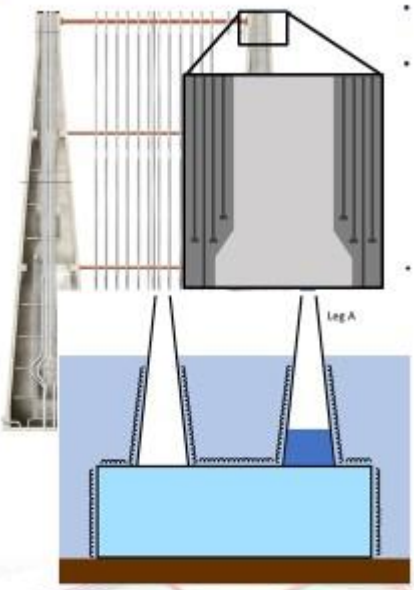
- Water Depth = 151m

Steel Transitions – Unique Challenges



- Constraints during construction
  - Extra long steel transitions
  - Span below water, unique in North Sea
- Corrosion
  - managed by coatings and CP
  - Current condition, minimal corrosion wall thickness loss since installation
- Bolted to top of concrete legs
  - Bolts grouted, cannot be inspected so condition unknown
- Steel transitions spanning below water add unique level of complexity for the decommissioning of the Dunlin Alpha CGBS

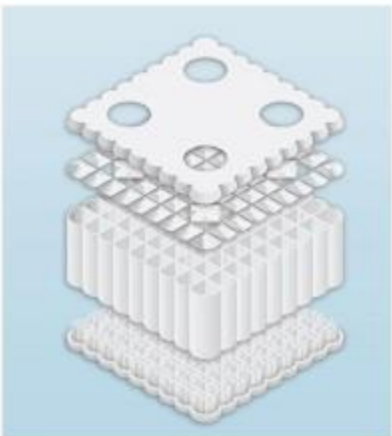
CGBS Legs - Key Features & Considerations



- 4 legs, 111m in length
- Ringbeam at 8m below LAT
  - Connection for steel transitions
  - Anchorage for the leg prestressing tendons
  - Integrity of legs dependent on retention of ringbeam
- Leg Internals
  - Legs house materials / equipment known as leg internals (piping systems, access, etc.)

Drawdown System
  - Water levels inside legs lower than outside, provides compression in the concrete

CGBS Cells - Key Features & Considerations



- Each cell
  - Roof, walls, base slab

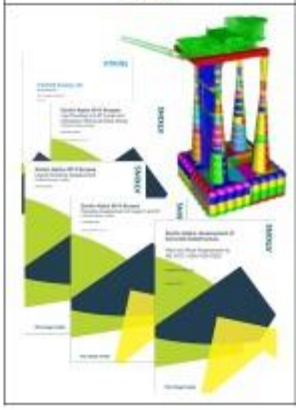
Item	Dimensions (length x breadth x height)
One cell	11 x 11 x 32m
81 cells	104 x 104 x 32m

- Total cell group ≈ 300,000 te (concrete, steel reinforcement & solid iron ore ballast)

Item	Weight (te)
Cells (9 x 9 = 81)	202,600
Iron Ore Ballast	88,000
Steel Skirts	728
Grout	unknown

- Grout and soil adhering to the base slab increases weight further

Structural Integrity & Decommissioning Study Work

Structural Integrity Study Work	Previous Decommissioning Study Work	Recent Decommissioning Study Work
		

Technical Challenges for Decommissioning

Full Removal (Option 4)
3 separate leg cuts (shallow, -55m, -119m) + cell removal
Scale / complexity of removing ≈ 300,000te at 151m depth
Technology development novel
Base slab + ballast + unknown grout involves thick vertical cuts
Suction release required to remove base slab / skirts
Option 6 considerations also apply

Remove to -55m (Option 6)
Cutting concrete at this scale subsea has not been done before
Transition bolt integrity – need for shallow and -55m leg cuts
Hostile Northern North Sea (cutting & lifting)

Remove Steel Transitions & Install Lighthouse (Option 5)
Lighthouse relies on ring beam. Operational issues with shallow cut above ring beam
40m lighthouse – complex installation and subsea connection
Long term integrity of the legs and cell group (degradation, longevity) - may damage cells

Leave In Place & Install Navaid (Option 9)
Long term integrity of the steel transitions, legs and cell group (corrosion, degradation, longevity) - may damage cells


FairfieldEnergy
Plenary Discussion on Future Engagement


FairfieldEnergy
Stakeholder Engagement
Carol Barbone
Stakeholder Relations


FairfieldEnergy
Reflections and Close
John Wiseman
Managing Director

Appendix 4: Decommissioning Documents List

FAIRFIELD ENERGY
DUNLIN ALPHA DECOMMISSIONING – STAKEHOLDER WORKSHOP – 8 November 2017

DOCUMENTS PROVIDED AT THE WORKSHOP FOR STAKEHOLDER REFERENCE

1. Concrete Gravity Base Re-Use Options and Conclusions
2. Concrete Gravity Base Refloat Options Study and Conclusions
3. Concrete Gravity Base In Situ Deconstruction Options and Conclusions
4. Concrete Gravity Base in Situ Decommissioning Options for Derogation
5. Concrete Gravity Base Stakeholder Engagement Summary Report
6. Dunlin Alpha Decommissioning Option Screening for Comparative Assessment
7. Dunlin CA Studies – Seabird Colonisation
8. CGBS Studies for Comparative Assessment – Study 4 Transition Piece
9. CGBS Studies for Comparative Assessment – Transition Pieces Refined Longevity Study
10. CGBS Studies for Comparative Assessment – Study 5 Aides for Navigation
11. CGBS Studies for Comparative Assessment – Study 6 Concrete Cutting & Removal
12. CGBS Studies for Comparative Assessment – Study 8 Leg Failure
13. Marine Growth Assessment
14. Dunlin CA Studies – Study 12 – Cell top Debris
15. Dunlin Alpha Transition Piece Corrosion Protection High Level Options Study
16. Dunlin Alpha Pre-decommissioning Cuttings Assessment Survey
17. Shipping and Fishing Decommissioning Risk Assessment Block 211/23
18. Dunlin Alpha Decommissioning Review of Technologies & Conceptual Methods for Cutting of Dunlin A Concrete Legs
19. Methodology for Separation of Dunlin Platform Transition Columns
20. Dunlin Wave Airgap Analysis
21. CGBS Studies for Comparative Assessment – Technical Risk Assessment
22. Dunlin A Platform CGBS Photographs Vol 1 of 2
23. Dunlin A Platform CGBS Photographs Vol 2 of 2

Appendix 5: Dunlin Alpha Structure and Comparative Assessment Options

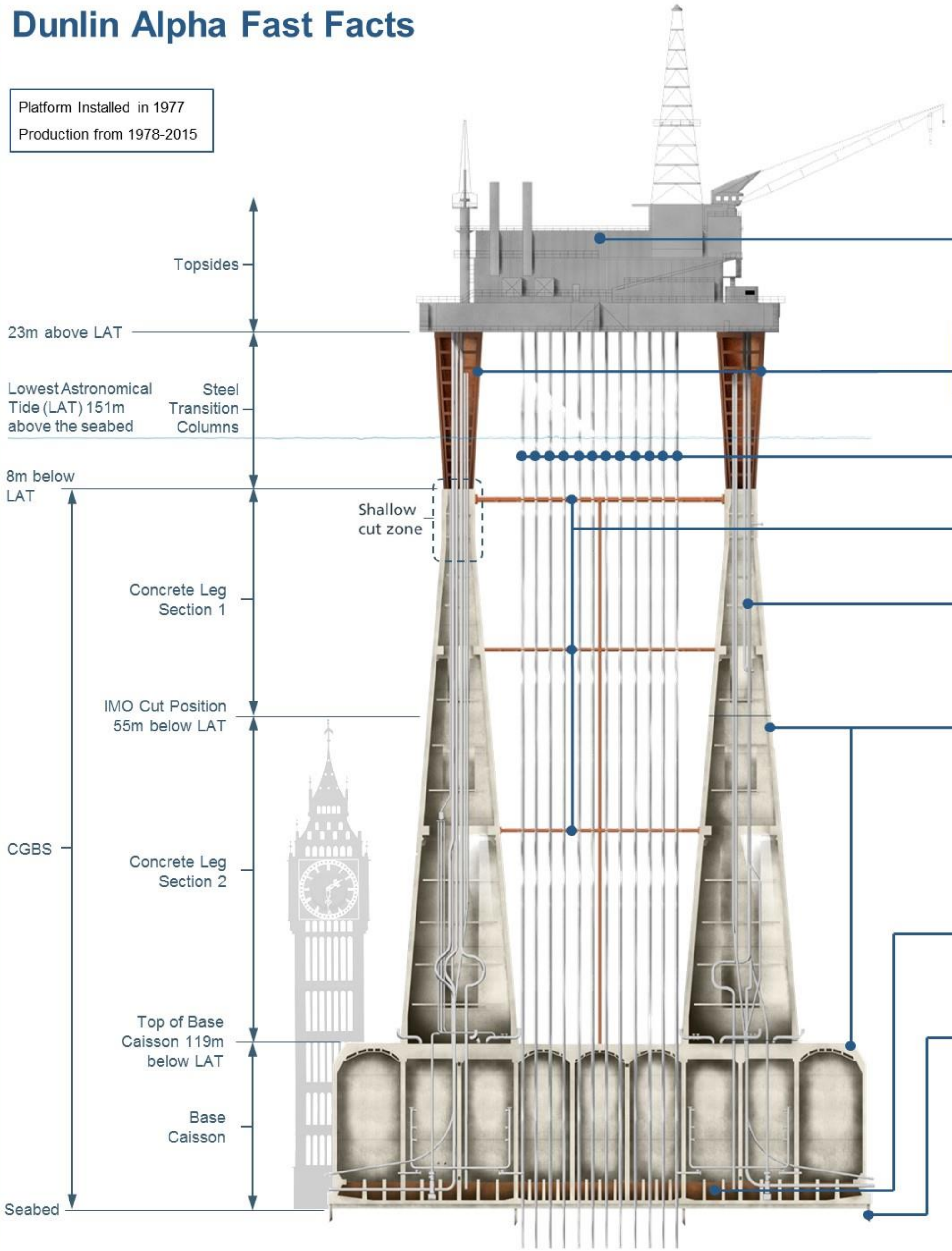
The following briefing sheet, *Dunlin Alpha Fast Facts*, shows an annotated diagram of Dunlin Alpha's structure and the range of decommissioning options that have been examined. The options include those that have been screened out, and the current candidates for comparative assessment.

Readers of this report may find this briefing sheet a useful point of reference to better understand the questions and comments reported in the main document.

Dunlin Alpha Fast Facts

FairfieldEnergy

Platform Installed in 1977
Production from 1978-2015

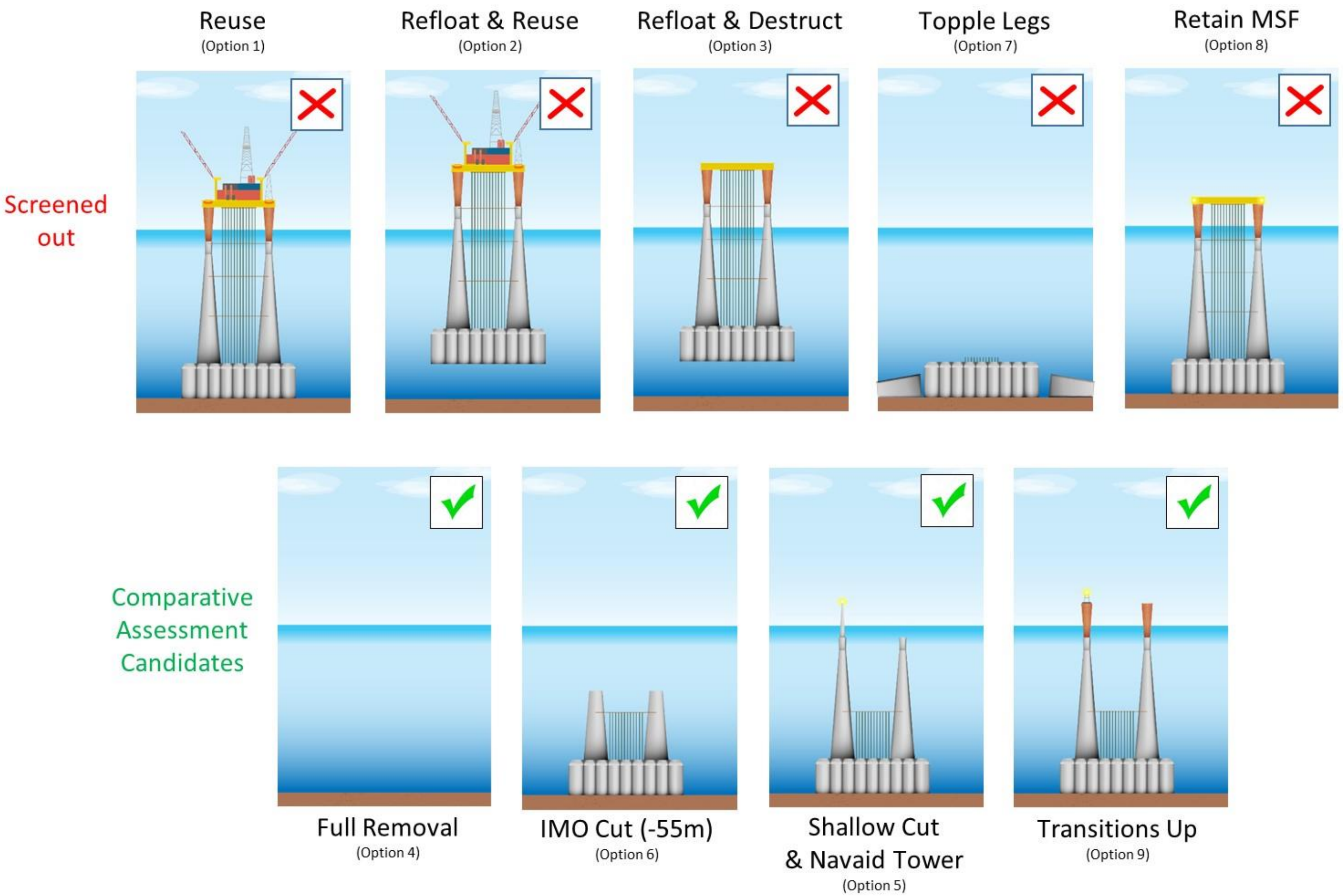


Infrastructure	Approximate Dimensions/Weight	Weight Excludes
Topsides (Dry)	19,255t 63.7m x 82.3m Plus 250t of hazardous materials and 28t of NORM **Total ≈ 19,535t**	Operational Weights e.g. Process Fluids Laydown
Steel Transition Columns A&B	2 x 295t 5.4m in diameter (cylindrical) and 31m tall **Total ≈ 590t**	Leg Internals Marine Growth
Steel Transition Columns C&D	2 x 500t 5.4 to 8.9m in diameter (conical) and 31m tall **Total ≈ 1,000t**	Leg Internals Marine Growth
Conductors	45 x 185m (long) x 30" conductors from EL(+)31m (LAT) to EL(-) 154m (LAT) (3m below seabed) **Total ≈ 3,840t**	Inner completions Marine growth
Conductor Guide Frames and Vertical Supports	1 at EL(-)10m (LAT), 1 at EL(-)40m (LAT), 1 at EL(-)76m (LAT) **Total ≈ 540t**	Marine Growth Cathodic Protection Skid
Leg Internals	All 4 steel transition columns and CGBS legs from EL(+)23m (LAT) to EL(-)119m (LAT) **Total ≈ 1,250t**	-
CGBS Primary Structure	Concrete leg section 1: 4 x 1,895t 13m to 6.7m in diameter (conical) and 47m tall Concrete leg section 2: 4 x 6,730t 22.65m to 13m in diameter (conical) and 64m tall Base Caisson: 202,000t 104m x 104m x 32m **Total ≈ 236,500t**	Transition Columns Marine Growth Leg Internals Base Caisson Internals Cell Contents Ballast
Drill Cuttings	Base caisson roof: 10,200m³ over 5,100m² Sea floor: 9,355m³ over 4,084m²	-
Iron Ore Ballast and Concrete Cover Layer	Approximately 104m x 104m x 3m deep **Total ≈ 96,800t**	-
Under Caisson Grout	**Total ≈ 500t**	-
Seabed Skirts	8 No x 104m x 4m **Total ≈ 1,450t**	-
Total Weight of CGBS and Transition Columns (Including Contingency)	**Total ≈ 336,000t**	Topsides Conductors Conductor Guide Frames Debris Drill Cuttings Cell Contents Under Caisson Grout

Rev: 7 Nov

Dunlin Alpha Fast Facts

Dunlin Alpha Comparative Assessment Options



Appendix 6: Acronyms

DUNLIN ALPHA DECOMMISSIONING: JARGON BUSTER

Acronym/Term	Description
AORP	Attic Oil Recovery Programme
Bathymetry	The study of seabed topography
BEIS	Department of Business, Energy and Industrial Strategy
BTEX	Benzene, Toluene, Ethylbenzene, Xyline
CA	Comparative Assessment
Cells	The storage compartments on Dunlin Alpha used for the production fluids and conductor cooling, located at the bottom of the CGBS
CGB	Concrete Gravity Base
CGBS	Concrete Gravity Based Structure: on Dunlin Alpha this comprises steel-reinforced concrete forming the storage caisson (75+6 cells) and four legs (up to -8m LAT)
CO2	Carbon dioxide
Conductor Guide Frames	On Dunlin Alpha these comprise 3 x steel support frames located at -10m LAT, -40m LAT and -76m LAT that comprise 48 slots to support the well completion tubulars
Conductors	On Dunlin Alpha, these comprise 46 x outer conductors (30" diameter) housing the inner completions and production tubulars
COP	Cessation of Production
CP	Cathodic Protection
Debris	Accidental dropped objects from the topsides' 40 year operational life (largely scaffold)
DECC	Department of Energy and Climate Change (now replaced by BEIS)
DFGI	Dunlin Fuel Gas Import
DP	Decommissioning Programme
DPI	Dunlin Power Import
Drill cuttings	Product from drilling; at Dunlin Alpha they are located on the caisson roof and seabed on the southern end of the caisson (Cell tops = 10,200m3 over 5,100m2, Seabed = 9,355m3 over 4,084m2)
DTM	Digital Terrain Model
Dunlin Cluster	*see Greater Dunlin Area*
Dynamic Model	Modelling typically involves the use of a computer program and mathematical/scientific correlations (or equataions) to model or predict the behaviour of a system in real time
EIA	Environmental Impact Assessment
EL	Elevation
EMT	Environmental Management Team (at BEIS)
EPRD	Engineering, Preparation, Removal and Disposal (used in connection with topsides decommissioning)
FEL	Fairfield Energy Limited
Greater Dunlin Area	Collective term for Dunlin Alpha including the CGBS, Osprey and Merlin tied back fields and facilities, and infrastructure
HLV	Heavy Lift Vessel

Acronym/Term	Description
HSE	Health & Safety Executive
HSE & AI	Health, Safety and Environment & Asset Integrity
HSSE	Health, Safety, Security and Environment
HVAC	Heating, Ventilation and Air Conditioning
IMO	International Maritime Organisation
IOEM	Invert Oil Emulsion Mud
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
Leg internals	Structural steel and equipment in the Dunlin Alpha transitions and CGBS legs from -119m LAT to +23m LAT
LSA	Low Specific Activity Scale - see NORM
LTOBM	Low Toxicity Oil Based Mud
Macrofaunal Analysis	Analysis of larger organisms in benthic sediments generally regarded as greater than 0.5mm in size
MBES	Multi-Beam Echo Sounder
MODU	Mobile Offshore Drilling Unit
MSF	Module Support Frame
NORM	Naturally Occurring Radioactive Material exists naturally in the geological environment. In the oil and gas industry, salts from the reservoir dissolve in the formation water (and injected seawater if this is used) and can precipitate out as LSA-containing scale deposits in the wells, pipelines and processing equipment
ODU	Offshore Decommissioning Unit (at BEIS)
OGA	Oil and Gas Authority
OGUK	Oil and Gas UK
OLF	Norwegian Oil and Gas Association (previously Norwegian Oil Industry Association)
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
Options 1-9	The different structural options for the Dunlin Alpha installation which have been considered; four have been identified as feasible
OSPAR Convention	The Oslo/Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OSPAR Decision 98/3	The 1998 OSPAR Decision on the disposal of disused offshore installations, to which the UK is a Contracting Party
P&A	Well Plugging and Abandonment: setting of cement plugs to isolate the reservoir. For Dunlin Alpha this includes removing the completion and conductors down to -76m LAT
PAH	Poly-aromatic Hydrocarbon
PL5	The export pipeline from the Dunlin Alpha installation
POB	Personnel On Board
Rebar	Short for 'Reinforcing Bar', rebar comprises steel bars or a mesh of steel wires used as a tensioning device in reinforced concrete and masonry structures to strengthen and hold the concrete in tension. It is often patterned to form a better bond with the concrete.
Ring Beam	A stiffened structural section with the CGB leg to take additional loads, e.g. the conductor guide frame and transition sections

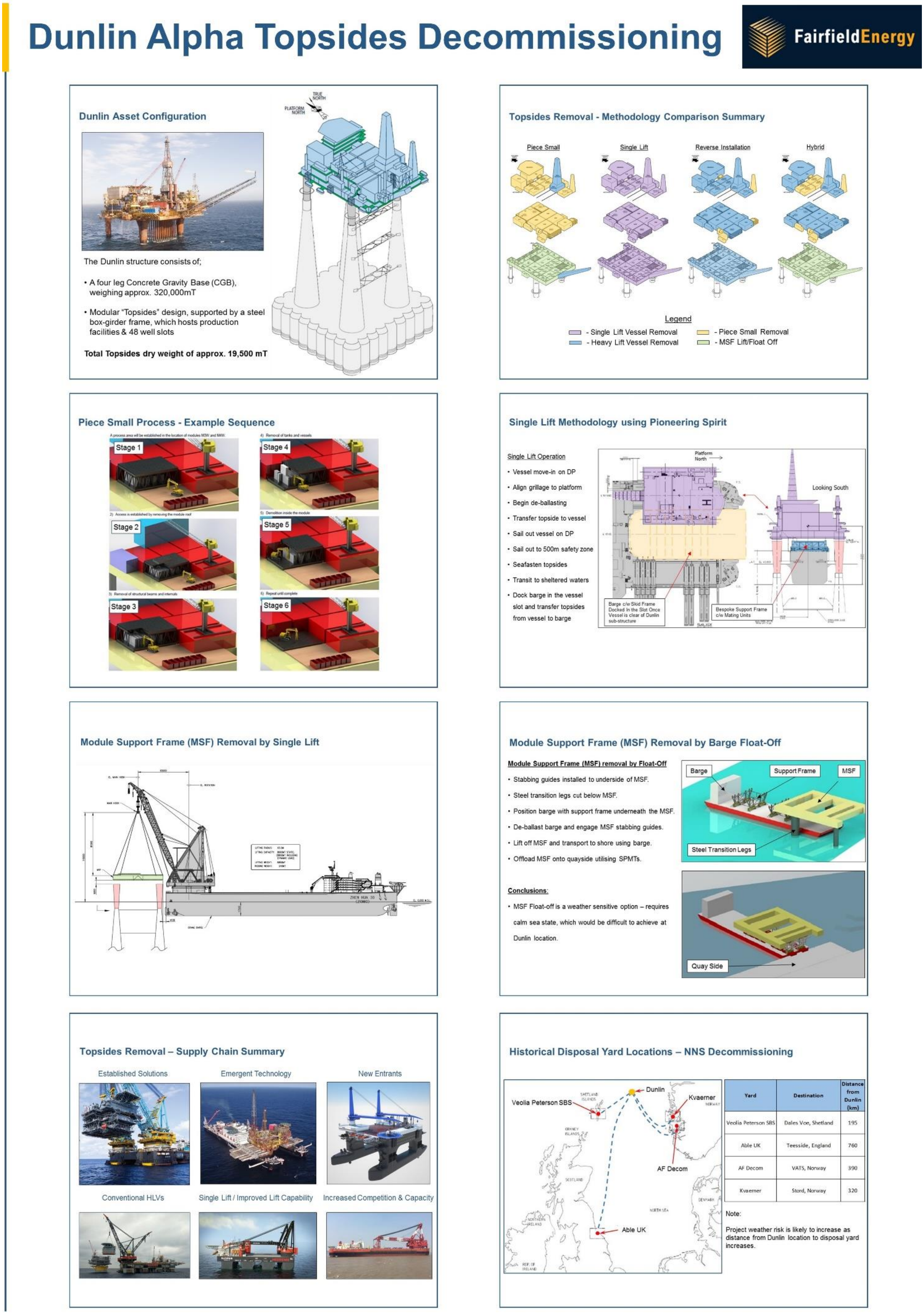
Acronym/Term	Description
Risers	The vertical portion of a subsea pipeline (including the bottom bend) arriving on or departing from a platform
ROV	Remotely Operated Vessel
SEPA	Scottish Environmental Protection Agency
SFF	Scottish Fishermen's Federation
SME	Subject Matter Expert
Synthetic Fluids	Fluids manufactured from starting products of known composition and purity
t / te / mT	metric tonnes
THC	Total Hydrocarbon Content
Topsides	Platform that sits on the 4 steel transitions of Dunlin Alpha comprising of the Module Support Frame (MSF), Module deck, Drilling deck and accommodation
Transitions	Steel columns which on Dunlin rise from -8m LAT to +23m LAT and act as the interface between the topsides and CGBS
Tubulars	Steel pipe
Umbilicals	A single or multiple cored line (e.g. cable or hose) used to deliver services between assets (e.g. power, hydraulics, chemicals)
Vibrocorer	Sampling device with an electric motor that creates vibrations which drives the core barrel into the soil
WBM	Water Based Mud

Appendix 7: Information Posters

This appendix contains a series of posters that were displayed at the workshop to illustrate in more detail the various structural and decommissioning aspects of Dunlin Alpha. These cover the following topics:

- Topsides
- Drill Cuttings
- Cell Contents
- Concrete Gravity Base Structure (Legs and Cells)

Topsides Information Posters

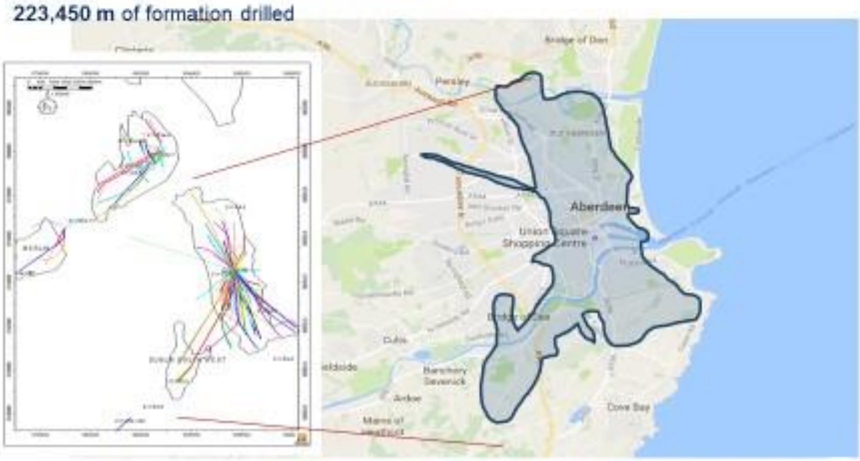


Drill Cuttings Information Posters

FairfieldEnergy

Drilling History

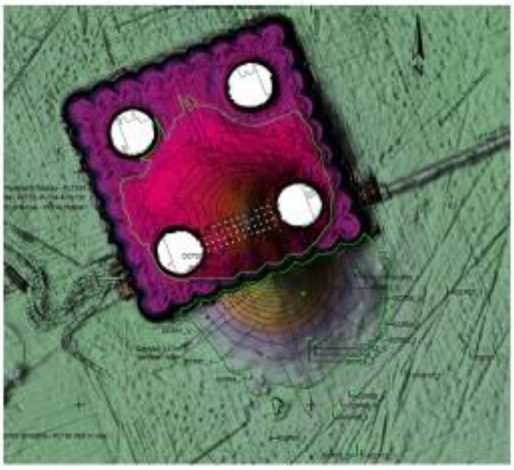
- Platform drilling commenced in **1977**
- **45** platform wells
  - ➢modified by further drilling **56** times
- **223,450 m** of formation drilled



FairfieldEnergy

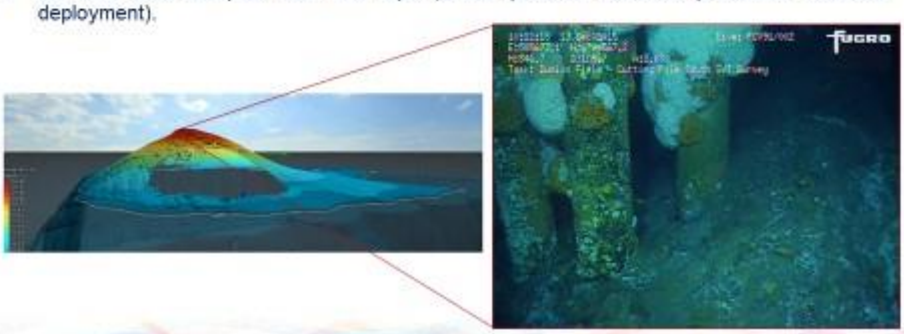
Drilling History

- Water Based Mud (**WBM**), Invert Oil Emulsion Mud (**IOEM**) and Low Toxicity Oil Based Mud (**LTOBM**) all used and discharged
- Pre-2001, cuttings were discharged to the top of CGBS and over spilled to seabed
- Post-2001, **5x** 8½" sections and **1x** 6" section were drilled (<**1%** of total cuttings generated)
- **31,431 m³ / 79,795 tonnes** of cuttings generated
  - ➢ >99% discharged to sea



Survey and Sampling Campaign

- Surveyed and sampled between November 2015 – April 2016.
  - Strategy compiled collaboratively by Fairfield, Fugro and Xodus Group;
  - In consultation with OPRED, and;
  - Fulfilling requirements of the DECC and the OLF Guidelines.
- Detailed bathymetric survey.
- **12x** seabed sample stations within cuttings pile footprint.
- **3x** 4 m vibrocore samples collected from seabed.
- **1x** ROV core sample from seabed (where pile gradient prohibited vibrocore deployment).
- **3x** ROV core samples from cell tops (where platform structure prohibited vibrocore deployment).



Drill Cuttings Pile Characterisation

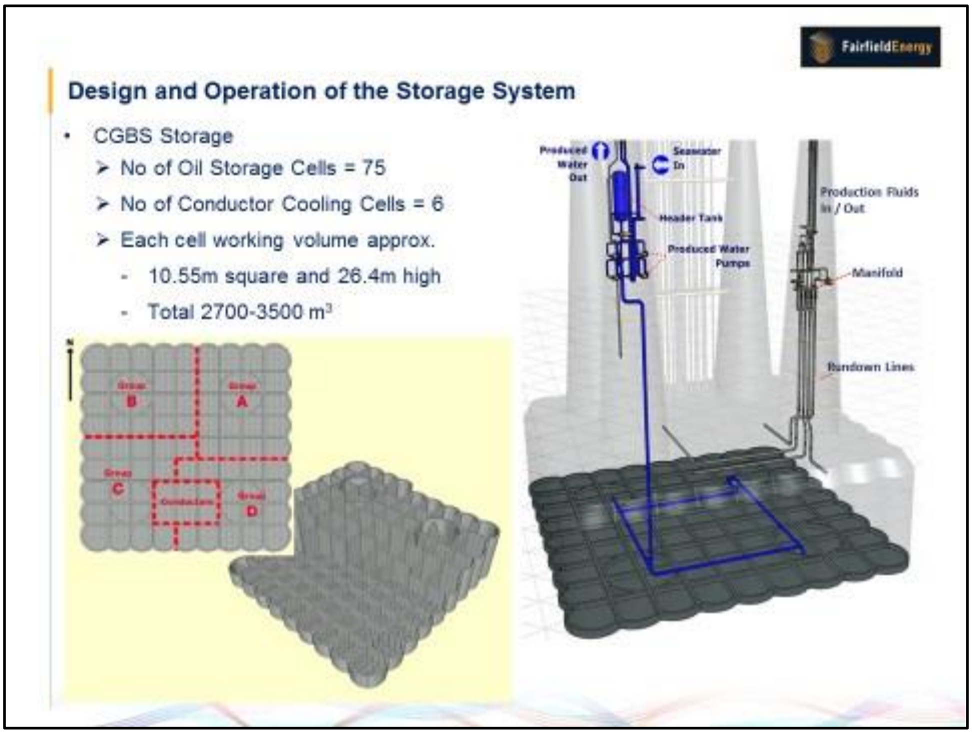
	CGBS	Seabed	Combined
Area (m^2)	5,100	4,084	9,184
Volume (m^3)	10,200	9,355	19,555
Max Height (m)	12.9	12.83	-
Min. THC (µg/g)	16,100	6.3	6.3
Max. THC (µg/g)	73,400	146,000	146,000
THC Leachate Concentration ($\mu g l^{-1}$)	192	262	227
THC Leaching Rate ($mg/m^2/day$)	124	170	147
Below OSPAR Oil Loss Threshold	✓	✓	✓
Below OSPAR Persistence Threshold	✓	✓	✓
Estimated Debris (Identified Targets)	-	-	440

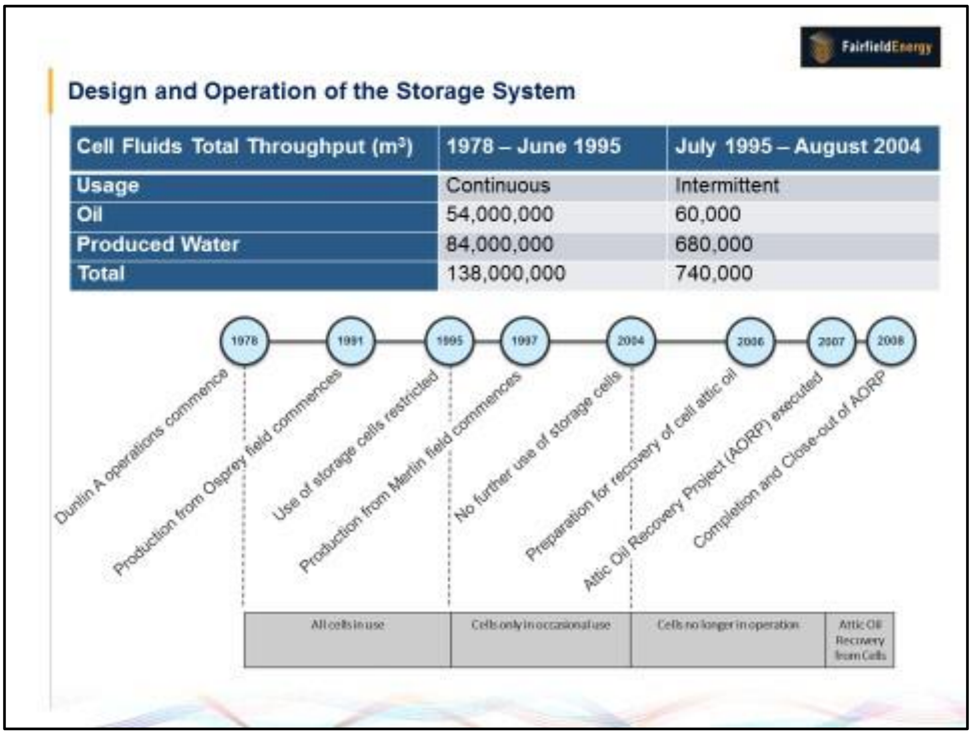
FairfieldEnergy

Status of Dunlin Alpha Cuttings Pile Work

- Work undertaken / complete
  - Pre-decommissioning Environmental Baseline and Habitat Assessments surveys, analyses and reporting
  - Field-wide and cell top Debris Surveys
  - Pre-decommissioning cuttings pile MBES surveys
  - Pre-decommissioning cuttings pile sampling, analyses, reporting
  - Assessment against OSPAR Oil Loss and Persistence Thresholds
- Work ongoing
  - Debris recoverability study work
  - Drill Cuttings technical document
    - Including pile management options and associated modelling
  - Further stakeholder engagement
- Future Work
  - Inclusion in Dunlin Alpha Comparative Assessment / Environmental Impact Assessment / Decommissioning Plan process and deliverables
  - Post-decommissioning surveys

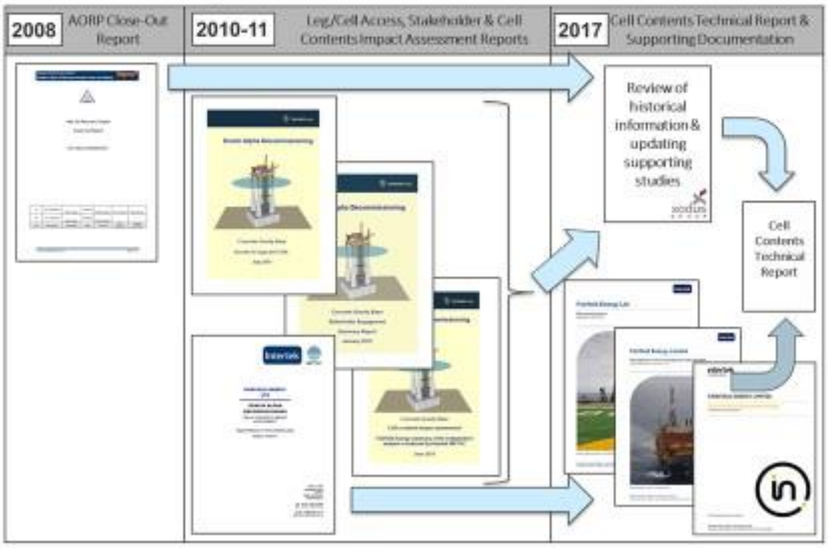
Cell Contents Information Posters



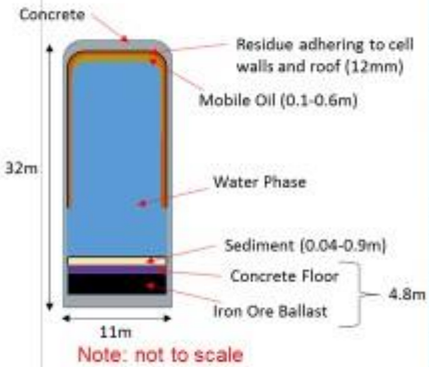


Cell Fluids Total Throughput (m³)	1978 – June 1995	July 1995 – August 2004
Usage	Continuous	Intermittent
Oil	54,000,000	60,000
Produced Water	84,000,000	680,000
Total	138,000,000	740,000

Cell Contents Study Work



Inventory Basis – Typical Cell

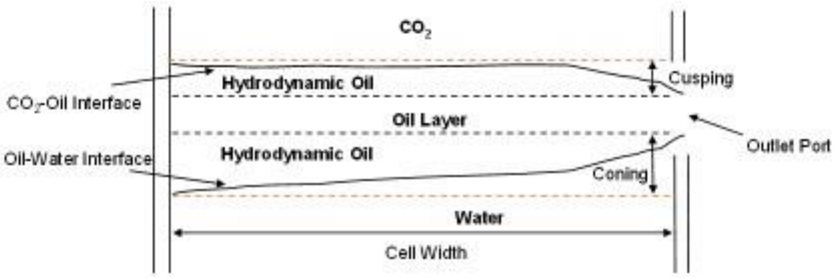


Parameter	Units	Minimum	Maximum
Mobile Oil			
Mobile Oil Volume	m^3	14.5	58.4
Depth of Oil in Attic Space	m	0.1	0.6
BTEX	tonnes	18.5	74.6
PAH	tonnes	1.06	4.26
Heavy Metals	tonnes	5.64×10^{-5}	2.27×10^{-4}
Chemicals	kg	0.50	2.03
Sediment			
Sand/Clay Volume	m^3	1.0	32.7
Scale Volume	m^3	0.6	2.8
Hydrocarbon Volume	m^3	1.0	32.7
Water Volume	m^3	1.0	32.7
Depth of Sediment	m	0.04	0.9
Heavy Metals	tonnes	0.053	0.107
NORM radioactivity	Bq/g	426	
NP/NPE	tonnes	<0.00002	<0.00113
Wall Deposits			
Deposited Wax Volume	m^3	1.40	4.51
Deposited Oil Volume	m^3	0.93	3.01
Thickness of Residue Layer	mm	0	12
Heavy Metals	tonnes	5.43×10^{-6}	2.28×10^{-5}
Water Phase			
Water Phase Volume	m^3	2628	3475
BTEX	tonnes	7.04×10^{-3}	9.31×10^{-3}
Heavy Metals	tonnes	5.08×10^{-5}	6.72×10^{-5}
Chemicals	tonnes	0.003	0.004

Inventory Basis – Mobile Oil

- Residual oil from AORP, evenly distributed.
- Hydrocarbons which have diffused over time from the sediment layer on the floor or wall deposits.
- Oil trapped in 10 "triangle" cells underneath the legs = 450m³.

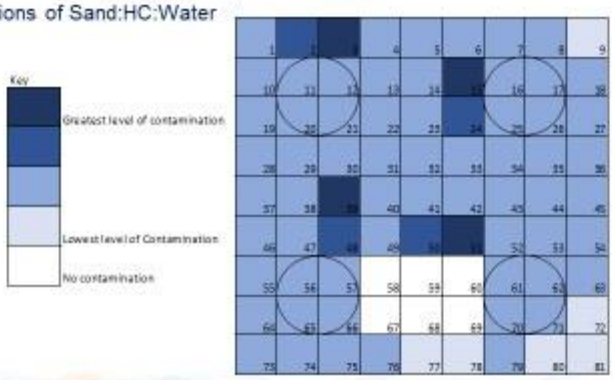
Cell Group	No of Cells	Mobile Oil Volume (m^3)
A	20	404.9
B	20	404.7
C	19	433.9
D	16	390.3
Total	75	1620



Inventory Basis – Solid and Sediment Materials

- Average sand deposition rate of 7g/m³
- Total solids deposition = 363m³
  - A:B:C:D Cell Group split = 0.25:0.3:0.3:0.15
- Total scale deposition = 159m³
- Uneven distribution within group, based on distance from inlet pipework and communication paths.
- Sediment - even proportions of Sand:HC:Water

Cell Group	No of Cells	Sediment Volume (m^3)
A	20	284.4
B	20	378.2
C	19	378.2
D	16	207.5
Total	75	1248



Inventory Basis – Material Adhered to Walls and Ceiling

- WAT = 24°C to 32°C
- No asphaltenes
- Thermal modelling, wax deposition = 0.00159mm.day^{-1} , approx. 12mm over field life
- Wax gel injection during the AORP

Cell Group	No of Cells	Wall Residue Volume (m³)		
		Hydrocarbon Deposits	AORP Wax	Total
A	20	79	78	157
B	20	79	78	157
C	19	77	0	77
D	16	70	0	70
Total	75	306	156	462

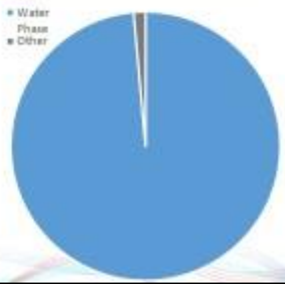
Inventory Basis – Water Phase

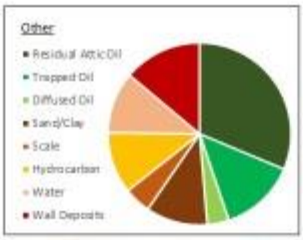
- Cells are completely liquid filled.
- Volume determined based on cell geometry.
- Heavy metal and HC concentration will vary between cells depending on contamination in other phases.

Cell Group	No of Cells	Water Volume (m³)
A	20	57750
B	20	57657
C	19	54908
D	16	46787
Conductor	6	16475
Total	81	233576

Inventory Basis – Summary Overview

Phase	Volume (m³)	%
Residual Attic Oil	1,043	0.44
Trapped Oil	449	0.19
Diffused Oil	128	0.05
Total Mobile Oil	1,620	0.69
Sand / Clay	363	0.15
Scale	159	0.07
Hydrocarbon	363	0.15
Water	363	0.15
Total Sediment	1,248	0.53
Wall Deposits	462	0.19
Water Phase	233,576	98.59





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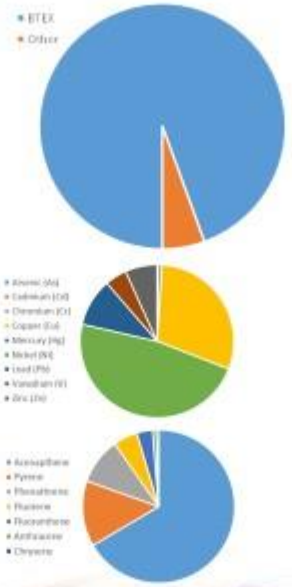
Inventory Basis – Summary Overview

Component	Mass (tonnes)	%
Benzene	146	5.92
Toluene	603	24.39
Ethylbenzene	492	19.89
Xylenes (o,p,m)	1095	44.27
Total BTEX	2336	94.47
Napthalene	47.6	1.92
Acenapthene	57.1	2.31
Pyrene	11.9	0.48
Phenathrene	8.4	0.34
Fluorene	4.4	0.18
Fluoranthene	2.9	0.12
Anthracene	0.7	0.03
Chrysene	0.4	0.02
Total PAH	133.4	5.40
Arsenic (As)	0.00	0.00
Cadmium (Cd)	0.00	0.00
Chromium (Cr)	0.03	0.00
Copper (Cu)	0.87	0.04
Mercury (Hg)	0.00	0.00
Nickel (Ni)	1.39	0.06
Lead (Pb)	0.30	0.01
Vanadium (V)	0.13	0.01
Zinc (Zn)	0.20	0.01
Total Heavy Metals	2.92	0.12
O_2 Scav, Scale Inh. & Demuls	0.34	0.01
NP/NPE	0.01	0.00
Total Chemicals	0.35	0.01
Total Mass	2473	100



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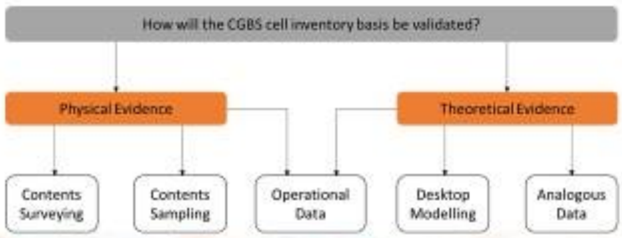
Inventory Validation – Methodology

1. Complete dataset – is a complete timeline of data available or is data available across all wells/fluids?
2. Native information – has the data come from actual Dunlin Alpha production operations documentation?
3. Measurement accuracy – what is the uncertainty of the data presented, accuracy of measurement instrumentation, data recording methods?
4. Calculation methodology (global quantification) – is the approach adopted suitable to quantify the total inventory of material within the cells?
5. Calculation methodology (location specific quantification) – is the approach adopted suitable to describe the variation in the inventory of material within and between individual cells?
6. Environmental Impact Sensitivity – would a deviation in the inventory basis result in a significant change to the environmental impact?



Inventory Validation – Physical Evidence (Survey / Sample)

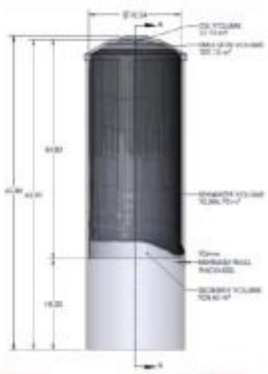
- Access
  - ➢ 11 options considered with 25 sub-options
  - ➢ Narrowed down options to use of rundown lines, riser/j-tubes or new external cell penetrations
  - ➢ Technology
    - Stinger Norway – Micro/Nano ROV
    - Tracerco – Backscatter Densitometer

Option	Group	Line Identifier	Accessible Cells
Rundown Lines			
5, 5b	A	P094	15 (6, 16 & 24)
5, 5b	C	P096	39 (38, 40 & 48)
5, 5b	D	P097	51 (50 & 52)
Risers/J-tubes			
6i	C	MK2	56 (55)
6ii		MK111	56 (55)
6iii	D	MK7	70 (79)
6iv		MK8	62 (63)
6v		MK9	62 (63)
6vi		MK11	62 (63)
6vii		MK12	62 (63)
6viii		MK13	62 (63)
6ix		MK14	71 (72)

Data obtained from cells shown in brackets may be limited

Inventory Validation – Theoretical Evidence

- Dynamic Modelling
  - Confirmed CO_2 displacement would have been effective
  - Confirmed oil extraction would have been effective, leaving behind a thin layer of oil between the CO_2 and water phases.
- Analogous Data
  - ➢ Similar structures with storage facilities investigated.
    - Shell – Brent Bravo, Charlie & Delta
    - TAQA – Cormorant Alpha
    - Statoil – Statfjord Alpha, Bravo & Charlie
    - Dong Energy – Siri
    - Conoco Phillips – Maureen Steel Gravity Platform and Articulated Loading Column
    - Conoco Phillips – Ekofisk Tank
    - Shell – Brent Spar
    - BP – Sullom Voe Terminal
- Operational Data
  - ➢ Sampling from topsides separators in 2009 and 2017
  - ➢ Export Pipeline Pigging in 2015



Cell Contents Management Options - Options and Effectiveness Criteria Definition

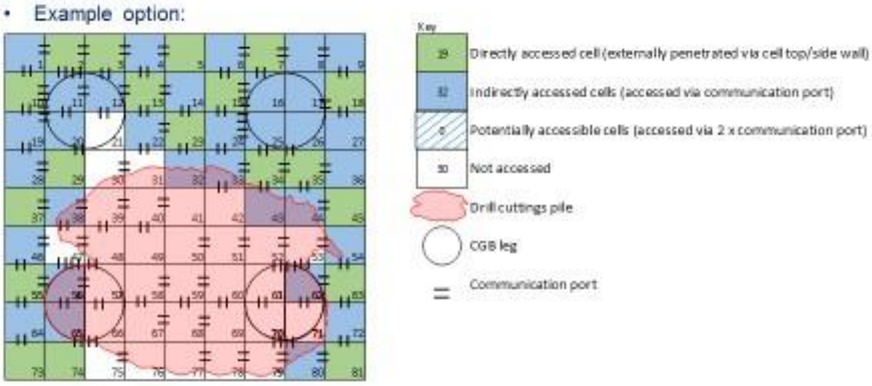
How will the CGBS cell contents be managed?

- Removal
- Bioremediate
- Capping
- Leave In Situ

- Option considerations include:
  - Presence of drill cuttings (full removal, minimal/moderate/substantial disturbance)
  - Direct/indirect cell penetrations – technical feasibility of running hoses to access fluids (oil/water) in neighbouring, leg and triangle cells
  - Volume of waste created
  - Duration of operations
  - Degree of wax contamination and management option efficiency
  - Degree of mobile oil contamination and management option efficiency
  - Degree of sediment contamination and management option efficiency
- Currently reviewing over 70 options in order to address these considerations and define options for Comparative Assessment

Cell Contents Management Options - Options and Effectiveness Criteria Definition

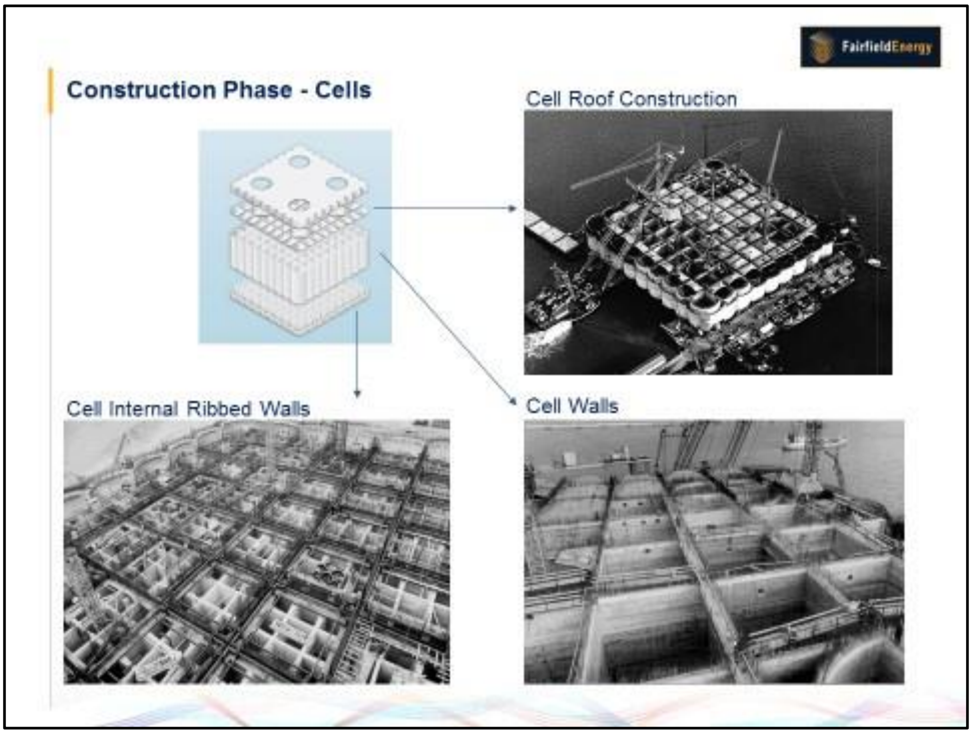
- Example option:



Cell Contents Management Options – Technical Requirements

- Cell Access
  - New cell penetration in cell tops – Enpro
  - New cell penetration in side wall – Atkins
- Contents Removal
  - Recovery of mobile oil, sediment, wall residue and water.
  - Technology development required to allow indirect access to neighbouring cells.
  - Internal structure design being examined in further detail to understand constraints, for example configuration of the formwork which supported the cell tops as they were originally constructed.
- Bio-remediation
  - Delivery of organisms, nutrients and oxidants to breakdown residual hydrocarbons.
- Capping
  - Delivery of material to encase the residual sediment and provide an additional environmental barrier.

Concrete Gravity Base Structure (Cells and Legs) Information Posters



Construction Phase - Legs and Steel Transition

Construction Phase – Legs and Cell Roof

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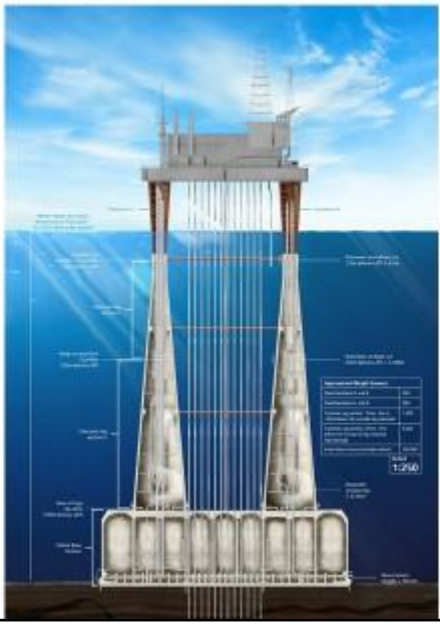
Structural Overview



- Steel Transitions
- Reinforced Concrete Legs
  - Leg Internals
  - Ring Beam
- 45 x conductors

  Conductor Guide Frames at 3 Levels
- Reinforced Concrete Cells

Item	Weight (te)
Cells (9 x 9 = 81)	202,600
Iron Ore Ballast	88,000
Steel Skirts	728
Grout	unknown

- Water Depth = 151m

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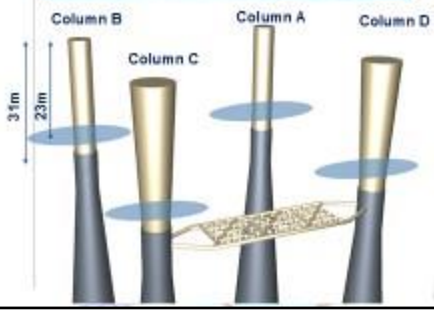
Steel Transitions – Unique Challenges



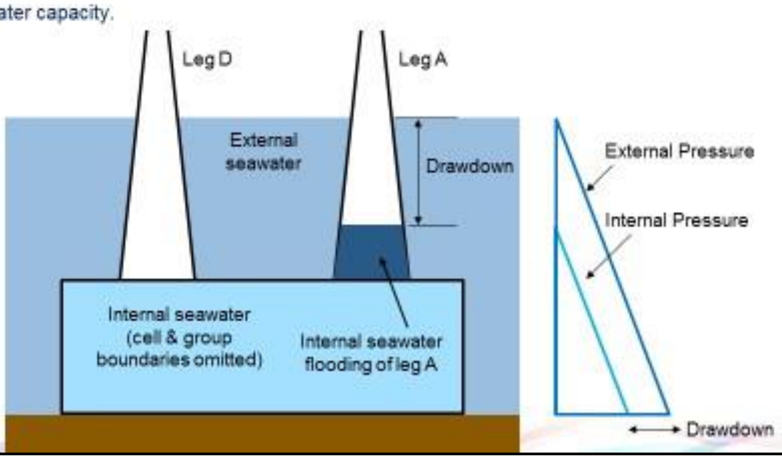
- Constraints during construction
  - Extra long steel transitions
  - Span below water, unique in North Sea
- Corrosion
  - managed by coatings and CP
  - Current condition, minimal corrosion wall thickness loss since installation
- Bolted to top of concrete legs
  - Bolts grouted, cannot be inspected so condition unknown
- Steel transitions spanning below water add unique level of complexity for the decommissioning of the Dunlin Alpha CGBS

CGBS Legs - Key Features & Considerations

- 4 legs, 111m in length
- Ringbeam at 8m below LAT
  - Connection for steel transitions
  - Anchorage for the leg prestressing tendons
  - Integrity of legs dependent on retention of ringbeam
- Leg Internals
  - Legs house materials / equipment known as leg internals (piping systems, access, etc.)
- Drawdown System
  - Water levels inside legs lower than outside, provides compression in the concrete

CGBS Drawdown System

- Leg A is partially filled with water up to EL +70m level, while legs B, C and D are maintained dry
- This induces compression in the concrete and maintains the pressure in the cells below external pressure, and this pressure differential is referred to as the drawdown system.
- The drawdown system acts with the prestressing system to give the concrete legs and cells greater capacity.



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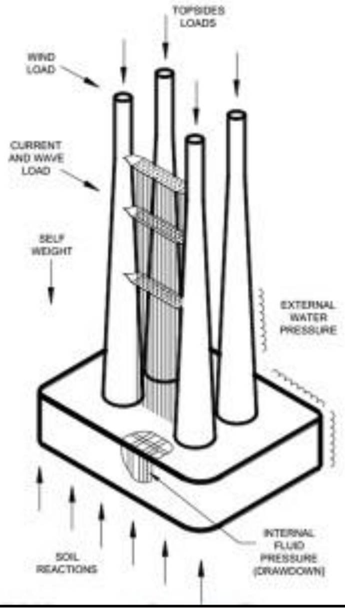
Loading on the Platform Substructure



Changes to substructure loading following topsides removal

- Environmental loading will reduce significantly due to removal of conductors to -74m
- Vertical loading will reduce significantly due to topsides removal
- Hydrostatic compression is lost when legs are flooded.
- Composite portal frame action is lost with MSF and topsides removed – legs behave independently instead of together

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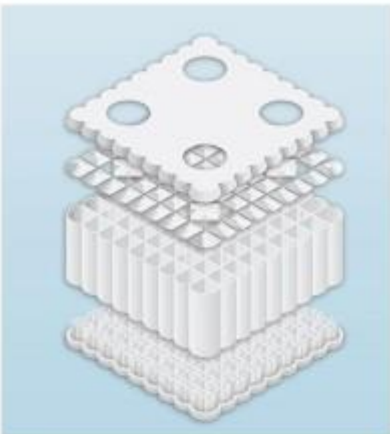
CGBS Cells - Key Features & Considerations



- Each cell
  - Roof, walls, base slab

Item	Dimensions (length x breadth x height)
One cell	11 x 11 x 32m
81 cells	104 x 104 x 32m

- Total cell group ≈ 284,000 te (concrete, steel reinforcement & solid iron ore ballast)

Item	Weight (te)
Cells (9 x 9 = 81)	202,600
Iron Ore Ballast	88,000
Steel Skirts	728
Grout	unknown

- Grout and soil adhering to the base slab increases weight further

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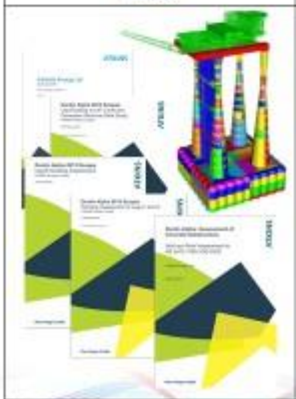
Structural Integrity & Decommissioning Study Work

- Decommissioning team has 40 years of Dunlin Alpha asset knowledge spanning from construction, operation (30 years with Shell, 10 years with Fairfield), late life and decommissioning.
- This includes extensive technical studies for the structural integrity management of the operational asset and supporting with decommissioning over last 10 years.
- The Dunlin Alpha decommissioning technical study work has benefitted from depth of asset knowledge, input from subject matter experts and experience gained from analogous decommissioning projects.

Structural Integrity Study Work	Previous Decommissioning Study Work	Recent Decommissioning Study Work
		

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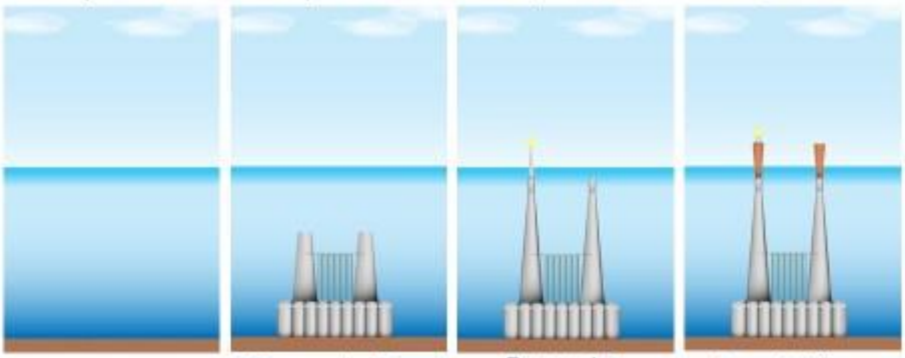
Decommissioning Options for Legs & Cells

Option 4	Option 6	Option 5	Option 9



Full Removal	Remove to -55m	Remove Leg Transitions & Install Navaid Lighthouse	Leave in Place & Install Navaid

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Technical Challenges for Decommissioning

Full Removal (Option 4)

- 3 separate leg cuts (shallow, -55m, -119m) + cell removal
- Scale / complexity of removing 284,000te at 151m depth
- Technology development novel
- Base slab + ballast + unknown grout involves thick vertical cuts
- Suction release required to remove base slab / skirts
- Option 6 considerations also apply

Remove to -55m (Option 6)

- Cutting concrete at this scale subsea has not been done before
- Transition bolt integrity – need for shallow and -55m leg cuts
- Hostile Northern North Sea (cutting & lifting)

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Technical Challenges for Decommissioning

Remove Steel Transitions & Install Lighthouse (Option 5)

- Lighthouse relies on ring beam. Operational issues with shallow cut above ring beam
- 40m lighthouse – complex installation and subsea connection
- Long term integrity of the legs and cell group (degradation, longevity) - may damage cells

Leave In Place & Install Navaid (Option 9)

- Long term integrity of the steel transitions, legs and cell group (corrosion, degradation, longevity) - may damage cells

Appendix 8: Evaluation

Stakeholder participants were asked to complete an evaluation questionnaire at the conclusion of the stakeholder workshop, 8 November 2017. This was in order to measure the success of the workshop from the stakeholders' perspective. Questions included those about stakeholders' level of satisfaction with the opportunity to give views and gather information, their confidence in Fairfield Energy to address the points they raised, and how the workshop process and environment met their needs. Both quantitative and qualitative responses were captured.

The workshop was attended by 63 external stakeholders, and 37 completed questionnaires were returned. The responses have been transcribed and collated without attribution, along with the original questions. Please note that participants did not always provide an evaluation score and/or comment in response to every question.

1. **How satisfied are you with the opportunity you have had today to give your views? Please select a score from 1 to 5, where 1 is "not at all" and a score of 5 is "very".**

Not at all satisfied--Very satisfied

Stakeholders' satisfaction with the opportunity to give their views:

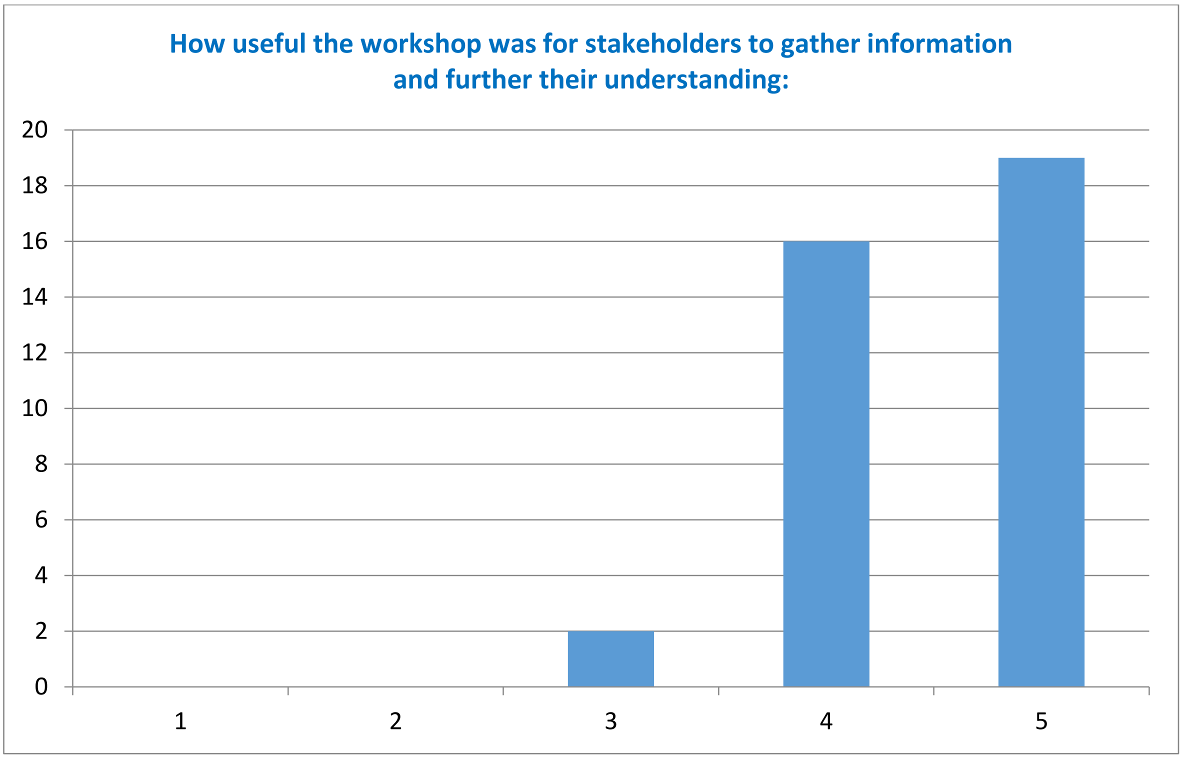
Those that gave a score of 4, made the following comments:

- Lots of discussion opportunities.
- Multiple opportunities made, inviting contribution.
- This was a very well-run day, but to give proper views on the breadth of information presented would have required more pre-reading. Follow-up will be really important now that the group has been engaged.
- Insight to shared issues.
- Positive side: Very structured. Negative side: difficult to discuss solutions outside 'the box'.
- Plenty of opportunity given. People encouraged to contribute by facilitators.
- Roundtable and carousel gave the opportunity to speak without the fear of addressing the entire room!
- A well-designed open discussion which I was able to contribute to, but found it more of a learning experience rather than something I could contribute to. A lot of technical discussion that lies outside of my area of interest.
- Very well organised and I have learnt a lot. It was great having small table discussions.
- More discussion around the table would have been helpful, perhaps with more structure.
- It was really nice and well organised along the conference.

Those that gave a score of 5, made the following comments:

- Good facilitators and small group discussions help with opportunities to share views.
- Appropriate level of information provided to enable open discussion.
- Lots of discussion opportunities, with Fairfield and amongst stakeholders - the format encouraged lots of dialogue and participation.
- The system planned allowed for it.
- Plenty opportunity to ask questions, whether following presentations, carousel talks or one-to-one over lunch or coffee.
- Very well organised. Excellent opportunity to engage with other stakeholders.
- Very well organised with appropriate time for questioning on the specific areas.
- Well prepared, thorough, sufficient time to reflect and comment.
- Well facilitated; good opportunities to engage.
- The Fairfield and R4C team were well prepared and gave me a good overview of the decommissioning project.
- Excellent opportunities to discuss and record queries and observations.
- Clear interest by Fairfield and interesting challenges from both sides.
- Well-structured sessions with excellent facilitation. Good listening skills and open, professional attitude from Fairfield staff and consultants.
- Very informative and drilled deep.
- Good event and well-structured to provide the opportunity for discussion.
- Many opportunities - large, small, one-to-one, communications.
- Pleased to be invited.
- After every presentation there was sufficient time given to ask questions if desired, but in particular, the single table discussions and the rotating sessions in the afternoon were good forums to raise discussion points.
- Plenty of opportunity for clarifications and individual conversations.

2. How useful was the workshop to gather information and further your understanding about the decommissioning plans? Please select a score from 1 to 5, where 1 is "not at all" and a score of 5 is "very".



Not at all useful--Very useful

How useful the workshop was for stakeholders to gather information and further their understanding:

Those that gave a score of 3, made the following comments:

- At this stage the plans are not finalised. Options available are similar to other decommissioning projects.

Those that gave a score of 4, made the following comments:

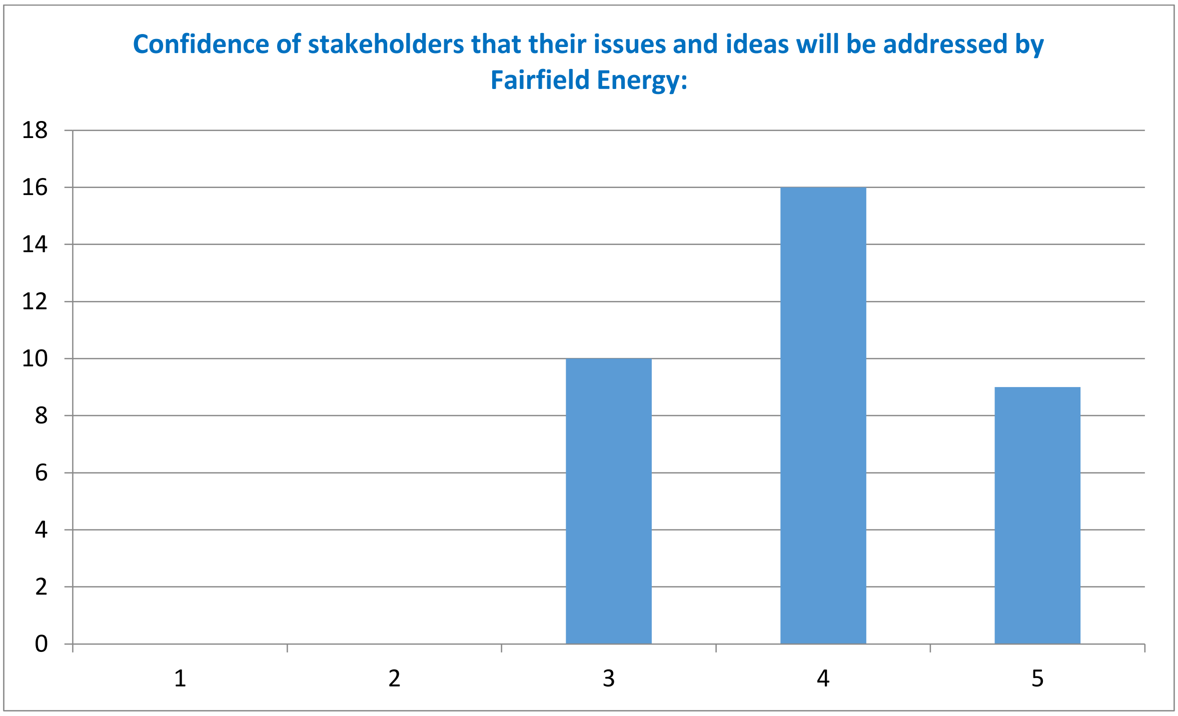
- Still a lot around options.
- Fairly familiar with scope and challenges already, but helpful clarification and other perspectives.
- Status of where Fairfield are with cells.
- Came away with a really good understanding of the process and the plans so far.
- Good background given, and to a non-engineer, it looked a reasonable study of the options.
- Decommissioning is a new field for me - so the workshop was very informative.
- Very informative with good visuals, not always clear on viability of alternatives e.g. full removals.
- Good to see all of the options that there are and the considerations that are taken. Open and honest.
- Previously aware of many elements of the plan.
- Good background and methods for decommissioning options.
- I found the material to be presented well and while much of the content was familiar to me there was additional information presented which gave me a clearer picture of the decision-making to date and some unique challenges which I had not been aware of.
- Would have liked to have heard about plug and abandonment updates - any challenge there. Also contracting approach and any opportunity or challenges there.

How useful the workshop was for stakeholders to gather information and further their understanding:

Those that gave a score of 5, made the following comments:

- Presentations, virtual reality, and model very useful.
- Information was well presented and followed up with further opportunities to discuss things in more detail.
- Lots of information, pitched at the right level - jargon buster was useful at times!
- Very good presentations.
- Very good visual aids.
- Covered a wide variety of topics and collected views from a large collection of people.
- New insights came out of the discussions. One or two of prime importance.
- Excellent level of expertise in both the presentations and questions and answer sessions.
- I found the detail of the complexity of full removal very interesting and informative.
- As above [very informative and drilled deep] and being able to question.
- Good to get story so far.
- Good process - open communications.

3. How confident are you that the issues and ideas you have raised will be addressed by Fairfield Energy? Please select a score from 1 to 5, where 1 is "not at all" and a score of 5 is "very".



Not at all confident---Very confident

Confidence of stakeholders that their issues and ideas will be addressed by Fairfield Energy:

Those that gave a score of 3, made the following comments:

- There were many important issues raised. Without a timescale for delivery of the project it is hard to judge how the issues will be addressed. Some may need research and development. Will timescales fit?
- I didn't really raise any issues.
- A lot of what I raised was already covered in plan.
- But only because I think a lot issues aren't really addressable as yet!
- Not sure how they will be dealt with.
- Difficult to judge. Cost likely to play a strong role.

Those that gave a score of 4, made the following comments:

- Didn't personally raise particular issues.
- Fairfield Energy appear to be listening. Generally there was extensive alignment.
- During the morning sessions the discussion was held with one or two people, not enabling other people the opportunity to ask questions.
- Appears a very open and constructive environment.
- Professional approach.
- I think it will be hard to quantify the 20% economic, 20% environmental etc. I think that as this project is one of the first, it should lead by example. I do hope that it doesn't lean towards cost.
- All the presenters engaged well with the comments from the stakeholders and listened to both sides of discussions.
- Didn't raise many issues - but they will need to cover those raised in their EIA.
- Sincere and professional facilitation so issues and ideas recorded, while hope to see results of attention that will be paid.
- Listened - but complex drivers not fully worked through.

Those that gave a score of 5, made the following comments:

- No doubts.
- The team seems very committed.
- As I raised few concerns (and they were of an operational nature) I am confident mine will be addressed. On the whole the attitude projected by all presenters gave me the feeling that the aim was to get to an “agreed by all” solution (albeit with some concessions) therefore I feel that most will go away from the day feeling that there concerns will be addressed – provided that it was indeed captured and is visible in the report generated from the session.
- They will all be considered.

4. **How well did the workshop process (the ways of working, the working environment) meet your needs? Please select a score from 1 to 5, where 1 is "not at all" and a score of 5 is "very".**

Not at all well---Very well

How well the workshop process met stakeholders' needs:

What worked well at today's workshop and why:

- Intel was very high.
- Mixing and networking.
- Round table sessions, work groups on specific issues, good recording of feedback.
- The day itself was fine but not all references in the document are readily available.
- Format was good, with all given a say.
- Enjoyed the carousel session.
- Good open discussion.
- Facilitation, scale, structure.
- Well organised and interactive.
- The session was well scheduled and good organisation along the process.
- As previously stated I felt the round the room sessions worked particularly well – although may have felt a touch short (unless you stayed for a double session and missed one of the other stations).
- Balance of presentations versus opportunity to input. More detail on the boards for further discussion.
- Well organised, excellent venue and facilities. Hopefully provides a template that others will use.
- Really positive, pleasant environment - people were open to making conversation with new people (which often isn't the case).
- Agenda well-structured, logical flow.

How well the workshop process met stakeholders' needs:

What worked well at today's workshop and why (continued):

- Very well structured.
- I liked the carousel session a lot - it worked well.
- Well organised, timed and right level of information.
- This was an excellent day.
- Well designed and delivered.
- Good time keeping; opportunity to take part in all sessions.
- The discussion and moving discussions. I thought that the introductory video was very informative.
- Carol [Barbone, Fairfield Energy, Stakeholder Relations]!
- Variety of session types.
- The right people in attendance.

What could be improved about today's workshop and how:

- Identifying issues and knowledge gaps before the four 15 minute presentations was difficult because unaware what has been done, what is known.
- No comment.
- Nothing to say here no improvements needed.
- Perhaps understandably, it sometimes felt we were being steered towards particular options.
- More opportunity to provide feedback from individuals.
- Perhaps more structure/ focussed discussion in smaller groups would have been more productive.
- Although almost impossible to complete 100%, the feedback on discussion points on the day could have been improved, very brief feedback for the table top discussions was held but nothing on the round the room afternoon sessions. Possibly because of this no additional questions were raised by the assembled company during the close out speeches. Some further discussion with specific examples on how the concerns/ discussion points raised fit in with the comparative assessment done to date would have been useful. While perhaps premature at this stage due to the status of the comparative assessment would it have been possible, or useful, to get a feeling from "the room" on option preference given the information presented and discussion held on the day?
- First table sessions asked what we would like to know more about, but hadn't had the presentations yet so not ready to answer this.
- More information provided or signposted in advance to save people asking questions that have been answered in the various studies or reports already done.
- Perhaps slightly more time for carousel discussions?
- Possibly consider pre-read material to enable more rapid start-up of the day.
- Better facilitation in the morning.
- Was this too late to influence Fairfield's plans for delivery of the decommissioning programme?
- Nothing - well done.

5. **If there are any stakeholders not present or who were not on the invitation list, who you think should be contacted about Dunlin Alpha decommissioning, please advise here:**

- The media - ways of informing the public and schools/colleges/ universities - informing and involving the next generation.
- TOTAL
- Were all those engaged in previous workshops here/ invited?
- OSPAR Directorate?

6. **If you have any other questions or issues not raised at today's workshop please write them here:**

- Consider onshore implications rather than solely offshore.
- I will email them to Carol [Barbone, Fairfield Energy, Stakeholder Relations].
- Can the Oil and Gas Technology Centre be of any help?
- Does the draft decommissioning report have a deadline? I hope not, as that may lead to the project being rushed.
- Big potential in exploring further the possible usage of option 9. I will be happy to provide further detail of an 'explosive project' for usage by other sectors.
- Strategy for leveraging off knowledge of supply chain.
- There was a question mark on the regulatory position on the toppling of the legs (option 7).

7. **If you would like a separate meeting with Fairfield Energy, please provide your name:**

Six requests for meetings /offers of help were put forward by stakeholders and these have been passed on to Fairfield Energy by the Resources for Change facilitation team.

8. **If you have any other comments you would like to make please write them here:**

- Thank you for the invite.
- I have specific experience of removing a gravity based structure - Maureen Alpha Platform - and would be happy to share my feedback and any lessons learned.
- Just thank you for the opportunity to contribute. It maybe starts to feel like a well-trodden path and getting 60 plus people together for a full day might not be necessary.
- Loved the virtual offshore rig tour!
- Well organised meeting and very comprehensive discussion and very open attitude to all comments. Well done.
- Thanks!
- Keen to understand how willing Fairfield are to share the previously undertaken reports.
- Professionally run. Well facilitated.
- Several other concrete gravity base structures have already been through this process, e.g. Brent, Frigg. Are Fairfield fully exploiting these experiences from other operators?
- I suggest structural health monitoring of the platform during the decommissioning process. We have novel techniques (inverse Finite Element Method technology) to predict the behaviour of the whole structure by using the discrete data collected. This will help to diagnose the structure properly. We have also novel techniques to predict the possible damages that can occur during the decommissioning process. I'll be happy to discuss for future.
- Very well run and informative/ engaging. Thank you.