BERR | Department for Business Enterprise & Regulatory Reform

APPROPRIATE ASSESSMENT

Blocks 106/30, 107/21 & 107/22 (Cardigan Bay)

DECEMBER 2007
FOR CONSULTATION

24TH OFFSHORE OIL AND GAS LICENSING ROUND

Appropriate Assessment

with regard to

24th Offshore Oil and Gas Licensing Round
Blocks 106/30, 107/21 & 107/22
(Cardigan Bay)

December 2007

Department for Business, Enterprise and Regulatory Reform
Energy Development Unit
Offshore Environment and Decommissioning

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1 SUMMARY

On 16th March 2006, the Secretary of State invited applications for Licences in the 24th Seaward Licensing Round (the 24th Round). Applications for Traditional Seaward, Frontier Seaward and Promote Licences were invited. The draft plan to hold a 24th Round had previously been subject to a Strategic Environmental Assessment (SEA), the sixth in a series undertaken by the then DTI (now the Department for Business Enterprise and Regulatory Reform (BERR)) since 1999. The SEA Environmental Report included *inter alia* detailed consideration of the status of the natural environment and potential effects of the range of activities which could follow licensing, including on conservation sites. The SEA Environmental Report was subject to a 3 month public consultation period, and a post-consultation report summarising and responding to feedback received has been produced as an input to BERR licensing decisions.

This appropriate assessment (AA) is made in order to satisfy the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended), which apply to offshore oil and gas activities in territorial waters and on the UK Continental Shelf (UKCS). This legislation implements the requirements of the Habitats Directive (92/43/EEC) and Wild Birds Directive (79/409/EEC) and creates a network of protected areas (Natura 2000 network). For simplicity, these Directives are hereafter referred to only as the 'Habitats Directive'. This AA is being undertaken under Article 6 of the Habitats Directive, to assess whether exploration licences applied for in Cardigan Bay in the 24th Round will have any adverse effects on the integrity of Natura 2000 sites also referred to as 'European Sites'. The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 came into force on 21st August 2007 and also require AA.

The Petroleum Act 1998 vests exclusive right of searching and boring for and getting petroleum within Great Britain and the territorial sea adjacent to the United Kingdom in the Crown and allows the Secretary of State, to grant licences to explore for and exploit these resources and those on the UK Continental Shelf (UKCS). Offshore licensing for oil and gas exploration and production commenced in 1964 and has progressed through a series of Seaward Licensing Rounds. The award of block licences confers no automatic right to conduct any offshore activities, which are subject to a range of statutory permitting and consenting requirements, including where relevant, activity specific AA. This AA has been undertaken in accordance with the European Commission Guidance (EC 2000), and with reference to various guidance and reports including the Habitat regulations guidance note (EN, 1997), the Planning and Policy Statement note 9 (ODPM 2005) and English Nature Research Reports, No 704 (2006).

Following an AA completed in January 2007 of the great majority of blocks applied for in the 24th Round, the Secretary of State offered 150 licences covering 246 blocks in February 2007. This AA considers blocks 106/30, 107/21 and 107/22 in Cardigan Bay applied for in the 24th Round but not included in the former AA to allow additional information to be collated. Details of specific projects cannot be defined at this stage in plan implementation. It considers, in the light of the conservation objectives of each relevant European Site, those activities that could follow block licensing which are likely to have a significant effect on European Sites, either individually or in combination with other activities. Where the assessment identified a potential for adverse effects on the integrity of European Site(s), the need and potential for mitigation measures to obviate or minimise the adverse effects were considered in reaching a conclusion.

The cetaceans in the Cardigan Bay SAC are part of one of only two resident populations of bottlenose dolphins known in UK waters (the other being in the Moray Firth). As such, knowledge about the location of, and seasonal variation in, the areas used by this resident population for breeding and foraging is important to understanding the potential adverse effects and in particular, how any such effects might be mitigated. However, knowledge of the bottlenose dolphin population in the Cardigan Bay area is currently less developed than in the Moray Firth and it could be difficult to impose suitable mitigation measures before activity starts. On this basis, applying the precautionary principle and on account of uncertainties about the size, distribution and location of the resident population of bottlenose dolphins within the Cardigan Bay Natura 2000 site, this assessment does not presently support the granting of consent under the Habitats Directive and award licences for blocks 106/30,

107/21 and 107/22, since there is not certainty, within the meaning of the ECJ Judgment in the *Waddenzee* case, that the plan will not adversely affect the integrity of relevant European Sites. This conclusion may be revisited once new data becomes available.

2 INTRODUCTION AND BACKGROUND

2.1 Introduction

On 16th March 2006, the then Secretary of State for Trade and Industry invited applications for Licences in the 24th Round. Applications for Traditional Seaward, Frontier Seaward and Promote Licences were invited (see Section 3.1 for further description of these types of licences). This AA has been undertaken as required by national regulations to assess whether granting licences in blocks 106/30, 107/21 and 107/22 will have any adverse effects on the integrity of Natura 2000 sites.

2.2 Background

The Habitats Directive requires, amongst other things, that Member States afford protection for certain species and habitats through the designation of Special Areas of Conservation (SAC) and Special Protection Areas (SPA) respectively. Collectively these Special Areas are known as "Natura 2000" sites, "European Sites" or of the "Natura 2000" network.

Article 6(3) of the Habitats Directive, first sentence, requires that "Any plan or project not directly connected with or necessary to the management of [a Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives." Article 6(3), second sentence says that "In the light of the conclusions of the assessment of the implications for the [Natura 2000] site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the [Natura 2000] site concerned …".

The AA has been undertaken in accordance with the European Commission's Methodological Guidance (EC 2000), the Habitat regulations guidance note (EN, 1997) and also the Planning and Policy Statement, note 9 (ODPM 2005) and with reference to the Judgments of the European Court of Justice (ECJ) in Cases C-127/02 (the "Waddenzee" case) and C-6/04 (Commission v. United Kingdom), and English Nature Research Reports, No 704. (2006).

This AA considers European Sites that are at any stage of designation or recommendation. The Natura 2000 network is a developing one, under current government policy, and as set out in paragraph 6 of Planning Policy Statement 9 (PPS 9) 'Biodiversity and Geological Conservation', potential sites in the process of being recommended formally to government are treated as engaging the Habitats Directive. Therefore, such sites are to be considered as any fully designated Natura 2000 site insofar as there is sufficient information on the feature(s) and boundaries of the site.

2.3 Need for Appropriate Assessment

The European Commission Guidance on Article 6 (EC 2000) notes that "A likelihood of significant effects may arise not only from plans or projects located within a protected site but also from plans or projects located outside a protected site." For this reason, it is important that Member States, both in their legislation and in their practice, allow for the Article 6(3) safeguards being applied to development pressures which are external to a Natura 2000 site but which are likely to have significant effects on it.

Analyses, consultations and discussions of environmental sensitivities have taken place prior to this assessment, in consideration of the conservation features in and adjacent to the areas of potential licensing. It has been ascertained to the satisfaction of BERR that an AA is required in respect of certain aspects of the proposed Licensing Round.

3 APPROPRIATE ASSESSMENT PROCESS AND SCOPE

3.1 Process

The whole AA process has been conducted on the following basis.

1. Screening stage

In complying with its obligations under Article 6(3), first sentence, the Department has applied the test set out by the European Court of Justice in the *Waddenzee* case (Case C-127/02). This test is that a plan or project not directly connected with or necessary to the management of a site must be subject to an AA if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects. In considering whether significant effects were likely to occur, the precautionary principle was applied. In considering whether the licensing of blocks 106/30, 107/21 and 107/22 required an AA, the Department:

- Identified the relevant blocks in the plan, in the context of this AA blocks 106/30, 107/21 and 107/22

- Identified the relevant Natura 2000 sites in the area of the plan or likely to be affected by it.[1]

  Relevant Natura 2000 sites considered included designated, candidate, possible, and draft coastal, marine and offshore SACs and SPAs whose location in relation to the blocks which have been applied for indicate the possibility of interactions.

- Considered the potential oil and gas activities that could follow adoption of the plan and in particular the potential sources of significant effects on Natura 2000 sites.

  This included both a generic consideration of oilfield activities and block specific consideration based on BERR assessment of prospectivity and indications of potential activity levels based on block applications – see Section 3.4

- Identified those Natura 2000 sites where no significant effects from the draft plan were likely, for example, because of distance or the features or natural history of the species for which the site is designated are not at risk. These sites are not considered further in this AA.

2. Appropriate Assessment stage

In carrying out this AA so as to determine whether it was possible to authorise the plan under Article 6(3), second sentence, the Department:

- Considered whether, on the basis of the precautionary principle it could be concluded that the integrity of relevant European Sites would not be affected by the plan. This impact prediction involved a consideration of the cumulative and in-combination effects.

- Examined, in relation to elements of the plan where it was not possible to conclude that the integrity of relevant sites would not be affected, whether appropriate mitigation measures could be designed which cancelled or minimised any potential adverse effects identified.

- Produced a draft AA Report and consulted with its statutory advisors and the public.

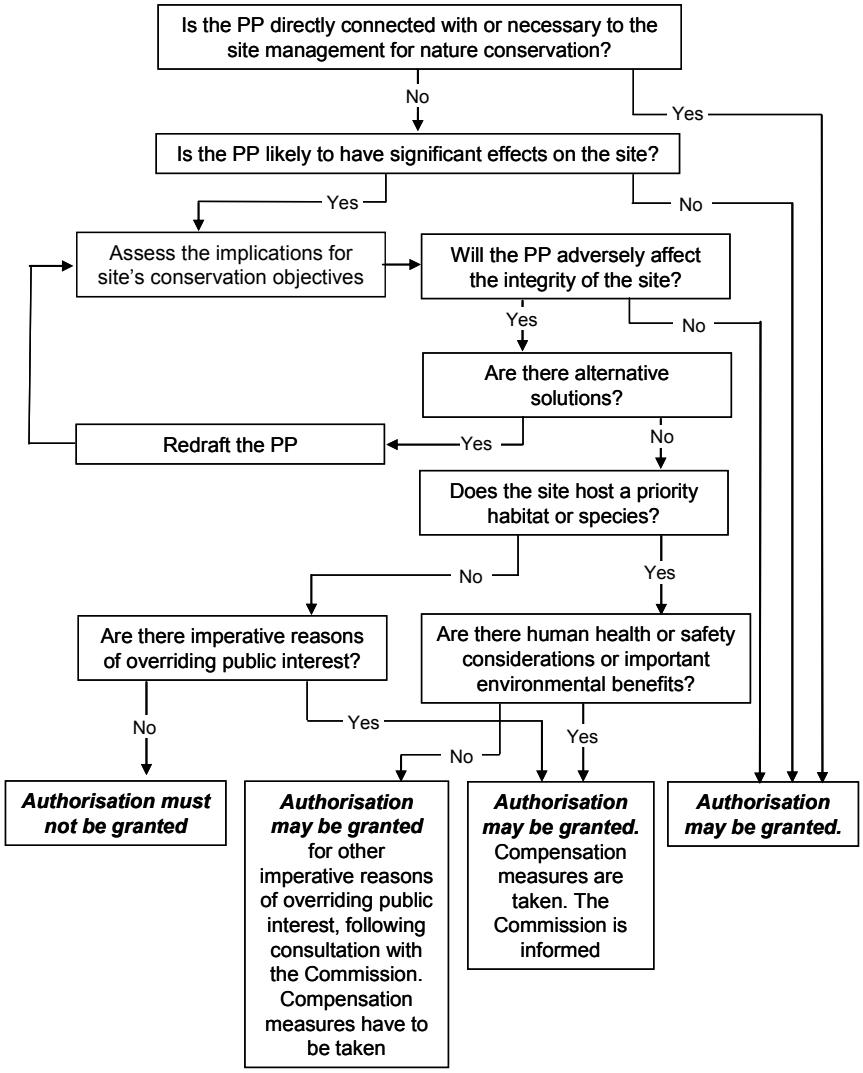
[1] EC 2000

- Considered whether, in the light of comments received, it was possible to go ahead with the plan.

  In considering this, the Department applied the test set out by the ECJ in the *Waddenzee* case, namely that a competent authority can authorise a plan or project "only if [it has] made certain that it will not adversely affect the integrity of that site. That is the case where no reasonable scientific doubt remains as to the absence of such effects."

A flowchart summarising the process is shown in Figure 3.1 where "PP" is plan or programme.

Figure 3.1 Summary of Procedures under the Habitats Directive for Consideration of Plans or Projects Affecting Natura 2000 Sites



Source: After EC (2000).

3.1.1 Site Integrity

Section 4.6.3 of the EC Guidance (2000) states "It is clear from the context and from the purpose of the directive that the 'integrity of the site' relates to the site's conservation objectives. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3), provided that the coherence of the network is not affected." The AA must therefore conclude whether the proposed activity adversely

affects the integrity of the site, in the light of its conservation objectives. English Nature (1997) states that this is whether the plan or project would adversely affect the "coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified" (PPG 9 box C10). An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation (English Nature, 1997).

3.2 Relevant blocks

Offshore blocks 106/30, 107/21 and 107/22, for which applications have been made during the 24th Seaward Licensing Round and are considered in this AA and shown on Figure 3.2.

3.3 The Natura 2000 Sites

Sites were first screened for inclusion/exclusion in the initial assessment with respect to their location to the blocks which are the subject of licence applications and in terms of the foreseeable possibility of interactions.

The initial list of sites for further consideration includes (see also Figures A1 and A2):

- Coastal and marine Natura 2000 sites (SPAs and SACs) from Anglesey to the Gower Peninsula and a small section of the north Devon coast (around Ilfracombe).

The sites together with their features of interest are summarised in Tables A1 and A2 in Appendix A together with more detailed location maps (Figures A1 and A2).

This initial list of sites was further screened (Appendix B), with impacts considered under the broad categories of:

- oil spills (including all liquid phase hydrocarbons);
- physical disturbance (e.g. trenching and placing deposits on the seabed)
- underwater noise (in particular, seismic surveys);
- in-combination (e.g. cumulative and synergistic and secondary/indirect)

It was determined on further consideration that no interaction with activities resulting from the licensing of blocks 106/30, 107/21 and 107/22 could be foreseen for a number of these sites because of the nature of the qualifying features, distance from blocks applied for and nature and scale of potential activities and these were not considered further.

Where a potential for a significant effect on a listed habitat or species was considered reasonably foreseeable from consideration of the geographic location of the sites, and the general characteristics of habitat and species present, these were considered further in Appendices D to F. Additionally, for those sites identified with the potential for a significant effect, detailed descriptions of the features present and their conservation objectives are provided in Appendix C. Whether such an impact represents an adverse effect on site integrity is then considered in detail as appropriate.

This AA is assessing the potential implications for European Sites of the proposed 24th Round licensing of blocks 106/30, 107/21 and 107/22 rather than considering the implications of specific individual projects. The award of licences for those 3 blocks may or may not give rise to subsequent development activity, the implications of which have been considered in this AA in so far as possible. Where relevant such future activities, will themselves be subject to the screening procedure and tests under the Habitats Directive which have been used to guide this AA.

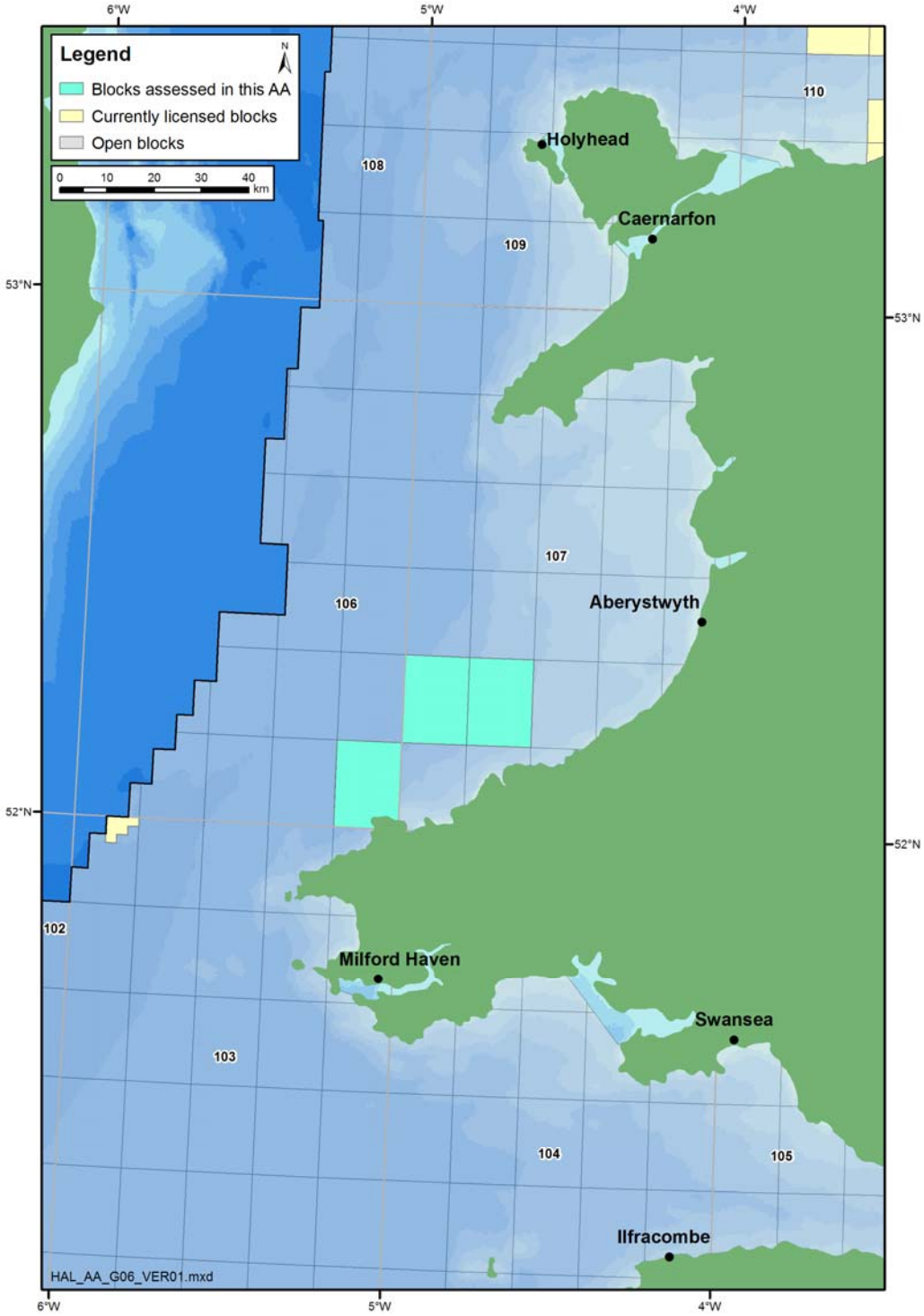
If the Secretary of State cannot be certain on the basis of the precautionary principle that the integrity of a European Site will not be affected by the plan the Secretary of State must consider whether appropriate mitigation measures will cancel or minimise the adverse effects. This could be by means of conditions in the appropriate consents that are being applied for at the time. Where necessary, the subsequent stages of the Habitats Directive will be applied as necessary and its obligations will be

discharged, which may mean withholding consent. It is emphasised that any Licence issued from the 24th Licence Round does not give blanket permission to any or all of the projects that may flow from it and it does not diminish the required assessment of environmental impacts for separate projects.

Consequently, the aim of this AA is to consider an outcome from the licensing that is reasonably foreseeable in terms of environmental impact, whilst taking into account the precautionary principle. In almost all circumstances this is equivalent to considering a reasonably foreseeable maximum degree of activity. Licences are awarded when judged against a number of criteria, including the amount of activity proposed. Once the licence has been awarded, it is possible for the Operator to undertake less or more activity depending upon a number of factors including results from early exploration.

The approach in this AA has been to take the proposed activity for a given block as being the maximum of any application for that block, and assume that all activity takes place. This more than satisfies the test of being reasonably foreseeable, and the environmental impacts of these activities are pessimistic. The 24th Round is for exploration for hydrocarbons with production being contingent on what is found during the exploration phase. It is impossible to state what future exploration will reveal. As and when specific activities and development projects are proposed, they will each be subject to regulatory assessment including the relevant tests under the Habitats Directive enabled by UK regulations. The outcome of such assessments includes the potential for consent to be withheld if it cannot be demonstrated that there will not be adverse effects on the integrity of a European Site.

Figure 3.2 Map showing Blocks assessed in this AA



4 DESCRIPTION OF THE PLAN

4.1 The licensing regime

The Petroleum Act 1998 vests exclusive rights of searching and boring for and getting petroleum[2] within Great Britain and the territorial sea adjacent to the United Kingdom in the Crown and allows the Secretary of State, to grant licences on behalf of Her Majesty to explore for and exploit these resources and those on the UKCS. The main type of offshore licence is the Seaward Production Licence. Offshore licensing for oil and gas exploration and production commenced in 1964 and has progressed through a series of Seaward Licensing Rounds. A Seaward Production Licence may cover the whole or part of a specified block or a group of blocks. A licence grants exclusive rights to the holders "to search and bore for, and get, petroleum" in the area covered by the licence. A licence does not confer any exemption from other legal/regulatory/fiscal requirements.

There are three types of Seaward Production Licences:

- Traditional Production Licences are the standard type of Seaward Production Licences and run for three successive periods or Terms. Each Licence expires automatically at the end of each Term, unless the Licensee has made enough progress to earn the chance to move into the next Term. The Initial Term lasts for four years and the Licence will only continue into a Second Term of four years if the agreed Work Programme has been completed and if 50% of the acreage has been relinquished. The Licence will only continue into a Third Term of 18 years if a development plan has been approved, and all the acreage outside that development has been relinquished.

- Frontier Production Licences are a variation of the Traditional Production Licence with four Terms rather than three. A Frontier Production Licence has a longer exploration phase (six years as opposed to four) with the objective of allowing companies to screen larger areas, during a two year Initial Term so they can look for a wider range of prospects. At the end of the Initial Term, the Licensee must relinquish 75% of the licensed acreage. The Second Term lasts four years at the end of which (i.e. when the Licence is six years old), the exploration Work Programme must have been completed and the Licensee must relinquish, 50% of what is left (i.e. leaving one eighth of the original licensed area). In this sense, the end of a Frontier Licence's Second Term corresponds to the end of a Traditional Licence's Initial Term.

- In the 21st Seaward Licensing Round (2002) the then DTI introduced Promote Licences. The general concept of the Promote Licence is that the Licensee is given two years after award to attract the technical, environmental and financial capacity to complete an agreed Work Programme. In effect, BERR will defer (not waive) its financial, technical and environmental checks until the preset Check Point. Promote Licensees are not allowed to carry out field operations until they have met the full competence criteria. The way this is implemented is that each Promote Licence carries a "Drill-or-Drop" Initial Term Work Programme. The Licence will therefore expire after two years if the Licensee has not made a firm commitment to BERR to complete the Work Programme (e.g. to drill a well). By the same point, it must also have satisfied BERR of its technical, environmental and financial capacity to do so.

The terms and conditions of the Licences are set out in the Petroleum Licensing (Exploration and Production) (Seaward and Landward Areas) Regulations Order 2004 (2004/352), as amended by the Petroleum Licensing (Exploration and Production) (Seaward and Landward Areas) (Amendment) Regulations Order 2006 (2006/784).

It is noted that the environmental management capacity and track record of applicants is explicitly examined by BERR, by way of written submissions and interviews, before licences are awarded.

[2] That is mineral oil or related hydrocarbon and natural gas

4.2 Work programmes

As part of the licence application process, applicant companies provide BERR with details of work programmes they propose to further the understanding or exploration of the blocks(s) in question. These work programmes are considered with a range of other factors in BERR's decision on whether to license the blocks and to whom. Although the approach in this assessment has been to take the proposed activity for a given block as being the maximum of any application for that block, and assume that all activity takes place as a result of the structuring of licences, it is possible to foresee what activity may potentially occur in the next four years, as this information is contained within the licence applications. On past experience, less activity actually takes place than is bid at the licence application stage. Activity after the initial four years is much harder to predict, as this depends on the results of the initial phase, which is, by definition, exploratory. A proportion of blocks awarded will be relinquished without any field activities occurring.

There are three levels of drilling commitment:

- A Firm Drilling Commitment is a commitment to the Secretary of State to drill a well. Applicants are required to make firm drilling commitments on the basis that, if there were no such commitment, the Secretary of State could not be certain that potential licensees would make full use of their licences. However, the fact that a licensee has been awarded a licence on the basis of a "firm commitment" to undertake a specific activity should not be taken as meaning that the licensee will actually be able to carry out that activity. This will depend upon the outcome of all relevant environmental assessments.

- A Contingent Drilling Commitment is also a commitment to the Secretary of State to drill a well, but it includes specific provision for BERR to waive the commitment in light of further technical information.

- A Drill-or-Drop (D/D) Drilling Commitment is conditional with the proviso, discussed above, that the licence is relinquished if a well is not drilled

It is made clear in the application guidance that a Production Licence does not grant carte blanche to carry out all petroleum-related activities from then on. Field activities, such as seismic survey or drilling, are subject to further individual controls by BERR, and a licensee remains subject to controls by other bodies such as the Health and Safety Executive. It is the licensee's responsibility to be aware of, and comply with, all regulatory controls and legal requirements.

4.3 First four-year exploration phase

The proposed work programmes for the first four-year period is detailed in the licence applications. For some activities, such as seismic survey noise and oil spills, the impacts can occur some distance from the licensed blocks and the degree of activity is not necessarily proportional to the size or number of blocks in an area. Therefore, it is appropriate to consider the impacts in a generic way. For the case of direct physical disturbance, the licence blocks being applied for are relevant, although there may still be pipelines that cross unlicensed blocks should any significant development ensue after the initial four-year exploratory period.

Based on previous experience, and for the purpose of the assessment, an estimate of the likely outcome from the 24th Round licence applications has been made. Note that Drill or Drop work programmes (subject to further studies by Licence holders) will probably only result in an actual well being drilled in less than 50% of the cases. Contingent wells are treated as firmer than Drill or Drop (perhaps 50 - 75%). The estimates of work commitments for Blocks or groups of Blocks derived by BERR based on applications received are as follows (where D/D = Drill or Drop, L = Licence):

- 106/30 – 1 L with 1 D/D
- 107/21 & 107/22 – 1 L with 1 D/D

4.4 Subsequent development

Experience from previous licensing rounds indicate that it is typical for less than half the wells drilled to reveal hydrocarbons, and of that half, less than half again will yield an amount significant enough to be considered on a list of potential developments. Depending on the expected size of finds, there may be further drilling to appraise the hydrocarbons (appraisal wells). Potential developments are then considered against current assets, current plans and a list of other discoveries. Discoveries that are developed will require further drilling, wellhead infrastructure, pipelines and possibly production facilities such as platforms, although most recent developments are tiebacks to existing production facilities rather than stand alone developments.

Therefore, the extent and timescale of development which may ultimately result from the 24th Round licensing of blocks 106/30, 107/21 and 107/22 is uncertain. Consequently, this assessment is generic in terms of the quantitative extent of development (e.g. numbers of platforms, lengths of pipelines) considered.

4.5 Licences applied for

Figure 3.2 shows part of the Welsh and Devonshire coast along with blocks 106/30, 107/21 and 107/22 for which licence applications have been made during the 24th Round in the context of existing licensed blocks.

5 ASSESSMENT OF THE EFFECTS OF THE PROJECT OR PLAN ON SITE INTEGRITY

5.1 Approach

The approach to ascertaining the absence or otherwise of adverse effects on the integrity of a European Site is set out in section 3.1 above.

Appendix A lists, maps and summarises the European Sites potentially affected by activities that could follow the licensing of blocks 106/30, 107/21 and 107/22 during the 24th Round. In Appendices B - F assessments are made of the implications for the identified European Sites and their qualifying features and species, were licences for the 3 blocks in Cardigan Bay granted. The assessment is based on the actual blocks applied for, an indication of potential work programmes for each and likely hydrocarbon resources if present. Following an initial screening exercise, the assessment has been restricted to those sources of impact judged to have the potential to affect European Sites, specifically, oil spills, physical and other effects, acoustic effects and in-combination effects. The following sections summarise the outcomes of the assessment.

Use has been made to Regulation 33 Advice prepared by the Country Agencies, since this typically includes advice on operations that may cause deterioration or disturbance to relevant features or species. The Regulation 33 Advice also includes an activities/factors matrix derived from Marlin (www.marlin.ac.uk). However, it is noted that several of the "probable" effects highlighted in the matrices are not inevitable consequences of oil and gas exploration and production since they can be mitigated through timing, siting or technology (or a combination of these). There is an expectation that these options would be evaluated in the environmental assessments required as part of activity consenting.

5.2 Conclusions for European Sites vulnerable to oil spills

Coastal European Sites may be vulnerable to oil spills although in the case of the Cardigan Bay blocks the anticipated hydrocarbon type, natural gas, serves to significantly reduce the risks since a major spill of persistent oil is not feasible from operations in the area.

Oil spills can have potentially adverse effects, and are controlled in direct proportion to this by a legal framework that minimises their occurrence, provides for contingency planning, response and clean up, and which enables prosecutions. It is not credible to conclude that in spite of the regulatory controls, an oil spill will never occur in the Cardigan Bay area as a result of 24th Round licensing. However, the potential risks of oil spills are mitigated since the hydrocarbons present are predicted to be natural gas and because of the limited inventories of light hydrocarbons associated with potential exploration or production activities in the blocks which undergo rapid natural dispersion. Appendix D2 and D3 describe oil spill risk and mitigative measures in detail and taking into account that information, it is concluded that oil spills arising from the proposed licensing of blocks 106/30, 107/21 and 107/22 will not result in an adverse effect on the integrity of the European Sites.

5.3 Conclusions for European Sites vulnerable to physical and other damage

5.3.1 Coastal Sites impinged on by blocks applied for

Coastal European Sites are potentially vulnerable to physical damage from drilling rig placement, drilling, installation construction, pipelaying and pipeline maintenance activities. While exploration or production activities could take place in or near to coastal SACs and SPAs, there are well proven methods to prevent impacts. There is a legal framework, via the necessary activity consents and Environmental Impact Assessment (EIA) regulations, to ensure that correct project timing, design and mitigation is employed so that the integrity of European Sites is not adversely affected.

Taking into account the information presented in Appendix C it is concluded that properly controlled (through the existing regulatory mechanisms), the activities that could follow from the licensing of blocks 106/30, 107/21 and 107/22 will not cause an adverse effect on the integrity of the European Sites considered in this AA.

5.3.2 Coastal Sites not impinged on by blocks applied for

Coastal European Sites are potentially vulnerable to physical damage from pipelaying and pipeline maintenance activities. While new pipelines could be constructed to allow export of gas found in the blocks to existing infrastructure, either through or near to coastal SACs and SPAs, there are well proven methods to prevent/mitigate impacts. There is a legal framework, via the necessary pipeline consents and EIA regulations, to ensure that correct project design and mitigation is employed so that the integrity of European Sites is not adversely affected.

Taking into account the information presented in Appendix E, it is concluded that activities arising from the licensing of blocks 106/30, 107/21 and 107/22 will not cause an adverse effect on the integrity of the European Sites.

5.4 Conclusions for European Sites vulnerable to acoustic disturbance

While it is clear that seismic survey noise may be detectable by marine mammals, there is no evidence that noise arising from seismic surveys presents a risk to the viability of populations in UK waters; and specifically not within designated European Sites. This would require direct mortality, behavioural response with implications for reproductive success (e.g. disturbance at fixed breeding locations) or reduced long-term ecological viability (e.g. sustained displacement from foraging grounds); such effects have never been documented. In the localised areas of European Sites designated for marine mammals, acoustic disturbance associated with seismic is intermittent and there is no evidence that cumulative effects of previous survey effort have been adverse. Despite considerable scientific effort, no causal link, or reasonable concern in relation to population viability has been found (see assessment in Appendix F).

A number of simple analyses on common noise sources have shown that seismic noise is well within the range of noises to which bottlenose dolphin and harbour porpoise are frequently exposed. Several studies note disturbance reactions in those species as a result of exposure to vessels and high frequency devices such as net pingers, which appear to have greater potential to interfere with cetaceans (e.g. because the noise is continuous or because it is tonal rather than ‘white noise’). Although hydrocarbon production platforms are sources of semi-continuous noise, they have not been observed to result in adverse effects on marine mammal occurrence in the vicinity of an installation.

In-combination effects from seismic surveys are not considered to be any greater than in-isolation effects; seismic surveys are deliberately not undertaken in the presence of other noise sources (such as piling or net pingers) that would compromise the acoustic signals.

However, SMRU (2007) emphasises that “[k]nowledge of bottlenose dolphins in the Cardigan Bay/Pembrokeshire area is less developed than in the Moray Firth”, the only other resident population of bottlenose dolphins known in UK waters. In particular, whilst for the Moray Firth there is a great deal of information on the size and distribution of the bottlenose dolphin population there is no comparable information on the population in Cardigan Bay. Knowledge about the location of, and seasonal variation in, the areas used by this resident population for breeding and foraging is important to understanding the potential adverse effects and in particular, how any such effects might be mitigated.

Given the information which is available at present on the bottlenose dolphin population in Cardigan Bay, it is difficult to characterise and quantify impacts on this population and consider how any such adverse effects might be mitigated. In particular, the mitigation measures which could be used to offset any potential adverse effects from oil and gas activities on a resident bottlenose dolphin population like that in Cardigan Bay rely on knowledge of the distribution and abundance of the

animals. Mitigation measures could be difficult to apply given current knowledge of dolphin distribution in Cardigan Bay in terms of where they forage and the importance of the coastal strip for both feeding and reproduction.

Therefore, in view of the information available, the Secretary of State considers that a precautionary approach to licensing be adopted until more information about the size and distribution of the resident dolphin population in Cardigan Bay has been collected. Consequently, there is currently no certainty within the meaning of the Waddenzee case that activities arising from the licensing of blocks 106/30, 107/21 and 107/22 will not cause an adverse effect on the integrity of the European Sites. Although the blocks should not be licensed at present, this position may be revised in the light of new information on the location of sensitive areas and times, and also on the effects of certain oil and gas activities.

5.5 In-combination effects

Although there are existing (e.g. shipping, fishing, military exercise areas, wildlife watching cruises) and planned (e.g. marine renewable energy device deployments) activities in or adjacent to blocks 106/30, 107/21 and 107/22 BERR is not aware of any projects which are likely to cause cumulative or synergistic effects that when taken in-combination with the activities discussed above would adversely affect the integrity of the relevant European Sites. In any case, there are effective regulatory mechanisms in place to ensure that operators and BERR take such considerations into account during activity permitting. These mechanisms generally allow for public participation in the process, and this will be strengthened by regulations amending the offshore EIA regime which are due to come into force later this year. In respect of oil and gas activities and other developments, these mechanisms also include project specific AA.

6 OVERALL CONCLUSION ON IMPACT

Taking account of the matters summarised above, the Secretary of State is, for the present, not able to grant consent to the plan (as defined) under the Habitats Directive and award the relevant licences. This is because there is not certainty, within the meaning of the ECJ Judgment in the Waddenzee case, that the plan will not adversely affect the integrity of relevant European Sites, taking account of the mitigation measures that can be imposed before any activity starts.

7 CONSULTATIONS AND CORRESPONDENCE

7.1 Consultations to date

Consultations have been undertaken with a range of bodies. Of most relevance to this assessment are the consultations with conservation bodies that relate to the features of the European Site.

7.2 How to comment on this AA

Please return any comments on this AA by Friday 14th March 2008.

All responses should include a reference to "Comments on Appropriate Assessment: 24th Offshore Oil and Gas Licensing Round - Blocks 106/30, 107/21 & 107/22 (Cardigan Bay)" and be submitted via the Offshore SEA website http://www.offshore-sea.org.uk or by e-mail to emt@berr.gsi.gov.uk .

Alternatively, written comments can be submitted to the address below:

Environmental Management Team
Department for Business Enterprise and Regulatory Reform
Energy Development Unit
4th Floor Atholl House
86-88 Guild Street
Aberdeen
AB11 6AR

Or by fax: 01224 254019

Confidentiality: Your comments may be made public by BERR in relation to this consultation exercise. If you do not want your name or all or part of your response made public, please state this clearly in the response. Any confidentiality disclaimer that may be generated by your organisation's IT system or included as a general statement in your fax cover sheet will be taken to apply only to information in your response for which confidentiality has been requested.

However, please also note that BERR may disclose information it holds pursuant to a statutory, legal or parliamentary obligation, including without limitation, requirements for disclosure under the Freedom of Information Act 2000 and/or the Environmental Information Regulations 2004. In considering any request for disclosure of such information under the Freedom of Information Act 2000 or the Environmental Information Regulations 2004, BERR will consider and make use of relevant exemptions or exceptions where they properly apply and, where relevant, will consider whether the public interest in withholding the information outweighs the public interest in disclosing the information. It is BERR's normal practice to consult and consider the views of third parties where necessary although decisions on disclosure are ultimately taken by BERR. However, any decision by BERR against the release of information can be appealed to the Information Commissioner and ultimately the Information Tribunal.

We will handle any personal data you provide appropriately in accordance with the Data Protection Act 1998 and the Freedom of Information Act 2000.

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APPENDIX A – THE DESIGNATED SITES

A1 Introduction

The following maps and tables show the locations of potentially relevant European sites and describe their qualifying features.

A2 Coastal and Marine Special Protection Areas

Figure A.1 Location of SPAs - Anglesey to Ilfracombe

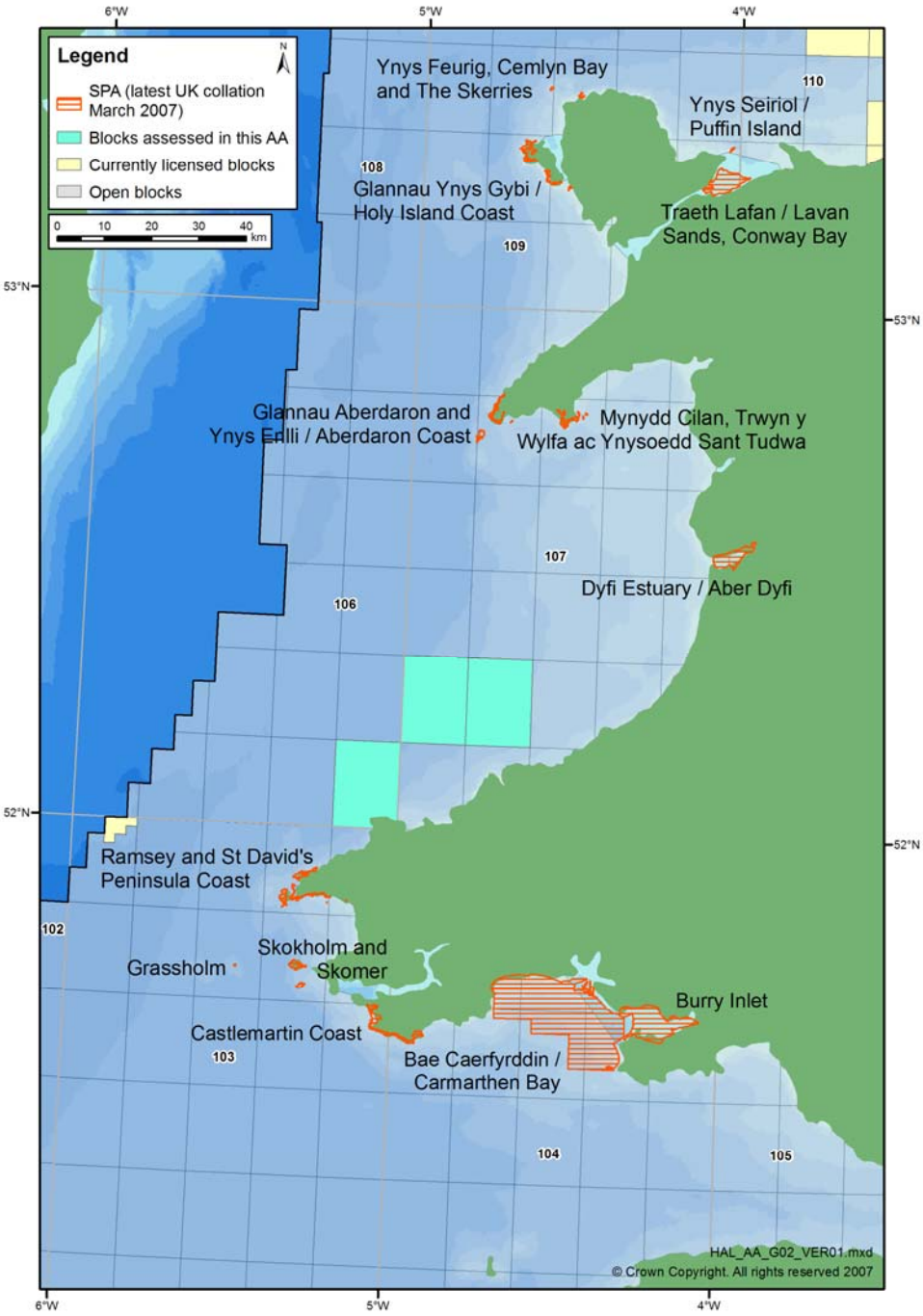

Table A.1 SPAs from Anglesey to Ilfracombe and their Qualifying Features

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages
WALES				
Traeth Lafan / Lavan Sands, Conway Bay SPA	2642.98	N/A	Over winter: Oystercatcher *Haematopus ostralegus*	N/A
Ynys Seiriol / Puffin Island SPA	31.21	N/A	Breeding: Cormorant *Phalacrocorax carbo*	N/A
Ynys Feurig, Cemlyn Bay and The Skerries SPA	85.66	Breeding: Arctic tern *Sterna paradisaea* Common tern *Sterna hirundo* Roseate tern *Sterna dougallii* Sandwich tern *Sterna sandvicensis*	N/A	N/A
Glannau Ynys Gybi/Holy Island Coast SPA	352.59	Breeding: Chough *Pyrrhocorax pyrrhocorax* Over winter: Chough *Pyrrhocorax pyrrhocorax*	N/A	N/A
Glannau Aberdaron and Ynys Enlli/Aberdaron Coast and Bardsey Island SPA	505.03	Breeding: Chough *Pyrrhocorax pyrrhocorax* Over winter: Chough *Pyrrhocorax pyrrhocorax*	Breeding: Manx shearwater *Puffinus puffinus*	N/A
Mynydd Cilan, Trwyn y Wylfa ac Ynysoedd Sant Tudwal SPA	373.55	Breeding: Chough *Pyrrhocorax pyrrhocorax* Over winter: Chough *Pyrrhocorax pyrrhocorax*	N/A	N/A
Dyfi Estuary/Aber Dyfi SPA	2048.11	Over winter: Greenland white-fronted goose *Anser albifrons flavirostris*	N/A	N/A
Ramsey, St. David's Peninsula Coast SPA	845.63	Breeding: Chough *Pyrrhocorax pyrrhocorax* Over winter: Chough *Pyrrhocorax pyrrhocorax*	N/A	N/A
Grassholm SPA	10.72	N/A	Breeding: Gannet *Morus bassanus*	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages
Skokholm and Skomer SPA	427.71	Breeding: Chough *Pyrrhocorax pyrrhocorax* Short-eared owl *Asio flammeus* Storm petrel *Hydrobates pelagicus*	Breeding: Lesser black-backed gull *Larus fuscus* Manx shearwater *Puffinus puffinus* Puffin *Fratercula arctica*	Breeding: Seabird
Castlemartin Coast SPA	1122.32	Breeding: Chough *Pyrrhocorax pyrrhocorax* Over winter: Chough *Pyrrhocorax pyrrhocorax*	N/A	N/A
Bae Caerfryddin / Carmarthen Bay SPA	33411.27	N/A	N/A	Wintering: Waterfowl
Burry Inlet SPA	6628	N/A	Over winter: Oystercatcher *Haematopus ostralegus* Pintail *Anas acuta*	Wintering: Waterfowl

A3 Coastal and Marine Special Areas of Conservation

Figure A.2 Location of SACs - Anglesey to Ilfracombe

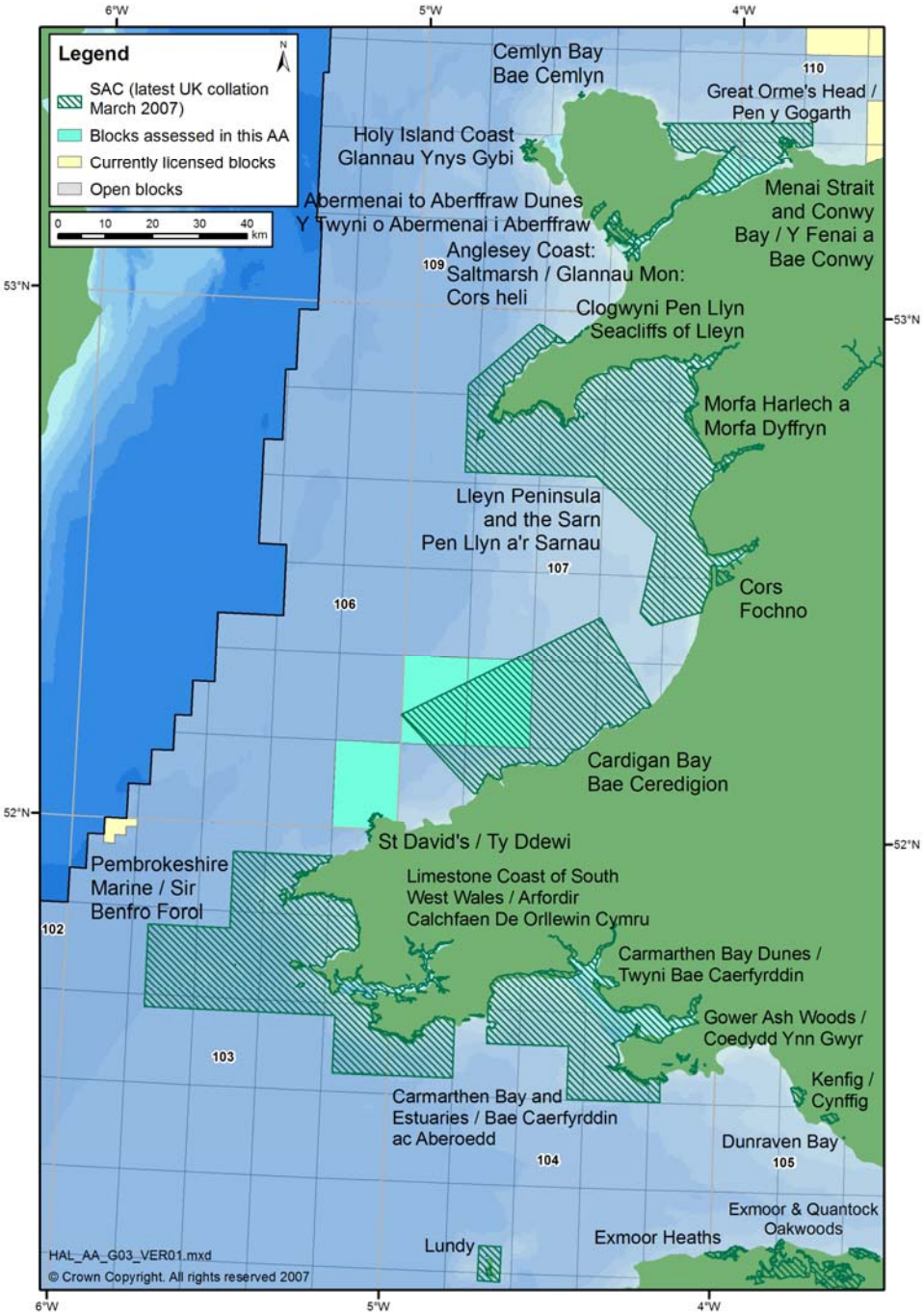

Table A.2 SACs from Anglesey to Ilfracombe and their Qualifying Features

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
WALES					
Great Orme's Head / Pen y Gogarth SAC	302.63	Heaths Grasslands	Sea cliffs	N/A	N/A
Y Fenai a Bae Conwy/Menai Strait and Conwy Bay SAC	26482.67	Sandbanks Mudflats and sandflats Reefs	Inlets and bays Sea caves	N/A	N/A
Bae Cemlyn/Cemlyn Bay SAC	43.43	Coastal lagoons	Vegetation of stony banks	N/A	N/A
Glannau Ynys Gybi/Holy Island Coast SAC	464.27	Sea cliffs Heaths	Heaths	N/A	N/A
Glannau Môn: Cors heli/Anglesey Coast: Saltmarsh SAC	1058	Salt marshes and salt meadows	Estuaries Mudflats and sandflats	N/A	N/A
Y Twyni o Abermenai i Aberffraw/Abermenai to Aberffraw Dunes SAC	1871.03	Coastal dunes	Standing freshwater	Petalwort *Petalophyllum ralfsii* Shore dock *Rumex rupestris*	N/A
Clogwyni Pen Llyn/Seacliffs of Lleyn SAC	1048.4	Sea cliffs	N/A	N/A	N/A
Pen Llyn a`r Sarnau/Lleyn Peninsula and the Sarnau SAC	146023.48	Sandbanks Estuaries Coastal lagoons Inlets and bays Reefs	Mudflats and sandflats Salt marshes and salt meadows Sea caves	N/A	Bottlenose dolphin *Tursiops truncatus* Otter *Lutra lutra* Grey Seal *Halichoerus grypus*
Morfa Harlech a Morfa Dyffryn SAC	1062.57	Coastal dunes	N/A	Petalwort *Petalphyllum ralfsii*	N/A
Cors Fochno SAC	652.71	Bogs	Bogs	N/A	N/A
Cardigan Bay/Bae Ceredigion SAC	95860.36	N/A	Sandbanks Reefs Sea caves	Bottlenose dolphin *Tursiops truncatus*	Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Grey Seal *Halichoerus grypus*
St David's/Ty Ddewi SAC	935.47	Sea cliffs Heaths	N/A	Floating water-plantain *Luronium natans*	N/A
Pembrokeshire Marine/Sir Benfro Forol SAC	138069.45	Estuaries Inlets and bays	Sandbanks Mudflats and	Grey Seal *Halichoerus grypus*	Sea lamprey *Petromyzon marinus*

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
		Reefs	sandflats Coastal lagoons Salt marshes and salt meadows Sea caves	Shore dock *Rumex rupestris*	River lamprey *Lampetra fluviatilis* Allis shad *Alosa alosa* Twaite shad *Alosa fallax* Otter *Lutra lutra*
Limestone Coast of South West Wales / Arfordir Calchfaen De Orllewin Cymru SAC	1594.53	Sea cliffs Coastal dunes	Heaths Grasslands Caves Sea caves	Greater horseshoe bat *Rhinolophus ferrumequinum* Early gentian *Gentianella anglica*	Petalwort *Petalophyllum ralfsii*
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	66101.16	Sandbanks Estuaries Mudflats and sandflats Large shallow inlets and bays Salt marshes and salt meadows Salt marshes and salt meadows	N/A	Twaite shad *Alosa fallax*	Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Allis shad *Alosa alosa* Otter *Lutra lutra*
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	1206.32	Coastal dunes	N/A	Narrow-mouthed whorl snail *Vertigo angustior* Petalwort *Petalophyllum ralfsii* Fen orchid *Liparis loeselii*	N/A
Gower Ash Woods / Coedydd Ynn Gwyr SAC	233.15	Forest	Forest	N/A	N/A
Kenfig / Cynffig SAC	1191.67	Coastal dunes Standing freshwater	Salt marshes and salt meadows	Petalwort *Petalophyllum ralfsii* Fen orchid *Liparis loeselii*	N/A
Dunraven Bay SAC	6.47	N/A	N/A	Shore dock *Rumex rupestris*	N/A
NORTH DEVON					
Exmoor and Quantock Oakwoods SAC	1895.17	Forest	Forest	Barbastelle *Barbastella barbastellus*	Bechstein`s bat *Myotis bechsteinii* Otter *Lutra lutra*
Exmoor Heaths SAC	10705.87	Heaths	Sea cliffs	N/A	N/A

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
			Bogs Fens Forest		
Lundy SAC	3064.53	Reefs	Sandbanks Sea caves	Grey seal *Halichoerus grypus*	N/A

A4 Annex 1 Habitat Abbreviations Used in Site Summaries

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
Bogs	Active raised bogs * Priority feature
	Blanket bogs * Priority feature
	Degraded raised bogs still capable of natural regeneration
	Depressions on peat substrates of the *Rhynchosporion*
	Transition mires and quaking bogs
Caves	Caves not open to the public
Coastal dunes	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
	Coastal dunes with *Juniperus* spp.
	Decalcified fixed dunes with *Empetrum nigrum*
	Dunes with *Hippophae rhamnoides*
	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)
	Embryonic shifting dunes
	Fixed dunes with herbaceous vegetation (`grey dunes`) * Priority feature
	Humid dune slacks
	Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`)
Coastal lagoons	Coastal lagoons *Priority feature
Estuaries	Estuaries
Fens	Alkaline fens
	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* * Priority feature
	Petrifying springs with tufa formation (*Cratoneurion*) * Priority feature
Forest	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae, Salicion albae*) * Priority feature
	Old sessile oak woods with *Quercus robur* on sandy plains
	Tilio-Acerion forests of slopes, screes and ravines
Grasslands	Alpine and subalpine calcareous grasslands
	Calaminarian grasslands of the *Violetalia calaminariae*
	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
	Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*) (important orchid sites) * Priority feature
	Species-rich *Nardus* grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe) * Priority feature
Heaths	Alpine and Boreal heaths
	European dry heaths
	Northern Atlantic wet heaths with *Erica tetralix*
Inlets and bays	Large shallow inlets and bays

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
Mudflats and sandflats	Mudflats and sandflats not covered by seawater at low tide
Reefs	Reefs
Salt marshes and salt meadows	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) *Salicornia* and other annuals colonising mud and sand *Spartina* swards (*Spartinion maritimae*)
Sandbanks	Sandbanks which are slightly covered by sea water all the time
Sea caves	Submerged or partially submerged sea caves
Sea cliffs	Vegetated sea cliffs of the Atlantic and Baltic coasts
Standing freshwater	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. Natural dystrophic lakes and ponds Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*
Vegetation of stony banks	Perennial vegetation of stony banks

APPENDIX B – SCREENING TABLES FOR IDENTIFICATION OF POTENTIAL EFFECTS

B1 Special Protection Areas

Site name	Features present[1]		Effects[2]				Consideration
	Breeding	Wintering	Oil spills[3]	Physical Disturbance	Acoustic disturbance	In-combination	
WALES							
Traeth Lafan/Lavan Sands, Conway Bay		✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Ynys Seiriol/Puffin Island	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Ynys Feurig, Cemlyn Bay and The Skerries	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Glannau Ynys Gybi/Holy Island Coast	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Glannau Aberdaron and Ynys Enlli/Aberdaron Coast and Bardsey Island	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Mynydd Cilan, Trwyn y Wylfa and the Saint Tudwal Islands	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Dyfi Estuary/Aber Dyfi		✓	✓	-	-	-	Hydrocarbon discharges from accidental spills (see Note 3) could

Site name	Features present[1]		Effects[2]				Consideration
	Breeding	Wintering	Oil spills[3]	Physical Disturbance	Acoustic disturbance	In-combination	
							theoretically affect the site. Mitigation is possible in terms of slick dispersal at sea. Qualifying feature (Greenland white-fronted goose) is only present in winter.
Ramsey and St David's Peninsula Coast	✓	✓	✓	-	-	-	Hydrocarbon discharges from accidental spills (see Note 3) could theoretically affect the site. Mitigation is possible in terms of slick dispersal at sea. Qualifying feature (breeding and over-wintering chough) .unlikely to be affected because although cliff-nesting, their general habitat and prey is terrestrial based.
Grassholm	✓		✓	-	-	-	Hydrocarbon discharges from accidental spills (see Note 3) could theoretically affect the site. Mitigation is possible in terms of slick dispersal at sea.
Skokholm and Skomer	✓		✓	-	-	-	Hydrocarbon discharges from accidental spills (see Note 3) could theoretically affect the site. Mitigation is possible in terms of slick dispersal at sea.
Castlemartin Coast	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Bae Caerfryddin/Camarthen Bay		✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Burry Inlet		✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)

Notes

1. *✓ denotes feature present*
2. *✓ denotes vulnerable to effect*
3. *Hydrocarbon type expected in the Cardigan Bay area is gas, therefore the oil spill for this assessment are other sources of hydrocarbon associated with drilling operations, e.g. diesel fuel, OBM and base fluid, helicopter fluid and hydraulic fluids.*

B2 Special Areas of Conservation

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic disturbance	In-combination	
WALES							
Great Orme's Head/Pen y Gogarth	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Y Fenai a Brae Conwy/Menai Strait and Conwy Bay	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Bae Cemlyn/Cemlyn Bay	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Glannau Ynys Gybi/Holy Island Coast	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Y Twyni o Abermenai i Aberffraw/Abermenai to Aberffraw Dunes	✓	✓	✓	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Glannau Môn: Cors heli/Anglesey Coast: Saltmarsh	✓		✓	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Clogwyni Pen Llyn/Seacliffs of Lleyn	✓		✓	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Pen Llyn a`r Sarnau/Lleyn	✓	✓	✓	-	✓	-	Site integrity would not be affected by emissions or discharges from

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic disturbance	In-combination	
Peninsula and the Sarnau							routine operations. Physical disturbance and accidental spills (see Note 3) may theoretically impact the site.
Morfa Harlech a Morfa Dyffryn	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Cors Fochno	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Cardigan Bay/Bae Ceredigion	✓	✓	✓	✓	✓	-	Emissions or discharges from accidental spills may theoretically impact some qualifying features of the site. These can be limited through mitigation, including slick dispersal and noise generating operations kept to minimum duration
St David's/Ty Ddewi	✓	✓	✓	✓	-	-	Emissions or discharges from accidental spills may theoretically impact on the site.
Pembrokeshire Marine/Sir Benfro Forol	✓	✓	✓	-	✓	-	Emissions or discharges from accidental spills may theoretically impact some qualifying features of the site. These can be limited through mitigation, including slick dispersal and noise generating operations kept to minimum duration
Limestone Coast of South West Wales/Arfordir Calchfaen De Orllewin Cymru	✓	✓	✓	-	-	-	Site integrity would not be affected by emissions or discharges from routine operations. Physical disturbance and accidental spills (see Note 3) may theoretically impact the site.
Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Carmarthen Bay Dunes/Twyni Bae Caerfyrddin	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic disturbance	In-combination	
Gower Ash Woods/Coedydd Ynn Gwyr	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Kenfig/Cynffig	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Dunraven Bay		✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
NORTH DEVON							
Exmoor and Quantock Oakwoods	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Exmoor Heaths	✓		-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)
Lundy	✓	✓	-	-	-	-	Site is remote from blocks and its integrity would not be affected by emissions or discharges from routine operations or accidental spills (see Note 3)

Notes

1. *✓ denotes feature present*
2. *✓ denotes vulnerable to effect*
3. *Hydrocarbon type expected in the Cardigan Bay area is gas, therefore the oil spill for this assessment are other sources of hydrocarbon associated with drilling operations, e.g. diesel fuel, OBM and base fluid, helicopter fluid and hydraulic fluids.*

APPENDIX C – RELEVANT SITE CONSERVATION OBJECTIVES

C1 Special Protection Areas

Site Name: Dyfi Estuary/Aber Dyfi SPA	
Designation	Special Protection Area
Location	Grid Ref: SN647954 Latitude 52º54'43"N Longitude 03º98'32"W
Area (ha)	2048.11
Summary	The Dyfi Estuary is located on the west coast of Wales on the boundary between Ceredigion, Gwynedd and Powys. The SPA comprises the estuary, with adjoining saltmarsh, marshy grassland and improved grassland. The estuarine complex is of outstanding physiographic interest and includes sandbanks, mud-flats, saltmarsh, peatbogs, river channels and creeks, with an extensive sand dune complex across the mouth of the estuary. The site is of importance as a traditional wintering area for Greenland White-fronted Goose *Anser albifrons flavirostris* – the most southerly regularly used area for this population in the UK. Until the early 1980s the geese roosted on the estuary and flew inland either to the Cambrian mountains or to the raised bog of Cors Fochno to feed. The geese now use the saltmarsh and grasslands for feeding and roost on the sandbanks and mud-flats.
Qualifying features for which the site is designated:	
Under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: **Over winter:** Greenland white fronted goose, *Anser albifrons flavirostris*, 144 individuals representing at least 1.0% of the wintering population in Great Britain.	
Conservation objectives:	
To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species	

Site Name: Ramsey and St David's Peninsula Coast SPA	
Designation	Special Protection Area
Location	Grid Ref: SM728285 Latitude 51º54'30"N Longitude 05º18'12"W
Area (ha)	845.63
Summary	The SPA of Ramsey and St David's Peninsula Coast is located in north Pembrokeshire in south-west Wales. The site comprises the island of Ramsey and an adjacent length of cliff and coastal habitats running around the peninsula of St David's. The huge and often greatly indented cliffs support a wide range of typical maritime vegetation communities, ranging from rock-crevice communities on the most exposed cliff faces to maritime grassland, heath and scrub on shallower slopes and in the hinterland. These coastal habitats support an important resident population of Chough *Pyrrhocorax pyrrhocorax*. These birds nest at high density in traditional locations within the cliffs and depend on the diverse mix of coastal habitats present and their low-intensity agricultural management.

Qualifying features for which the site is designated:

Under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

During the breeding season:

Chough *Pyrrhocorax pyrrhocorax*, 11 pairs representing at least 3.2% of the breeding population in Great Britain

Over winter:

Chough *Pyrrhocorax pyrrhocorax*, 22 pairs representing at least 3.2% of the wintering population in Great Britain

Conservation objectives:

To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

Site Name: Grassholm SPA	
Designation	Special Protection Area
Location	Grid Ref: SM598093 Latitude 51º43'50"N Longitude 05º28'43"W
Area (ha)	10.73
Summary	Grassholm is a small island which lies about 18 km west of the mainland coast of Pembrokeshire in south-west Wales. It is a rather low, flat-topped basalt island with limited terrestrial vegetation owing to the effects of large numbers of breeding seabirds, together with the influence of salt spray and wind exposure. Grassholm is of major importance as a breeding site for Gannet *Morus bassanus*. The seabirds feed outside the SPA in nearby waters, as well as more distantly elsewhere in the Irish Sea.
Qualifying features for which the site is designated:	
Under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: **During the breeding season:** Gannet, *Morus bassanus*, 33,000 pairs representing at least 12.5% of the breeding North Atlantic population (Count as at 1994/5)	
Conservation objectives:	
To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and to ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species	

C2 Special Areas of Conservation

Site Name: Lleyn Peninsula and the Sarnau/Pen Llyn a'r Sarnau SAC	
Designation	Special Area of Conservation
Location	Grid Ref: SH401130 (central point) Latitude 52º41'39"N Longitude 04º21'59"W
Area (ha)	146023.48
Summary	Lleyn Peninsula SAC lies in the north of Cardigan Bay, and incorporates a large area of coastal and marine environment. It is designated for a variety of coastal, intertidal and subtidal habitats, along with dolphins, seals and otters as secondary species features.

Qualifying features for which the site is designated:

Annex 1 Habitat
Primary feature: Sandbanks which are slightly covered by sea water all the time, estuaries, coastal lagoons, large shallow inlets and bays, reefs
Secondary features: Mudflats and sandflats not covered by seawater at low tide, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), submerged or partially submerged sea caves

Annex 2 Species
Primary features: None
Secondary features: Bottlenose dolphin *Tursiops truncatus*, otter, *Lutra lutra*, grey seal *Halichoerus grypus*

Conservation objectives:

For Annex I Habitats
To avoid deterioration of the qualifying habitats (listed above) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest.

To ensure for the qualifying habitats that the following are maintained in the long term:

- Extent of the habitats on site
- Distribution of the habitats within site
- Structure and function of the habitats
- Processes supporting the habitats
- Distribution of typical species of the habitats
- Viability of typical species as components of the habitats
- No significant disturbance of typical species of the habitats

For a habitat feature to be considered to be at Favourable Conservation Status, All of the following must be true:

- The area of habitat must be stable in the long term, or increasing
- Its quality including in terms of ecological structure and function) must be maintained
- Any typical species must also be at FCS, as defined below
- The factors that affect the habitat, including its typical species, must be under control

For Annex II Species
To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest.

To ensure for the qualifying species that the following are established then maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within the site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

For a species feature to be considered to be at Favourable Conservation Status, all of the following must be

Site Name: Lleyn Peninsula and the Sarnau/Pen Llyn a'r Sarnau SAC
true: • The size of the population must be being maintained or increased • The population must be sustainable in the long term • The range of the population must not be contracting • Sufficient habitat must exisit to support the population in the long term • The factors that affect the species, or its habitat, must be under control This definition of FCS for habitats and species is based on, and is entirely consistent with, the statutory definition of FCS for habitats and species given in Article 1 of the Habitats Directive (Council Directive 92/43/EEC of the 21st May 1992 on the conservation of natural habitats and of wild fauna and flora [Official Journal of the European Communities OJ no. L206, 22.7.92, p.7,

Site Name: Cardigan Bay/Bae Ceredigion SAC	
Designation	Special Area of Conservation
Location	Grid Ref: SN214641 (central point) Latitude 52º14'47"N Longitude 04º37'02"W
Area (ha)	95860.36
Summary	Cardigan Bay SAC lies in the southern half of Cardigan Bay, and covers a coastal/marine area extending several kilometres offshore. These waters support important numbers of bottlenose dolphin, in addition to grey seals and lamprey. Several important subtidal habitats are present.

Qualifying features for which the site is designated:

Annex 1 Habitat
Primary feature: None
Secondary features: Sandbanks which are slightly covered by sea water all the time, reefs, submerged or partially submerged sea caves

Annex 2 Species
Primary features: Bottlenose dolphin *Tursiops truncatus*
Secondary features: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, grey seal *Halichoerus grypus*

Conservation objectives:

For Annex I Habitats
To avoid deterioration of the qualifying habitats (listed above) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest.

To ensure for the qualifying habitats that the following are maintained in the long term:
- Extent of the habitats on site
- Distribution of the habitats within site
- Structure and function of the habitats
- Processes supporting the habitats
- Distribution of typical species of the habitats
- Viability of typical species as components of the habitats
- No significant disturbance of typical species of the habitats

For a habitat feature to be considered to be at Favourable Conservation Status, All of the following must be true:
- The area of habitat must be stable in the long term, or increasing
- Its quality including in terms of ecological structure and function) must be maintained
- Any typical species must also be at FCS, as defined below
- The factors that affect the habitat, including its typical species, must be under control

For Annex II Species
To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate

Site Name: Cardigan Bay/Bae Ceredigion SAC

contribution to achieving favourable conservation status for the qualifying interest.

To ensure for the qualifying species that the following are established then maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within the site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

For a species feature to be considered to be at Favourable Conservation Status, all of the following must be true:

- The size of the population must be being maintained or increased
- The population must be sustainable in the long term
- The range of the population must not be contracting
- Sufficient habitat must exisit to support the population in the long term
- The factors that affect the species, or its habitat, must be under control

This definition of FCS for habitats and species is based on, and is entirely consistent with, the statutory definition of FCS for habitats and species given in Article 1 of the Habitats Directive (Council Directive 92/43/EEC of the 21st May 1992 on the conservation of natural habitats and of wild fauna and flora [Official Journal of the European Communities OJ no. L206, 22.7.92, p.7,

Site Name: Pembrokeshire Marine/Sir Benfro Forol SAC

Designation	Special Area of Conservation
Location	Grid Ref: SM503093 (central point) Latitude 51º43'35"N Longitude 05º36'57"W
Area (ha)	138069.45
Summary	Pembrokeshire Marine SAC covers the entire Pembrokeshire coast and islands, extending up to several kilometres offshore at certain points. It includes several estuaries, inlets and bays and reef areas, in addition to a variety of other important intertidal and subtidal habitats. The site is occupied by important numbers of grey seal, shore dock, several species of fish and otter.

Qualifying features for which the site is designated:

Annex 1 Habitat
Primary feature: Estuaries, large shallow inlets and bays, reefs
Secondary features: Sandbanks which are slightly covered by sea water all the time, mudflats and sandflats not covered by seawater at low tide, coastal lagoons, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), submerged or partially submerged sea caves

Annex 2 Species
Primary features: Grey seal *Halichoerus grypus*, shore dock *Rumex rupestris*
Secondary features: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, Allis shad *Alosa alosa*, Twaite shad *Alosa fallax*, otter *Lutra lutra*

Conservation objectives:

For Annex I Habitats
To avoid deterioration of the qualifying habitats (listed above) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest.

To ensure for the qualifying habitats that the following are maintained in the long term:

- Extent of the habitats on site
- Distribution of the habitats within site
- Structure and function of the habitats
- Processes supporting the habitats
- Distribution of typical species of the habitats
- Viability of typical species as components of the habitats
- No significant disturbance of typical species of the habitats

Site Name: Pembrokeshire Marine/Sir Benfro Forol SAC
For a habitat feature to be considered to be at Favourable Conservation Status, All of the following must be true: • The area of habitat must be stable in the long term, or increasing • Its quality including in terms of ecological structure and function) must be maintained • Any typical species must also be at FCS, as defined below • The factors that affect the habitat, including its typical species, must be under control
For Annex II Species To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest. To ensure for the qualifying species that the following are established then maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within the site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species For a species feature to be considered to be at Favourable Conservation Status, all of the following must be true: • The size of the population must be being maintained or increased • The population must be sustainable in the long term • The range of the population must not be contracting • Sufficient habitat must exisit to support the population in the long term • The factors that affect the species, or its habitat, must be under control This definition of FCS for habitats and species is based on, and is entirely consistent with, the statutory definition of FCS for habitats and species given in Article 1 of the Habitats Directive (Council Directive 92/43/EEC of the 21st May 1992 on the conservation of natural habitats and of wild fauna and flora [Official Journal of the European Communities OJ no. L206, 22.7.92, p.7,

APPENDIX D – CONSIDERATION OF SITES AND POTENTIAL EFFECTS FROM OIL SPILLS

D1 Overview of effect and context (frequency and severity, coastal vs offshore)

The potential for oil spills associated with exploration and production, the consequences of accidental spillages, and the prevention, mitigation and response measures implemented have been reviewed in successive SEAs covering the UKCS areas. In part, this is because oil spills are probably the issue of greatest public concern in relation to the offshore oil and gas industry (although evidence indicates this is a perceived risk, as opposed to objective risk). SEAs 1 to 6 have concluded, for successive parts of the UKCS, that in relation to existing exposure to risk as a result of shipping, the incremental risk associated with exploration and production (E&P) is moderate or low.

A large number of site- and activity-specific risk assessments have also been carried out as a component of Environmental Assessments and under the relevant legislation (implementing the International Convention on Oil Pollution, Preparedness, Response and Co-operation (OPRC)).

Direct mortality of seabirds in the event of oil spill is clearly highly relevant in the context of designated coastal breeding site SPAs (and possible SPA extensions). In relation to nearshore areas designated as SPAs due to concentrations of waterbirds, vulnerability to surface pollution has been quantified by JNCC in terms of the Offshore Vulnerability Index (OVI). Additional analyses have been carried out in some areas; for example, analysis of seasonal importance of sub-areas of the Irish Sea, in terms of abundance of divers, grebes and seaduck, was carried out as part of supporting studies for SEA 6 (Barton & Pollock 2005)

For activities in proximity to sensitive shorelines, the Department's guidance (DTI, 2002) requires that the risk of shoreline contamination be determined through an appropriate risk assessment, and operators with oil spill scenarios that could impact the shoreline must have access to appropriate oil spill response resources suitable for shoreline clean-up operations. These resources should be capable of mobilising to prioritised locations within the estimated beaching time established through oil spill modelling under worst case conditions (normally a 30 knot onshore wind).

The following section provides a high-level overview of risks, regulation, contingency planning and response capabilities; followed by an assessment of risks presented to European Sites by activities which could follow licensing of Blocks 106/30, 107/21 & 107/22. As risks tend to be generic between sites, these have been categorised based on ecological sensitivity and an evaluation of spill probability and severity.

D2 Spill risk

Risk assessment, under the terms of OPRC, includes considerations of probability and consequence; generally comprising an evaluation of:

- **Historical spill scenarios and frequency** – hydrocarbon spills have been reported from exploration and production facilities on the UKCS since 1974 under PON1 (formerly under CSON7). Well control incidents (i.e. "blowouts" involving uncontrolled flow of fluids from a wellbore or wellhead) have been too infrequent on the UKCS for a meaningful analysis of frequency based on historic UKCS data. The only significant blowouts on the UKCS to date have been from West Vanguard (1985) and Ocean Odyssey (1988), both involving gas.

  The major types of spill from mobile drilling rigs have been organic phase drilling fluids (and base oil), diesel and crude oil. Topsides couplings, valves and tank overflows; and infield flowlines and risers are the most frequent sources of spills from production operations, with most spills being <1 tonne. A large proportion of reported oil spills in recent years (since about 1990) have resulted from process upsets (leading to excess oil in produced water).

Analysis of statistics of oil spills from the oil and gas industry has been undertaken by UKOOA (now Oil and Gas UK) (2002). This suggested that the best indicator of oil spill frequency was volume of production (rather than number of installations, number of fields or type of installation, although these all have an influence). From 1975 and 2001, between zero and 2.3 spills occurred each year per million tonnes of oil produced (or oil-equivalent, in the case of gas/condensate production).

An annual review of reported oil and chemical spills in UK waters – covering both vessels and offshore installations – is made on behalf of the Maritime and Coastguard Agency by the Advisory Committee on Protection of the Sea (e.g. ACOPS 2004). Across the whole review area, 21 discharges of 2 tonnes or more were reported during 2003 including 15 attributed to offshore oil and gas installations (ACOPS 2004). BERR data for UKCS offshore installations in 2003 include 375 reported spillages, totalling 83 tonnes. Over the preceding decade, the reported number of spills has increased, consistent with more rigorous reporting of very minor incidents (e.g. the smallest reported spill in 2003 was 0.0001 litre). However, the underlying trend in spill quantity (excluding specifically-identified large spills) indicates an annual average in recent years of around 100 tonnes. In comparison, oil discharged with produced water from the UKCS in 2003 totalled 5190 tonnes.

Historic major spill events from UKCS production facilities include the Claymore pipeline leak in 1986 (estimated 3,000 tonnes), Piper Alpha explosion, 1988 (1,000 tonnes), Captain spill, 1996 (685 tonnes) and Hutton TLP spill, 2000 (450 tonnes). Although potentially significant at a local scale, these volumes are minor when compared to other inputs of oil to the marine environment, such as riverine inputs (OSPAR 2000).

- **Fate of spilled oil** – the main oil weathering processes following a surface oil spill are evaporation, dispersion, emulsification, dissolution, oxidation, sedimentation and biodegradation. The majority of the anticipated reservoir hydrocarbons in the Irish Sea and Southern North Sea (SNS) are gas, with a limited content of condensate. A dry gas blowout would not result in significant deposition of liquid hydrocarbons to the sea surface, and there have been no large condensate spills on the UKCS resulting from exploration and appraisal (E&A) drilling in a comparable reservoir. Model predictions are that even a large condensate spill would evaporate and disperse relatively quickly; similarly diesel spills generally evaporate and disperse without the need for intervention. A major diesel spill of ca. 1000 tonnes would disperse naturally in about 8 hours and travel some 24km under extreme conditions of a constant unidirectional 30 knot wind

- **Trajectory of any surface slick** – Coincident with these weathering processes, surface and dispersed oil will be transported as a result of tidal (and other) currents, wind and wave action. To support environmental assessments of individual drilling or development projects, modelling is usually carried out for a major crude oil release, corresponding to a blowout, and for smaller diesel or fuel oil releases, which are expected to be less persistent. Representative modelling cases from various parts of the UKCS have been reviewed by successive SEAs.

- **Ecological effects** – the most vulnerable components of the ecosystem to oil spills in offshore and coastal environments are seabirds and marine mammals, due to their close association with the sea surface. Seabirds are affected by oil pollution in several ways, including oiling of plumage and loss of insulating properties, and ingestion of oil during preening. Pollution of the sea by oil, predominantly from merchant shipping, can be a major cause of seabird mortality. Although locally important numbers of birds have been killed on the UKCS directly by oil spills from tankers, for example common scoter off Milford Haven following the Sea Empress spill in 1996, population recovery has generally been rapid. Chronic pollution resulting from illegal dumping or tank washing probably has a greater chronic impact on seabirds than accidental spills from shipping casualties.

The Offshore Vulnerability Index (OVI) developed by JNCC and used to assess the vulnerability of bird species to surface pollution considers four factors:

- the amount of time spent on the water,
- total biogeographical population,
- reliance on the marine environment,
- potential rate of population recovery (Williams *et al.* 1994).

Vulnerability scores for offshore areas are determined by combining the density of each species of bird present with its vulnerability index score. Of the species commonly present offshore in UK offshore waters, gannet, skuas and auk species may be considered to be most vulnerable to oil pollution due a combination of heavy reliance on the marine environment, low breeding output with a long period of immaturity before breeding, and the regional presence of a large percentage of the biogeographic population. In contrast, the aerial habits of the fulmar and gulls, together with large populations and widespread distribution, reduce vulnerability of these species.

As the major breeding areas for most wildfowl and wader species are outside the UK (in the high arctic for many species), population dynamics are largely controlled by factors including breeding success (largely related to short-term climate fluctuations, but also habitat loss and degradation) and migration losses. Other significant factors include lemming abundance on arctic breeding grounds (e.g. white-fronted goose). Variability in movements of wintering birds, associated with winter weather conditions in continental Europe, can also have a major influence on annual trends in UK numbers, as can variability in the staging stops of passage migrants.

Generally, marine mammals are less vulnerable than seabirds to fouling by oil, but they are at risk from hydrocarbons and other chemicals that may evaporate from the surface of an oil slick at sea within the first few days. Grey and common seals come ashore regularly throughout the year between foraging trips and additionally spend significantly more time ashore during the moulting period (February-April in grey seals and August-September in common seals) and particularly the pupping season. Animals most at risk from oil coming ashore on seal haul-out sites and breeding colonies are neonatal pups, which are therefore more susceptible than adults to external oil contamination.

Benthic habitats and species may also be sensitive to deposition of oil associated with sedimentation, or following chemical dispersion. The proportion of a surface spill that is deposited to the seabed might be expected to increase as a result of high turbulence and suspended solids concentrations in the water column, both associated with storm conditions in shallow water. Studies of macrobenthic infauna following the Braer spill (Kingston et al. 1995), which occurred under such conditions, found no significant changes in benthic community structure, as characterised by species richness, individual abundance and diversity, which could be related to the areas of seabed affected by the spill. This may have been because Braer oil was of such low toxicity as to significantly disrupt benthic community structure, or because the sampling programme was carried out too soon after the spill to enable the full effects of its impact to be detected. In recognition of this, BERR has conducted further sampling of the study area, ten years after the spill event, results from which have indicated a substantial decline in sediment hydrocarbon concentrations.

In contrast, evidence from the Florida barge spill (Buzzards Bay, Massachusetts, September 1969, in which 175,000 gallons (700m^3) of diesel fuel were released) suggests that in certain circumstances, contamination from oil spills could be long-term. Monitoring immediately following the spill suggested rapid recovery (reviewed by Teal & Howarth 1984), while subsequent studies (sampling in 1989) indicated that substantial biodegradation of aromatic hydrocarbons in saltmarsh sediments had occurred (Teal et al 1992). However, thirty years after the spill, significant oil residues remain in deep anoxic and sulphate-depleted layers of local salt marsh sediments (Reddy et al 2002, Peacock et al 2005). The ecological consequences of this residual contamination are unclear, although there is potential for remobilisation of sediment-bound contaminants through bioturbation or storm events (in which case, aerobic biodegradation would be expected to be rapid).

D3 Regulation, contingency planning and response capabilities

Spill prevention and mitigation measures are implemented for offshore exploration and production through The Offshore Petroleum Production and Pipe-lines (Assessment of Environmental Effects) Regulations 1999 and The Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation) Regulations 1998. The required measures include spill prevention and containment measures, risk assessment and contingency planning.

Offshore, primary responsibility for oil spill response lies with the relevant Operator, although the Secretary of State's Representative may intervene if necessary. The Maritime and Coastguard Agency (MCA) is responsible for a National Contingency Plan and maintains four Emergency Towing Vessels stationed around the UK, which remain on standby at sea. In addition, the MCA maintains a contractual arrangement for provision of aerial spraying and surveillance, with aircraft based at Coventry and Inverness. Within two days, aircraft can deliver sufficient dispersant to treat a 16,000 tonne spill within 50 miles of the coast anywhere around the UK. BERR is a partner in this arrangement and undertakes regular aerial surveillance of offshore installations. MCA holds 1,400 tonnes of dispersant stockpiled in 14 locations around the UK, in addition to counter-pollution equipment (booms, adsorbents etc.) which can be mobilised within 2-12 hours depending on incident location.

Similar response capabilities, providing a tiered response capability, must be available to Operators prior to commencing drilling or production activities. These provisions are made under various long-term commercial contracts with specialist contractors, supplemented where necessary (e.g. for remote locations) with additional stockpiles. Site-specific Oil Spill Contingency Plans must also be submitted to BERR for approval prior to operations. Additional conditions can be imposed by BERR, through block-specific licence conditions (i.e. "Essential Elements")

D4 SPA/SAC qualifying species and sites

For the purposes of this assessment, European Sites have been categorised based on ecological sensitivity and an evaluation of spill probability and severity (taking into account distance from blocks under offer, and probably hydrocarbon type). This classification is by necessity a simplification of available information, but serves to provide a basis for the high level assessment required at this stage of the licensing process. Potential effects of specific E&P activities would be risk assessed under the controlling legislation outlined above.

A number of Annex I habitats have been excluded from the following assessment, on the basis of vulnerability:

- submerged reefs & sandbanks – not generally vulnerable to surface oil pollution, except possibly following application of chemical dispersants (generally not permitting in waters shallower than 20m)

- lagoons, dunes – sites above Mean High Water Springs not generally vulnerable to surface oil pollution, except possibly to wind-blown oil or evaporated hydrocarbons

- sea cliffs, sea caves – generally not considered sensitive due to wave reflection and rapid recovery (e.g. Gundlach & Hayes 1978)

NB several sites are represented in more than one risk category; only sites with species or habitats considered to be potentially at risk from oil spills are listed.

In each list, sites considered to be vulnerable to bunker or lube oil spills (proximity to known gas reserves) are coloured green; sites not considered to be vulnerable to spills originating from blocks under offer (excluding exceptional circumstances) are coloured black.

D5 Cliff-breeding seabird colonies with possible SPA extensions

These sites are designated for colonial breeding seabirds (including auks, fulmar, kittiwake, cormorant, and gannet) which nest either on, or generally associated with sea cliffs.

Grassholm SPA and Ynys Seiriol / Puffin Island SPA

D6 Petrel, tern, skua or gull breeding populations with possible SPA extensions

These sites are designated for breeding seabirds, which generally forage over sea areas adjacent to (or in some cases at considerable distance from) breeding sites.

Skokholm and Skomer SPA, Aberdaron Coast and Bardsey Island SPA and Ynys Feurig, Cemlyn Bay and the Skerries SPA.

D7 Open coastline supporting wintering waders and seaduck

These sites contain coastal and intertidal habitats which support a variety of wintering waders and seaduck often in large aggregations. The birds feed on wetlands and the surrounding shallow waters.

Traeth Lafan / Lavan Sands, Conway Bay SPA, Bae Caerfryddin/Carmarthen Bay SPA and Burry Inlet SPA.

D8 Enclosed firth, loch or estuary supporting wintering waterfowl

These sites contain semi-enclosed coastal and intertidal habitats (particularly wetlands) supporting a variety of wintering waterfowl and waders, often in large aggregations. Some species (e.g. sea-ducks) feed beyond the boundaries of sites.

Dyfi Estuary/ Aber Dyfi SPA

D9 Mudflats and sandflats

These sites are estuaries and other coastal areas with intertidal sandflats and mudflats and/or permanently submerged shallow sandbanks. The biological communities associated with these sites are related to the degree of sheltering and subsequent sediment type. Sheltered sites with fine, muddy sediments may support a high diversity and abundance of invertebrates and waterfowl.

Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC

D10 Estuaries

These sites are complexes of several subtidal and intertidal habitats with varying freshwater influence. The sediments of estuaries support various biological communities, while the water column provides an important habitat for free-living species, such as fish, and juvenile stages of benthic plants and animals. Estuaries often contain several different Annex I habitats.

Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC and Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC

D11 Saltmarshes

These sites comprise intertidal mud and sandflats colonised by vegetation due to protection from strong wave action. Pioneering saltmarsh vegetation exists where tidal flooding is frequent, with progression to more diverse, stable communities in upper reaches where tidal flooding is less frequent. Upper reaches can be valuable for plants, invertebrates and wintering or breeding waterfowl.

Anglesey Coast: Saltmarsh SAC and Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC

D12 Inlets and bays

These sites are large indentations of the coast, and generally more sheltered from wave action than the open coast. They are relatively shallow, with water depth rarely exceeding 30m, and support a variety of subtidal and intertidal habitats and associated biological communities.

Pembrokeshire Marine SAC, Lleyn Peninsula and the Sarnau SAC and Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC

D13 Bottlenose dolphins

These sites are utilised by populations of bottlenose dolphins.

Pen Llyn a`r Sarnau/Lleyn Peninsula and the Sarnau SAC and Cardigan Bay/Bae Ceredigion SAC

D14 Seal breeding sites

These sites comprise coastal habitats (beaches, estuaries, sandflats and rocky shores) with important breeding colonies of seals (common and/or grey seals). Seals forage for prey in surrounding waters and may also travel considerable distances beyond the boundaries of sites (particularly grey seals).

Pembrokeshire Marine SAC, Cardigan Bay/Bae Ceredigion SAC, Lundy SAC,

D15 Coastal otter sites

These sites are shallow, inshore coastal areas utilised by important populations of otter *Lutra lutra* for feeding.

Carmarthen Bay and Estuaries/Bae Caerfyrddin ac Aberoedd SAC, Pen Llyn a`r Sarnau/Lleyn Peninsula and the Sarnau SAC, Pembrokeshire Marine SAC

D16 Conclusion

Individual European Sites have been categorised in terms of potential vulnerability, based on location and known hydrocarbon prospectivity of the blocks included in this AA and therefore the nature and magnitude of credible risks. Two categories of vulnerability were identified:

1. Some sites are considered to be at very low risk with the potential only for impacts from minor spills of fuel and other oils (because reservoir prospectivity is for gas)
2. Many sites are considered not to be at risk of oil spills associated with activities in the blocks applied for, due to location.

The incremental risk associated with activities resulting from the proposed licensing (i.e. additional to existing risk; primarily associated with shipping and other maritime activities) is very low. This results from the combination of low probability and low severity (since most spills would be relatively small). The activities which could reasonably be expected to follow from the proposed licensing would not have a significant effect on the existing risks associated with other activities.

Following licensing, specific activities considered to present a risk to European Sites would be evaluated by the Department under mandatory contingency planning and AA procedures. In all cases, rigorous spill prevention, response and other mitigation measures are implemented for offshore exploration and production.

Given the availability of mitigation measures, the Department considers that E&P activities in so far as they may cause oil spills, will not adversely affect the integrity of European Sites.

APPENDIX E – CONSIDERATION OF SITES AND POTENTIAL PHYSICAL AND OTHER EFFECTS

E1 Introduction

Several activities associated with oil and gas exploration and production can lead to physical disturbance, damage, alteration or contamination of seabed habitats and geomorphological features, with consequent effects on benthic communities. The prime potential sources of effect are summarised below, followed by a consideration of the foreseeable effects on draft, possible and designated SACs assessed to be at potential risk.

E2 Physical damage at the seabed

The main sources of physical disturbance of the seabed from oil and gas activities are:

- Anchoring of semi-submersible rigs - semi-submersible rigs use anchors to hold position, typically between 8 and 12 in number at a radius depending on the water depth, and cause seabed disturbance from the anchors and chain or cables, and in cohesive sediments, leave 'anchor mounds' after their retrieval.

- Placement of jack-up rigs - jack-up rigs, normally used in shallower water, leave three or four depressions from the feet of the rig (the spud cans) around 15-20m in diameter. In locations with an uneven seabed, material such as grout bags may be placed on the seabed to stabilise the rig feet.

- Drilling of wells and wellhead removal - the surface hole sections of exploration wells are typically drilled riserless, producing a localised (and transient) pile of surface-hole cuttings around the surface conductor. After installation of the surface casing (which will result in a small quantity of excess cement returns being deposited on the seabed), the blowout preventer (BOP) is positioned on the wellhead housing. These operations (and associated activities such as ROV operations) may result in physical disturbance of the immediate vicinity (a few metres) of the wellhead. When an exploration well is abandoned, the conductor and casing are plugged with cement and cut below the mudline (sediment surface) using a mechanical cutting tool deployed from the rig and the wellhead assembly would be removed. The seabed "footprint" of the well is therefore removed.

- Production platform jacket installation - limited physical footprint similar to a drilling rig, but present on site for longer period. Since it is not currently viable to export gas by pressurised tanker, virtually all new field developments will need an export route. By far the most common means of exporting gas is via existing facilities and pipelines, as this involves a minimum of pipework, although the infrastructure that is physically nearest is not always suitable due to availability of capacity, incompatible gas pressures etc.

- Subsea template and manifold installation - limited physical footprint at seabed, smaller than a drilling rig, but present on site for longer period.

- Pipeline, flowline and umbilical installation, trenching and potentially, placement of rock armour - a typical pipelaying project includes the following operations:
    - Pipeline route survey(s);
    - Pre-sweep operations to minimise pipe spanning;
    - Trenching, either involving a plough or a jetting rig;
    - Pipelaying;
    - Backfilling of the original sediments;
    - Rock dumping to stabilise sections of pipe that are insufficiently buried.

- Testing and commissioning.

There are many variations on this. Large pipes (greater than 16" diameter) do not have to be trenched according to a general industry agreement as they will not be moved by fishing gear, but they may still need to be trenched for thermal insulation or to prevent upheaval buckling (due to buoyancy). Trenches may require several passes before they are of the required depth, or it may be impossible to achieve the required depth due to obstructions, in which case rock is usually placed on the pipeline (rock dump) to protect and stabilise it.

Vessels are required for surveying, trenching, pipelaying, backfilling, rock dumping and post-lay surveying (depending on what operations are undertaken). It may be that a single vessel performs multiple operations, e.g. trenching, pipelaying and backfilling may be done by the pipelay vessel. The pipelay vessel must steer an accurate route, and it will either be anchored by multiple anchors on either side (anchor handling) or it will be located by dynamic positioning (DP). In the case of anchor handling, anchors are picked up from the rear of the vessel by anchor handling tugs and dropped in front of the vessel as it moves forward. These anchors disturb the seabed and the anchor chains can also disturb the seabed in the vicinity of the anchor where the catenary swings over the seabed. Floats may be used in some circumstances to lift the anchor chain off the seabed but this significantly reduces the tension that can be created. This means that the lateral distance at which they can be deployed is smaller, and they are not safe to use in bad weather. DP vessels use multiple thrusters and a geographical positioning system to maintain course. These powerful thrusters are a significant source of marine noise. It is possible that the turbulence created could disturb sediments in shallow water although no data on this has been found.

If pipes are buoyant (e.g. many gas pipelines), they may be trenched and backfilled/rock dumped to counter buoyancy or alternatively a concrete weight coating may be required. In some circumstances where the pipe does not float, pipes may be laid in a trench but not backfilled, relying on the natural deposition processes to restore a level seabed.

Trenching equipment either displaces sediments physically using a plough, creating two 'levees' either side of the trench, or a jetting system fitted to a 'sword' is used to liquidise the sediments and break up aggregations, which are then sucked away and either discharged immediately in the vicinity or are stored on the vessel for dumping at another location. Both systems rely on a rig of 150-200 tonnes which sits on skids on the seabed and is towed by a vessel. Trenching and backfilling equipment disturbs the seabed. Creating the trench is obviously intentional but there will be a zone either side of the trench that is also disturbed. Including the skids of the trencher, the width of seabed directly affected is around 10-12m. Both methods create a plume of suspended solids.

Material excavated by a trencher may be returned as backfill by means of a backfill plough. The backfill plough sweeps a wider area of seabed than the trencher and, including its runners which compress the seabed, it modifies a width of around 24m of seabed.

Rock dump (or rock placement) is used either to fill in depressions prior to placing a pipe or to cover a pipe once laid. The Department's decommissioning guidelines assume that rock dump will not be removed from the seabed (DTI, 2006). Rates of rock dump may be 5,000 m^3 per kilometre of pipeline, which would cause cover around 11-12m width along the pipeline. Typically, the 'rocks' used comprise an inner layer of 5mm ('pea') gravel covered by an armour layer of cobbles in the order of 5-10kg each. The armour layer is designed to resist the range of bottom currents in the area, i.e. the rock dump is not expected ever to move from its location. If the pipeline is lifted on decommissioning, the rock dump may be displaced and the pea gravel may migrate, but guidelines for decommissioning pipelines are still in preparation and there is no OSPAR requirement to remove pipelines or rock dump.

Benthic communities along rock dump areas will differ significantly from surrounding communities, given the stability and shelter afforded by the rock in contrast to the prevailing sandy sediments. It is plausible that the rock will provide a suitable substrate for the development of *S. spinulosa* reef in some areas. This is, however, speculation, and there is little published information on rock dump ecology.

Assuming that suspended sediment plumes from pipelaying are similar to (or less severe than) dredging plumes, and considering the suggestions of Elliot et al. (1998), plumes from pipelaying have the potential to:

- reduce light penetration and hence primary production
- modify the surface sediment composition
- smother the benthos and clog feeding or respiration apparatus
- create a disturbed benthic community, reduce diversity, (although in the short term there may be an increase in species richness possibly due to making resources and niches available) introduce contaminants into the water column and affect larval recruitment

Elliot *et al.* (1998) also note that impacts from dredging plumes may be small in areas of high tidal currents, and quotes Poiner and Kennedy (1984) as an example where a dredge plume produced low levels of suspended sediment and did not appear to smother the benthos. It emphasises that subtidal sandbanks are the result of relatively high-energy conditions and as such they will be naturally disturbed by large changes in the hydrographic conditions e.g. storms. The ability of the community to recover from sediment disturbance is high because of the predominantly mobile nature of the component species. Therefore the influx of material such as dredge spoil should be accommodated.

Newell *et al.* (2004) noted that trailer dredging over an area of mixed substrate in the English Channel had no impact on community composition of macrofauna within the dredge site. In the same area, Hitchcock and Bell (2004) reported that the physical impact of dredging on the seabed was limited to a zone approximately 300m downtide of the dredged area. No suppression of benthic community structure was recorded beyond 100m from the dredge site. Species variety, population density, biomass and body size of macrofauna was enhanced for 2 km in each direction along the axis of the tidal streams.

Newell *et al.* (2004), quoting other sources, estimated the nature and rate of recolonisation processes in marine deposits following cessation of dredging in the English Channel. Recovery of species diversity to within 70-80% of that in the surrounding deposits was generally achieved within 100 days. Recovery of population density was achieved within 175 days. In contrast, restoration of biomass following growth of the individual colonising species was incomplete even 18 months after cessation of dredging. These data for the time taken for restoration of the biomass agree with those in the literature where recovery of biomass after initial recolonisation by the macrofauna of sands and gravels has been reported to take 2-3 years.

MMS (1999) quote various sources and report that recolonisation takes 1-3 years in areas of strong currents and up to 5-10 years in areas of low current velocity. Longer recovery times are reported for sands and gravels where an initial recovery phase in the first 12 months is followed by a period of several years before pre-extraction population structure is attained.

Oil and gas SEAs have compared the physical disturbance effects of oilfield activities to those of fishing and natural events in shallow water (e.g. storm wave action), and concluded that oilfield effects are typically minor on a regional scale. It is generally accepted that the principal source of human physical disturbance of the seabed and seabed features, is trawl fishing. Trawl scarring is a major cause of concern with regard to conservation of shelf and slope habitats and species (e.g. Witbaard & Klein 1993, de Groot and Lindeboom 1994, Kaiser *et al*. 2002a, Kaiser *et al*. 2002b, Gage *et al*. 2005). On the basis that seabed disturbance is qualitatively similar to the effects of severe storms, sand and gravel habitat recovery from the processes of anchor scarring, anchor mounds and cable scrape is likely to be relatively rapid (1-5 years) in most shallower and exposed (as opposed to sheltered) areas.

The broadscale distribution of biotopes of conservation importance is relatively well understood. Within the boundaries of designated and dSACs the occurrence of habitats of interest is usually known with greater precision.

The routine sources of potential physical damage are controlled by a range of statutory measures including Consent to Locate, PON15B, Environmental Statement, Pipeline Works Authorisation and were relevant AA. Based on the results of the assessments including AA BERR may require

additional mitigation measures to cancel or minimise any adverse effects, or where this is not possible, refuse consent.

E3 Marine discharges

As described in previous oil and gas SEAs, marine discharges from exploration and production activities include produced water, sewage, cooling water, drainage, drilling wastes and surplus water based mud (WBM), which in turn may contain a range of hydrocarbons in dissolved and suspended droplet form, various production and utility chemicals, metal ions or salts (including Low Specific Activity radionuclides). In addition to these mainly platform-derived discharges, a range of discharges is associated with operation of subsea infrastructure (hydraulic fluids), pipeline testing and commissioning (treated seawater), and support vessels (sewage, cooling and drainage waters). The effects of the majority of these are judged to be negligible in the context of 24th Round blocks and Natura 2000 sites and are not considered further here. They would also be considered in detail in project specific AAs, Environmental Statements and chemical risk assessments under existing permitting procedures.

Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades, and oil concentrations in the major streams (drilling wastes and produced water) have been substantially reduced.

OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations provides for a reduction in the discharge of oil in produced water and also includes a presumption against the discharge to sea of oil in produced water from new developments.

Drilling wastes are a major component of the total waste streams from offshore exploration and production, with typically around 1,000 tonnes of cuttings resulting from an exploration or development well. Water-based mud cuttings are discharged at, or relatively close to, sea surface during “closed drilling”, whereas surface hole cuttings will be discharged at seabed during “open-hole” drilling. Use of oil-based mud systems, for example in highly deviated sections or in water reactive shale sections, would require the onshore disposal or reinjection of the waste materials.

Mud systems used in surface hole drilling for exploration wells are usually simple (seawater with occasional viscous gel sweeps) and would not result in significant contamination of sediments. However, the composition of closed drilling discharges likely to result from exploration, appraisal and development drilling (and to a lesser extent from well maintenance activities) is more complex, and will include cuttings (i.e. rock in varying degrees of consolidation and in a range of particle sizes), barite or other naturally occurring dense minerals, salts (sodium and potassium chloride), bentonite, and a range of mud additives in much smaller quantities. Water-based mud additives perform a number of functions, but are predominantly polymeric organic substances and inorganic salts with low toxicity and bioaccumulation potential.

Operational chemicals/substances for use in the UKCS have to be notified and tested under the Offshore Chemical Notification Scheme (OCNS), administered by BERR using scientific and environmental advice from CEFAS (the Centre for Environment, Fisheries and Aquaculture Science). Information required on the OCNS list include a ranking for each chemical (Hazard Quotient (HQ) values or OCNS group) and an indication of whether they would have a adverse environmental effect (Risk Quotient or RQ values). HQ values are generated the CHARM (Chemical Hazard Assessment & Risk Management) model and provide an indication of the potential hazard. Chemicals are ranked according to their worst-case HQ (Gold (HQ = >0-<1); Silver (>=1-<30); White (>=30-<100); Blue (>=100-<300); Orange (>=300-<1000), and Purple (>=1000). Where HQ values cannot be generated using CHARM, chemicals continue to be ranked according to their revised OCNS group (A, B, C, D and E), with Group E representing the least potential hazard. Group Z indicates those chemicals with zero discharge.

A permit application for the use and discharge of chemicals is required by *The Offshore Chemicals Regulations 2002* and is required to be submitted to BERR in advance of the commencement of drilling.

In addition to mud on cuttings, surplus water-based mud may be discharged at the sea surface during or following drilling operations. Due to its density, a proportion of the particulate component of the mud (including barite) may settle in the vicinity of the discharge point.

The discharge of surface hole cuttings at the seabed is likely to produce a discrete transient pile of cuttings surrounding the conductor. Although this may be disturbed by emplacement of and removal of the wellhead assembly, a small pile is likely to remain for a period following well abandonment or suspension. The duration over which this pile persists will be dependant on the tidal and other currents of the area. This material will consist of shallow formation cuttings and will be very similar to surficial sediments in composition and characteristics. Most of the chemical additives typically used in the drilling of the surface sections are categorised by OSPAR as PLONOR (**P**ose **L**ittle **O**r **NO R**isk to the marine environment) or inorganic and have the lowest Hazard Quotient (Gold or OCNS Group E).

The discharge of cement and component chemicals, some 100-120 tonnes per well, is likely both as direct annular returns at seabed and at surface following displacement of excess cement from the wellbore. Cement returns to seabed surface are routinely monitored by ROV so pumping of cement can be stopped when returns appear at the seabed. The majority of the cement and cement chemicals have either PLONOR status or have Gold Band CHARM HQs and adverse effects have not been reported.

Beyond the zone of physical smothering immediately around the wellhead, ecological effects of surface hole cuttings discharge are considered to be negligible.

A major insoluble component of WBM discharges, which will accumulate in sediments, is barite (barium sulphate). Barite has been widely shown to accumulate in sediments following drilling (reviewed by Hartley 1996). Barium sulphate is of low bioavailability and toxicity to benthic organisms. Other metals, present mainly as salts, in drilling wastes may originate from formation cuttings, from impurities in barite and other mud components, or from other sources such as pipe dopes.

When WBM is used to drill the lower hole sections of the well, a proportion is normally discharged either on cuttings, or as excess mud if the required technical properties of the fluid cannot be maintained e.g. through dilution with water. The great majority (approximately 95% by weight) of the constituents of most WBM would be expected to be included in the OSPAR PLONOR list.

Four main types of environmental effect are associated with the discharge of WBM and cuttings drilled with WBM:

- Plume formation and turbidity, mainly associated with silt and clay particles which do not settle rapidly through the water column
- Settlement of particulates on the seabed, potentially causing physical smothering and changes to substrate characteristics
- Organic enrichment and subsequent oxygen depletion associated with enhanced aerobic microbial activity in surface sediments
- Direct toxicity effects in the water column and affected seabed

In general, none of the above has proved to be significant following extensive use and discharge of WBM in the North and Irish Seas. The chemical formulation of WBM avoids or minimises the inclusion of toxic components, and the materials used in greatest quantities (barite and bentonite) are of negligible toxicity (barium sulphate is of low bioavailability and toxicity to benthic organisms e.g. Starczak *et al*. 1992).

Organic additives to WBM perform a number of functions, but are predominantly polymeric substances and glycols with low toxicity and bioaccumulation potential (DTI 2003). A large proportion of organic components is likely to dissociate from cuttings and discharged mud in the water column, and can be expected to biodegrade with no observable environmental effects.

Dispersion of mud and cuttings is influenced by various factors, including particle size distribution and density, vertical and horizontal turbulence, current flows, and water depth. In deep water, the range of cuttings particle size results in a significant variation in settling velocity, and a consequent gradient in the size distribution of settled cuttings, with coarser material close to the discharge location and finer material very widely dispersed away from the location, generally at undetectable loading. The typical conclusion of cuttings dispersion reports is that the particulate concentrations at the seabed would be negligible (and insignificant in the context of naturally occurring particulates) at distances of more than a few hundred metres from a wellhead.

Although the presence of drilling material at the seabed close to the drilling location (<500m) is often detectable, there is a substantial body of evidence available from North and Irish Sea monitoring studies, e.g. Daan and Mulder (1996) and Rees (1994), and laboratory studies, e.g. Neff *et al*. (1989) that indicates little or no detectable effects of WBM discharges in shelf water depths. In contrast to the general picture of limited effects of WBM discharges, Cranford and Gordon (1992) reported low tolerance of dilute bentonite clay suspensions in scallops (*Placopecten magellanicus*). Cranford *et al*. (1999) found that used WBM and its major constituents, bentonite and barite caused effects on the growth, reproductive success and survival of *Placopecten*, which were attributed to chronic toxicity and physical disturbance. It may be that *Placopecten* is especially sensitive to drill muds (or fine sediments in general) or that in the field WBM discharges rapidly disperse to below effective concentrations.

Most studies of ecological effects of drilling wastes have involved soft-sediment species and habitats. Studies of the effects of water based mud discharges from 3 production platforms in 130-210m water depth off California found significant reductions at some stations in the mean abundance of 4 of 22 hard bottom taxa investigated using photographic quadrats (Hyland *et al*. 1994). These effects were attributed to the physical effects of particulate loading, namely disruption of feeding or respiration, or the burial of settled larvae.

E4 Other effects

The actual or potential introduction of non-native species through vessel movements is an issue of major concern. Through the transport and discharge of vessel ballast waters (and associated sediment), and to a lesser extent fouling organisms on vessel/rig hulls, large numbers of non-native species may be introduced to the marine environment. Should these introduced species survive and form an established breeding population, they can exert a variety of negative effects on the environment. These include: displacing native species by preying on them or out-competing them for resources such as prey and habitat; irreversible genetic pollution through hybridisation with native species; increased occurrence of toxic algal blooms. The economic repercussions of these ecological effects can be very significant. In response to this, a number of technical and procedural measures have been proposed (such as the use of ultraviolet radiation to treat ballast water) or introduced such as a mid-ocean exchange of ballast water (the most common mitigation against introductions of non-native species). International management of ballast waters is addressed by the International Maritime Organisation (IMO) through the International Convention for the Control and Management of Ships Ballast Water & Sediments, which was ratified in 30 States in 2005. The Convention includes Regulations with specified technical standards and requirements (IMO Globallast website).

The potential effects of light on birds have been raised in connection with offshore oil and gas over a number of years (e.g. Weise *et al*. 2001). As part of navigation and worker safety, oilfield installations and associated vessels are lit at night and the lights will be visible at distance (some 10-12 nm in good visibility). The attractive effect of lights on seabirds in cloudy nights is enhanced by fog, haze and drizzle (Weise *et al*. 2001). The lights on installations and vessels are primarily non-flashing so the behavioural effects noted by Bruderer *et al*. (1999) in response to a strong searchlight being switched on and off are not anticipated.

Plan level considerations of this potential source of effect on Natura 2000 sites are that the likely number of developments following block licensing is expected to be limited, with most being subsea tiebacks to existing infrastructure and that mitigation is possible. For example, potential effects can

be mitigated through the control or avoidance of well test and routine flaring during production, and timing controls can be used since drilling and construction are temporary activities. It is therefore concluded that adverse effects from light are not expected.

Physical disturbance of seaduck and other waterbird flocks by vessel and aircraft traffic associated with oil and gas exploration and production are possible, particularly in SPAs established for shy species such as common scoter. Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. As with light, this source of potential effect is considered unlikely to result in significant effects at Natura 2000 sites because of the projected limited scale and nature of developments and because mitigation is possible which would be identified during activity specific assessment and permitting processes. Available mitigation measures include strict use of existing shipping and aircraft routes, timing controls on temporary activities to avoid sensitive periods. It is therefore concluded that adverse effects from physical disturbance are not expected.

APPENDIX F – CONSIDERATION OF SITES AND POTENTIAL ACOUSTIC EFFECTS

F1 Overview of effects of acoustic disturbance

Compared to the noise derived from seismic surveys, noise from other oil and gas activities is relatively minor; sequential oil and gas SEAs have assessed noise in some detail, and the following discussion is focussed on seismic noise, as the primary concern. The potential for significant effect is therefore largely related to the anticipated type, extent and duration of seismic survey associated with proposed licensing. The range over which noise propagates (and effects may result) varies with water depth, density stratification, substrate and other factors, and is therefore area-specific.

Of all marine organisms, marine mammals are regarded as the most sensitive to acoustic disturbance. This is due to their use of acoustics for echolocation and vocal communication, and their possession of large, gas filled organs which are sensitive to rapid pressure changes. Most concern in relation to seismic noise disturbance has been related to cetacean species. However, some pinnipeds (seals, sea lions and walruses) are known to vocalise at low frequencies (100-300Hz) (Richardson *et al*. 1995), suggesting that they have good low frequency hearing and are therefore sensitive to acoustic disturbance. Otters, where present in coastal habitats, may also experience acoustic disturbance through seismic exploration. However, they generally occupy shallow, inshore areas where the propagation of seismic noise is very limited. Acoustic disturbance of pinnipeds from aircraft is also a matter of concern.

In Appendix A3, several species of lamprey, and three other species of fish are identified as primary or qualifying Annex II species amongst three different SACs. The majority of these fish are anadromous, and occupy estuaries and coastal waters for part of their life cycle.

Many species of fish are highly sensitive to sound and vibration (review in MMS 2004). Exposure to high sound pressure levels has been shown to cause long-term (>2 months) damage to sensory cells in fish ears (Hastings *et al*. 1996, McCauley *et al*. 2003). Other reported effects include threshold shifts (hearing loss), stress responses and other behaviour alterations (review in Popper *et al*. 2003). A number of field studies have observed displacement of fish and reduced catch rates, suggested to be attributable to behavioural responses to seismic exploration (e.g. Skalski *et al*. 1992, Engås *et al*. 1996, Hassel *et al*. 2004, Slotte *et al*. 2004). Specific to Atlantic salmon, Knudsen *et al*. (1994) showed that a source of intense low frequency sound (10Hz) within a river acted as an acoustic barrier to young salmon, with fish being displaced to an area where the intense sound was absent.

There are currently no UK Natura 2000 sites with marine invertebrates as qualifying features. However, invertebrates such as crabs and squid may form an important component of the diet of qualifying Annex II species, for example bottlenose dolphin *Tursiops truncatus*.

The study of effects of seismic noise on invertebrates is limited, and it has been suggested that no reliable conclusions can be made that negative effects exist or not (Moriyasu *et al.* 2004). Recent studies into the effects of seismic exploration on crustaceans have shown no significant long term effects on physiology, behaviour or catch rates (Christian *et al*. 2003, DFO 2004, Parry & Gason 2006). Due to their well developed nervous system, cephalopods such as squid may be more sensitive to seismic noise than other invertebrates; however, evidence for effects of seismic noise on these animals is very limited (review in Moriyasu *et al*. 2004).

Direct effects on seabirds because of seismic exploration noise could occur through physical damage, or through disturbance of normal behaviour. Diving seabirds (e.g. auks) may be most at risk of acute trauma. The physical vulnerability of seabirds to sound pressure is unknown, although McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic in some species (penguins) would be high, hence only at short ranges would individuals be adversely affected. Mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere. A study has investigated seabird abundance in Hudson Strait (Atlantic

seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of fulmar, kittiwake and thick-billed murre (Brünnich's guillemot).

Airborne noise, for example from helicopter overflights, could potentially disturb birds in coastal SPAs, although in the context of other military and civilian aircraft activities the anticipated level of E&P related noise is insignificant. In specific cases of concern, mitigation through routing restrictions would be implemented.

F2 Noise sources and propagation

With the exception of explosives and modern military sonar, airgun arrays used for seismic surveys are the highest energy man made sound sources in the sea; broadband source levels of 248-259 dB re 1μPa are typical of large arrays (Richardson *et al*. 1995). Airgun noise is impulsive (i.e. non-continuous), with a typical duty cycle of 0.3% and slow rise time (in comparison to explosive noise). Most of the energy produced by airguns is below 200 Hz, although some high frequency noise may also be emitted (Goold 1996, Gordon and Moscrop 1998). Peak frequencies of seismic arrays are generally around 100Hz; source levels at higher frequencies are low relative to that at the peak frequency but are still loud in absolute terms and relative to background levels.

Current levels of seismic survey in the UKCS are around 20-30 surveys per year, which has been the case for the past few years. This has declined from 75 surveys in 1997 (the Department's database of PON14 closeout submissions).

The oil and gas SEA process has reviewed general aspects of noise propagation. Most environmental assessments of noise disturbance in deep water use simple spherical propagation models to predict sound pressure levels at varying distances from source. However, additional signal modification and attenuation may result from a combination of reflection from sub-surface geological boundaries, sub-surface transmission loss due to frictional dissipation and heat; and scattering within the water column and sub-surface due to reflection, refraction and diffraction in the propagating medium (see SEA 4). In shallow water, reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels than for spherically propagated low frequency signals (which penetrate the seabed).

In general, as distance from the array increases, higher frequencies are attenuated more rapidly and beyond a few kilometres, the main contribution is in the 2kHz region. Finally beyond around 12km it will be the main low-frequency pulse of around 250Hz that has the main contribution. However, local propagation effects may have significant influence: for example frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal. Simple models of geometric transmission loss may therefore be unreliable in relatively shallow water; in areas of complex seabed topography and acoustic reflectivity; where vertical density stratification is present in deep water; and where the noise does not originate from a point source. In the St George's Channel, Goold and Fish (1998) recorded 8 kHz sounds above background levels at a range of 8km from the source, even in a high noise environment.

Available measurements indicate that drilling activities produce mainly low-frequency continuous noise from several separate sources on the drilling unit (Richardson *et al*. 1995, Lawson *et al*. 2001). The primary sources of noise are various types of rotating machinery, with noise transmitted from a semi-submersible rig to the water column through submerged parts of the drilling unit hull, risers and mooring cables, and (to a much smaller extent) across the air-water interface. Under some circumstances, cavitation of thruster propellers is a further appreciable noise source.

Drilling noise has been monitored west of Shetland, in the vicinity of the Foinaven and Schiehallion developments (Swift & Thompson 2000). High and variable levels of noise were initially believed to result from drilling related activity on two semi-submersible rigs operating in the area. However, subsequent analysis found more direct correlation between the use of thrusters and anchor handlers, during rig moves, and high levels of noise (Swift & Thompson 2000). Further measurements of

drilling and pipelay noise in the North Sea have been sponsored by the industry (Nedwell & Needham 2001, Nedwell *et al*. 2001, Nedwell *et al*. 2002).

Although there is little published data, noise emission from production platforms is thought to be qualitatively similar to that from ships, and is produced mainly by rotating machinery (turbines, generators, compressors).

Acoustic disturbance of pinnipeds from aircraft is also a matter of concern. Animals which are hauled out for pupping or moulting are probably the most susceptible to such disturbance (Richardson *et al*. 1995). Richardson *et al*. (1983) provide a review of effects of aircraft on pinnipeds. Overflying aircraft may cause seals to temporarily vacate pupping beaches, which could result in separation of mothers and pups. In open water, seals generally dive when an aircraft passes overhead at low altitude. Low flying helicopters have been observed to be disturbing in certain circumstances.

F3 Effects thresholds in marine mammals

Richardson *et al.* (1995) defined a series of zones of noise influence on marine mammals, which have been generally adopted by SEAs and EAs undertaken in relation to previous Licensing Rounds. Similarly, data on marine mammal responses have been exhaustively reviewed (e.g. Richardson *et al*. 1995, Gordon *et al*. 1998, Lawson *et al*. 2001, Simmonds *et al*. 2003). Four zones are recognised which will generally occur at increasing sound level: (1) the zone of audibility; (2) zone of responsiveness; (3) zone of masking; (4) zone of hearing loss, discomfort or injury. Potential acute effects include physical damage, noise-induced hearing loss (temporary and permanent threshold shifts) and short-term behavioural responses. Postulated chronic effects (for which evidence is almost entirely absent) including long term behavioural responses, exclusion, and indirect effects. The most likely physical/physiological effects are generally considered to be shifts in hearing thresholds and auditory damage.

Australian seismic guidelines (Environment Australia 2001) consider that “sounds heard by whales of over approximately 140 dB in feeding, breeding or resting areas may be considered likely to significantly disturb whales that are present. Sounds heard by whales of over 150 dB in other areas, such as migratory paths, may significantly disturb whales that are in the area”. In contrast to this behavioural consideration, the National Marine Fisheries Service (NMFS) criterion for onset of Level A harassment resulting from seismic noise, under the US Marine Mammal Protection Act (180 dB re 1 µPa rms) and for Level B harassment (160 dB) were determined in relation to the likelihood of auditory threshold shifts (MMS 2004).

Most research effort has concentrated on large whales and Richardson *et al*. (1995) commented on an almost total lack of studies on effects of geophysical surveys on delphinid species. Using recorded airgun pulses from a 2D seismic survey with a 2,120 cubic inch airgun array, measured as power spectral density and re-calculated using a weighting method for comparison with a dolphin audiogram obtained using pure tone bursts, Goold (1996) and Goold & Fish (1998) concluded firstly that common dolphins were able to tolerate seismic pulses at a distance of 1 km from the array; and secondly that received levels at this distance were equivalent to a SPL of 133 dB re 1 µPa rms at 20 kHz.

Ketten (2001) concludes, from a comprehensive review, that a signal intensity of 140 dB that is also 80-90 dB over the individual threshold at each frequency is required for significant threshold shifts, i.e. a blanket figure of overall noise level is not appropriate. Typically, dolphins take avoidance action >90 dBht (Nedwell, 2005) (dBht is a species-specific parameter used to estimate perceivable level of sound). The zone around a seismic vessel where sound levels are >90 dBht is relatively small, perhaps a radius of 1.5km around the centre of the array, although (as noted above) local propagation effects make this sort of small-scale prediction imprecise. This would correlate with observed reactions taking place within 1-2km, although avoidance cannot be entirely instinctive, as dolphins are observed moving towards seismic vessels within this range, particularly after airguns have been firing for some time (Stone 2003).

Little is known of the acoustic abilities and sensitivities of beaked and pilot whales, although these species almost certainly use echolocation clicks spanning the sonic and low ultrasonic frequency range (MMS 2004). Hooker and Whitehead (2002) report echolocation clicks from diving bottlenose

whales over the Gully submarine canyon on the Scotian Shelf; while clicks and frequency modulated whistles have been reported from beaked whales, with frequencies ranging between 300 Hz and 40 kHz (see review in MMS 2004). It is therefore assumed that beaked whales have good auditory capabilities over this frequency range, and will be susceptible to a similar range of disturbance and physiological effects to those observed in other cetacean species. In recent years, concerns in relation to beaked whales have also been associated with the use of military sonars, following a number of mass stranding events and the postulation of potential mechanisms of physical trauma in deep-diving marine mammals (e.g. Jepson *et al*. 2003, Moore & Early 2004). To date, these mechanisms including formation of gas bubbles (and resulting decompression sickness or "bends"), either due to a behavioural response or directly induced by sound, have not been associated with geophysical surveys.

Behavioural responses to anthropogenic noise have generally been studied by visual or acoustic monitoring of abundance. Visual monitoring of cetaceans during seismic surveys has been carried out for several years throughout the UKCS. Stone (2003) carried out a detailed statistical analysis of 1,652 sightings during 201 seismic surveys, representing 44,451 hours of observational effort. Sighting rates of white-sided dolphins, white-beaked dolphins, *Lagenorhynchus* spp., all small odontocetes combined and all cetaceans combined were found to be significantly lower during periods of shooting on surveys with large airgun arrays. In general, small odontocetes showed the strongest avoidance response to seismic activity, with baleen whales and killer whales showing some localised avoidance, pilot whales showing few effects and sperm whales showing no observed effects.

In terrestrial mammals, exposure to loud sounds can lead to temporary threshold shifts (TTS), permanent threshold shifts (PTS) and non-auditory tissue damage, which may be fatal. For continuous sound sources, the intensity of the signal relative to the hearing threshold at that frequency, and the duration of the exposure can both affect the timing of the onset of TTS and PTS. For impulsive sounds, the intensity, pulse duration, pulse repetition rate and duration of exposure can all affect the timing and extent of TTS and PTS. With the absence of reliable information on the levels of sound likely to cause hearing damage in most marine mammal species, it has been common practice to transfer human Damage Risk Criteria (DRC) to other mammals. Richardson *et al*. (1995) predict that at low frequencies (<500 Hz) TTS would occur at around 165-180 dB re 1μPa@1m in phocids and at around 180-210 dB re 1μPa@1m in small odontocetes.

These represent the DRC estimates for exposure to continuous noise. For impulsive, intermittent sounds, e.g. airgun firing, the sound levels may be significantly higher, and will depend on the length and number of pulses received. Richardson *et al* (1995) estimated the DRC for 100 pulses to be 138 dB above absolute hearing threshold. This would be approximately 208 dB for a harbour seal and would be higher for small odontocetes. Such levels could be encountered directly below, or within 100m horizontal distance, from a large commercial airgun array.

Harris *et al*. (2001) studied the occurrence and behaviour of seals (predominantly ringed seals *Phoca hispida*) during a near-shore seismic survey off the coast of northern Alaska. Near identical sightings rates occurred during periods of no airguns firing, one airgun, and a full array (8-11 120in^3 airguns), although during full array shooting, seals showed partial avoidance of a zone within a 150m radius of the vessel. Despite this, most seals remained close enough to a seismic line to be exposed to received levels exceeding 190db re 1μPa (rms) when diving.

Blackwell *et al*. (2004) observed ringed seal behaviour on ice and in the water surrounding an oil production facility (63-3000m) during pipe-driving operations. Mean underwater sound levels were 157dB re 1μPa at 63m, and <180dB re 1μPa at all distances. Seals exhibited little or no reaction to noise, and were observed swimming in open water as close to 46m from the facility throughout pipe-driving operations. It was suggested that the seals around this facility were habituated to industrial sounds.

TTS has been induced, experimentally, in three pinniped species, harbour seal, northern elephant seal and Californian sea lions (Kastak & Schusterman 1996, Kastak *et al* 1999). All three species showed a similar TTS of 4.6-4.9 dB, after 20-22 minutes of exposure at 65-70 dB above threshold level in the frequency range 0.1-2 kHz. Both harbour and grey seals showed short term avoidance behaviour during controlled exposure experiments with small airguns (Thompson *et al.* 1998). In both

cases seals abandoned foraging sites and swam away from airguns but returned to forage in the same areas on subsequent days.

Models of grey seal habitat preference supported by satellite telemetry data suggest that foraging movements are on two geographical scales: long and distant trips from one haul-out site to another; and local repeated trips to discrete offshore areas. Foraging destinations at sea are typically localized areas characterized by a gravel/sand seabed sediment; the preferred burrowing habitat of sandeels, an important component of grey seal diet. Recent studies of foraging at sea by common seals have been funded by SNH and the Department (Sharples *et al.* 2005). These indicate high site fidelity to haul-out sites, but ranging over substantial distances at sea; for example, seals tagged in The Wash travelled repeatedly to between 75 and 120 km offshore and as far as 220 km to assumed foraging patches. All but one of the seals tagged, which used a haul-out site 60 km north of The Wash, remained faithful to the haul-out site at which they were captured. The implications for both common and grey seals are that ecological effects at considerable distances from a designated SAC may influence the breeding population of the site.

However, long-term population trends in both grey and common seals are generally positive: the grey seal population in the northeast Atlantic has been increasing at around 6% annually since the 1960's and its current size is estimated at around 130,000-140,000 individuals.

Other effects of sound in marine mammals have been postulated, including triggering the onset of Decompression Sickness (DCS) either through behavioural modification or direct physical activation of microbubbles (see above). Possibly more meaningful in relation to Annex IV of the Directive than to an Article 6(3) Appropriate Assessment [of specific sites], concerns have been raised that the cumulative effect of sequential seismic surveys could act as a barrier to marine mammal migration. For example, in relation to the Atlantic Margin area, Gordon *et al*. (1998) considered that sound fields from planned seismic surveys in 1997, assuming a spherical propagation model and a threshold intensity of 160dB re 1 μPa, would form a "virtually unbroken barrier to any marine mammal wishing to move north-south along the shelf edge". Available evidence (largely based on acoustic monitoring, Clark & Charif 1998, Swift *et al.* 2002) does not suggest that broadscale marine mammal distribution patterns have been influenced by seismic activity to date. Nevertheless, there is little doubt that successive seismic surveys could have a cumulative effect on animal distribution and movements as a result of repetitive behavioural disturbance.

F4 SAC qualifying species and sites

As discussed above, it is considered that marine mammals are the only qualifying species which may potentially be affected (in terms of conservation status) by acoustic disturbance. A recent report produced by the Sea Mammal Research Unit (SMRU), University of St Andrews, summarises the research to date on marine mammals in the Cardigan Bay area, and discusses the potential impact of oil and gas exploration and development on these populations. The report (SMRU 2007) is included as an appendix to this AA (Appendix G). The screening tables (Appendix B) identified the potential for acoustic disturbance in the following sites:

Pembrokeshire Marine/Sir Benfro Forol SAC

(Primary Annex II species grey seal; qualifying Annex II species otter)
Block 106/30 lies a minimum of 6km to the north-east of the SAC, blocks 107/21 and 107/22 lie 25-28km to the north-east of the SAC.

Grey seals haul out at several sites within the Pembrokeshire Marine SAC, and form part of a population of 5,000-7,000 animals breeding in Welsh and Irish waters of the Irish Sea (Keily *et al.* 2000). Colonies in the SAC are representative of grey seal colonies in the south-western part of the breeding range in the UK, and represent over 2% of annual UK pup production. These animals forage in waters both within the SAC and at several locations throughout Cardigan Bay and the Irish Sea (Hammond *et al*. 2005).

While beaches in the SAC and surrounding area are used by seals to pup, moult and haul out between foraging trips, these activities are not considered susceptible to acoustic disturbance (SMRU 2007). However, seismic survey occurring in any of the blocks applied for is likely to be audible to seals within the SAC and over a large proportion of Cardigan Bay and the surrounding waters. The exact effects which this may have are unknown, although available evidence suggests that significant effects at a population level are unlikely. Noise levels suggested to cause auditory damage in phocids are rapidly attenuated with distance from source, and would therefore be highly unlikely to propagate into the SAC. Distances over which hearing damage may occur are well within the effective range of the mitigation measures which would be employed to minimise disturbance to marine mammals. Additionally, any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including AA.

While there is potential for acoustic disturbance to distrupt foraging activities, this is likely to be short-term and infrequent with population level effects highly unlikely. With regard to the potential effect of oil and gas exploration and development (OGED) on grey seals in the Pembrokeshire Marine and Cardigan Bay SACs, SMRU (2007) conclude that "The main foraging areas identified are neither within the SACs nor close to the Blocks applied for so OGED is not expected to impact the integrity of the site for grey seals."

Cardigan Bay SAC

(Primary Annex II species bottlenose dolphin; qualifying Annex II species grey seal)
Blocks 107/21 and 107/22 overlap the SAC; block 106/30 lies a minimum of 4km to the south-west.

While bottlenose dolphins are found over much of the Irish Sea, animals are most frequently recorded from Cardigan Bay, particularly south of Aberystwyth. They are sighted year round, but in larger numbers during late summer. The population inhabiting the SAC and coastal waters south-west to Fishguard has been estimated at 213 individuals (95% confidence interval = 183-279), concentrated in coastal waters (Baines *et al*. 2002). The overall population is likely to be larger since its range is not restricted to the waters of the SAC. Dolphins appear to use the inshore waters of Cardigan Bay for both feeding and reproduction, and in the summer months calves and juveniles are often observed with adult individuals or groups.

Although some animals are present near-shore in every month of the year, sightings rates increase through the summer, peaking in July-August, with a low between October and April. A long-term land-based study (1989-96) at New Quay in Cardigan Bay, West Wales, found that 92% of all sightings occurred between April and November, with 48% between June and August; sightings rates were lowest in March and highest in July (Bristow & Rees 2001). Further coastal observations of bottlenose dolphin within the Cardigan Bay SAC have been made by Pierpoint & Allan (2006), who noted that sighting rates were higher at Mwnt, Ynys Lochtyn and New Quay Harbour. In accordance with previous reports, female dolphins with calves were recorded more frequently at Mwnt than elsewhere; the high level of occurrence (> 50% of watches in which dolphins were present) suggested site fidelity by females with calves through the summer months.

Seismic survey occurring anywhere in the blocks applied for will be audible to dolphins within the SAC and over a large proportion of Cardigan Bay and the surrounding waters. The exact effects which this may have are unknown, although available evidence suggests that significant effects at a population level are unlikely. Noise levels suggested to cause auditory damage in small odontocetes are rapidly attenuated with distance from source, and would therefore not propagate more than a few hundred metres into the SAC. Such distances are well within the effective range of the mitigation measures which would be employed to minimise disturbance to marine mammals. Additionally, any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including AA.

Small odontocetes have been shown to exhibit avoidance behaviour to seismic survey (Stone & Tasker 2006), therefore there is potential for acoustic disturbance to distrupt foraging activities. However, this is likely to be short-term and infrequent with population level effects unlikely. With regard to the potential effect of oil and gas exploration and development (OGED) on bottlenose dolphin in the Cardigan Bay SACs, SMRU (2007) conclude that "The size and overall distribution of

the population that uses the SAC is uncertain; however, it is clear that the Cardigan Bay SAC, in particular, is an important area for bottlenose dolphins." "Given current knowledge of the distribution of the dolphins within the SAC (mostly along a coastal strip within a few km of the coast of southern Cardigan Bay), the location of the Blocks applied for, and the relative lack of sensitivity of dolphins to low frequency sound, OGED *(oil and gas exploration and development)* is unlikely to impact the integrity of the site unless activities within the coastal strip in which the dolphins are regularly seen were sufficient to cause more than temporary disturbance." Nonetheless SMRU (2007) emphasises "Knowledge of bottlenose dolphins in the Cardigan Bay/Pembrokeshire area is less developed than in the Moray Firth" (the only other resident population of bottlenose dolphins known in UK waters) and on this basis it is concluded that a precautionary approach to licensing is required until there is an improved information base on important areas for this species in Cardigan Bay.

Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarns SAC

(Qualifying Annex II species bottlenose dolphin, otter, grey seal)
Blocks 107/21 and 107/22 lie a minimum of 25km to the south-west of the SAC. Block 106/30 lies further to the south-west.

Lleyn Peninsula and the Sarns on the north-west coast of Wales is designated primarily for a range of marine habitats (Annex I), with three species of marine mammal cited as qualifying species. Considerations of effects on bottlenose dolphin and grey seal are similar to those discussed above for Pembrokeshire Marine and Cardigan Bay SACs.

In combination effects

Seismic survey and other noise producing activities that might follow the licensing of Blocks 106/30, 107/21 & 107/22 are anticipated to be widely separated in space and time. Therefore, any acoustic disturbance to marine mammals causing displacement from foraging areas will be short-term and infrequent. SMRU (2007) note that, "The effects of repeated surveys are not known, but insignificant transient effects may become important if potentially disturbing activities are repeated and/or intensified." As noted above the number of seismic surveys is substantially less than historic peaks and as a result significant in-combination effects with past oil and gas activities are not foreseen. Similarly, while significant in-combination effects with noise from other activities such as shipping, fishing, military exercising, marine construction are feasible, they are not viewed as likely to occur in or adjacent to relevant European Sites because of the controls in place on 24th Round and other block activities, including EIA and AA which require other noise sources to be considered during the consenting process.

Mitigation

The major operational control and mitigation over seismic surveys in the UK are implemented through JNCC's Guidelines for minimising acoustic disturbance to marine mammals from seismic surveys (latest revision April 2004). These were originally introduced on a voluntary basis as part of the UK's commitment under ASCOBANS, but have subsequently been required by licence conditions in many areas. Member companies of Oil & Gas UK (formerly the UK Offshore Operators Association, UKOOA) are required to comply with these Guidelines in all areas of the UK Continental Shelf. The guidelines list several aspects of operational planning which should be considered in relation to minimising potential disturbance, including timing (particularly to avoid breeding and calving seasons) and planning to use the lowest practicable power levels.

The JNCC guidelines include a requirement for visual monitoring of the area prior to airgun firing to determine if marine mammals are in the vicinity, and a slow and progressive build-up of sound to enable animals to move away from the source. In areas of high sensitivity the guidelines require a competent Marine Mammal Observer (MMO) on the source vessel to carry out visual monitoring (during daylight hours) before and during the survey; two MMOs are required for surveys north of 57° latitude due to the longer daylight hours.

JNCC will also advise BERR that passive acoustic monitoring (PAM) should be used as a mitigation tool if sensitive species are likely to inhabit a proposed survey location. Due to the importance of

Cardigan Bay to marine mammals, BERR would expect that passive acoustic monitoring (PAM) would be used as a mitigation tool.

As part of activity permitting through the PON14 process, BERR requires an environmental assessment to accompany applications for offshore seismic surveys. Consideration of such applications includes BERR conservation advisers and may result in additional mitigation being required and may trigger a specific AA. Seismic surveys wholly within territorial waters were previously not necessarily subject to the PON14 regulatory approval mechanism (see SEA 6 recommendations). To resolve this, the Offshore Petroleum Activities (Conservation of Habitats) (Amendment) Regulations 2007 have been made. These regulations amend the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 which implement the Habitats Directives.

However, as noted above, SMRU emphasise that knowledge of the resident population of bottlenose dolphins in the Cardigan Bay/Pembrokeshire area is less developed than in the Moray Firth. In particular, whilst for the Moray Firth there is a great deal of information on the size and distribution of the bottlenose dolphin population there is no comparable information on the population in Cardigan Bay. Knowledge about the location of, and seasonal variation in, the areas used by this resident population for breeding and foraging is important to understanding the potential adverse effects and in particular, how any such effects might be mitigated.

Given the information which is available at present on the bottlenose dolphin population in Cardigan Bay, it is difficult to characterise and quantify impacts on this population and consider how any such adverse effects might be mitigated. In particular, the mitigation measures which could be used to offset any potential adverse effects from oil and gas activities on a resident bottlenose dolphin population like that in Cardigan Bay rely on knowledge of the distribution and abundance of the animals. Mitigation measures could be difficult to apply given current knowledge of dolphin distribution in Cardigan Bay in terms of where they forage and the importance of the coastal strip for both feeding and reproduction.

Therefore, in view of the information available, the Secretary of State considers that a precautionary approach to licensing be adopted until more information about the size and distribution of the resident dolphin population in Cardigan Bay has been collected. Consequently, there is currently no certainty within the meaning of the Waddenzee case that activities arising from the licensing of blocks 106/30, 107/21 and 107/22 will not cause an adverse effect on the integrity of the European Sites. Although the blocks should not be licensed at present, this position may be revised in the light of new information on the location of sensitive areas and times, and also on the effects of certain oil and gas activities.

APPENDIX G – SMRU 2007 REPORT

Potential impact of Oil and Gas Exploration and Development on SACs for bottlenose dolphins and other marine mammals in the Moray Firth and Cardigan Bay/Pembrokeshire

June 2007

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Potential impact of Oil and Gas Exploration and Development on SACs for bottlenose dolphins and other marine mammals in the Moray Firth and Cardigan Bay/Pembrokeshire

Sea Mammal Research Unit, University of St Andrews

CONTENTS

1. Introduction

This report assesses the potential for Oil and Gas Exploration and Development OGED to impact on the *integrity of the site* of SACs for bottlenose dolphins and other marine mammals in the Moray Firth and Cardigan Bay/Pembrokeshire. A related aim is to assess the potential for *disturbance* of animals in the SACs.

The *integrity of the site* has been defined as 'the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified' (EC 2000). A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required. When looking at the *integrity of the site*, it is therefore important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long-term. The term *disturbance* is not fully defined.

In this report, we take the view that SACs are established to enhance and maintain the favourable conservation status of the target populations; any OGED activity that significantly compromised the ability of the site to achieve this could be said to impact on the *integrity of the site*. An increased risk of injury or death of an animal could seriously compromise the integrity of the site but there is no indication that this would occur as a result of OGED. The *integrity of the site* could also be impacted if the fitness of individual animals were affected by OGED such as might occur if they were excluded from favoured foraging areas or the relationship between mothers and young calves were disrupted.

Disturbance is difficult to categorise. Clearly even a trivial impact of a human impact could be classed as disturbance but, in the context of this report, the issue is whether OGED activity has the potential to disturb bottlenose dolphin and other marine mammal activity in a biologically significant way. Whether or how much this occurs depends on the overlap between activities and the nature of them. For example, slight changes of direction of a travelling individual or school as a result of OGED activity could not be classified as biologically significant. Similarly, the temporary movement of an individual or school away from a vessel undertaking a seismic survey would also not be a cause for concern. But OGED activity that resulted in more than short-term exclusion of animals from an important foraging or socialising area could be biologically significant and, therefore, disturbing. In this report we focus on potentially significant disturbance of marine mammals caused by noise, contaminants and indirect effects through their prey.

2. Effects of sound from OGED on marine mammals

There is an increasing awareness of the importance of sound to marine mammals (MMC 2007). Any man-made noise could potentially have an effect on a marine mammal. The effects could range from mild irritation through impairment of foraging or disruption of social interactions to hearing loss and in extreme cases to injury or even death. Richardson *et al.* (1995) provide an extensive and authoritative treatment of the impacts of anthropogenic noise on marine mammals. This work is updated in the reviews of the sensitivity of marine mammals to noise by the Sea Mammal Research Unit in its reports on background information on marine mammals for the Strategic Environmental Assessment, the most recent of which is Hammond *et al.* (2006).

Most of the noise generated by offshore oil operations is low frequency, mostly <1kHz, although higher frequency sounds are also generated. Seals are known to be sensitive to those frequencies whereas small (toothed) cetaceans are relatively insensitive to low frequencies. There are no direct measurements of either the frequency range or sensitivities of hearing in large whales, but circumstantial evidence suggests that they may have good low frequency hearing. An extensive review of available information on marine mammal audiograms has recently been collated by Nedwell *et al.* (2004).

The extensive literature on the effects of seismic surveys on marine mammals has been reviewed by Gordon *et al.* (2004). There is circumstantial evidence that powerful air guns could cause

behaviourally mediated damage and stranding in some species (Malakoff 2002; Gentry 2002). More data are needed to confirm this, or otherwise. There is currently no direct evidence that seismic air guns cause these effects, however mitigation measures are designed to avoid air gun operation when cetaceans are in the vicinity of the ship and to use a 'soft start' to operations. Seismic surveys have been shown to cause avoidance behaviour in grey and harbour seals (Thompson *et al.* 1998), in a range of large cetacean species (e.g. McCauley *et al.* 1998) and, recently, in small odontocetes (Stone & Tasker 2006). The effects of repeated surveys are not known, but insignificant transient effects may become important if potentially disturbing activities are repeated and/or intensified.

Toothed cetaceans appear to be tolerant of vessel noise and are regularly observed in areas where there is heavy traffic. Some baleen whales are reported to avoid large vessels in some areas. In general, whales show little response to slow approaches by vessels but may swim rapidly away from directly approaching vessels or those producing changes in sound intensity (Richardson *et al.* 1995).

There are few data on reactions of marine mammals to drilling noise. Baleen whales appear to be tolerant of low levels but show some avoidance behaviour when sounds are loud. There is no evidence that small odontocetes are influenced by drilling noise (Richardson *et al.* 1995, Todd *et al.* 2007).

Decommissioning work that involves the use of explosives is likely to impact animals in the vicinity. The effects of underwater explosions on marine mammals range from physical damage that can be lethal if sufficiently serious, behaviourally mediated damage and stranding (e.g. Jepson *et al.* 2003), and damage to hearing (e.g. Ketten *et al.* 1993). Difficulties in observing and monitoring behaviour and the apparent attractiveness of submerged structures mean that some marine mammals, especially seals, are likely to be damaged in blasts.

3. Contaminants

There is a large body of literature on contaminants in marine mammals. Detailed reviews on the levels of contaminants found, the patterns of different compound groups in various species and the temporal changes in concentrations include: Aguilar and Borrell (1997), Geraci and St. Aubin (1990), Hall (2001), Law (1996), O'Shea (1999), Reijnders, Aguilar and Donovan (1999). This information is reviewed in the Sea Mammal Research Unit reports on background information on marine mammals for the Strategic Environmental Assessment, the most recent of which is Hammond *et al.* (2006).

A substantial amount of information is available on the uptake of lipophilic contaminants by marine mammals, such as polychlorinated biphenyls, DDTs and chlorinated pesticides. Studies on captive and wild populations have shown that these compounds probably have toxic effects on the reproductive and immune systems. Certain heavy metals such as mercury, lead, cadmium, copper and zinc are taken up by marine mammals although there is little evidence that these cause substantial toxic responses, except at high concentrations. Cetacean species which feed lower down the food chain may be at risk from exposure to polyaromatic hydrocarbons, although very little is known about current exposure levels or the effects of chronic exposure in marine mammals.

Chemicals generated by oil and gas activities are also released from other sources such as land-based waste disposal facilities and land run-off. It is not possible to attribute the levels of such chemicals recorded in marine mammals to oil and gas activity.

Oil spills

Direct mortality of marine mammals as a result of contaminant exposure associated with major oil spills has been reported, e.g. following the Exxon Valdez oil spill in Alaska in 1989. Many animals exposed to oil developed pathological conditions including brain lesions. Additional seal pup mortality was reported in areas of heavy oil contamination compared to unoiled areas (Frost & Lowry, 1993).

More generally, marine mammals are less vulnerable than seabirds to fouling by oil, but they are at risk from hydrocarbons and other chemicals that may evaporate from the surface of an oil slick at sea within the first few days. Symptoms from acute exposure to volatile hydrocarbons include irritation to the eyes and lungs, lethargy, poor coordination and difficulty with breathing. Individuals may then drown as a result of these symptoms.

Grey and harbour seals come ashore regularly throughout the year between foraging trips and additionally spend significantly more time ashore during the moulting period (February-April in grey seals; August in harbour seals) and particularly the pupping season (September-December in grey seals; June-July in harbour seals). Animals most at risk from oil coming ashore on seal haul-out sites and breeding colonies are neonatal pups, which are more susceptible than adults to external oil contamination (Ekker *et al.* 1992).

There have been no specific studies on the direct acute or chronic toxicity of oil dispersants to seals and cetaceans.

4. Impact of OGED on marine mammal prey

Impacts of OGED on fish and cephalopods have been reviewed extensively in previous SEA studies (see especially Rogers & Stocks 2001). These impacts have the potential to knock onto predatory marine mammals through two routes; as vectors for pollutants (see Section 3, above) and by changing food availability.

Several aspects of OGED are known to impact local fish populations. Of those studied, the most marked are seismic surveys. While organisms in close proximity to air gun arrays are thought to be at risk of injury or death, for fish populations, concern generally focuses on the non-lethal behavioural effects of the disturbance (Rogers & Stocks 2001). This is particularly relevant when seismic surveys are to be undertaken close to significant fish aggregations, such as spawning sites. The clearest evidence of disruptive effects has been shown in the Barents Sea. Five days of airgun use were found to reduce the abundance of cod and haddock to a distance of at least 30 km from the shooting area and for a minimum of five days after survey completion (Engås *et al.* 1996). Because such effects are thought to result from behavioural avoidance they are likely to be transitory and there is no evidence yet of long-term adverse impacts on either the spawning success of fish or their availability to predators. However, there is sufficient concern to suggest that a precautionary approach be adopted for the use of this equipment at times of significant fish aggregation (Rogers & Stocks 2001) and these aspects are mitigated/controlled by block licence conditions and activity consenting which includes assessment and advice to the DTI from FRS/Cefas. Disturbance impacts of other OGED activities are less marked. Shipping and other machinery noise is known to impact the distribution of acoustically sensitive species (Mohr 1971; Misund & Aglen 1992), but these impacts are both local and temporary and therefore unlikely to significantly alter marine mammal foraging success.

Unlike temporary disturbance, habitat alterations have the potential to produce longer term changes in fish and cephalopod assemblages. Of particular relevance to OGED are permanent or semi-permanent structures that offer hard substrates for settlement or refuge at the seabed (e.g. rocks placed for scour or trawl protection), fixed to the seabed (jackets, well heads etc), or in/on the water column (moorings, FPSOs etc). Artificial reef structures are known to alter local fish communities (Stanley and Wilson 1997; Wilhelmsson *et al.* 2006) but the scale of these structures relative to those used by relevant marine mammal populations and UK SACs, renders their potential for significant prey recruitment low. This, coupled with the energetic demands of marine mammals, means that alterations of marine mammal diet opportunities can only occur to small degrees or, more likely, for a small number of specialising individuals.

It has been suggested that the safety zones around oil and gas installations and their associated fishery exclusions may act to protect fish populations from capture and thereby enhance stocks. There is actually little evidence to support this assertion (Rogers & Stocks 2001). Furthermore, the scale of these inadvertent Marine Protected Areas is unlikely to allow the establishment of sufficiently large prey populations to enhance the foraging opportunities for marine mammals at the population level.

In summary, OGED activities have been demonstrated to impact prey species (particularly fish) such as those present in the diet of marine mammals using the Moray Firth and Cardigan Bay SACs. With the exception of seismic surveys at times of significant prey aggregation, these impacts, however, are not believed to be sufficiently large, widespread or persistent to significantly change the foraging opportunities of SAC related marine mammal populations and thus not believed to impact the integrity of the sites.

5. Moray Firth

5.1 Blocks and SAC

The Moray Firth SAC for bottlenose dolphins and the Block applied for are shown in Figures 1 and 2.

Extensive seismic survey work and the drilling of oil wells have been ongoing in the Moray Firth area since the 1960s; all wells have been drilled outside the SAC boundary.

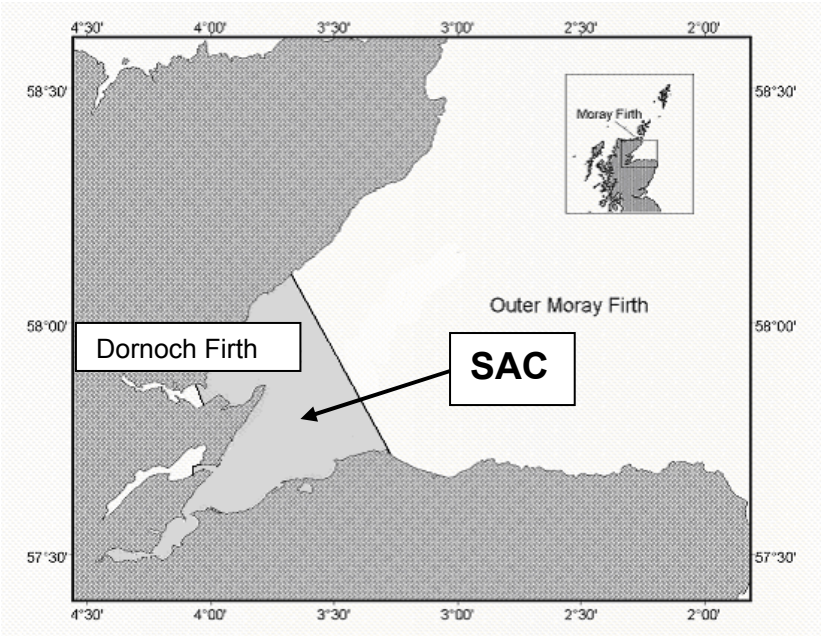

Figure 1. The Moray Firth SAC for bottlenose dolphins. There is also an SAC for harbour seals in the Dornoch Firth.

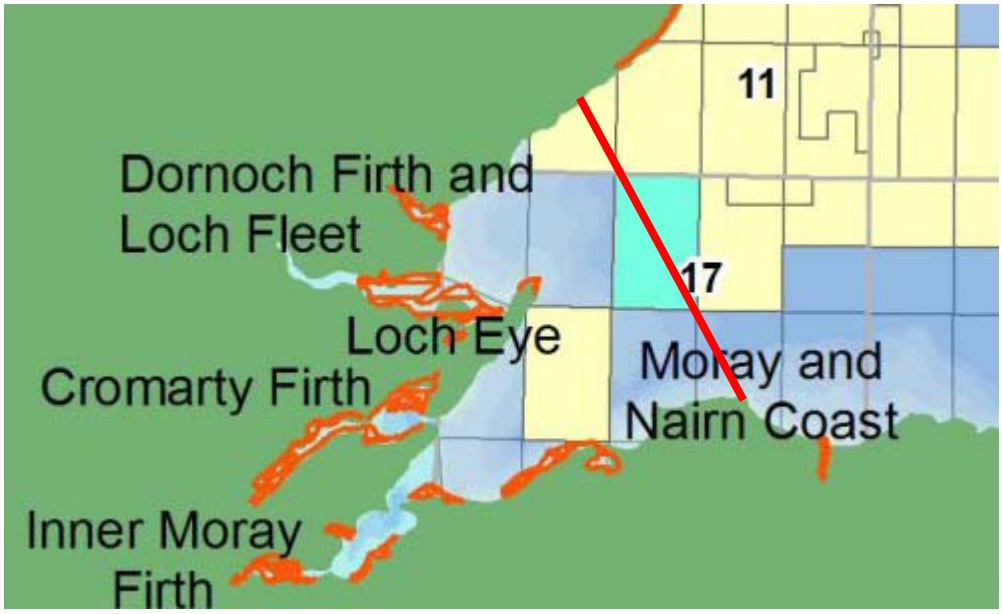

Figure 2. Block applied for (in pale blue) lying across the outer boundary (red line) of the Moray Firth SAC for bottlenose dolphins.

5.2 Marine mammals in the Moray Firth

5.2.1 Bottlenose dolphin

The bottlenose dolphin is a cosmopolitan species occurring in warm and temperate waters throughout much of the world. Although often considered a coastal species, it is also frequently seen in offshore waters in some areas. In the north-eastern North Atlantic there are a number of well-documented and, in some cases, well-studied coastal and apparently resident populations along the Atlantic margin of Europe. One of these inhabits the waters of eastern Scotland.

The bottlenose dolphins off eastern Scotland range from north of the Moray Firth to south of the Firth of Forth. The few observations offshore in the North Sea may indicate that this population is also distributed offshore at least for part of the year. In the 1980s, its range was focussed in the Inner Moray Firth but since the mid 1990s, in particular, range has expanded south to waters off Aberdeen, St Andrews Bay and the Firth of Forth (Wilson *et al.* 2004). Dolphins are seen year round in the inner Moray Firth but further away from Inverness in winter (Wilson *et al.* 1997a). They are also seen year round off Aberdeen but the rate of sightings is highest in November-May. Peak sightings occur in June-August in St Andrews Bay. Within the inner Moray Firth, there are three areas where sightings are concentrated: the Kessock Channel, Chanonry narrows, and around the mouth of the Cromarty Firth. These areas were originally identified by Wilson *et al.* (1997a), using data from 1990-1992, but have since been confirmed through analysis of data from 1990 to 2000 (Wilson *et al.* 2004). Dolphins are rarely encountered away from the coast in the Moray Firth.

From genetic studies it appears that Scottish east coast bottlenose dolphins are more closely related to the Welsh population in Cardigan Bay and to individuals stranded around the southern coast of England than to individuals encountered in the Scottish Western Isles (Parsons *et al.* 2002).

Abundance in 1992 was estimated at 129 individuals (95% CI = 110-174) using mark-recapture analysis of photo-identification data (Wilson *et al.* 1999a). Data collected up to 1997 were analysed to estimate rates of survival and reproduction, which were incorporated in a population viability analysis (PVA) to predict likely future population trends (Sanders-Reed *et al.* 1999). These models predicted that, if conditions remained the same, the Scottish east coast population was likely to decline at a rate of around 5% per annum. However, this has since been shown not to be the case because annual estimates of abundance calculated for the years 1990 to 2002 show no clear trend (Figure 3). More recently, Lusseau *et al.* (2006) found evidence for two social communities of bottlenose dolphins in this population; an inner community mostly comprising individuals that have only been seen in the inner Moray Firth and an outer community whose members have been seen both within and outside the inner Moray Firth.

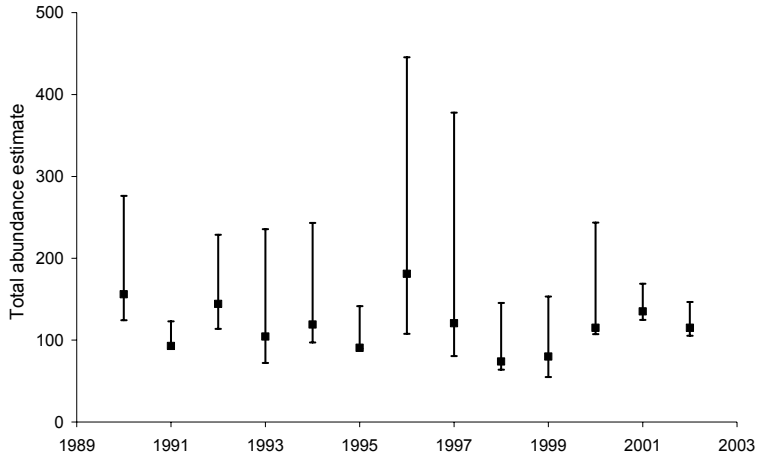

Figure 3. Abundance estimates for the Scottish east coast bottlenose dolphin population based on surveys carried out between May and September over the whole known range of the population. Error bars represent the 95% confidence interval around the estimates (Thompson et al. 2004).

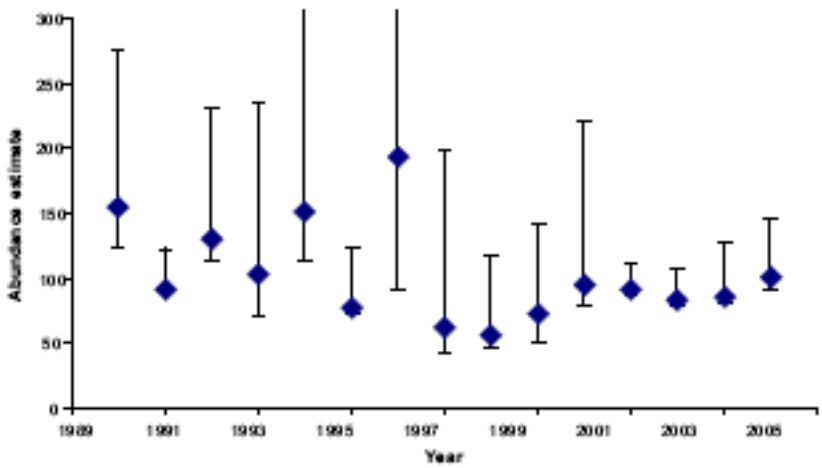

Figure 4. Trends in annual estimates of the number of dolphins using the Moray Firth SAC, based upon surveys conducted during the core-study inner Moray Firth study area (Thompson et al. 2006).

Estimates of abundance calculated from data collected only from the inner Moray Firth have underestimated the total size of the population in recent years and thus are unlikely to give a true representation of the number of animals using the whole SAC (Thompson *et al.* 2004). The apparent decline through 1999 in estimates of the number of dolphins using the Moray Firth SAC (Thompson *et al.* (2006); Figure 4) is based on data from only the inner Moray Firth and is therefore unlikely to represent the situation for the whole SAC.

Seismic surveys in the SAC have occurred during the period covered by the lack of trend in abundance of the bottlenose dolphin population inhabiting this area (Figure 3).

Post-mortem analyses of stranded animals have identified that some fishery by-catch occurs and that at least some calf mortality results from infanticide (Patterson *et al.* 1998). Bottlenose dolphins from eastern Scotland have a high prevalence of several different types of skin lesion (Thompson & Hammond 1992; Wilson *et al.* 1997b). In comparison with similar data from other parts of the world the prevalence and severity of lesions are high but mainly related to exposure to water of low salinity and/or temperature (Wilson *et al.* 1999b). The causal links underlying these patterns remain unknown, but it is possible that they are related to an increase in physiological stress, potentially making the animals more prone to other factors, including anthropogenic agents such as contaminants (McKenzie *et al.* 1997) or infections from viruses, bacteria or fungi. Subsequent studies have shown that severity and prevalence of lesions vary among individuals in the Moray Firth and that variation patterns can be related to the behaviour of infectious diseases (Wilson *et al.* 2000).

Information on the diet of bottlenose dolphins is sparse. A study of prey remains in ten stomachs from stranded and by-caught animals around Scotland between 1990 and 1999 found the main prey to be cod, saithe, and whiting (Santos *et al.* 2001). Several other fish species were also found, including salmon and haddock, as well as some cephalopods.

5.2.2 Harbour porpoise

Harbour porpoises are frequently observed in the Moray Firth (Hastie *et al.* 2003). They are part of a large population distributed widely across the North Sea, numbering approximately 250,000 animals (Hammond *et al.* 2002; SCANS-II - http://biology.st-andrews.ac.uk/scans2/). The distribution of harbour porpoises in the North Sea appears to have shifted southwards between 1994 and 2005 but the estimated abundance in the North Sea and adjacent waters has not changed (SCANS-II - http://biology.st-andrews.ac.uk/scans2/). The diet in eastern Scottish waters appears to be dominated by whiting and sandeel (Santos *et al.* 2004). Other prey include other gadoid species and octopus.

5.2.3 Grey seal

Grey seals are common in the northwestern North Sea. The population has been increasing since the 1960s but growth may now be slowing. Overall, there is a gradual trend towards a stable level of pup production, although central and southern North Sea pup production continues to increase. Telemetry data show that grey seals forage in the outer Moray Firth and widely off eastern Scotland (Matthiopoulos *et al.* 2004). The diet of grey seals has been studied extensively around Scotland. In the northern North Sea, grey seal diet comprises primarily sandeel and gadoids, particularly cod and haddock (Hammond & Grellier 2006).

5.2.4 Harbour seal

Counts of harbour seals in the inner Moray Firth have declined from more than 1,000 in the mid 1990s to around 700-800 animals since 2003 (Duck *et al.* 2006; Lonergan *et al.* 2007). The decline is consistent with the effect of shooting seals to protect salmon fishing and aquaculture (Thompson *et al.* 2007). The few counts over the same period in the wider Moray Firth show no evidence of change (Lonergan *et al.* 2007). Telemetry data show that harbour seals that haul out in the inner Moray Firth forage widely in the outer Moray Firth, particularly east and north of the Dornoch Firth (Sharples *et al.* 2005). The main prey of harbour seals in this area in 1989-1992 were found to be sandeels, lesser octopus, whiting, flounder, and cod (Tollit &Thompson 1996).

5.3 Potential for impact of OGED on the site

The Scottish east coast bottlenose dolphin population is small, and therefore inherently vulnerable, and the Moray Firth SAC is an important area within its range. All individuals in this population use this area some of the time and some individuals have never been seen outside the inner Moray Firth. However, given current knowledge of the distribution of the dolphins within the SAC (mostly in the inner Moray Firth and along the south shore), the location of the Block applied for, and the relative lack of sensitivity of dolphins to low frequency sound, OGED is unlikely to impact on the integrity of the site. Current knowledge of dolphin distribution within the SAC (mostly in the inner Moray Firth and along the south shore) and the location of the Block applied for indicate that anything other than minor disturbance of dolphins by OGED is unlikely.

The harbour seal population in the Moray Firth is relatively small. Beaches in the area are used by harbour seals to pup, moult and haul out between foraging trips. Grey seals use the Moray Firth to haul out, particularly in summer. No impact of OGED would be expected on these land-based activities, except in the event of an oil spill. Harbour and grey seals also forage in the SAC. They are more sensitive than small cetaceans to low frequency sound and continued seismic activity in favoured foraging sites could therefore potentially result in animals being excluded from important areas. However, OGED is unlikely to impact foraging and therefore the integrity of the site because the foraging areas identified are dispersed over much of the Moray Firth in the case of harbour seals, and to the north of the Block applied for in the case of grey seals.

The Moray Firth forms only a very limited part of the range of the large North Sea harbour porpoise population. It is unclear what integrity of the site means for this species, but there is no reason to believe that OGED would impact it.

6. Cardigan Bay and Pembrokeshire

6.1 Blocks and SACs

The Cardigan Bay (bottlenose dolphins and grey seals) and Pembrokeshire Marine (grey seals) SACs and the Blocks applied for are shown in Figure 5.

Extensive seismic survey activity has occurred in Cardigan Bay since the 1970s, except close inshore (within about 10km). A few experimental wells have been drilled in the area, mostly 25km or more from shore.

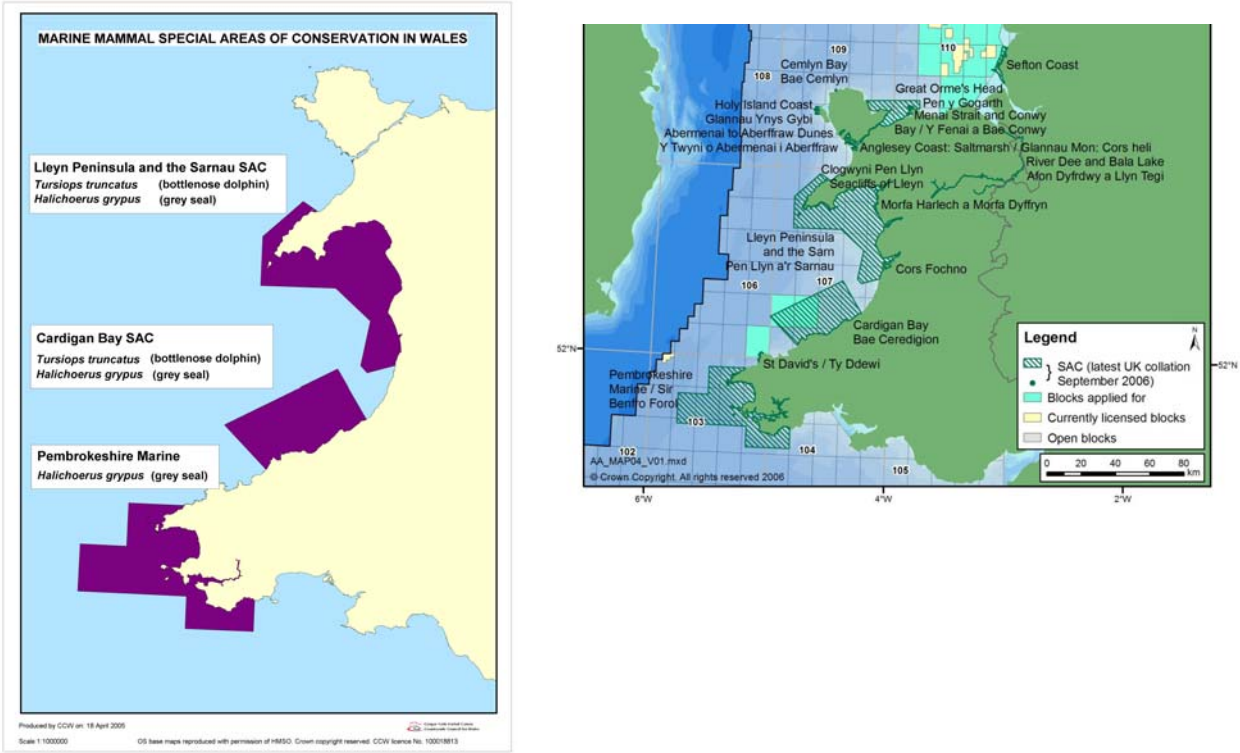

Figure 5. SACs for bottlenose dolphins and grey seals in Wales, and Blocks applied for (in pale blue) overlaid on SACs in Cardigan Bay and Pembrokeshire.

6.2 Marine mammals in Cardigan Bay and west Wales

6.2.1 Bottlenose dolphin

The bottlenose dolphin is a cosmopolitan species occurring in warm and temperate waters throughout much of the world. Although often considered a coastal species, it is also frequently seen in offshore waters in some areas. In the northeast North Atlantic there are a number of well-documented and, in some cases, well-studied coastal and apparently resident populations along the Atlantic margin of Europe.

The bottlenose dolphin is found over much of the Irish Sea, but mostly in Cardigan Bay and particularly south of Aberystwyth and off the coast of County Wexford in southeast Ireland. In the northern Irish Sea, the species is sighted regularly in summer off the Galloway coast of southwest Scotland, around the Isle of Man and north Anglesey. Abundance in this area was estimated very imprecisely in summer 2005 at 235 animals (95% CI = 63-870) (SCANS-II - http://biology.st-andrews.ac.uk/scans2/).

The population inhabiting the Cardigan Bay SAC and coastal waters down to Fishguard has been estimated using mark-recapture analysis of photo-identification data at 213 individuals (95% CI = 183-279), concentrated mainly in coastal waters (Baines *et al.*, 2002). However, the overall population is likely to be larger since the species occurs some distance north of the SAC.

Bottlenose dolphins occurs year-round in this area but sighting rates increase through the summer, peaking in July-August, with a low between October and April; group sizes are largest in late summer. A long-term land-based study (1989-1996) at New Quay in Cardigan Bay, West Wales found that 92% of all sightings occurred between April and November, with 48% between June and August; sightings rates were lowest in March and highest in July (Bristow & Rees, 2001). These findings were similar to those reported from a shorter study (1987-1990) from the same locality, where numbers were highest between June and August, although in that study there was a secondary peak in November and December (Lewis & Evans, 1993).

Photo-identification studies indicate that individuals may range over tens of kilometres up and down the coast, and there is some evidence for an offshore population comprising larger groups, which seasonally enter coastal waters and mixes with coastal animals (Lott *et al.* 2005).

A summary of recent work indicates a population of around 150-300 animals in the SAC area in May-September with no evidence of change in the last few years. Animals that are seen regularly in the SAC are also seen outside it in the wider Cardigan Bay area. In summer, distribution is concentrated close to the shore but in winter animals appear to be distributed more offshore than in summer (Evans 2007).

The level of understanding of bottlenose dolphin use of Cardigan Bay contrasts with the situation in the inner Moray Firth where photo-identification studies have allowed good definition of spatial use of the area.

6.2.2 Harbour porpoise

In the Cardigan Bay SAC, an abundance estimate of 122 animals (95% CI 90-165) was made between May and October 2001, but with three times as many sightings in August-September compared with May-July (Baines *et al.* 2002). There is no estimate of the numbers of porpoises in the Pembrokeshire Marine SAC; however, acoustic monitoring in West Wales suggests peak activity in December (Pierpoint *et al.* 1999). Harbour porpoises in these areas are part of a larger population that is widely distributed in the Irish Sea, with particular concentrations in the southern sector where it occurs year-round. Abundance in the Irish Sea was estimated in summer 2005 at 15,200 (CV = 0.35) animals (SCANS-II - http://biology.st-andrews.ac.uk/scans2/).

Stomach contents of harbour porpoises from the Irish Sea suggest that, for smaller animals at least, gobies are an important source of food, while poor-cod and whiting also make a significant contribution to the diet of adults (IoZ/SMRU unpublished data).

6.2.3 Grey seal

Grey seals haul out in southern Cardigan Bay and at several sites around Pembrokeshire (Keily *et al.* 2000); these areas are covered by the SACs shown in Figure 4. The size of the population breeding in Welsh and Irish waters of the Irish Sea has been estimated at 5-7,000 animals (Keily *et al.* 2000).

Telemetry data have identified areas that are used by grey seals in the Irish Sea (Hammond *et al.* 2005). These include an area of the southern part of Cardigan Bay extending 40-50 km offshore, and another group of areas west and south of Dyfed (Figure 6). Note, however, that some areas were visited by only one or two individuals; the area in southern Cardigan Bay is one of these so less importance should be attached to this area.

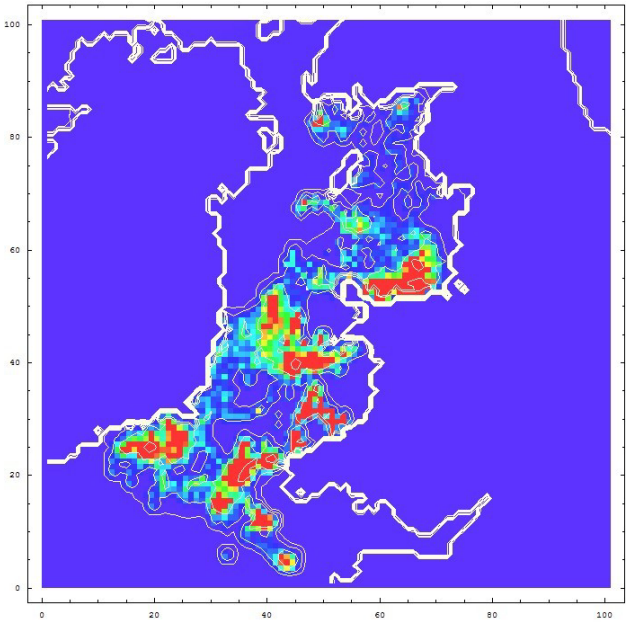

Figure 6. Modelled at sea usage by 19 grey seals fitted with transmitters at Hilbre, Bardsey and Ramsey Islands (from Hammond et al. 2005). 'Hot' colours indicate greater usage.

6.3 Potential for impact of OGED on the sites

Knowledge of bottlenose dolphins in the Cardigan Bay/Pembrokeshire area is less developed than in the Moray Firth. The size and overall distribution of the population that uses the SAC is uncertain; however, it is clear that the Cardigan Bay SAC, in particular, is an important area for bottlenose dolphins. The considerations of whether the integrity of the site would be compromised and whether disturbance would be caused by OGED are the same as for the Moray Firth SAC. Given current knowledge of the distribution of the dolphins within the SAC (mostly along a coastal strip within a few km of the coast of southern Cardigan Bay), the location of the Blocks applied for, and the relative lack of sensitivity of dolphins to low frequency sound, OGED is unlikely to impact the integrity of the site unless activities within the coastal strip in which the dolphins are regularly seen were sufficient to cause more than temporary disturbance.

Beaches in the area are used by grey seals to pup, moult and haul out between foraging trips; no impact of OGED would be expected on these land-based activities, except in the event of an oil spill. The main foraging areas identified are neither within the SACs nor close to the Blocks applied for so OGED is not expected to impact the integrity of the site for grey seals.

The Cardigan Bay/Pembrokeshire SACs forms only a limited part of the range of the Irish Sea harbour porpoise population. It is unclear what integrity of the site means for this species, but there is no reason to believe that OGED would impact it.

7. Cumulative and synergistic effects

An assessment of cumulative effects is dependent on knowledge of other plans or projects involving human activity, which is beyond the scope of this document.

Both the Moray Firth and Cardigan Bay/Pembrokeshire SACs are currently subject to range of anthropogenic effects other than OGED, including shipping, recreational activity, fishing, sewage outfall and contaminant runoff. The available information indicates that the bottlenose dolphins and other species that inhabit these areas are able to coexist side-by-side with these activities and their effects. The addition of OGED activity in the vicinity could potentially lead to an adverse impact. However, given the assessment that OGED is unlikely to impact the integrity of the sites, additional synergistic effects would also appear to be unlikely.

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