

Review of the Shell/Exxon Brent
Decommissioning Derogation
Assessment and of the corresponding
proposal by UK BEIS

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About Scientia et Sagacitas Limited

Is a UK based specialist consultancy that provides guidance on oil and gas decommissioning issues such as: - Regulatory Compliance, Stakeholder Engagement, Late Life Asset management, preparing for decommissioning (both at Corporate Level (e.g. business processes) and at Individual projects level, as well as independent reviews of documentation/proposals for decommissioning works.

Scientia et Sagacitas Limited has access to over 40 years of direct practical decommissioning project experience via its owners and also operates a “virtual” technical network of decommissioning associates with multi-discipline expertise capable of resourcing every aspect of late-life management and decommissioning functional requirements. Historically the owners have worked with Clients ranging from international operators; national oil companies; ‘Tier-1’ contractors; environmental consultancies; government departments/agencies; engineering/pipeline/environmental/marine/safety consultancies and industry bodies.

ACRONYMS

BEIS	Department of Business Energy and Industrial Strategy
CA	Comparative Assessment
CGBS	Concrete Gravity Base Structure
CMSTG	Cell Management Stakeholder Task Group
FEED	Front End Engineering and Design
GBS	Gravity Base Structure
HLV	Heavy Lift Vessel
HMRC	UK Her Majesty’s Revenue & Customs
HMT	UK Her Majesty’s Treasury
IRG	Independent Review Group
LAT	Low Astronomical Tide
OiW	Oil in Water
OGA	Oil & Gas Authority
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Oslo Paris Commission
PPL	Potential Loss of Life
PPM	Parts Per Million

1 Executive Summary

This document summarises the various findings drawn from the review of numerous public domain documents relating to the Shell/Exxon Brent Decommissioning Derogation Application with a view to providing an independent assessment of completeness and compliance of the Derogation proposals with regard to the requirements and intent of the OSPAR Decision 98/3. The review analysed the documentation submitted in January 2019 by the UK government within the OSPAR consultation procedure and, additionally, the underpinning ‘support’ documentation provided by Shell/Exxon on their website. By reading the supporting documentation first, a clearer picture has been obtained as to what has or has not been done by Shell/Exxon. An independent assessment could then be made of the Decommissioning Programme/Derogation Application documents submitted by OPRED/BEIS.

Additional attention is drawn to the Independent Review Group’s Final Report document – which whilst initially appearing to support Shell/Exxon’s proposals raises several concerns that remain unresolved. These concerns are generally covered within the sections that follow.

1.1 The Current Derogation Application

The current derogation application seeks approval to leave the following structures and their contents in situ awaiting natural degradation and long-term release into the marine environment.

- Partial well conductor and well tubing strings inside Brent Bravo, Brent Delta drilling legs; Brent Charlie lower concrete caisson cells; and, Brent Alpha jacket footings
- Brent Alpha Jacket footings
- Brent Bravo and Delta Concrete Gravity Base Structures
- Brent Charlie Concrete Gravity Base Structure
- All oil contaminated water inventories within the Concrete Gravity Base Structures
- All oil contaminated sediments within the Concrete Gravity Base Structures
- All drill cutting piles.

The ongoing management and monitoring of any residual structures/materials is loosely defined with few specific commitments being made and no defined timetable or indicative work scopes.

Several of the key recommendations are ‘supported’ by the use of a Comparative Assessment process which identifies the ‘preferred option’. The Shell/Exxon CA process used is heavily based upon the Documented CA process outlined in the BEIS Guideline. (*BEIS Guidance Notes, Decommissioning of Offshore Oil and Gas Installations and Pipelines, Nov 2018*)

1.2 Review Findings

The review of the inventory of Technical Documents issued by Shell/Exxon to OSPAR Signatories and into the Public Domain for consultation, highlights that in some areas Shell/Exxon should be commended for their work.

- The development of a sonar mapping tool to allow volumes of sediments to be mapped is of a high quality and indicative of the technological advances to overcome problems that the Oil & Gas Industry can deliver when there is the will to do so.
- The works that Shell/Exxon have conducted to address the management of the Concrete Gravity Base Structures are considered to represent the best CGBS removal works executed to date and should be used as a benchmark for other CGBS decommissioning proposals to meet or surpass in the future.

The works done have been executed by specialist, experienced Concrete Gravity Base Structure designers/installers and risk assessment specialists, and clearly demonstrate the risks involved in attempting to either refloat the structures or demolish them in situ. As such, the proposal to derogate the CGBS lower caissons is supported and it is recommended that no objections be raised to the proposal to leave the CGBS lower caissons in situ.

Based upon the above there are no unresolvable additional actions required to address any remaining concerns related to the CGBS lower caisson proposals for the structures to be left in situ. This recommendation does not however currently include the following components of the derogation application:

- Well conductors left inside the Brent Bravo and Delta drilling legs
- The management of the CGBSs legs
- The management of the CGBSs Storage, Tri Cell and Mini Cell contents

The above being said, however, there are several major issues that still require resolution to ensure compliance with OSPAR Decision 98/3 requirements. The Independent Review Group (IRG) Final Report also highlights a number of these issues and the authors regard it concerning that BEIS OPRED do not appear to have asked the applicant for some of the identified major issues to be resolved. The reason for this situation is unclear – but it is likely that the sheer volume of documentation issued to be reviewed may have been a contributing factor. The bullet points that follow are identified as the primary issues of concern:

1.2.1 Approach to the Decommissioning Project

- The desire to submit a singular Decommissioning Programme and Derogation Application for all four platforms has clearly caused problems throughout the project lifespan, as it placed a drive to produce answers to very complex issues as soon as possible, when obtaining adequate data was nearly impossible to achieve (e.g. cell sampling operations on live producing platforms with pressurised environments).
- This approach also prevents the project from considering how things may mature as experiences are gained over time and ensuring that ‘Best Available Technology’ has always been applied. The Brent project is somewhat exceptional in that the field is being shut down in a phased manner over some 20 years. Accordingly, assessments made on issues such as Cell Content Management for Brent Delta may be superseded by the time Brent Charlie is to be decommissioned.
- Shell/Exxon seem to have adopted a ‘Field Development’ methodology and approach towards the issues that is inappropriate for a decommissioning project. This has resulted in issues, such as applying ‘averages’ of sample results to engineering works etc., which is inappropriate and results in too many uncertain factors that have not been resolved.
- A better and more pragmatic approach of splitting issues into separate submissions (e.g. Wells/Topsides/ ‘Clean CGBS’ submission and later CGBS Cell Contents submission when better cell contents data sets are available) would have been fitter for purpose and should be considered for future CGBS decommissioning projects.

1.2.2 Comparative Assessment Process/Decision Making

Primarily based upon Comparative Assessment Process - BDE-F-GEN-QA-6003-00007

(See Section 8.1 to 8.6 Pages 35-39 of this document for more details)

- A review of the Shell/Exxon Brent Decommissioning Project decision-making process has shown that the base Comparative Assessment (CA) process is heavily derived from the BEIS Guideline CA process which is fundamentally flawed and introduces a high level of mathematical bias towards any considered option that has minimal offshore decommissioning works scope. In effect, with the result that ‘Leave in Situ’ will invariably be the CA ‘Preferred Option’.
- Both the BEIS and Shell/Exxon Brent CA processes are thus structured to produce results that are diametrically opposed to OSPAR Decision 98/3’s presumption of full removal. They should not therefore be considered ‘Fit for Purpose’.
- The quality of base data feeding into the CA process is critical – as shown in the diagram that follows.

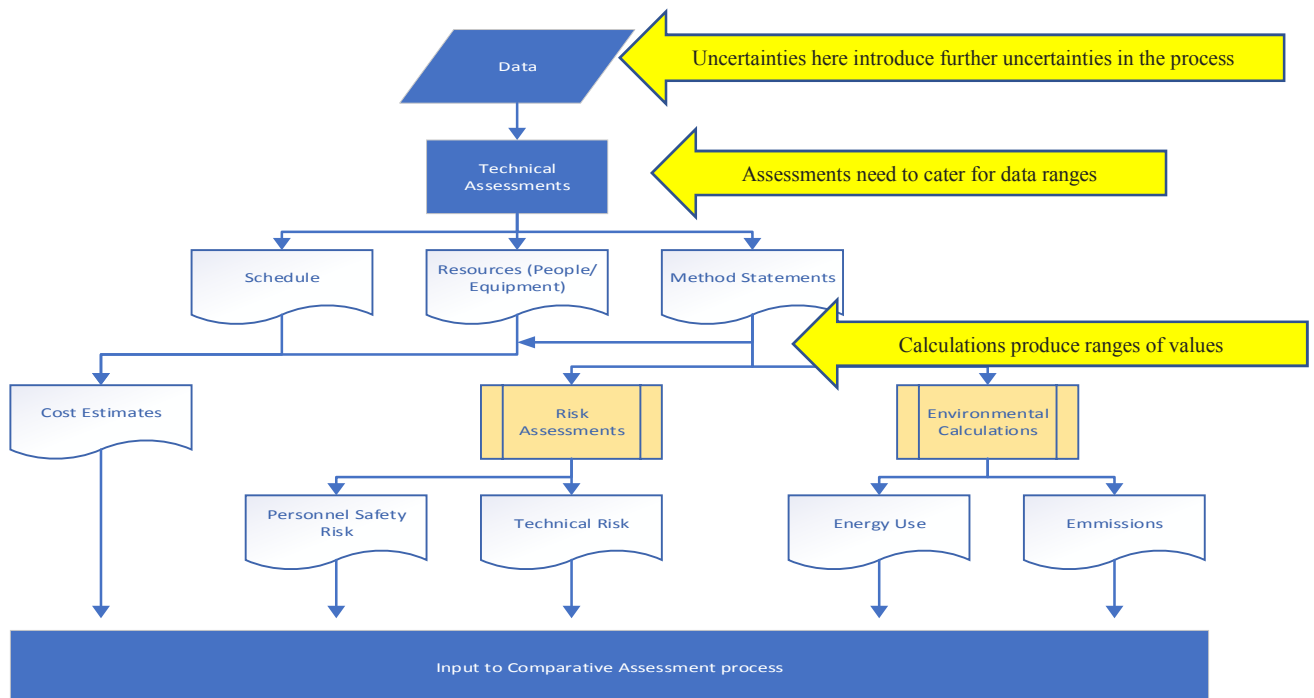


Figure 1 How Quality of Data Impacts any CA process.

- Where poor data exists and is coupled with ‘immature’ technical studies (AACE Feasibility/Conceptual or Class 5/4 as shown in Fig 2 following) there should be recognition that significant uncertainties will exist. These will produce ‘ranges’ of costs, schedules, risk levels etc. that should be incorporated into any CA process evaluation. This is a requirement of OSPAR Decision 98/3 Annexe 2 Section 10.
- These uncertainties should be addressed by introducing ranges into the CA process, or even new CA exercises for different scenarios, which Shell/Exxon have clearly failed so to do in all cases. As such the current works are considered non-compliant with OPSAR Decision 98/3 requirements, and there remains a distinct possibility that the ‘preferred options’ are inaccurately identified especially when the difference between options is scored as minimal.

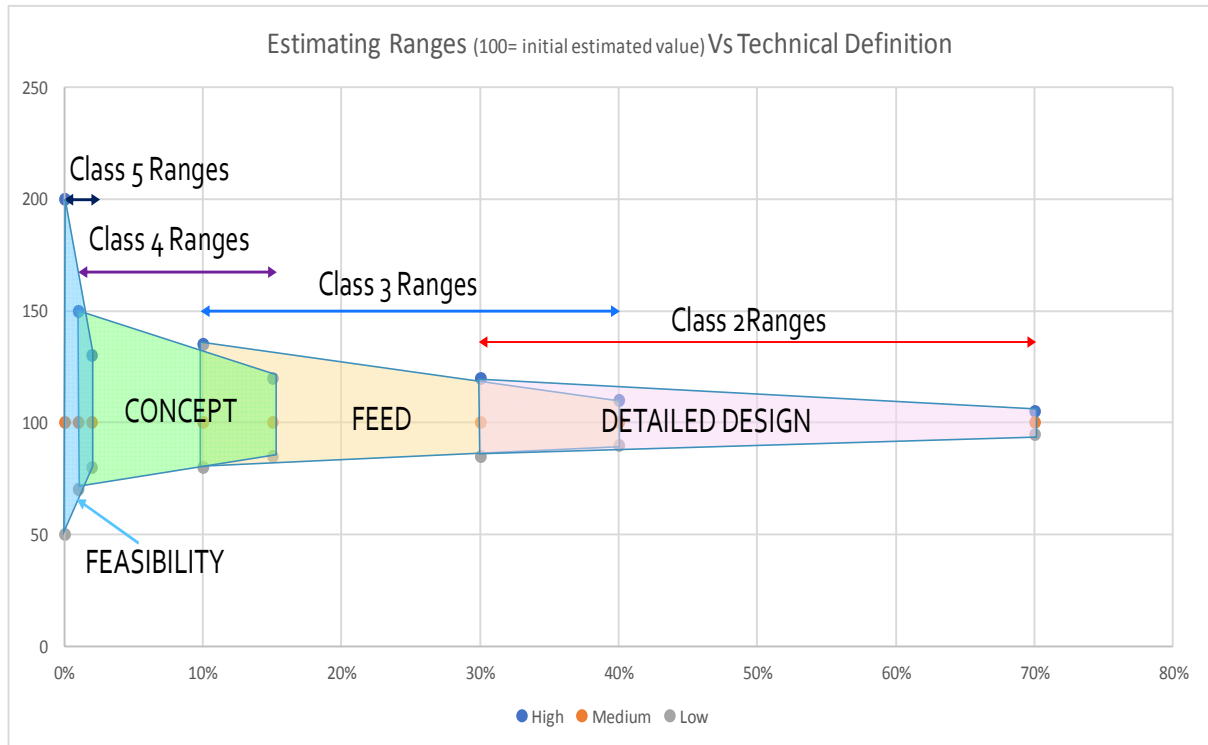


Figure 2 Indication of Range Overlap due to 'maturity' of studies

- Owing to the long-term timeframes on issues such as CGBS cell contents release into the environment (circa 250 -1000 years in the future) the CA process cannot realistically be used, as inputs relating to long-term risk, environmental impacts etc. are not considered quantifiable thus introducing significant uncertainty bands.
- Shell/Exxon established a Cell Management Stakeholder Task Group (CMSTG) (see Brent Cell Contents TD - BDE-F-GBS-BA-5801-00002), which offered external Stakeholders the chance to review, amend the CA process criteria, and apply different weightings for the CGBS Storage Cell Contents issue. This can be considered the first such 'fully inclusive' CA process in the UK Oil & Gas Industry, and as such should be commended.
- Its output is significantly different to the 'standard' BEIS or Shell/Exxon CA criteria and weightings – and produced different results to Shell/Exxon's Derogation proposal. The 'Leave in Situ' option was the lowest ranked option in the CMSTG CA process.
- Shell/Exxon unfortunately appear to have ignored these works and applied their own CA process to come up with different results, with 'Leave in Situ' being the 'preferred option'.
- The Shell/Exxon final decision making appears to have introduced further elements for consideration such as Reputation and Business Drivers – but their decision-making process is opaque to external Stakeholders, with some decisions appearing 'inconsistent' (e.g. CGBS Storage Cell Attic Oil removal decision, versus 'Leave in Situ' proposal for Storage Cell Storage Cell oil contaminated water and sediment inventories.)

1.2.3 Technical Report Issues

(See Sections 8.6 & 8.8 Pages 39 & 40/41 of this document for more details)

- The volume of information supplied by Shell/Exxon into the public domain for consultation (circa 3120 pages in total) and the extended review period (60 days) is considered unduly onerous on both Stakeholders and Regulators and is considered likely to have resulted in scant

review and therefore limited challenges being made by interested parties including BEIS OPRED.

- The above, when coupled with the CMSTG issues earlier discussed, brings into question the validity/value of the Stakeholder engagement process and its relevance to decision-making.
- ‘The Decommissioning Programme’ (see Brent Field Decommissioning Programmes - BDE-F-GEN-AA-5880-00015) and supporting documents are now 2 years old – as such they will not reflect the latest state of the project, nor possibly its knowledge.
- Of more concern is the fact that several of the key referenced supporting documents are now some 8-10 years old, (see page 291 Brent Cell Contents TD - BDE-F-GBS-BA-5801-00002), with few signs of Shell/Exxon having progressed them or the technologies therein deployed in the interim.
- Some 430 studies (page 10 Shell E-News Nov 2011) have been commissioned by Shell/Exxon for the project but there is no way by which Stakeholders can easily access the vast majority of them. Even the IRG only reviewed 300 reports (IRG Final Report) but it is noted that a further reduction in ‘used studies’ to some 150 are referenced within the Shell/Exxon public domain issued information.

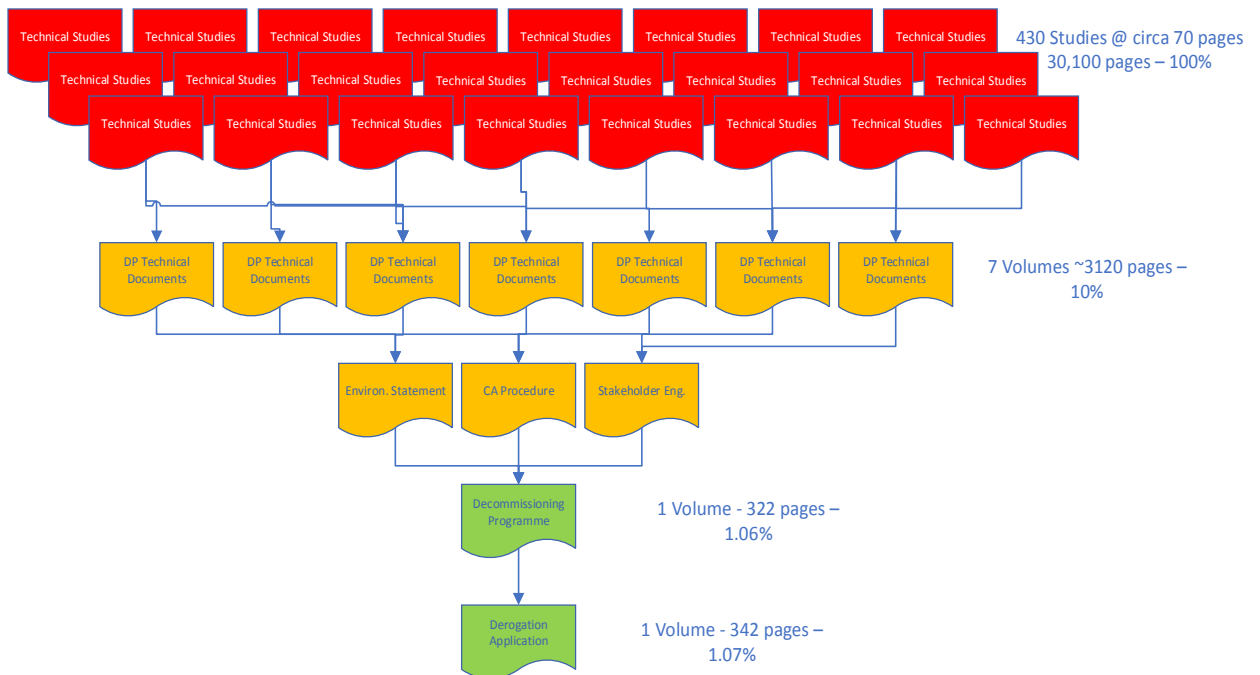


Figure 3 Documentation Layering for Shell Brent Decommissioning

- This reduction in available information hinders the ability of Stakeholders to ensure that Shell/Exxon have not been ‘selective’ in the choice of information used to support their proposals and reassured that studies with contrary conclusions or concepts have been purportedly sidelined .

1.2.4 Brent Alpha Jacket Footings

Primarily based upon Brent Alpha Jacket Technical Document - BDE-A-JKT-BA-5801-00001
 (See Section 3.2 Page 21 of this document for more details)

- Shell/Exxon indicate that the Brent Alpha Jacket Footings could be removed at an estimated cost of £60 million. However, the derogation recommendation is clearly supported using the biased CA process.

- Drill cuttings around the footings would be disturbed if the footings were removed – but the level of disturbance could be minimised by use of internal leg cuttings tools, that would need development.

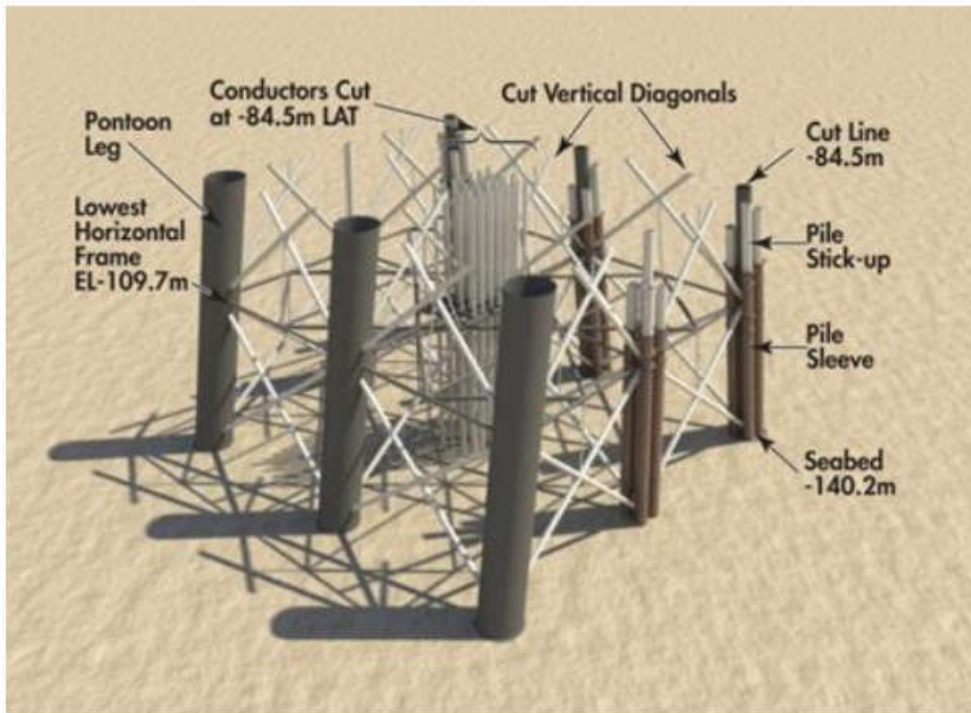


Figure 4 Brent Alpha Derogated Footings Proposal (from Shell Brent Alpha Jacket Technical Document BDE-A-JKT-BA-5801-00001 Page 39)

- Shell/Exxon have not unambiguously discounted the technical feasibility of footings removal
- Recent statements by BEIS at the Decommissioning Conference, St Andrews, Nov 2017 (see <https://www.energyvoice.com/oilandgas/decom/157503/decom-conference-ospar-decommissioning-rules-right-place-oguk-says/>) appear to indicate a policy of relaxation of the method of calculating ‘jacket weights’, potentially increasing the number of steel jacket derogation applications in the UKCS from 33 to 50. This re-interpretation of the OSPAR Decision 98/3 is contrary to the spirit and intent of OSPAR objectives and should be challenged.
- Shell/Exxon have applied this new methodology – but in the case of this steel jacket, it does not have any impact on the classification of the jacket as a ‘Derogation Candidate’ owing to its original installation weight.
- Some 20 years after the OSPAR Decision 98/3 the drive to develop technology for footings removal still does not appear to have evolved, which is of concern. The above ‘relaxation’ by BEIS will further erode the oilfield service sector’s business case for developing tools to make jacket footings removal a more attractive proposition. This lack of incentive to deliver the OSPAR Decision 98/3 objectives by BEIS and the Industry should be challenged, with consideration being given to the introduction of a US Government Bureau of Safety and Environmental Enforcement style ‘Idle Iron’ (see Appendix A) type of time limit (e.g. no more jacket derogation approvals post 2025, and an expectation for currently derogated jacket footings to be removed by 2030)

1.2.5 Concrete Gravity Base Structure Storage Cell Sampling

Primarily based upon Brent Cell Contents Technical Document - BDE-F-GBS-BA-5801-00002

(See Section 6 Pages 28- 31 of this document for more details)

- The quality of the base data used impacts all subsequent engineering and environmental analysis works throughout the project, as shown in section 1.2.2. The base data made available as a result of sampling operations is very limited in both quantity and quality.
- Owing to poor Asset Stewardship, Shell/Exxon's records of production inputs to the cells have been poorly maintained thus restricting the available data sets to 'the last ten years or so' (page 46, Shell Brent GBS Content Technical Document -BDE-F-GBS-BA-5801-00002). This fact increases the significance of actual, contemporary physical mapping and sampling data sets
- Cell sampling/mapping operations were severely constrained by Shell/Exxon's decision to sample on 'operational' platforms. As such, cell sampling operations were extremely limited and produced small sample volumes (6 kg of sediments and 10 litres of water) from only 3 out of 42 oil storage cells (N.B. there are some estimated ~72,000 tonnes of sediments and 638,000 m³ of oily water in situ according to Shell/Exxon.)
- There are unresolved concerns that the cell sampling operations may have produced contaminated samples, thus further invalidating sample analysis results and casting doubt on subsequent works applying this data set.
- The above shortfall in empirical data has led to numerous assumptions and assertions in subsequent activities like - engineering works; CA exercises; and, environmental impact assessments, rather than fact-based data being used.
- Brent Bravo and Brent Charlie Storage Cell inventories are 'assumed' with no factual evidence to support the assumptions. Brent Delta inventories are 'extrapolated' from 3 poor cell sample results across the remaining 13 cells. The Brent Delta results were then further unjustifiably extrapolated across the other CGBS storage Cells on Brent Bravo and Charlie. Even Shell/Exxon indicate this is a concern in their documentation but then appear to ignore the implications.
- Without a proper assessment of the volumes and nature of the materials inventory in the storage cells it is not possible to identify, with confidence, the necessary works to recover/remove inventories. For example, Interphase material volumes have not been mapped, so there can be no confidence in any estimates of what removal operations will really be required. As such, there are concerns about the use of indicative/assumed data in the CA process, thus introducing significant levels of uncertainty into the process with accompanying bias into scoring exercises and ultimately the 'preferred options'.

1.2.6 Concrete Gravity Base Structure Storage Cell Contents Management

Primarily based upon Brent Cell Contents Technical Document - BDE-F-GBS-BA-5801-00002

(See Section 7 Page 32-33 of this document for more details)

- There appears to be confusion with respect to the waste classification of the CGBS storage cell inventories, with indications that at least 3 differing sets of Regulations (OSPAR Decision 98/3, London Protocol and Offshore Oil & Gas production operations discharge regulations) appear to have been 'selectively' applied to the Attic oil/Interphase materials, water and sediment inventories (which are shown in the diagram below). The issue of CGBS storage cell contents classification is an area that requires urgent clarification.

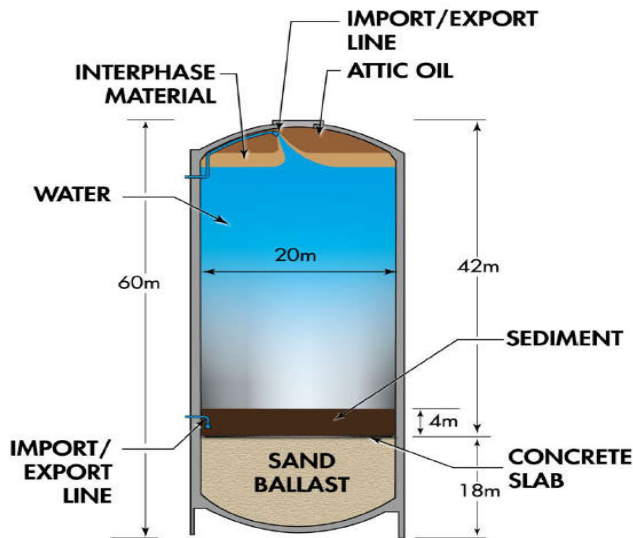


Figure 5 CGBS Storage Cell Diagram (from Shell Brent GBS Contents Technical Document BDE-F-GBS-BA-5801-00002 Page 28)

- The application of the CA process to CGBS Storage, Tri and Mini Cell contents is not clearly justified and appears to be based upon separate discussions with BEIS. It is not clear that the OSPAR Decision 98/3 can be applied to them under the ‘other substances contained within them’ phrase from the OSPAR Decision 98/3 (Annexe 2 3a)), nor that the CA process used is appropriate for the issue under consideration. This approach requires discussion, clarification and agreement within the OSPAR Commission before it can be accepted as appropriate.
- The adoption of ‘conceptual’ cell contents removal studies means that there are significant ranges in estimated values (safety, technical feasibility, costs, schedules etc.) that should have been incorporated into their Comparative Assessment (CA) Process evaluations as uncertainty bands, but they have not been. This is a failure to comply with OSPAR Decision 98/3, Annex 2, requirement 10
- Comparative Assessment supporting technical studies are noted as having been completed some 8 - 10 years ago, with no evidence of updating prior to the submission of the derogation application in 2018. Meaning that the use of ‘Best Available Technology’ is not being applied. This is non-compliant with OSPAR Article 2(3) that requires ‘Contracting Parties to take full account of the latest technological developments and practices when adopting programmes and measures and to this end requires Contracting Parties to define with respect to programmes and measures the application of best available techniques (BAT) and best environmental practice (BEP), including, where appropriate, clean technology;
- The above technical works were restricted in scope and capability to produce robust conclusions due to a chronic lack of data relating to the volume, nature and physical properties of the storage cell inventories (i.e. cell sampling had not been done at the time of study). Insufficient post sample updating works have been conducted since 2011.
- The environmental impact assessments for cell content release are all based upon releases occurring into ‘today’s environment’, totally ignoring the fact that these releases will most likely occur in some 250 -1000 years’ time, so there is considerable uncertainty about the validity of any of the impact assessments provided. There is furthermore no sign of the ‘Precautionary Principle’ being applied to this issue.
- None of the studies have indicated that removal of the entire storage cell inventories is technically infeasible.

- With the appropriate engineering and risk mitigation works we consider that safe and full recovery of the cell contents is a technically viable solution, until physically proven otherwise.

1.2.7 Concrete Gravity Base Structure Storage GBS legs

Primarily based upon Shell Brent Gravity Base Structure Technical Document - BDE-F-GBS-BA-5801-00001

(See Section 4.2 Pages 24-26 of this document for more details)

- The use of the biased CA process negates the proposal to leave the CGBS legs upright as the ‘preferred option’.
- The leaving of well conductor sections in the Brent Bravo and Brent Delta drilling legs potentially increases the probability of ‘partial leg collapse’ occurring in the future. Partial collapse could increase risks to other users of the sea by creation of a shallow draft submerged, non-visible obstruction and would increase risks to any personnel involved in removing this marine hazard. It is noted that increased marine traffic would exacerbate this issue. This issue is not adequately addressed in Shell/Exxon proposals.
- The early removal of the Brent Delta topsides appears to have prejudiced the Brent Delta CGBS legs ‘up/down decision’ by adding complex extra works into any potential CGBS cutting down operations, despite earlier misleading assurances they would not. This issue should be addressed at OSPAR Commission level.
- The IRG has expressed serious concerns about the long-term management of any CGBS legs that were left up penetrating the sea surface, e.g.
 - their inevitable collapse in time,
 - the potential for partial collapse,
 - the ability to effect significant remedial works on a degraded structure and
 - the total inability to realistically predict the ongoing risks to other users of the sea and any Remedial Project crews

Note: These concerns remain unanswered.

- The removal of the option of ‘placement of cut down legs on the seabed’ due to BEIS ‘Toppling’ guidance should be challenged.

1.2.8 Partial Removal of Well Conductors

Primarily based upon Brent Topsides Technical Document - BDE-F-GBS-BA-5801-00002 and Brent Gravity Base Structure Technical Document - BDE-F-GBS-BA-5801-00001

(See Sections 3.3 & 4.1 Page 21-22 & 23-24 of this document for more details)

- Conductors are not an integral part of the substructure, nor are they so integrated that they cannot be removed, and so are not covered by OSPAR Decision 98/3 definition of footings.
- There is no justification provided for leaving these materials in situ in any of the Shell/Exxon issued documentation.
- The leaving of well conductors in situ inside the Brent Bravo and Delta drilling legs will make any CGBS leg cutting more complex and so could be considered as ‘prejudicing’/‘pre-empting’ a derogation decision with CGBS legs upright before the derogation decision is made.
- Despite assurances from BEIS, the early removal of the Brent Delta topsides has prejudiced a derogation decision relating to the CGBS legs as the removal of the left in situ well conductors prior to leg cutting activities is now a significantly more complex operation than it would have been had the conductors been recovered whilst the drilling derrick was operational.

- There is no demonstration of the collapse timings of these partial conductor sections to show that they will fail and collapse before the main CGBS leg sections/Brent Alpha jacket sections and so will not form an additional snagging hazard to fishermen.
- There does not appear to have been any substantial assessment of the additional disturbances of the cuttings pile that will be created when each individual well conductor section collapses – these additional impacts will incrementally increase the amount of disturbance of the pile in the future.

1.2.9 Drill Cuttings

Primarily based upon Brent Drill Cuttings Technical Document BDE-F-SUB-BA-5801-00001
(See Sections 3.1 and 5 Page 20 and 26 respectively of this document for more details)

- Drill Cutting samples have not been taken from underneath the platforms (*page 32 IRG Final Report*) with samples being primarily some 50+m from the platforms - which implies that samples taken from the drill cuttings piles do not appear to have been taken applying the Best Available Technology, nor commensurate with comparable sampling by other Operators.
- Samples have only been retrieved from the shallow sediment layers. (*IRG Final Report Page 32*). The shallow sampling results in any analysis being obtained thus does not justify extrapolation across the whole cutting piles. It is highly likely that samples from deeper within the piles will show more signs of contamination with the older hydrocarbon-based drilling fluids/chemicals originally used residing in the lower levels of the cuttings piles.
- The long-term prognosis for the cuttings piles is that they will not remain undisturbed as, some 250+ years into the future, sections of any derogated footings, CGBS legs and ‘left in situ’ well conductor strings will collapse into the pile and disturb it/resuspend it in the water column. Without deep samples from within the pile it is not possible to assess the level of potential contamination from these future disturbances.
- There is an inability to accurately model future contaminant release environmental impacts as the future condition of the receiving environment cannot be predicted. It is thus not possible to accurately assess the environmental impact of disturbance to establish that the environmental impacts will be minimal. The IRG raised this issue, but it appears to have been ignored by the applicant. Given this situation it is unclear why the ‘precautionary principle’ is not being applied.
- Out of date software – the software used for drill cuttings/cell contents dispersion modelling/analysis was not designed for the purpose to which it has been put and has not been developed or improved for over 12 years.

1.3 Summary Assessment of the Shell/Exxon Proposal

The following table indicates the overall assessment of the Shell/Exxon Brent Decommissioning Derogation Proposal – colour-coded as follows:

Green = Acceptable proposal based on information supplied with Decommissioning Programme Technical Documents

Orange = Currently not considered OSPAR Decision 98/3 compliant. Proposal needs more works to fully justify the position taken and ensure OSPAR Decision 98/3 compliance.

Red = Currently not considered OSPAR Decision 98/3 compliant. Proposal needs major works to justify the position taken and ensure OSPAR Decision 98/3 compliance.

N/A = Not Applicable

As can be seen there are significant issues to be resolved prior to potential acceptance.

Issue	Brent Alpha	Brent Delta	Brent Bravo	Brent Charlie	Comments
Wells Plugging and Abandonment	All wells plugged and Abandoned	All wells plugged and Abandoned	All wells plugged and Abandoned	All wells plugged and Abandoned	Ongoing monitoring of wells for leaks requires more clarity and a stated methodology and resource implications
Wells Conductors	Partial Removal	Leave in Situ	Leave in Situ	Partial Removal	No justification provided for Leave in Situ proposal.
Drill Cuttings Management	Leave in Situ	Leave in Situ	Leave in Situ	Leave in Situ	No Deep Samples, no use of Best Available Technology, no consideration of long-term disturbance, which will occur as degrading structures collapse. No application of 'Precautionary Principle'
Topsides	Recover to Shore for Disposal	Recover to Shore for Disposal	Recover to Shore for Disposal	Recover to Shore for Disposal	Early Topsides removal implications on well conductor removal/CGBS leg cutting operations and CGBS leg collapse issues require more clarification
Steel Jacket Footings Proposal	Leave in Situ	N/A	N/A	N/A	Biased CA process used to justify Leave in Situ. Shell/Exxon indicate can be removed for ~ £60million. Review of contemporary cutting techniques required.
CGBS Lower Caisson Management Proposal	N/A	Leave in Situ	Leave in Situ	Leave in Situ	Thorough Removal assessments. Probably best quality CGBS removal works to date in the Industry
CGBS Legs Management Proposal	N/A	Leave Upright to collapse in long-term	Leave Upright to collapse in long-term	Leave Upright to collapse in long-term	Left in Situ conductors introduce bias against cut down, for Bravo & Delta legs. Long term management risks not addressed properly, reconsideration of 'placement on seabed' option required.
CGBS Tri Cell Inventory proposal	N/A	Leave in Situ	Leave in Situ	N/A	Waste Classification of Inventory unclear. Regulations applicable to inventory unclear. Biased CA process used to support decision.
CGBS Mini Cell Inventory Proposal	N/A	Leave in Situ	Leave in Situ	N/A	Waste Classification of Inventory unclear. Regulations applicable to inventory unclear. Biased CA process used to support decision.
CGBS Attic Oil Management Proposal	N/A	Full Removal	Full Removal	Full Removal	Lack of justification for removing these fluids but not others from storage cells. Volumes may be underestimated due to lack of mapping/sampling in cells.
CGBS Interphase Materials proposal	N/A	Full Removal	Full Removal	Full Removal	Lack of justification for removing these fluids but not others from storage cells. No volumes estimated or mapped. Physical composition unspecified. Potential major cell contents recovery operational risk
CGBS Storage Produced /Oil contaminated Water Inventory Proposal	N/A	Leave in Situ	Leave in Situ	Leave in Situ	Waste Classification of Produced/oil Contaminated Water unclear. Regulations applicable to inventory unclear. Stated by Shell/Exxon as not covered by OSPAR 98/3 Decision. Use of 'average' sample results unacceptable. Implausible Environmental Impact assessments provided due to long term future release scenarios – unclear why the 'precautionary principle' is not being applied. Wide range of limited sample results undermine assumptions made. Full removal should be considered as viable option. Brent Charlie inventory uncertainties are unacceptably high. CMSTG works appear to be ignored. Biased CA process used to support decision. No account taken of timeframe to develop better removal techniques and post-production operational conditions.
CGBS Storage Sediments Inventory Proposal	N/A	Leave in Situ	Leave in Situ	Leave in Situ	Waste Classification of Sediments unclear. Regulations applicable to Inventory unclear. Stated by Shell/Exxon as not covered by OSPAR 98/3 Decision. Use of 'average' sample results unacceptable. Implausible Environmental Impact assessments provided due to long term future release scenarios – unclear why the 'precautionary principle' is not being applied. Wide range of sample results undermine assumptions made. Full removal should be considered as viable option. Brent Charlie inventory uncertainties unacceptably high. CMSTG works appear to be ignored. Biased CA process used to support decision. No account taken of timeframe to develop better removal techniques and post-production operational conditions
Ongoing Monitoring Proposal	Poorly defined	Poorly defined	Poorly defined	Poorly defined	Lack of clarity about how long-term issues will be properly managed. Unjustifiable Shell/Exxon commitments about activities some 250+ years in the future. Monitoring requirements will increase as structures degrade hundreds of years in the future. No legacy planning.
Remedial Works in the future	Inadequate Definition	Inadequate Definition	Inadequate Definition	Inadequate Definition	Lack of clarity about how long-term issues will be properly managed. Unjustifiable Shell/Exxon commitments about activities some 250+ years in the future. Chance of remedial works will increase as structures degrade hundreds of years in the future. No legacy planning.
Liability Management	Inadequate Definition	Inadequate Definition	Inadequate Definition	Inadequate Definition	Lack of clarity about how long-term issues will be properly managed. Unjustifiable Shell/Exxon commitments about activities some 250+ years in the future. Liabilities may increase as structures degrade hundreds of years in the future. No legacy planning.

2 Introduction

2.1 The Brent Field

The Brent field is iconic in the industry, as one of the oldest and largest fields in the North Sea. The field is operated by Shell with Exxon and Shell as 50% equity holders in the Asset and so jointly and severally liable through Section 29 Notices for decommissioning operations, as well as the management of any ongoing liabilities. Shell as Operator has assumed the role of the public face for the Decommissioning works, but Exxon by necessity is heavily engaged throughout the project management/decision making processes. As such the term “Shell/Exxon” is used throughout this document.

The diagram below shows the complexity of the field and its infrastructure.

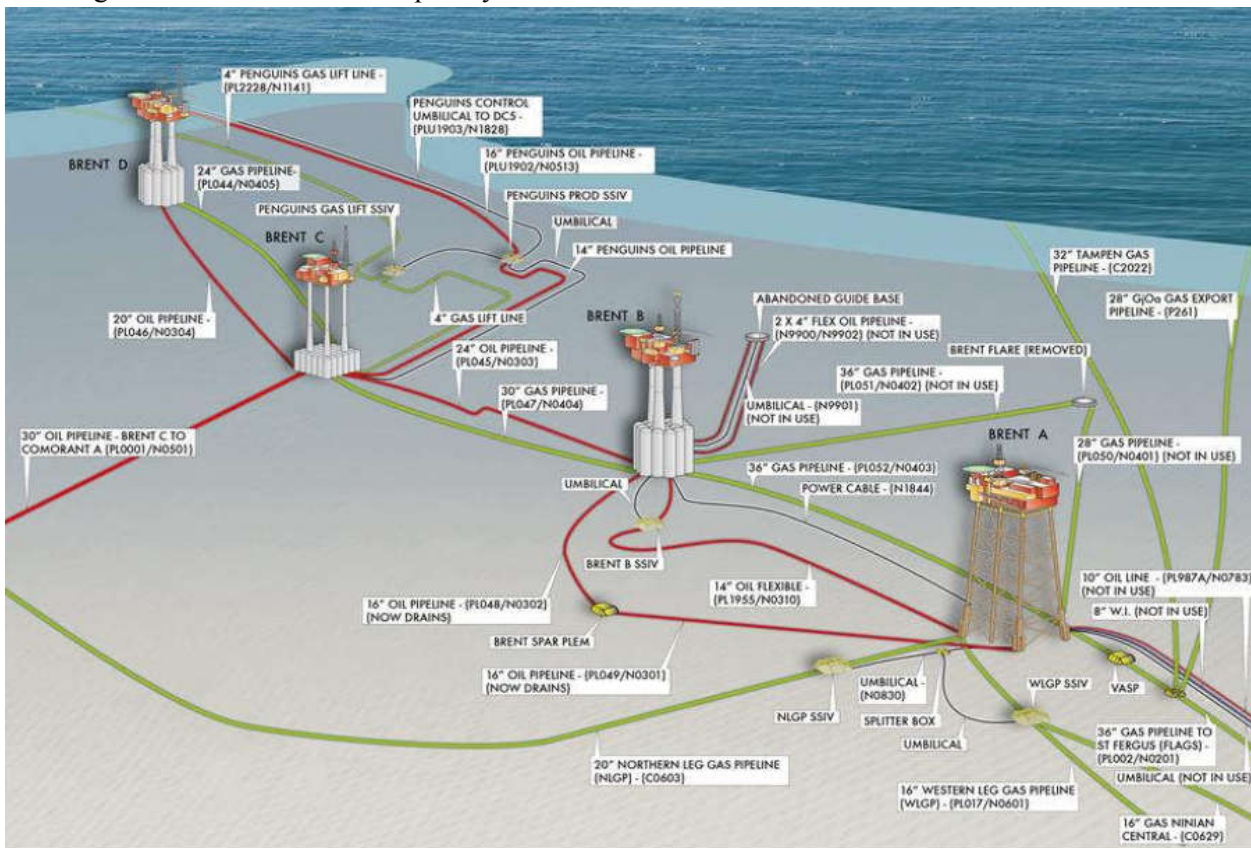


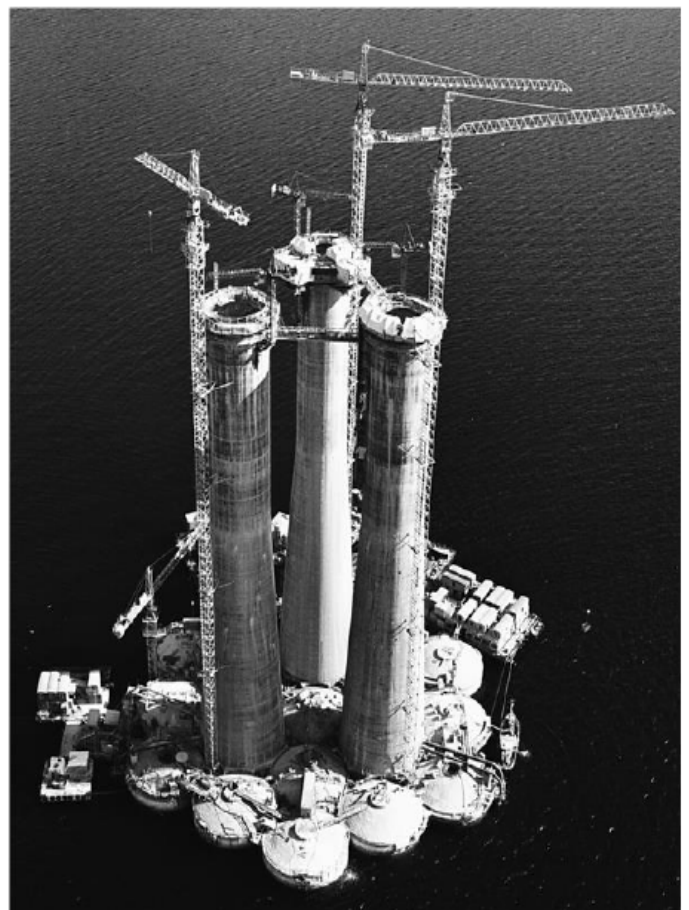
Figure 6 Brent Field Layout & Infrastructure (cover page Brent Decommissioning Programmes Document Shell Report Number BDE-F-GEN-AA-5880-00015)

The pictures that follow show the Brent Alpha jacket and the two types of CGBS substructures (ConDeep and Sea Tank) illustrating comparative size and scale. During construction, all the substructures were floated into position and ballasted down. Brent Alpha was secured to the sea floor by large steel piles, whilst the CGBSs ‘self-secure’ into the seabed by a combination of their own weight, ballast materials, suction below the CGBS base, and injected grout (cement) between seabed and CGBS base.

Review of the Shell Brent Decommissioning Derogation Assessment and of the corresponding proposal by UK BEIS



Figure 7 Brent Alpha Jacket at Load Out for Installation (from Shell Brent Alpha Jacket TD - BDE-A-JKT-BA-5801-00001)



On the CGBS platforms, the oil storage cells are at the bottom of the structure – and thus their “rooftops” are located some 80m below sea level.

The information following has been extracted from the Shell Brent Environmental Statement document and summarises the Brent field installations material weights.

Review of the Shell Brent Decommissioning Derogation Assessment and of the corresponding proposal by UK BEIS

Brent Alpha platform (topsides, jacket and conductors)	47,453 tonnes
Brent Bravo Topsides and CGBS	364,817 tonnes
Brent Charlie Topsides and CGBS	327,880 tonnes
Brent Delta CGBS	325,418 tonnes
Drill Cuttings around platforms	68,700 tonnes
Approx. 600 tonnes of seabed debris	
28 Pipelines, approximately 103km in length, comprising approximately 25,159 tonnes of steel, 21,896 tonnes of concrete and 16,000 tonnes of rock dump.	
4 Structures weighing approximately	467 tonnes
Approx. 489 Concrete Mattresses weighing approximately	1762 tonnes
Approx. 4156 grout bags weighing	104 tonnes

It is noted that additional inventories to those associated with the above substructures themselves have been included within the Derogation application such as CGBS Storage Cell Contents, CGBS Mini and Tri cell Inventories and a significant number of well conductor/casing strings.

2.2 Brent Field Status

The Shell/Exxon Brent field currently is in a state of partial shutdown. Brent Alpha (Steel Jacket Platform) and Brent Bravo (ConDeep) are currently in the early stages of decommissioning with wells being plugged and abandoned, and topsides being prepared for removal. Brent Delta has had wells plugged and abandoned, and topsides removed although it is noted that long sections of well conductors have been left inside the drilling legs rather than removed during plugging and abandonment activities. Brent Charlie (Sea Tank) remains in operation/production with the Cessation of Production date currently not specified in the Shell/Exxon Brent Decommissioning Programme documentation.

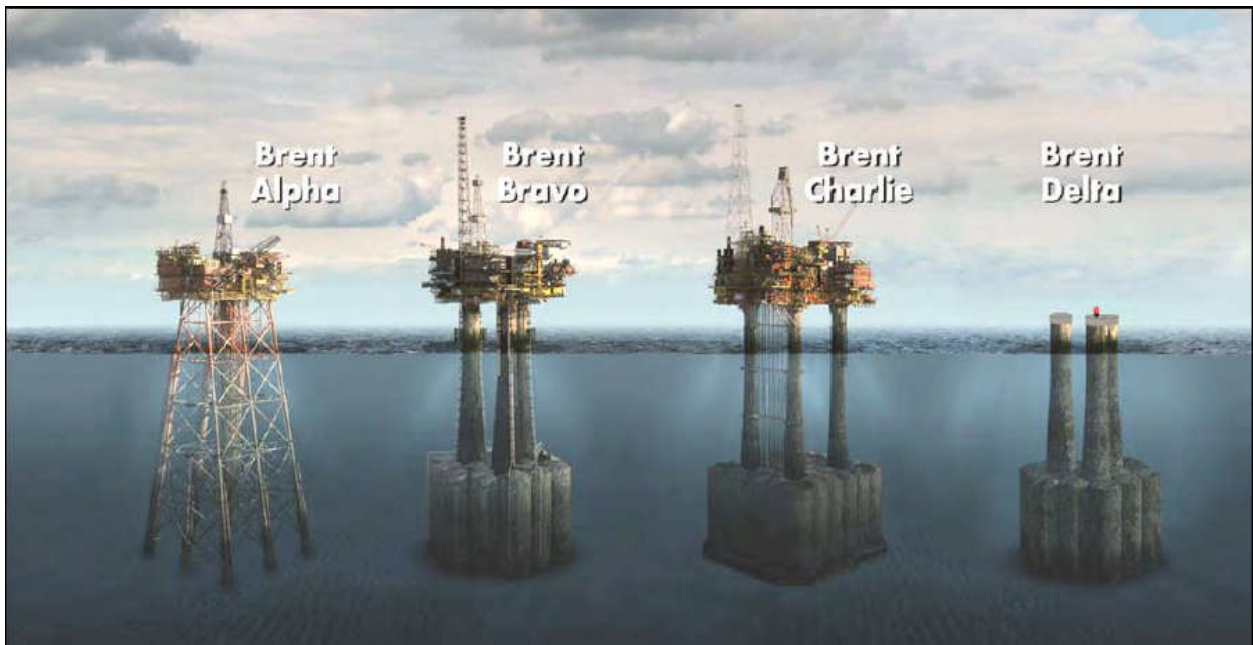


Figure 9 Brent Field Platforms – Current Condition. (from Shell E-news Jan 2019)

2.3 Shell/Exxon Brent Derogation Application

The current OSPAR Derogation Application relates to the three Concrete Gravity Base Structures (Brent Bravo & Delta (ConDeeps) and Brent Charlie (Sea Tank)) and the large Steel Jacket Footings (Brent Alpha). Approval of this Derogation Application as proposed will result in the following

Review of the Shell Brent Decommissioning Derogation Assessment and of the corresponding proposal by UK BEIS

inventories remaining in the sea at the end of decommissioning operations (extracted from Shell Environmental Statement Document No: BDE-F-GEN-HE-0702-00006): -

Brent Field Facility	Approximate quantities of materials left in the sea
Brent A jacket footings	9,700 tonnes steel
	4,700 tonnes grout
	850 tonnes marine growth
	160 tonnes anodes
Three GBS	583,500 tonnes concrete
	251,000 tonnes sand ballast
	34,000 tonnes steel
	20,500 tonnes grout
Contents of GBS drilling legs and minicell annulus	8,580 m ³
GBS cell contents	638,500 m ³ cell water
	40,595 m ³ cell sediment
Seabed drill cuttings	20,918 m ³
Cell top drill cuttings	13,412 m ³
Tri-cell drill cuttings	26,800 m ³ (maximum estimate)
Pipelines left in place (mostly trenched, some rock dump)	47,392 tonnes of pipelines (steel, concrete, protective coating and concrete mattresses)
Rock dump added	149,000 t rock dump during decommissioning (plus existing Brent Field rock dump footprint of approximately 10,000 m ²)

Figure 10 Materials Data (from Shell Brent Environmental Statement Document Table 18-1 - BDE-F-GEN-HE-0702-00006)

which includes the following estimated hydrocarbon inventories: -

	Volume (m ³)	Hydrocarbon load (t)
Cell contents	39,408 (sediment)	11,228*
Tri-cell drill cuttings***	26,772	4,926**
Drilling leg waste material	4,000	46
Minicell annulus material	500	20

*includes 266 t of oil contained within cell water

**based on maximum concentration

***The seabed and cell top drill cuttings (if left *in situ*) will also, in 500+ years, continue to lose oil to the marine environment; estimated to be less than 10 t (per annum) in total, based on Table 13-5.

Figure 11 Estimated Oil (Tonnes) in Proposed Derogated Inventories (from Shell Environmental Statement Table 17-4: BDE-F-GEN-HE-0702-00006)

It should be noted, however, that the oil in sediment values above are based upon shallow samples that are probably ‘unconsolidated’ and thus may have over-estimated water contents, and that the oil in water estimates are based upon an inappropriate ‘average’ value of oil in water (417 ppm) whereas the range of oil in water results from 3 storage cells ranges from 30ppm to 1081 ppm. As such, these “average values” should be treated as ‘indicative’ estimates, rather than definitive

3 Brent Alpha Derogation Application

There are several concerns about the Shell/Exxon Brent Alpha Derogation Application that should be addressed prior to approval. Resolving these concerns will take additional effort by Shell/Exxon to make a stronger case for their proposal. Currently the case for approval is considered weak.

A primary concern is that approval on the basis of the content of this current Application will set a lower level of quality of submission, and a dilution of the overall process, clearly defined by OSPAR Decision 98/3. More specifically the following issues should be addressed:

3.1 Drill Cuttings

According to Shell/Exxon, the Brent Alpha drill cuttings are to remain in situ undisturbed as their sampling results indicate that the best long-term management is to leave in situ. There are however concerns that require resolution as follows: -

- Poor sample quality – the samples taken from the drill cuttings pile do not appear to have been taken using the Best Available Technology and so are very shallow (circa up to 70cm depth penetration). *‘Similarly, except at Brent South, the core samples from the previous surveys have only penetrated to a limited depth, and it would be desirable for an attempt also to be made in the post-decommissioning survey to collect samples from the deeper parts of the cutting piles, provided this can be done without undue expense or difficulty, in order to supplement the incomplete information already available. (Page 32, IRG Final Report)* Samples are known to have been taken from 6 m deep within another cuttings pile using a Remote Operated Vehicle (*BP Valhall 2010 -2012*). The shallow sampling results in an analysis being obtained that does not justify extrapolation across the whole cuttings pile. It is highly likely that samples from deeper within the pile will show more signs of contamination with the older hydrocarbon-based drilling fluids/chemicals originally used.
- Pile Disturbance - The long-term prognosis for the cuttings pile is that it will not remain undisturbed as, in due course sections of the jacket footings and proposed ‘left in situ’ well conductor strings will collapse into the pile and disturb it/resuspend it in the water column. Without deep samples from within the pile it is not possible to assess the level of contamination from these disturbances. Additionally these disturbances will occur some 250+ years into the future – thus it is not possible to accurately assess the environmental impact of disturbance to establish that the environmental impacts will be minimal. The IRG raised this issue, but it appears to have been ignored. *‘There are many uncertainties in the modelling of the fate of drill cuttings and cell contents especially in the long term, and the models available do not appear to have been developed significantly since the Drill Cuttings Initiative JIP ended in 2004’ (IRG Final Report, Section 5.2 i, Page 36).*

With regards to the disturbance of the cuttings pile it should be noted that in Norway there has been a significant relocation of cuttings piles undertaken to effect removal of jackets – even though the optimal solution for those cuttings pile has been identified as ‘Leave in Situ’. These operations have been safely executed without the use of divers – so there is an extensive experience base to draw upon. Approaches should be made to the Norwegian Regulators to see what environmental impacts have been seen during these operations, and to see if the spreading out of cuttings piles has improved cutting pile degradation rates. There may be an option to disperse the cuttings to enhance natural remediation rates.

3.1.1 Proposed Works to Address Concerns

- Shell/Exxon to obtain higher quality samples from deeper in the cuttings pile using Best Available Technology (e.g. Stinger from Norway).
- Shell/Exxon/BEIS to liaise with Norwegian Environmental Regulators on issues such as cuttings dispersion/relocation and environmental impacts thereof.
- Shell/Exxon to assess environmental impact of release of ‘lower layer cuttings’ into the environment when disturbed.

3.2 Brent Alpha Jacket Footings

The Shell/Exxon works addressing the removal of the jacket footings is very much an “Industry standard” approach. We do not fully agree with the BEIS assertion that the technology does not exist as cutting tools have been deployed by the salvage industry to cut through sunken ships etc. There is no evidence that these, or similar tools could not be adapted and deployed for jacket sections – but it is likely that their use would result in slow/expensive operations. Shell/Exxon state that they believe that the jacket footings could be removed at an additional cost of some £60 million – which implies that they believe that the technology can be developed and deployed (*Page 82 Shell Brent Alpha Jacket Technical Document Shell Report Number BDE-A-JKT-BA-5801-00001*). However, the rapid pace of recent developments in cutting technologies, both pyrotechnic and mechanical, suggests that this whole topic should be constantly be updated to be contemporary.

There are options for reducing the disturbance of the cuttings pile during removal operations, such as cutting the piles internally rather than externally and this option should be subject of further investigation by either Shell/Exxon or the Industry, if the OSPAR objectives are to be met in the future.

Some 20 years after the OSPAR Decision 98/3 it is concerning that no effort has been applied by either the oil industry or the regulators to advance the necessary technology to meet OSPAR objectives. A time limit on derogations for large jackets would undoubtedly encourage the development of these tools. The Oilfield Service Contractors will not develop such tools under current circumstances as derogation applications will currently be submitted as a first choice by operators – and therefore there is no foreseeable demand for these tools for these applications.

3.2.1 Proposed Works to Address Brent Alpha Footings Concerns

- BEIS to provide more clarity on how they intend to advance the development of the necessary tooling to effect full removal of lower jacket sections – thus reducing derogation applications as expected by OSPAR.
- Continued assessment of advancing cutting technologies within both the energy and salvage sectors

3.3 Brent Alpha Well Conductors

The proposal to leave the lower well conductor and casing strings in situ is considered unacceptable for the following reason:

- They are not an integral part of the Substructure, nor are they so integrated that they cannot be removed, and so are not covered by OSPAR Decision 98/3.
- No justification is provided for leaving these materials in situ in any of the Shell/Exxon issued documentation – indeed sections within the Shell/Exxon public domain information imply that well plugging and abandonment operations will remove the conductors and 20”/13^{3/8}” casings. (e.g. *Retrieved sections of tubing, casing and conductors are returned to shore*

for recycling.' (page 85 Shell Decommissioning Programme Shell Report Number BDE-F-GEN-AA-5880-00015)); this is at best an error on Shell/Exxon's part, or at worst a disingenuous deception in order to save money.

- From Shell/Exxon's documentation the issue of Armawrap on Talon connectors restricting conductor removal operations is primarily (circa -70 m LAT) above the proposed derogation cut line at -84.5m LAT. There is no evidence provided that any of the lower conductor sections have Armawrap/Talon connectors restricting their removal. As it is unlikely that all the wells have these issues some additional sections can be removed without significant difficulties.
- There is no demonstration of the collapse timings of these items to show that they will fail and collapse before the main jacket sections and so will not form an additional snagging hazard to fishermen and other potential Users of the Sea.
- There does not appear to have been any substantial assessment of the additional disturbances of the cuttings pile that will be created when each individual well conductor section collapses – these additional impacts will incrementally increase the volume and frequency of disturbance of the pile in the future.

The above being said, there is a reasonable case to be made for leaving the conductors cut just above the drill cuttings pile that Shell/Exxon have completely failed to identify. In this case the justifications are (a) pulling the entire string through the cuttings pile will cause environmental disturbance of the pile, (b) when pulled through the pile, the cuttings will collapse into the resultant hole making it impossible to see where the well was – this will make identification of any future leaking well difficult and (c) their presence will provide a visible bore path to the exiting well top hole that could aid any remedial works that may be required in the future.

3.3.1 Proposed Works to Address Brent Alpha Well Conductor Concerns

- Shell/Exxon to provide a better description of the well/conductors indicating which wells have Armawrap/Talon connector issues below the -84.5 m LAT cut level that may hinder removal.
- Shell/Exxon to provide better/clearer justification for the rationale for leaving the lower sections in place – noting that a BEIS based Comparative Assessment is not considered sufficient justification.
- Shell/Exxon to provide more clarity on the expected degradation of the remaining well conductor/casing sections and their potential to become or remain snagging hazards in the future. Shell/Exxon to provide more information on expected collapse mechanisms/timings to show demonstrate sequence of collapse.
- Shell/Exxon to provide a strategy for ongoing monitoring and survey of the potential snagging risks and mechanism for recording data and relaying it to fishermen and other users of the sea
- Shell/Exxon to consider removing conductor/casing sections down to just above top of drill cutting pile, after having assessed implications of doing so.

4 Brent Bravo, Charlie and Delta GBS Decommissioning

The works that Shell/Exxon have conducted to address the management of the Concrete Gravity Base Structures are considered to represent the best CGBS removal works executed to date within the UKCS and should be used as a benchmark for other future CGBS decommissioning proposals to meet or surpass in the future.

The works done have been executed by specialist, experienced Concrete Gravity Base Structure designers/installers and risk assessment specialists, and clearly identify the issues arising and demonstrate the risks involved in attempting to either refloat the structures or demolish them in-situ. As such, the proposal to derogate the CGBS lower caissons is supported and it is recommended that no objections be raised to the proposal to leave the CGBS lower caissons in situ.

Based upon the above there are no additional actions required to address any concerns related to the CGBS lower caisson proposals for the structures to be left in situ. This recommendation does not however include the following:

- Well conductors left inside the Brent Bravo and Delta drilling legs
- The management of the CGBSs legs
- The management of the CGBSs Storage, Tri Cell and Mini Cell contents

The above items are addressed in later sections.

4.1 GBS Well Conductor Management

The issue of a 'Leave in Situ' recommendation for significant well conductor lengths, with 20" and 13 3/8" casing strings in situ should also be challenged. It is considered that the well conductors are not covered by the OSPAR Decision 98/3 as they do not constitute part of the substructure (i.e. they do not meet the definition in 1 (b) i, ii, or iii). Accordingly, it is unclear why they have been left in situ as this action does not comply with the BEIS 'Clean Sea Bed' policy, nor clearly neither is a derogation under OSPAR Decision 98/3 permitted.

It is noted that the Brent Delta Topsides Decommissioning Programme stated somewhat ambiguously, in the Assessment Document: *"On Brent Delta the conductors are located inside the two drilling legs and their presence has implications for any programme of work to remove all or part of these legs. All the Brent Delta wells have now been plugged and abandoned, and we have started the conductor removal campaign with the circulation-out of conductor fluids and displacement with seawater; we plan to complete this campaign before the 2016 lifting season. The scope of conductor removal does not prejudge the outcome of our CA for the GBS or the recommendation that will be presented in the Brent Field DP; it keeps open all technically feasible options for the Brent Delta GBS (Page 17, chapter 3.2.4 Brent Delta Topsides Decommissioning Programme Shell Report Number BDE-D-TOP-AA-5880-00001).*

The bold section in the above quote implies that the conductors will be removed, although it is noted that Shell/Exxon later refer to *'the scope of conductor removals does not prejudge....'* which could be interpreted as meaning that the full conductor sections are not going to be removed. There is a clear contradiction.

There appears to be no technical reason for leaving all these strings in situ within the Brent Delta and Bravo drilling legs. It is noted that Shell/Exxon have not provided any justification for leaving the well conductors, 20" and 13 3/8th" casings in situ in any documentation provided for public consultation. It is concerning that BEIS are supporting the Shell/Exxon proposal as leaving these items in situ goes

against the BEIS ‘Clean Sea Bed’ policy and ignores the stated BEIS ‘precautionary’ and ‘polluter pays’ principles.

Additionally, there appears to have been no attempt to address the implications of partial leg collapse with so many conductor/casing strings inside. This leads to a situation that the Independent Review Group identified as an issue

As the wells have been protected, and they will continue to be protected, from the worst of the elements by the CGBS legs they are likely to remain in a better condition than the CGBS legs as they degrade – this increases the potential for any collapsing CGBS leg to get ‘hung up’ on the conductors potentially leaving the collapsing leg in an unsafe condition, requiring significant potentially dangerous remedial works. There is no evidence of Shell/Exxon assessing the implications of leaving significant well conductor inventories in situ on future CGBS leg collapse scenarios – which has been indicated by the IRG as a major concern that required resolution – but once again appears to have been ignored.

It is likely that the conductors are in reasonable condition and so could be removed by the existing platform-drilling rig at the end of plugging and abandonment operations. The rationale for leaving the conductors and casings in situ appears to be solely a cost reduction measure.

It should also be noted that the leaving of well conductors in situ inside the Brent Bravo and Delta drilling legs when the topsides are removed by implication means that the CGBS legs will be left upright – as their presence will make leg cutting down more complex and so could be considered as ‘prejudicing’/‘pre-empting’ a derogation decision before the application/decision is made.

In this case Brent Delta topsides early, Decommissioning Programme approval and topsides removal could be non-compliant with section 5.22 of the BEIS Guidance Notes Decommissioning of Offshore Oil and Gas Installations and Pipelines Nov 2018 and the spirit and intent of OSPAR Decision 98/3 as the removal of the left in situ well conductors is now a significantly more complex operation and pre-empt a derogation decision relating to the CGBS Legs.

4.1.1 Proposed Works to Address CGBS Well Conductor Concerns

- Shell/Exxon to produce an updated documentation set that clearly demonstrates the rationale for leaving well conductors in situ and their impact on any future leg collapse mechanisms.
- Shell/Exxon to produce documentary evidence of the impact on CGBS leg cuttings operations of ‘Left in Situ’ well conductor strings and to demonstrate that the early removal of Brent Delta topsides has not prejudiced any potential future CGBS leg removal operations.

4.2 GBS Legs Management

The IRG raised serious concerns about the long-term management of any CGBS legs that were left up and penetrating the sea surface; their inevitable collapse in time; the potential for partial collapse and significant remedial works on a degraded structure; and, the total inability to realistically predict the ongoing risks to other users of the sea. These concerns are shared by the Scottish Fishermen’s Federation who have now formally adopted a ‘CGBS Legs Cut Down to -55 m LAT’ position in their recently published ‘[SFF Offshore Oil and Gas Decommissioning Policy and Key Principles](#)’ document which is contrary to the position that they held earlier in the Shell/Exxon Decommissioning Project timeline. Given the forecast increases in marine traffic in the future, and the predicted long-term collapse of the legs to such a level that they become a shallow draft vessel hazard the potential for the CGBS legs to become a long-term shipping collision hazard is an issue that requires careful consideration. Shell/Exxon have failed to address these concerns and appear to have made the decision

to leave CGBS Legs in situ as early as Mid-2014 even though the Decommissioning Programme had not been submitted for either public or OSPAR consultation.

Shell/Exxon partially acknowledge this fact as herein stated: *'If the GBS legs were to be partially removed at some time in the future, any external preparatory work for cutting would be carried out just before the cutting operation began and would not require the presence of the topside. In the drilling legs, the upper parts of the conductors would be cut and removed by a heavy lift vessel (HLV) before the legs were cut.'* (Page 16 Brent Delta Topsides Decommissioning Programme (Final Revision June 2015 Shell Report Number BDE-D-TOP-AA-5880-00001)

Their actions whilst conducting well plugging and abandonment operations (i.e. not removing the conductors, 20" and 13 3/8" casings from the drilling legs) are believed to have prejudiced the ability to remove Brent Delta Legs, and may impact Brent Bravo leg cutting down options, by making lower conductor section removal more complex than removal by the drilling derrick systems.

There is no evidence of any supporting documentation that demonstrates that removing the conductor sections from the drilling legs by HLV is a safer, more efficient methodology than using the drilling derrick on the topsides as part of plugging and abandonment operations.

The concern is that by removing the topsides early subsequent conductor removal operations will expose any workers involved to more risk; be likely to cost more; and, will introduce bias into any Leg Up/Leg Down CA decision making process.

The conductor removal works will broadly require

- the removal of any concrete cap that was installed upon topsides removal
- the installation of a working platform on the cut leg
- the installation of down well cutting gear on a well by well basis
- the attachment of lifting lugs/pins etc. to allow crane uplift
- the handling of long heavy conductor string sections (circa 60m long) from leg to either crane barge or cargo barge
- the lowering of said conductor string into a horizontal position to either crane barge or cargo barge
- backloading from barge to quayside

These operations are likely to be as least as complex as traditional conductor recovery operations but may well be significantly more expensive due to the cost of the lift vessel. There is however no documentation provided that justifies the assumption that 'the scope of conductor removals does not prejudice....' Page 17 Shell Brent Delta Topsides Decommissioning Programme Shell Report Number BDE-D-TOP-AA-5880-00001

As shown above there are concerns relating to the use of the Shell/Exxon Brent CA process in any CGBS Leg decisions – owing to the bias within the process. There is no foreseeable way that if conductor removal operations were required in advance to leg cutting operations, partial leg removal would be a preferred option due to the sheer scope of works required to effect the operations. As such it is clear that early topside removal on Brent Bravo and Delta will prejudice CGBS decommissioning options despite Shell/Exxon's assurance that they do not.

4.2.1 Proposed Works to Address CGBS Leg Management Concerns

- Shell/Exxon to provide more information relating to the implications (risk, technical feasibility, cost emissions etc.) of removing the remaining conductors' sections using an HLV on Brent Delta drilling legs as mentioned in their GBS Technical document.
- Shell/Exxon to provide assessments of leg collapse scenarios where existing conductor strings remain in situ to ascertain that 'partial leg failure' will not result in a degraded leg being 'hung up' on a series of relatively intact conductor strings.
- Shell/Exxon to provide clear evidence that the proposed use of an HLV to remove conductor strings is indeed safer than using the drilling rig and equipment to remove them – thus clearly indicating that they have not inappropriately introduced bias into the CGBS Legs decision.

5 Drill Cuttings Management

There are numerous contaminated drill cuttings piles located within the Brent field – the ones of primary interest are as shown below

- Drill Cuttings around the platform foundations
- Drill Cuttings on GBS Storage Cell Roof Tops some 40m above the seabed,
- Drill Cuttings within the GBS drilling legs,

The mapping of location and bathymetry of the cuttings piles has been done using industry standard technology and there are no discernible reasons for querying the results.

However, there is evidence that the relatively simple drill cuttings surveys have not used Best Available Technology and have as a result not obtained deep cores (>70cm) from underneath the platform topsides in the main cutting pile sections. The resulting samples can thus only be considered indicative of drill cutting pile contents – the deeper layers in the deeper cuttings piles could contain significantly more contamination – however this cannot be currently verified due to lack of samples.

This lack of quality data was raised by the Independent Review Group, but no additional works have been undertaken since 2015. It is also noted that the results from this sampling programme were not available at the time of the Technical Document being drafted (2017) the reason for this delay is not given, nor are any results. Accordingly, any works relating to the management of the drill cuttings piles needs revision and updating as a minimum, especially if there are differences between the various survey results and deeper samples have been obtained.

It is also noted that the software used for cuttings dispersion analysis was not designed to address cuttings dispersal from some 40m above seabed and has not been modified/developed for some 12 + years. As such there is doubt about the analyses works executed being accurate enough to be used for environmental release assessments.

5.1 Proposed Works to Address Drill Cuttings Concerns

- If the 2015 survey has not obtained deep core samples the main drill cutting piles at Brent Alpha, Bravo, Charlie and Delta should be re-sampled using the Stinger drill cutting sampling tool which has obtained cores from some 6m within an 11m pile (*see Stinger Technology AS <http://www.stinger.no/cases/subsurface-drill-cuttings-classification> - BP Valhall Drill Cuttings Sampling 2010 - 2012*).
- The software to be used for dispersion analysis should be updated and modified as a result of research/model testing – this should be done via a Joint Industry Project with significant external stakeholder input/buy in.

- Based upon the sample results the necessary environmental impact assessments should be re-visited ideally using the modified software.
- BEIS should demonstrate how they propose to address the conflict between long term drill cuttings disturbance; the lack of ability to accurately model long-term future environmental conditions; and, these impacts and the ‘precautionary principle’.

6 GBS Cell Contents Sampling/Mapping

The Brent field decommissioning project is not the first decommissioning project to address oil storage gravity base issues but is clearly hindered by a lack of accurate record keeping. As such in addition to the need to map the storage cell sediments to establish their volumes there is a need to sample the

- contaminated sediments within the GBS Mini cell /Utility Legs
- contaminated sediments within the storage cells themselves

to identify the long-term management options available for these contaminants. Due to the location of these contaminants, accurate cell mapping and sampling is one of the most complex issues the Brent Decommissioning Project is dealing with. The need to secure verifiable, quality data required to inform decision-making is considered by many external stakeholders as paramount, to ensure compliance with OSPAR Decision 98/3.

6.1 Cell Sediment Volume Mapping

Credit should be given to Shell/Exxon for their cell content mapping activities where they have deployed state of the art equipment and data processing to measure cell sediment levels in 4 storage cells. Unfortunately, Shell/Exxon have provided no substantive evidence of any other supporting activities having taken place that helps to justify the extrapolation of these limited results across the other cells and platforms (e.g. the construction of Industry available Computational Fluid Dynamics models to predict volumes that have been validated by the actual results and subject to external review/challenge)

It is noted that there are ranges of volumes presented on the limited cell mapping activities. Cell sediment volumes appear to have a range of some 8% between calculated and mapped volumes (*pages 57,58 Shell Brent GBS Contents Technical Document Shell Report Number BDE-F-GBS-BA-5801-00002*), and within a cell group (circa 28% difference in volumes). Mapping comparisons between Brent Delta Cells and Brent Bravo cells also indicate a difference of some 7 - 38% between cell volumes (*Cell 18 Delta Vs Cell 18 Bravo and Cell 9 Delta Vs Cell 18 Bravo pages 57,58 Shell Brent GBS Contents Technical Document*). Even within the Shell/Exxon documents there are indications that they are aware of the range of data issue. *'NASA concluded that the calculated volume of sediment in Cell 18 on Brent Bravo is of the same order of magnitude as those measured in Cell 9, Cell 17 and Cell 18 on Brent Delta'* (*Page 72 Shell Brent GBS Contents Technical Document Shell Report Number BDE-F-GBS-BA-5801-00002*).

Interphase materials have not been mapped despite the fact they are identified as 'being removed' on a 'best endeavours' basis. Without a proper assessment of the volumes involved it is not possible to identify the necessary works to recover such materials – with the potential outcome being an early decision to stop trying to recover such inventory, when volumes are found to be larger than expected, or the materials prove harder to extract than anticipated.

The above ranges in data, and complete lack of physical data for Brent Bravo and Brent Charlie cell contents mean that it is not possible to say with confidence that extrapolating results from mapped cells across the 3 CGBS structures is a fair and valid approach to cell mapping and cell content volume calculations.

On Brent Charlie there is the additional issue of contamination of non-oil storage cells by crude oil due to poor operations management offshore. This clearly causes Shell/Exxon problems with estimating the volumes of attic oil, interphase materials and sediments that are within the CGBS (section 8.8 Shell Brent GBS Contents Technical Document). It is noted that currently no mapping of Brent Charlie cells has taken

place. As such the volumes involved are unknown as even Shell/Exxon admit *‘It is not possible to quantify the volumes of hydrocarbon pushed into the peripheral cells as a consequence of these events. There is therefore a certain amount of speculation regarding the residual volume of attic oil trapped inside the peripheral cells’* (Page 34 Shell GBS Contents Technical document Shell Report Number BDE-F-GBS-BA-5801-00002).

Based upon the above there are questions about the accuracy of data available to be used within the engineering of cell contents remediation activities, and the Environmental Impact Assessment of cell contents release. It appears that the proposals to leave cell contents in situ in Brent Bravo and Charlie currently look premature as they are not based upon accurate, valid information and fail to meet OSPAR Decision 98/3 Annexe 2 Item 7 requirements. Brent Delta information, whilst being more substantive than that for Brent Bravo and Charlie, still has enough uncertainty to raise questions about the validity of the proposal to leave the contents in situ. The IRG raised this issue in their final report *‘a) In particular, the evidence supporting leaving the cell contents in place may be considered adequate to support the EIA, but is still uncertain because, i) The information available to verify the nature, quantity and composition of the cell contents is limited to that obtained from the Brent Delta cell sampling (3 cells), Brent Delta attic oil recovery (water samples from 3 additional cells), and an additional sonar sounding on Brent Bravo.’* (Page 4 IRG Final Report)

6.2 Sampling Operations

Owing to self-imposed technical constraints Shell/Exxon have not been able to secure high quality information from their sampling efforts – this has resulted in the decommissioning programme submission containing a high number of assumptions and assertions. It is not clear that this approach meets OSPAR98/3 Decision intent of a properly executed scientific, evidence-based assessment.

There is no discernible Cell Sampling strategy available – it appears that the strategy has been based upon ‘getting any sample from any accessible storage cell’. It is clear that after numerous failed sampling operations, costs became an issue. The samples taken on Brent Delta were from cells that could be reached by the platform crane to reduce costs – not for any targeted sampling strategy.

6.2.1 Sampling Operation results

Sample sizes were heavily constrained by the access constraints into the storage cell (a 3” diameter hole) – as such their volumes are very limited (6 kg in total out of an estimated 72,000+ tonnes of sediments). The sampling method only recovered ‘shallow’ samples from the sediment layer (no more than 70 -100 cm out of a 4 m deep layer) and may have allowed sample contamination during recovery through the interphase/attic oil layers at the top of the storage cell. Samples were not taken from any identifiable sample grid, due to the limitations of the sampling tool, and the total absence of a sampling grid. The IRG raised their concerns about the sampling/extrapolation issue as shown:

Despite the very considerable effort required to obtain and analyse the samples, the information gained from the sampling programme is limited, and thus may not be fully representative of the remaining cells or of those of the other platforms because

- *Only three cells on one of the platforms, out of the many cells on three platforms, have been sampled.*
- *The sediment sampler penetrated only the top few decimetres of the approximately four metres thick sediment layer.*

- *The sediment material was disturbed during sampling and the estimates of certain physical properties are unreliable.*
- *Samples were comingled prior to analysis so that no vertical profile information became available.*
- *There is a marked variation in the concentrations of some of the contaminants in the sediment and particularly in the water samples.*
- *Some of the samples may have become contaminated during transit of the sampler through the attic oil/interphase material layers. (page 23 IRG Final Report)*

The IRG has recommended that additional cell mapping activities are undertaken, and extra samples are obtained to ensure the validity of current assumptions. Shell/Exxon again appear to have totally ignored this in their Derogation Application/Decommissioning Programme.

6.2.2 Extrapolation of Results

Within the Shell/Exxon supporting technical documentation there are considerable degrees of uncertainty – which are noticeably absent from discussion in the derogation application. Shell/Exxon often quote one value when in fact there are ranges at play. The Independent Review Group noted this issue, but it again appears to have been ignored by Shell/Exxon – this does not comply with OSPAR Decision 98/3 Annexe 2 Section 10 ‘*The assessment shall take into account the inherent uncertainties associated with each option and shall be based upon conservative assumptions about potential impacts.*’ – Shell/Exxon have attempted to address this issue by making conservative estimates in their works – especially modelling of dispersion volumes etc. but notably the use of ‘average’ values has failed to ensure that the extreme analysis results have been addressed.

For example, the cell water analysis results indicate a range of 30 mg/l Oil in Water to 1081 mg/l Oil in water between sampled cells. Shell/Exxon have averaged these results at 417 mg/l Oil in Water and claim it is within their assumed modelling limit of 503 mg/l. This fails to address the fact that one analysis result is more than twice their assumed value (1081 mg/l vs 503 mg/l). The lack of discussion about this issue is notable.

Neither Brent Bravo nor Charlie storage cells have been sediment sampled – so there is no hard evidence base to support the assertion that the contents are similar across all CGBS platforms, despite the fact they maybe, for the reasons Shell/Exxon have stated. It should be noted that each platform storage cell group historically has received ‘closed drains’ wastes (i.e. inventories from topsides operations and brownfield construction works over the decades) and so there may be different contaminants in the storage cells between platforms. Shell/Exxon admit as much, but state that the volumes of such contaminants are likely to be very small. This is possibly true, it is still highly probable that a different contaminant inventory exists between cell groups that may require checking.

In addition to this issue the failure to address uncertainty bands has additional significant Comparative Assessment bias implications and is an additional source of major concern.

Based upon the above, without samples or mapping, it is impossible to see how Brent Bravo and Charlie derogation applications meet OSPAR Decision 98/3 requirements – as such they must be considered premature applications and thus approval cannot be supported.

The Brent Delta application features similar issues with the quality of the data used to propose to leave the cell contents in situ – and thus without additional samples/mapping the proposal cannot be supported as it also is non-compliant with OSPAR Decision 98/3.

6.2.3 Proposed Works to Address Cell Sampling/Mapping Concerns

- Additional sampling and mapping operations are required to obtain better quality and volumes of data which to work to get a better understanding of inventories.
- The restrictions Shell/Exxon placed on themselves, by insisting on trying to obtain samples on an operational platform, have caused significant difficulties and have resulted in inadequate samples, both in terms of quality and volume. The more pragmatic approach of splitting the Derogation Application into individual platform ‘Clean CGBS’ and subsequent individual ‘CGBS Storage Cell Contents’ applications, would be more practical, allowing a more aggressive approach towards sampling; better data availability to support decision making; and, potentially easier more appropriate remediation works.
- In the absence of a validated computer model to predict cell sediment inventories, Brent Bravo and Brent Charlie storage cells will require sampling and mapping in a proper manner so as to obtain high quality samples in sufficient volumes to allow appropriate analysis.

7 CGBS Storage Cell Contents Management

The CGBS storage cells have primarily been used to store produced crude oil during production operations. In some cases, they have been used as an integral part of the production process by being used as production oil/water separation facilities to ensure that the bulk solids and water limits are met for export. In other cases, they have been used as fuel storage cells. As such it does not seem unreasonable to classify any residual materials as predominantly production operations waste streams.

After production operations stopped using the storage cells, these were bulk de-oiled and left shut in. This has resulted in the storage cells being left full of the following inventories.

Attic Oil: A small volume of raw crude oil trapped at the top of each cell.

Interphase material: A high viscosity emulsion of water and oil that has accumulated at the junction of the attic oil and the water phase. It should be noted that volumes of interphase material are currently unquantified by Shell/Exxon, and their presence on the Ekofisk Oil Storage CGBS caused significant difficulties in de-oiling the storage cells. Currently all storage cell cleaning is suspended on Ekofisk Tank.

Water phase: The water phase is comprised mostly of produced water from final separation, prior to overboard discharge during the field's gas production phase.

Cell Sediments that have settled out/dropped to the bottom of the storage cells from the crude oil, while it was being separated and stored, forming a layer on the cell base, comprised of sand/ mineral particles which will be coated with a film of oil, other chemicals and as yet unidentified other toxins/heavy metals/low specific activity scale.

In addition to the issues raised by poor sampling operations discussed in the separate sampling briefing note there are questions that remain unresolved as shown below: -

7.1 Classification of the Storage Cell residual contents

Confusingly Shell/Exxon also suggest that the CGBS Storage Cell contents may be covered by normal Production Operations discharge regulations or London Dumping regulations. (*Section 12.6.2 page 104 Shell Brent GBS Contents Technical Document Shell Report Number BDE-F-GBS-BA-5801-00002*).

As such, there appear to be 3 differing sets of Regulations that may apply to the issue at hand, but their application is unclear within any Shell/Exxon or BEIS documents. Noting that the Maureen decommissioning project treated all removed storage cell inventories as production waste streams and Ekofisk Oil Storage Tank derogation was approved on the basis that the storage cells would be cleaned of all inventories (i.e. oil, interphase materials, oily water and bottom oil contaminated sediments) the issue of GBS cell contents classification is an area that requires urgent clarification with BEIS and OSPAR

Should clarification be given that neither OSPAR 98/3 nor Production Operations Discharge regulations apply then London Dumping Convention/Protocol rules may apply. But this would indicate the requirement to issue a 'Dumping permit' some 250+ years ahead of the intended release. Currently it is not known if the Shell/Exxon approach is acceptable to stakeholders, or indeed complies with the spirit and intent of the various regulations. Nor is it clear that a Dumping Permit can justifiably be issued.

7.2 Confused Approach to Cell Contents Classification

In the midst of this confusion Shell/Exxon appear to have arbitrarily agreed with BEIS that the cell contents classification can be ‘split’ with differing regulations/approaches applied to attic oil/ interphase materials (Production Operations regulations?) and oily water/cell sediments (BEIS based CA process). Whilst this may seem an understandable approach, it appears inappropriate and inconsistent and should be resolved by OSPAR/BEIS clarifications, especially where the biased CA process is being used for such a potentially contentious issue.

7.3 Feasibility of Cell Contents Removal Operations

Given recent advances in cutting techniques and deep-water mining and with the appropriate data sets and the volume of engineering/ risk mitigation works, it is considered that safe and full recovery of the cell contents is a potentially viable solution, although it will undoubtedly be a costly, time-consuming activity set. Here the relevance of the ‘precautionary principle’ and ‘polluter pays’ principles comes into play, given the long-term nature of the disposal proposals for these inventories.

These removal operations will require a significant input of technical effort and appreciable project resources, which clearly have not been invested by Shell/Exxon for some 9+ years. It is unlikely that these operations will result in risk levels above normal operational risk acceptance limits, if they are engineered up properly. Shell/Exxon should allow the salvage/dredging industry to address the issues at hand, as they are generally better equipped to deal with these sorts of complex operations (e.g. removal of sunken vessel inventories, recovery of the Kursk, Concordia refloating etc.) than the standard offshore oil industry supply chain.

7.4 Setting Up for ‘Failure’?

The use of the expression ‘*however, and it may not be possible to remove the attic oil from all cells*’ (page 82, Shell Brent GBS Contents Technical Document BDE-GBS-BA-5801-00002) should be an immediate warning indicator to the reader of a high degree of uncertainty existing about the issue at hand (in this case the removal of attic oil from Brent Charlie storage cells), and potentially an attempt by the Authors to lay the groundwork for failure to meet commitments/expectations. It appears that Shell/Exxon are effectively proposing to use ‘best endeavours’ to deal with some Attic Oil and Interphase materials – which is of concern. This issue can be mitigated somewhat by securing more detailed information about the activity sets required than those available in the various Decommissioning documents (i.e. the lack of clarity on Brent Bravo and Charlie inventories needs resolving, and more detailed engineering works are required).

7.5 Proposed Works to Address Cell Contents Management Concerns

In addition to the actions recommended in section 6 relating to cell content sampling the following actions are recommended: -

- BEIS need to clearly state in the public domain which Regulations apply to the various CGBS Storage Cell inventories (i.e. their Classification) and demonstrate that their proposed classifications are compliant with OSPAR Objectives and other International Regulatory Instruments.
- Any proposed classification of CGBS storage cell inventories needs to be confirmed as acceptable to OSPAR Contracting Parties.

- The option for full cell content removal should be engineered up to FEED level, as a minimum, using high quality input data when it becomes available. These works should also include a detailed assessment of environmental implications of full removal operations.
- Once better quality cell contents data has been obtained, more detailed engineering assessments should be executed to establish the workscopes required to effect full removal to shore. This should include, as a minimum: -
 - All access hole cutting assessments should be revisited/updated by Specialist Salvage Companies to ensure that Best Available Technologies have been assessed.
 - Applying cell sampling results, a complete re-assessment of sludge recovery tools and methodologies (including re mobilisation of sludges) should be conducted.
 - Using the data relating to interphase materials (volumes/composition etc.), the entire interphase material removal process should be assessed to ensure that the full workscope is understood and scheduled/costed.
 - Where technologies are not currently able to deliver the required performance, a programme of Research and Development works should be developed – this has the potential to be undertaken as a Joint Industry Project.
- The use of any CA process for decisions relating to the management of CGBS Storage Cell Contents requires full re-consideration. Ideally, Inventory Full Removal should be required, unless it can be clearly demonstrated that it is technically infeasible, or safety risks are beyond acceptable parameters.

Where it is agreed a CA process is to be used

- Other identified options for Cell Contents Management should not be re considered until the appropriate level of engineering works have been completed.
- Owing to the long term release scenarios of any inventories ‘left in situ’, and the inability to accurately assess potential release impacts so far in the future, the option of ‘Leave In Situ’ should be removed from further consideration in all cases.
- The entire decision making process relating to the Cell Contents Management issue requires re-evaluation using OSPAR agreed criteria and weightings, not the current BEIS or Shell/Exxon ones, coupled with higher quality engineering assessments.
- Where a comparative assessment (CA) process is used to help decision making, multiple CA assessments should be conducted when estimating ranges are wider than say +/- 15% (i.e. either FEED engineering level is completed before decisions are made, or multiple CA assessments are made covering the ranges of input data, rather than single values)
- If it is accepted that a ‘clean’ Brent Delta CGBS can remain in situ (even with the Legs Up/Down issue unresolved) the lack of drawdown on the structure will allow larger access holes to be made, and potentially for the Delta CGBS Storage Cells to be used for a Long Term JIP to be executed, by which differing Cell Contents Management technologies can be tested/developed on a cell by cell basis if required.

8 Other Issues

8.1 Problems with the decision-making process

It is noted that despite much attention being drawn to the use of a Comparative Assessment process, the final decision-making processes by Shell/Exxon management are opaque and unclear. Reference is made to ‘other factors’ being used to make the final decision, such as ‘reputation’ or ‘business drivers’, but there is evidence of the decisions that have been made where there is no limited or no evidence (e.g. the decision to remove Attic Oil/Interphase materials from Storage Cells but leave oil contaminated water and sediment inventories). It is thus difficult to ascertain the exact philosophy and evaluation techniques behind some of the recommendations – but clearly reducing costs is a major decision driver, as most of the recommendations made reflect the cheapest options.

8.1.1 Proposed Works to Address Concerns

- Shell/Exxon to provide more transparency with regards to their decision making criteria
- Shell/Exxon to provide more clarity on the weightings/score used to inform their decisions
- Shell/Exxon to revisit CA based decisions and re-assess decisions using better quality input data.
- BEIS to demonstrate why the CA process promoted in the BEIS Guideline is ‘fit for purpose’ and helps meet OSPAR Decision 98/3 objectives.

8.2 Problems with the CA Process

It is noted that the CA process has been used by Operators in numerous ways for various derogation submissions – but few are actually compliant with BEIS Guideline expectations.

The original intent of the BEIS decommissioning guidelines was to encourage Operators to engage fully with Stakeholders on decommissioning issues, and implied that Stakeholders would be involved in the identification of CA criteria and their weightings. This has not materially happened throughout the last 20 years, with only a few decommissioning projects coming anywhere close to meeting this aspiration.

As such there is an increasing disconnection between Regulators aspirations, Operator behaviours and Stakeholder expectations, yet there has been no discernible intervention from the Regulators on this issue. The lack of Stakeholder input into the CA criteria and weightings has resulted in the BEIS Guideline CA process becoming the default position. This has made the CA process more of a ‘Show and Tell’ exercise rather than a formal Stakeholder engagement activity.

A review of the Shell/Exxon Brent Decommissioning Project decision-making process has shown that the base Comparative Assessment (CA) process, which is very much based upon the BEIS Guideline process, used by Shell/Exxon to inform their final decisions, is fundamentally flawed and introduces a high level of mathematical bias towards any decommissioning option that has minimal offshore works scope. The base bias indicates an almost automatic score of 81.8% in favour of ‘very much reduced decommissioning scopes’ or the ‘Leave in Situ’ option.

There is no foreseeable way that any decommissioning option involving significant offshore activities can surpass this score using current Shell/Exxon or BEIS guideline criteria definitions and weightings, or indeed Shell/Exxon’s criteria and weighting values. Its application is, as once described by a third party, a ‘Derogators Charter’.

The fact that this CA process is considered appropriate by the UK Government BEIS OPRED department in its decommissioning guidance notes is of concern, as its continued use will constitute a

major undermining of the stated BEIS OPRED Clear Seabed Policy, as well as failing to meet their underpinning 'Precautionary' 'Polluter Pays' Principles (*BEIS Guideline Note Decommissioning of Offshore Oil and Gas Installations and Pipelines Nov 2018 Page 6 Section 1.1*). BEIS clearly either fails to appreciate this fact or has potentially chosen to allow its continued use as it helps meet other Government department desires for reducing decommissioning costs (OGA) and hence reduce tax rebates/reliefs (HMRC/HMT).

Owing to the level of bias within the guideline CA process, for any decommissioning project this whole exercise is highly questionable as a value adding exercise - using the BEIS guidance CA criteria and weightings, the preferred option will always be the one with minimal offshore operations. Accordingly, it appears that the use of this CA process, as it stands today, could be considered as tokenism or a 'green washing' activity.

It is additionally noted that the bias within the process is such that its use is considered directly contrary to the OSPAR Decision 98/3 'Presumption of Full Removal' – thus undermining the intent of the OSPAR Commission decision. As a result, there appears to be significant ambiguity within the UK Government as to its commitments towards meeting OSPAR Commission aims, a perceived position which requires urgent clarification.

The above being said, it should be noted that without using the CA process the following decision would be driven by technical/ safety risks that are considered unacceptably high by today's standards and so would remain the same:

- Clean Concrete Gravity Base Structure 'Leave in Situ' recommendation

Similar conclusions are currently reached for the following decisions – but there is some doubt about the quality of the information by which the CA process reached its conclusions.

- Brent Alpha Jacket Footings 'Leave in Situ' recommendation
- Multiple pipelines 'Leave in Situ' recommendation.

It should be noted that the above two latter recommendations are primarily driven by the abject failure of the UK Regulators to make the Oil Industry address full jacket/pipeline removal in the 20 years since the OSPAR 98/3 Decision, as well as the Oil Industry's unwillingness to prepare for decommissioning activities in advance. This is an issue that should be addressed by the OSPAR Commission in due course.

8.2.1 Proposed Works to Address Concerns

- The current BEIS Guideline CA process should be re-developed to address the following issues:
 -
 - The use of a CA process when addressing significantly different scopes/options
 - The inherent bias within the Criteria and Weighting towards minimal offshore decommissioning scopes.
 - Making any CA process more compliant with OSPAR Decision 98/3 objectives.

8.3 Introduction of Technical/Safety Risk Bias into the CA process

In many cases, where the CA process has been used, it appears that unmitigated risk values are used, which introduce an element of technical bias into the process, especially when a 'Leave in Situ/Do Nothing' option is one of the options still under consideration. *'It is also noted that it is likely that any high operational risks could in practice probably be reduced (mitigated downwards) by a successful*

contractor, but no allowance for this has been made in the CAs, nor is it given any prominence in the DP' (page 35 IRG Final Report).

Additionally, review of the CA process shows that Shell/Exxon have applied more bias by doing the CA process when some options are poorly defined – *'Although a credible programme of work has been described for removing the sediment (as a slurry in combination with the water phase), no FEED or design work has been undertaken. (Page 167, paragraph 2 Shell Brent GBS Contents Technical Document Shell Report Number BDE-F-GBS-BA-5801-00002).* As such the values used within the CA process will have a wide range of uncertainty associated with them and often risk will be over-stated as even Shell/Exxon admit ***'The risks to our project personnel offshore (and onshore) would be amenable to further reduction and the estimated PLLs for these two groups of personnel are therefore over-estimates of the actual risk. Nevertheless, the estimated safety risk to offshore project personnel is significant.'*** (Page 168, Section 17.3.3.5 Brent GBS Contents Technical Document Shell Report Number BDE-F-GBS-BA-5801-00002)' The above statement clearly shows that even Shell/Exxon know their process has bias within it.

In summary the use of a heavily biased CA process, based upon low-level engineering, using singular immature estimated values, ignoring Stakeholder guidance/challenge, being influenced by subjective assessments by Shell/Exxon Management alone should be considered unacceptable practice.

8.3.1 Proposed Works to Address Concerns

- All CA processes executed to date require updating using ranges that reflect the uncertainty levels that exist to reach OSPAR Decision 98/3 Annexe 2 Section 10 compliance.
- The ranges used should be evaluated for a post-risk mitigation scenario (e.g. there should be no assumption of divers being deployed if the contractual intent would be to conduct works in a diver-less manner)
- CA exercises should be constrained to evaluating differences between similar scopes/options (e.g. between options to deliver full removal, or between options to cut CGBS legs down) and should not be applied between differing options (e.g. between full removal and 'Leave in Situ')
- Multiple CA assessments should be conducted where there is a wide variety in technical maturity between options being considered covering the range of scenarios, to ensure even-handedness in the assessment.
- A differing methodology of selecting between the differing viable 'Decommissioning Options' needs to be developed as the current CA process is biased towards minimal offshore works and so is not compliant with OSPAR Decision 98/3 objectives.

8.4 Data Quality/Availability

The OSPAR 98/3 Decision makes it explicit that any derogation should be backed up by scientific evidence etc. Over and above the issue of poor-quality storage Mini and Tri-cell contents data a noticeable feature of the Shell/Exxon documentation is that there seems to be a lot of reference to more detailed information 'pending' – this implies that for Brent Bravo and Brent Charlie, in particular, the submission of a derogation application is premature. Statements that samples have yet to be taken, or analysed, or that Brent Charlie is still in operations, so inventories may change etc. only serve to support the 'premature' submission hypothesis.

In addition to rejecting the Derogation Proposals on the grounds that they are premature, other reasons for rejection include use of a biased CA process; insufficient technically assured data; and, that the proposals (including ongoing liability management) are too non-committal (e.g. Brent Charlie Attic Oil

removal ‘may not be possible’) gives little indication of what is to be expected in terms of quantities to be handled and volumes that can be expected to be recovered coupled with too many potential scope reduction issues yet to be resolved (e.g., interphase volumes, amount of debris/cuttings clearance and actual cell access methodology)).

If, however some negotiations are required, it would be possible to accept the application to derogate the clean GBS structures on the understanding that considerably more effort is put into the understanding and management of the storage cell contents and that an appropriate CA process is used in due course using higher quality information and more advanced engineering to inform any decisions.

8.4.1 Proposed Works to Address Concerns

- More sampling operations should be conducted on Brent Delta in the short term to enable new CFD models to be developed and validated.
- Dependent upon the results of the Brent Delta based development works, Brent Bravo storage cells should be sampled in due course.
- Brent Charlie storage cell sampling operations require additional development works so as to be able to establish the level of contamination.
- All studies used within the CA processes should be revisited to establish the ranges that exist due to their lack of technical maturity.
- All CA processes executed should be revisited using the above developed input ranges rather than singular values.

8.5 Stakeholder Engagement

Whilst Shell/Exxon should be given some credit for the establishment of the Cell Management Stakeholder Task Group to specifically address the contentious issue of how to manage the large inventory of contaminated materials within the GBS storage cells, the amount of credit to be given is seriously eroded by the apparent failure to use the CMSTG output in any credible manner when making final CGBS Cell Contents recommendations.

The CMSTG scope of activities is the first time that external Stakeholders have significantly reviewed complex decommissioning issues and helped define appropriate CA criteria and weightings. However, the criteria and weightings developed by the CMSTG are noticeably different from those provided by BEIS as guidance and should, in fact, have had a high degree of influence on decision making, as they represent a much broader spectrum of societal interests than those held by BEIS and the Oil Industry. However, Shell/Exxon’s end use of the CMSTG’s work is considered unacceptable, as it appears that, to all intents and purpose, their workings and findings have been completely ignored and Shell/Exxon made their own decision without taking any real account of Stakeholder inputs and with little clarity as to how these decisions were made. This obscurity in decision making was pointed out by the IRG *‘The IRG therefore regrets that the basis of the standard weights selected by Shell has not been documented or explained, so that it remains impossible to judge whether these are reasonable or not.’* (Page 34 IRG Final Report) But the situation remains unaltered.

This issue undermines the efforts made by Shell/Exxon to engage with Stakeholders, as it appears that this has been treated and executed as a Public Relations exercise, rather than a serious attempt to engage with Civil Society. This impression is further reinforced by the Independent Review Group indicating in their report, several concerns that had been raised but remain unresolved (Section 5.1 Page 35 IRG Final Report).

8.5.1 Proposed Works to Address Concerns

- Shell/Exxon should provide clearer evidence that the use of their CA process for the Cell Contents Management recommendations does not totally ignore the CMSTG inputs.
- Shell/Exxon should provide more clarity on how the final recommendations have been made (i.e. decision criteria used)
- Where necessary Shell/Exxon should completely re-evaluate any CA, activities performed to date, using Stakeholder developed criteria and weighting, rather than using the BEIS guideline, or current Shell/Exxon criteria, and demonstrate how these activities have influenced their recommendations.

8.6 Technical Document Management/Availability

In addition to the above Stakeholder Engagement issues, it is notable that the availability of data for public scrutiny is poor. Some 430 studies are understood to have been commissioned by Shell/Exxon over the years, but there is no singular listing of these studies describing what works were commissioned, and why they have/have not been progressed. The IRG are understood to have reviewed some 300 of these studies, but there is no indication which studies were reviewed, and which were not, nor why not?

The Decommissioning Programme and supporting technical documents refer to a significant number of studies that are not available freely for public review – which in today’s environment of pdf files and the internet is unjustifiable. Shell/Exxon’s offer to allow access to paper copies in their offices places an undue demand on stakeholder’s time and resources and presumes proximity. It is understood, there are also studies that were commissioned but are not referenced – potentially indicating the ‘cherry picking’ of studies to suit Shell/Exxon’s preferred end-position, rather than allowing non-supportive or challenging information into the public domain.

8.6.1 Proposed Works to Address Concerns

- Shell/Exxon should release a copy of the Master Document Register for public review.
- All documents of technical studies conducted should be readily accessible to Stakeholders without recourse to Shell (i.e. on the Internet.). Where appropriate redactions may take place where commercially sensitive information is contained within the documents (e.g. definitive tendered costs).

8.7 Decision Timings

It is of concern that some of the decisions relating to various decommissioning issues appear to have been made several years ago, after which no further works appear to have been conducted. Some of these decisions have potentially pre-empted Derogation Decisions, which is non-compliant with OSPAR expectations.

For example, the decision to leave the CGBS legs up appears to have been made before the completion of Brent Delta well plugging and abandonment in 2014 as, rather than remove the conductors and internal casings, they were left in situ. Their presence within the leg will make any cutting operations for leg removal significantly more complex and when conducting a Comparative Assessment on CGBS Leg Management options will introduce a bias into the scoring system that will most likely preclude the leg removal option. Assertions from the UK Regulators that early approval of topsides removal of Brent Topsides would not influence later decisions relating to the management of substructures is factually incorrect. This should be challenged within OSPAR consultation and review processes.

Similarly, there are concerns that the current proposals are based upon inadequate information but that decisions have been made to ignore Stakeholders indications that the quality and volume of data needed to be improved. The handling of the CMSTG works is a cause for concern, as despite their direct and contentious input, there appears that prior decisions were made to use a non-Stakeholder approved CA process, and to ignore the CMSTG inputs entirely.

8.7.1 Proposed Works to Address Concerns

- Clarification should be sought from BEIS about their understanding of the actual implications of early topsides removal on subsequent CGBS Leg Management options.
- A complete re assessment of the CA process for Cell Contents Management Options is required using CMSTG criteria and weightings including the use of ranges where values have uncertainty bands identified.
- The various technical options should be reassessed using (a) better quality data and (b) equally engineered solutions, ideally up to FEED level as a minimum.
- The ‘Legs Up’ decision needs to be reassessed in such a manner to address IRG concerns relating to future liability/remedial works.
- The option to cut down the legs and place them on the seabed needs to be assessed after discussions with the Regulators to confirm that ‘placement’ is not classified as ‘toppling’.

8.8 ‘Out of Date’ Submission

It should be noted that the Decommissioning Programme has clearly been ‘stuck’ in the overall UK Government/Operator approval process and is now 2 years old – as such it will not reflect the latest state of the project, nor possibly its knowledge. Of more concern though is the fact that several of the referenced supporting documents are now some 8-10 years old, with little signs of Shell/Exxon progressing them in the interim, nor updating data and/or analysis/recommendations.

It is particularly noticeable that there seems to have been no progress on Cell Management issues such as bio remediation, cell access, capping operations etc. since 2010/2011. The indications are that no further substantive works have been done, even after 2014 limited samples results became available. The failure to progress these works further is not explained by Shell/Exxon. This implies a series of internal decisions being made by Shell/Exxon before activities like Cell Sampling and those of the Cell Management Stakeholder Task group had completed its works

For reasons best known to Shell/Exxon the various 2017 issued documents do not necessarily reflect the latest levels of understanding of issues. Where documents are now some 8 - 10 years old technology/knowledge will have moved on (e.g. remediation techniques, slurry pumping etc.) – there is no indication that Shell/Exxon have followed these developments and incorporated them into their thinking. The reason for this lack of updating is not given, but it is suspected that Shell/Exxon felt they had made their decision and there was no further need to work the issues. It is highly likely that they did not anticipate an 8 - 10-year delay in Decommissioning Programme submission.

Of significant note is that BEIS required additional drill cutting sampling operations post 2007 when they considered the data to be out of date at 7 years old. It is difficult to see why the same concerns do not apply to the technology issues that Shell/Exxon have indicated existed in 2009 - 2011. An example of technology improvements was recently provided by Shell/Exxon when they reported in the Shell e-news document of Jan 2019 that they had successfully cut a 400mm diameter hole through 860mm of

reinforced concrete for topsides removal operations –the successful execution of these works means that the stated position in the Decommissioning Programme relating to CGBS Cell access hole cutting is out of date. No resulting update nor Addendum has been issued.

8.8.1 Proposed Works to Address Concerns

- Consideration should be given to revisiting/updating technical studies that are now over 5 years old especially where there is evidence of technology improvements (e.g. cutting holes in concrete and internal cutting of steel members)
- All appropriate technical studies should be updated when additional better-quality data becomes available, especially for Platforms that are in their early stages of decommissioning (e.g. Brent Bravo cell contents, drill cutting samples, CGBS leg cutting operations, Brent Charlie Cells etc.)

It should be noted that a major update of the Shell/Exxon documentation will probably require a reassessment of their Decommissioning Programme and supporting CAs, ideally on an agreed criteria and weightings basis, rather than the current biased approach.

On detailed reading, the Derogation Application, Decommissioning Programme and supporting documentation appears to have little overall cohesion or consistency of approach/methodology. This would appear to reflect multiple authors over an extended period of compilation. Taking account of all the suggestions above:

- It is suggested that once the various technical and regulatory issues are resolved, the document should be re-formatted and rewritten in a cohesive and accessible manner.

9 Conclusions

Based upon the above the following conclusions can be made.

- Despite assurances from BEIS OPRED to the contrary, the Derogation Assessment supplied is not considered to demonstrate enough compliance with OSPAR Decision 98/3 requirements to warrant acceptance of any of the proposals made other than the proposal to leave the ‘clean’ lower CGBS caissons (storage cells) in situ.

This means that the following derogation proposals are considered to be non-compliant with OSPAR Decision 98/3:

- Well Conductor Sections to be ‘Left in Situ’ inside Brent Delta and Bravo Drilling legs
- Well Conductor Sections to be ‘Left in Situ’ within Brent Alpha footings.
- CGBS Legs to be left upright
- CGBS Storage Cell Oil Contaminated Water Inventories to be ‘Left in Situ’
- CGBS Storage Cell Oil Contaminated Sediments to be ‘Left in Situ’
- Drill Cuttings Mounds to be ‘Left in Situ’ around Brent Alpha, Bravo, Delta and Charlie platforms.
- Brent Alpha Jacket Footings to be ‘Left in Situ’

The primary areas of non-compliance relate to the following areas:

- Use of a Comparative Assessment process to identify ‘preferred options’ that is so inherently biased towards ‘Minimal Offshore Works’/Leave in Situ options that it is diametrically opposed to the OSPAR Decision 98/3 expectation of full removal. The CA process used throughout the Project is not considered ‘fit for purpose’.
- Failure to engage widely with Stakeholders to review, vet and develop appropriate CA criteria and weightings for use in the CA process, as recommended by BEIS Guidance Notes, coupled with a failure to explain why the CMSTG CA works have not been applied within the CGBS Cell Contents decision making process – thus negating their input and undermining the Stakeholder Engagement process.
- Additional bias that has been added to the CA process by the use of differing low maturity technical studies that are unable to demonstrate that the evaluated CA process input values are truly reflective of the option being considered. (e.g. Shell documentation indicates that further reductions in risk are likely with additional engineering works in some cases)
- Failure to account for the ranges of uncertainties that exist within the studies/assessments made within the CA process used – contrary to OSPAR Decision 98/3 Annexe 2 Section 10 requirements.
- Failure to recognise that the uncertain timings of environmental releases from any contaminated CGBS Storage Cells in particular so far in the future (circa 250 - 1000 years) means that it is impossible to accurately assess the likely prevailing environmental conditions where the release will occur, nor the impacts of such releases. All environmental assessments are currently based upon releases in the short term and so are subjective. This is considered non-compliant with OSPAR Decision 98/3 Annexe 2 Section 3 (b) requirements.
- Confusion as to which Regulations apply to CGBS Storage Cell Contents, resulting in a ‘selective’ and inconsistent approach to Attic Oil/Interphase materials and Oil contaminated water and sediment inventories. Potentially inappropriate use of the CA process to address Oil contaminated water and sediment inventories management issues (i.e. these inventories may well be covered by existing other Regulations which will drive their management options, in preference to application of OSPAR Decision 98/3)

- Inadequate poor-quality data relating to CGBS Storage cells contents; lack of a coherent sampling strategy for cell contents; and, unjustifiable ‘averaging’ and ‘extrapolation’ of sample results for use in technical assessments. These are all considered to be non-compliant with OSPAR Decision 98/3 Annex 2 Sections 4, 7 and 10 requirements.
- Failure to adequately identify what management measures might be required to prevent or mitigate adverse consequences of the disposal at sea and shall determine the scope and scale of any monitoring that would be required after the disposal at sea as specified by OSPAR Decision 98/3 Annex 2 Section 11.
- Introduction of further, undefined business drivers into the decision making process without due explanation nor evaluation of overall influence on process, leading to opaque and unclear Shell/Exxon decision making criteria. This lack of clarity does not comply with the overall intent of OSPAR Decision 98/3
- Insufficient cataloguing, topic identification of and Stakeholder accessibility to studies and reports, therefore limiting potential discussion and dialogue on issues of major societal interest, plus failure to address concerns and shortcomings identified by IRG in their Final Report.
- Application of an inappropriate strategy for cell sampling (i.e. whilst platform is still operational) resulting in unnecessary technical complexity in sampling operations producing limited poor quality storage cell samples.
- Use of outdated technologies for the sampling of drill cuttings resulting in inadequate deep cores being retrieved.
- Use of unvalidated modelling techniques for assessing the dispersal of cuttings and cell contents for locations above seabed level, such as cell roof tops.
- Failure to continually monitor developing contemporary technologies/methods for various topics, such as techniques and equipment for internal tubular cutting resulting in use of and reference to studies that are some 8+ years old.

It should be noted that

- some of the above compliance issues may potentially be resolved quite simply by the provision of more detailed up to date information, however, others will require a substantial volume of work to become OSPAR compliant. In particular the primary issues of CGBS Storage Cell Inventory Classifications and the design and use of an appropriate Comparative Assessment process are expected to take time to resolve with potentially large subsequent implications (e.g. a substantial number of reworks)
- there are numerous other lesser compliance issues that need addressing that are identified within the main sections of the report.

10 Reviewed Documentation

The following documents have been reviewed in the creation of this report.

1. Documents Issued to OSPAR Contracting Parties for Review

- Consultation On The UK Government's Intention To Issue A Permit Under Paragraph 3(A) And 3(B) Of Ospar Decision 98/3 For Leaving In Situ The Footings Of The Brent Alpha Steel Jacket And The Brent Bravo, Brent Charlie And Brent Delta Gravity Based Concrete Installations
- Brent Decommissioning Derogation Assessment
An Assessment Of Proposals For The Disposal Of The Disused Steel And Concrete Substructures Of The Brent Field Installations. Submitted to the UK Department for Business, Energy and Industrial Strategy. Shell Report Number BDE-F-GEN-HX-7180-00001 November 2018

2. Public Domain Shell/Exxon Brent Decommissioning Documents from the following website:

<https://www.shell.co.uk/sustainability/decommissioning/brent-field-decommissioning/brent-field-decommissioning-programme.html>

which provides access to the following documents

2(a) Decommissioning Programme Documents

Brent Field Decommissioning Programmes	Shell Report Number BDE-F-GEN-AA-5880-00015
Environmental Statement	Shell Report Number BDE-F-GEN-HE-0702-00006
Environmental Statement Appendix 1	DNV GL No: PP077172 - Revision 11, February 2017
Environmental Statement Appendices 2-6	DNV GL No: PP077172 - Revision 11, February 2017
Brent Delta Topside Decommissioning Programme	BDE-D-TOP-AA-5880-0000

2 (b) Technical Documents

Comparative Assessment Process	Shell Report Number BDE-F-GEN-QA-6003-00007
Brent Topside TD	Shell Report Number BDE-F-TOP-HE-0709-00001
Brent Alpha Jacket TD	Shell Report Number BDE-A-JKT-BA-5801-00001
Brent Gravity Base Structure TD	Shell Report Number BDE-F-GBS-BA-5801-00001
Brent Cell Contents TD	Shell Report Number BDE-F-GBS-BA-5801-00002
Brent Drill Cuttings TD	Shell Report Number BDE-F-SUB-BA-5801-00001
Stakeholder Report	Shell Report Number BDE-F-GEN-HX-5480-00001
IRG Report	

3. Other Documents

Shell Brent Decommissioning E-News	May 2009 – Jan 2011
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11 Appendix A US Bureau of Safety and Environmental Enforcement Idle Iron Strategy

Source: <https://www.bsee.gov/faqs/what-is-the-idle-iron-policy-and-why-does-it-exist>

What is the “idle iron” policy and why does it exist?

In October 2010, BSEE published Notice to Lessee (NTL) 2010-G05, “Decommissioning Guidance for Wells and Platforms” (sometimes referred to as the “Idle Iron” policy) to clarify existing regulations that apply when a well or platform is “no longer useful for operations,” and needs to be plugged (in the case of a well) or removed (in the case of platforms and other structures). NTL 2010-G05 clarifies that BSEE orders wells that were not useful (had not produced for five years) at the time the NTL was published to be plugged by October 2013. Any well that became “idle” or not useful for lease operations subsequent to the NTL’s publication is expected to be plugged no later than 3 years after the well became “idle.” The NTL also clarifies that BSEE will enforce the decommissioning of platforms considered “idle” or no longer useful at the time the NTL was published by October 2015. Any platform that became “idle” or not useful for lease operations subsequent to the NTL’s publication is expected to be decommissioned no later than 5 years after the platform became “idle.”

Platforms affected by the “Idle Iron” NTL are decommissioned in accordance with OCSLA regulations as described in Q1. The final disposition of the material may be a scrap yard, fabrication yard, or an artificial reef site.

In the wake of several destructive hurricanes between 2004 and 2008 that severely damaged active and inactive oil and gas infrastructure in the Gulf of Mexico, BSEE published the “Idle Iron” policy so that inactive facilities and structures would not litter the Gulf of Mexico or threaten increased risks to the marine environment and navigation. Inactive wells and platforms are susceptible to the adverse effects of severe weather. Inactive platforms may topple during storms and cause significant environmental contamination (such as the release of hydrocarbons to the surrounding waters), damage operating infrastructure, and result in new navigation and safety hazards.