From:	Victoria Lane (Brodies Solicitors)
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Subject:	Spirit Energy ISH 1 Submission - Appendices List and Appendix ZD - ZO [BRO-D.FID4510105]
Date:	14 December 2018 23:26:32
Attachments:	image002.png image004.png image006.png image008.png image010.png image012.png SE_ISH_1 - Appendix ZN - Comprehensive analysis of flying conditions (percentage frequency outcome) based on 3-hourly weather date for J6A (1 October 2017 – 29 September 2018)_44088947_1.PDF SE_ISH_1 - Appendix ZM - Expert assessment of flying conditions for ARA – Sample of weather forecasts at Block J-West (1 October 2017 – 29 September 2018)_44088940_1.PDF SE_ISH_1 - Appendices_List - 14 December 2018_44089241_1.PDF SE_ISH_1 - Appendix ZO - Issue Specific Hearing 1 (4 December 2018) - Summary of Evidence_44089235_1.PDF SE_ISH_1 - Appendix ZL - Composite of SE and Orsted Maps (including nautical miles diameter and air or surface)_44088926_1.PDF SE_ISH_1 - Appendix ZK - Map of Hornsea and 7.5nm radius (including nautical miles diameter and air or surface)_44088925_1.PDF SE_ISH_1 - Appendix ZJ - Map of Hornsea and 5nm radius (including nautical miles diameter and air or surface)_44088923_1.PDF SE_ISH_1 - Appendix ZI - Map of Hornsea and 2nm radius (including nautical miles diameter and air or surface)_44088922_1.PDF SE_ISH_1 – Appendix ZH - Map of Hornsea and all radii (including nautical miles diameter and air or surface)_44088915_1.PDF SE_ISH_1 - Appendix ZG - Spirit Energy Technical Note_44089234_1.PDF SE_ISH_1 - Appendix ZF - Legislative Framework Summary - 14 December 2018_44089227_1.PDF SE_ISH_1 - Appendix ZE - Addendum to AviateO International Limited Report (December 2018)_44089225_1.PDF SE_ISH_1 - Appendix ZD - Addendum to Noble Denton Marine Services Report to Spirit Energy Report Review of Marine Hazards (December 2018)_44089055_1.PDF

CONFIDENTIAL MESSAGE - INTENDED RECIPIENT ONLY

Please find attached Appendix ZD – ZO

Kind regards

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APPENDIX ZD

ADDENDUM TO NOBLE DENTON MARINE SERVICES REPORT TO SPIRIT ENERGY REPORT REVIEW OF MARINE HAZARDS (DECEMBER 2018)

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TECHNICAL NOTE

Date:	14th December 2018	**Ref:**	TN – 777	**Rev:** 0
Project No:	10074959 Task 60	**Client:**	Spirit Energy	
Attn:	Max Rowe			
Author:	Robert Sinclair	**Checked:**	Sujit Viswanathan	
Subject:	Addendum to Report A 13423 Rev 3 – Review of Marine Hazards – Hornsea 3 Windfarm			

1 Introduction

Noble Denton marine services were instructed by Spirit Energy to undertake a further study following the Issue Specific Hearing on 4th December 2018 at Norwich. This Technical Note serves as the addendum to the report referenced in the subject.

2 Scope of Work

Review additional information provided by Spirit and information gathered during the Issue Specific Hearing and prepare and addendum to the report to identify hazards related to Spirit Energy's assets in the proximity to the Hornsea 3 windfarm development.

3 Addendum to A 13423 – Rev 3

3.1 Consequences of collisions / allisions with gas platforms

The key to Spirit Energy Report A13423 Rev 3 Review of Marine Hazards is the real concern of avoiding risk to life of personnel, and risk to the environment and to the Spirit Energy assets operating in the Greater Markham Area to exploit gas. These risks are manifest in the well identified Major Accident Hazards associated with vessel collisions with stationary gas platforms ("allisions") and the severe to catastrophic consequences of gas fires associated with ruptured risers where a vessel allides with such a stationary asset. An impact with a kinetic energy in excess of 5 mega joules has the potential to cause severe damage to such a platform. See Table 4-1 of the Review of Marine Hazards (6th November 2018). The details of the potential effects of the proposal in relation to the existing offshore infrastructure and the fundamental shortfalls and gaps in the assessment carried out, are set out, with cross-references, in section 4.3 of the Review. Section 5 of the Review summarises the 18 hazards identified.

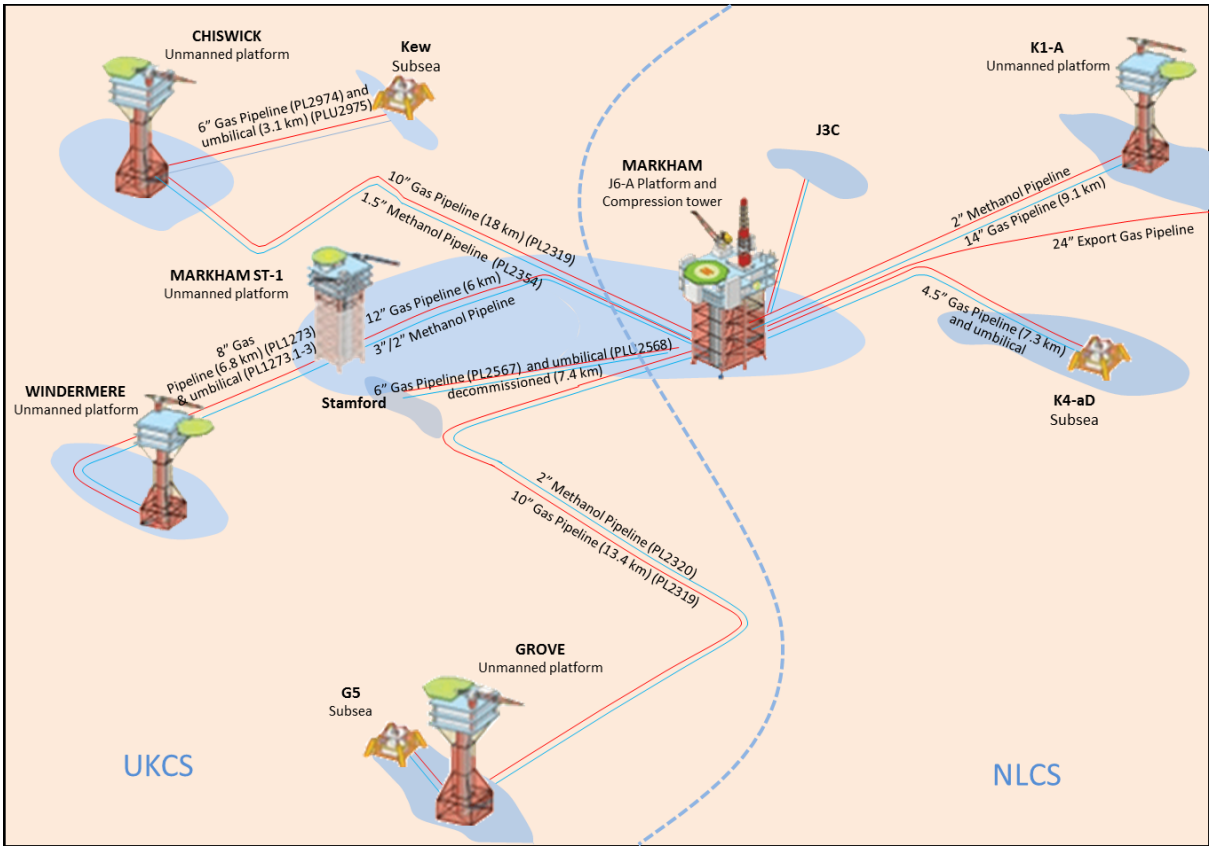

Figure 1 – Schematic of Markham and ST 1 adjacent facilities

Ref Figure 1.6.4 of the Markham ST-1 Decommissioning Programmes (31st January 2018) (Doc ID: CEU-DCM-GMA00025-REP-0010 Rev C1) shows a schematic of the Spirit Energy Installations of concern. Figure 2-1 of the Review of Marine Hazards (6th November 2018) shows the location of the existing Spirit Energy offshore infrastructure.

The consequences of any accident, to life or an asset or lost resources, especially a marine collision with a producing gas platform, are extremely high. A vessel allision can deform the structural column(s) supporting the platform with consequential deformation of gas risers and their rupture resulting in an uncontrolled escape of gas and subsequent explosion.

As detailed in the Review, and Spirit Energy's Written Representation of 7 November 2018, the risk of allision arises from three categories of vessel –

- Spirit Energy's own vessels (supply vessels and specialist works vessels);
- The Applicant's vessels (supply vessels and specialist works vessels), and
- Third party vessels.

Reference the Letter from HSE to Oil and Gas UK (see Marine Review 4.1.4), the Head of Energy of the Offshore Safety Directive Regulator wrote to OGUK on 19th September 2018 about allision risk to oil and gas platforms. (there in relation to vessels attending an installation and equally applicable to the risk arising from third party vessels) and said:

"*Structural failure is a major accident hazard for all offshore installations …*

The displacement of vessels attending offshore installations has been increased through the years since offshore oil and gas operations began in the UKCS. The operations carried out from these vessels has also increased in frequency and scope over time. The capacity of existing installations to withstand collisions from such vessels has, at best, remained generally unchanged. The unmitigated major accident risk of structural failure due to ship collisions from attending vessels has therefore increased overall. This risk must be controlled through the hierarchy of risk control, in accordance with Schedule 1 of the Management of Health and Safety at Work Regulations 1999…
The offshore regulatory regime requires installation duty holders to identify major accident hazards. HSE expects that this will include the potential for structural failure due to attendant vessel collision. Risks arising from the hazards must be evaluated and suitable measures implemented to control them to an acceptable degree "

3.2 Displacement of vessel traffic

The Applicant's actual scheme design cannot be known at this time and the scale awaits a final funding decision. The Application currently only demarcates the outline of the area where turbines in future may be sited. However, the Applicant has provided two ideas for layouts with proposed turbines at least 1km part from each other (Layout A and Layout B). See ES, Chapter 3, Project Description (PINS Reference A6.1.3). A vessel can currently, subject to their own risk assessment (MGN543), transit in the 1km gap between each turbine. The suggested layouts show a grid of fixed turbines as small dots on two alignments parallel with the south western part of the proposed diamond shape array area. The suggested alignments create channels between the proposed turbines that align between the north west part of the diamond and between the Grove Installation to the south east and J6A that serve to encourage vessel transit from west to east and vice versa along the alignment of the channels.

It is also considered likely that, in westerly gale conditions, a volume of displaced traffic travelling north/south will avoid transit of the channel between Hornsea 2 and Hornsea 3, rather passing to the east of the array area bringing them into close proximity with the Spirit Energy offshore installations. This could be exacerbated by the fact that they are required to enter and leave the TSS 'Off Botney' at as shallow an angle as possible.

Separately it is considered likely that, in northerly gale conditions, a volume of displaced traffic travelling westwards/eastwards will transit south of Hornsea 2 and Hornsea 3, and around the south east corner of the array area bringing them into close proximity with the Grove offshore installation. This could be from the requirement that when they chose to avoid using the TSS are required to avoid it by as wide a margin as possible.

Each of the scenarios above are of real concern because of the potential affects on safe vessel navigation close to the Spirit Energy offshore installations and other infrastructure.

The Applicant's ES addresses ALARP in Volume 2, Chapter 7, Shipping and Navigation (PINS Reference A6.2.7) but does not address displaced vessel allision with the Spirit Energy offshore installations. A careful examination of the ES chapter on inter-related effect shows no consideration of vessel allision with SE offshore installations arising from displaced vessels.

3.3 ALARP Principle

The Applicant has not undertaken an ALARP assessment of the potential effects of the displaced traffic in the circumstances described above. MGN 543, Annex 3, paragraph 3(c) requires ALARP "conducted as part of the Navigation Risk Assessment". The NRA

Methodology for Assessing Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations, pages 5-60, Section C4(ii) also requires ALARP by which to establish the tolerability of the risk (here, of allision with SE offshore infrastructure). MGN 372, page 9, paragraph 4.3 provides that permanent safety zones are "not expected to be established around entire windfarm arrays, as compelling risk-assessed arguments would be required for their establishment". The Conclusion on page 11 notes the challenges to safe navigation presented by offshore renewable energy installations.

In particular, the proposed windfarm has the potential to affect the offshore infrastructure by causing vessel displacement so as to increase the numbers of vessels close to the installations of SE by the introduction of the proposed array close to the west of the existing infrastructure. The increase changes and increases the risk of vessel allision with Spirit Energy offshore infrastructure.

Spirit Energy is concerned to reduce these risks to As Low as Reasonably Practicable (ALARP). Any hazard from an increase in traffic, or difficulty in detecting such traffic, or traffic passing in closer proximity to the assets in the Greater Markham area will, from a probability perspective, serve to increase risk. Consequences will remain severe to catastrophic. Nowhere in the application documentation is this level of consequence acknowledged or assessed.

With reference to the Applicant Document HOW03_6.2.7 Volume 2 – Ch7 – Shipping and Navigation;

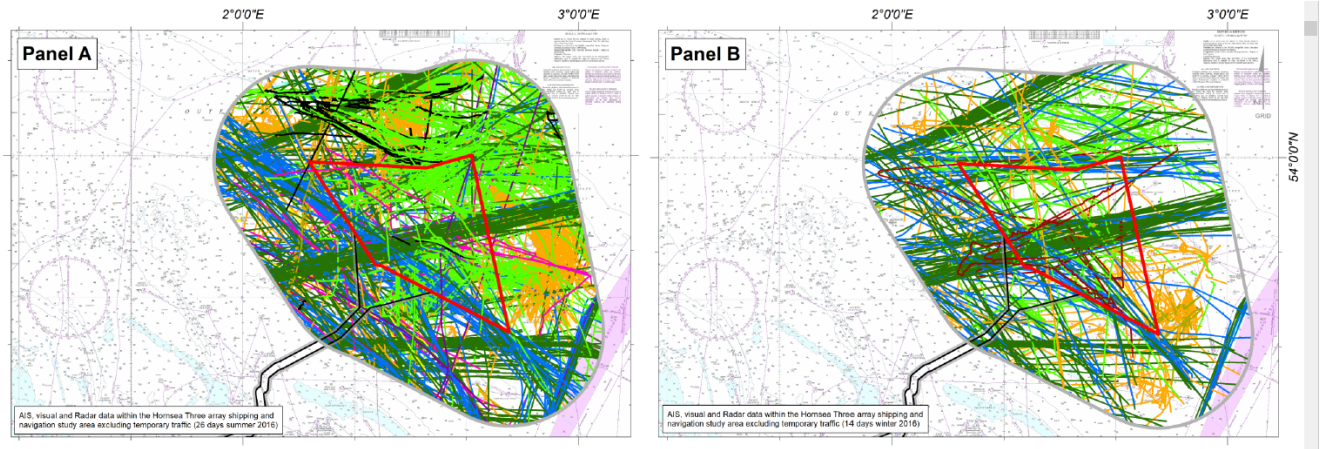

Figure 2: (Extract from Figure 7.3 of above document) - Overview of existing marine traffic survey data

The above figure shows an output from the traffic surveys undertaken in summer and winter 2016. This shows the area immediately west of the existing offshore infrastructure to be heavily trafficked by a range of vessels. It is noted that this also excludes temporary traffic – and only 40 days summer and winter 2016 are considered and so is not considered a realistic basis for assessment. The document then goes on to list a large number of wind farms which have either been recently made operational, are under construction, consented or are applied for in the Southern North Sea. The combined area of Hornsea 1, 2 & 3 alone, is much greater than existing windfarms in UK waters, in addition to the numerous others. As much as Spirit Energy have indicated that they do not object in principle to the Application, their concern in this case is the proximity of the proposed eastern boundary to Spirit Energy's assets, and the impacts this development, combined with the numerous others has on traffic flow and hence has on the risk of vessel collision with existing offshore infrastructure and activities. The additional burdens of managing these risks, under its obligations as per the UK Safety Case Regulations, is also of consideration.

3.4 Vessels Not Under Command (NUC) / Drift Speeds

The proximity of the eastern boundary of the turbine array also gives rise to the risk of vessel allision in the event of a vessel going NUC due to an engine failure or other technical problem. This risk relates to;

(i) vessels involved in the construction or servicing of the wind farm in a drift-on position with the Spirit Energy's infrastructure.
(ii) Spirit' Energy's supply vessels or specialist vessels in a drift-on position with the wind farm.
(iii) Third party vessels making a passage between the windfarm and SE assets.

This issue is discussed at section 4.2.4 of the Review and within Spirit Energy's Representation of 7 November 2018.

At the Issue Specific Hearing on 4 December 2018, the witnesses for the Applicant and Spirit Energy discussed their assumptions in respect of an appropriate rate of knots for wind driven drift. Since that hearing further investigation has confirmed that an assumption of 4 knots (as referred to in the Review, section 4.2.4) should not be considered extreme. Reference is made to the Marine Accident Investigation Branch report into a collision between Saga Sky and Stema Barge II off the Kent Cost on 20th November 2016. (Ref Report No 03/2018 March 2018):

"After Saga Sky had passed through Dover Strait in the south-west traffic lane, the weather deteriorated significantly with the approach of Storm Angus. The south-westerly wind and tidal stream significantly reduced the ship's progress. The master attempted to turn the ship to starboard to steer a reciprocal course and run with the weather until the storm abated. The effect of the wind acting on the ship's cranes and aft superstructure overcame the turning moment of the rudder and prevented the turn from being completed. Despite maintaining propulsion, Saga Sky was blown broadside over a distance of approximately 7.4nm while the master continued with his attempts to turn the vessel to starboard until it collided with Stema Barge II. The combination of wind and tide propelled Saga Sky, beam on to the wind, at speeds of up to 9kts, and even after deploying both anchors the ship continued to move under the effects of the storm."

In such weather conditions, and with short drift distances between the windfarm and Spirit Energy installations, it is unlikely that a tug with a barge under tow, parting its towline near the eastern boundary of the array, could recover the wire and re-connect the emergency tow wire before any potential collision. Barges loaded with tripod foundations, or transition pieces will have a high windage and hence high drift speeds. The type of ERRV generally used in the southern North Sea area has no towing capability and therefore could not intervene in such circumstances.

The risk of allision by NUC vessels with Spirit Energy's infrastructure has not been considered as part of the ALARP assessment within the Navigational Risk Assessment (ES, Vol. 5, Annex 7.1). Neither has it been considered within ES chapter on inter-related effects (ES, Vol. 2, Chapter 12).

3.5 MGN 372

Ørsted's representative at the Issue Specific Hearing 1 (ISH 1) on 4th December 2018, cited MGN372 (Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs) and it was stated that the MGN advises shipping not

to pass through a windfarm. In fact, and in line with MGN 543, Annex 1, Section 3(a), MGN 372 includes:

> **4.8 Options**
>
> 4.8.1 In taking account of this guidance there are, in simple terms, three options for mariners:
>
> (a) Avoid the OREI area completely,
>
> (b) Navigate around the edge of the OREI, or
>
> (c) In the case of a wind farm, navigate, with caution, through the wind farm array.

Figure 4: Extract from MGN372

The extract above clearly expresses the view of the MCA that navigating through the wind farm array is a valid option for a vessel.

We also note the statement at paragraph 22.13.3.15 of the Navigational Risk Assessment (Ref Volume 5, Annex 7.1 – Navigational Risk Assessment (PINS Doc Ref A6.5.7.1) that the Dutch Fishing Association VISNED also noted that in good weather fishing vessels are likely to transit through the wind farm.

3.6 Environmental Statement Conclusions and Assumptions

Figure 3: (Extract from Figure 7.14 of HOW03_6.2.7 Volume 2 – Ch7 – Shipping and Navigation PINS Ref A6.2.7*) Current cumulative scenario, 90th percentile*

In ES, Volume 5, Annex 7.1, Navigational Risk Assessment (PINS Reference A6.5.7.1)(May 2018), page 87, Figure 18.6 asserts a "Simulated AIS following installation of the Hornsea Three Array Area" as showing no vessel traffic within the area of the DCO application shown red above in Figure 3. In light of MGN 372, page 9, paragraph 4.3 providing that permanent safety zones are "not expected to be established around entire windfarm arrays,

as compelling risk-assessed arguments would be required for their establishment", and in the absence of evidence by the Applicant of such a compelling argument, it is not a credible simulation to show no vessel traffic within the red area in Figure 3 with up to 300 turbines envisaged as constructed. In the absence of that compelling risk-based argument from the Applicant (as is currently the case), the Figure 18.6 is does not appear to be consistent with MGN 372, paragraph 4.3 because it appears to assume a permanent safety zone excluding vessels from the entire array area. Figure 18.6 cannot be relied on to show the foreseeable vessel traffic situation were the array to be populated by actual turbines.

Therefore, it is not credible to consider that the traffic indicated in Figure 2 above, with the addition of Hornsea 1, Hornsea 2, and Hornsea 3 is projected to translate into no or no additional traffic passing close to Spirit Energy assets at the 90th percentile level (areas within which 90% of vessel traffic transiting a route are situated as per MGN 543).

Referring to ES Volume 5, Annex 7.1 Part 2 – Navigational Risk Assessment (PINS Doc Ref A6.5.7.1) Table 14.1 indicates that the Applicant consulted 47 Regular Operators to inform the assessment – only 6 responded. 39 organisations were invited to the Hazard Workshop – only 13 attended. Consequently, a number of potential scenarios have not been adequately tested. In addition, a number of theoretical assumptions made in the above document also do not bear close scrutiny:

- The assumption that no vessels will pass through the windfarm. As the number of windfarms increase, and larger areas of sea room are subsumed into them, this practice becomes more likely. Within MGN 543 it is clearly stated in Annex 1, Section 3, that in the UK vessels have the freedom to pass through a windfarm, notwithstanding the presence of a safety zone around each turbine:

"*In the UK all vessels have freedom to transit through OREIs, subject to any applied safety zones, and their own risk assessments, which should take account of factors such as vessel size, manoeuvrability, environmental factors and competency of the Master and crew. MGN 372 (or subsequent update) provides further guidance on navigation in and around OREIs.*

a. *MCA has statutory obligations to provide Search and Rescue (SAR) services in and around OREIs in UK waters. Turbine layout designs must be designed to allow safe transit through OREIs by SAR helicopters operating at low altitude in bad weather, and those vessels (including rescue craft) that decide to transit through them. Developers should therefore carry out further site specific assessment to build on previous assessments to assess the proposed locations of individual turbine devices, substations, platforms and any other structure within the wind farm or tidal/wave array. This assessment should include the potential impacts the proposed location may have on navigation and SAR activities."*

MGN 543 mandates the layout design to allow for safe vessel transit through an array. Whilst a 500 m safety zone is mentioned during construction, MGN 543, Annex 3, paragraph 7 makes clear that there may be "50m safety zones during operation". This allows for a 900m channel between each line of turbines during operation (500m x 2 = 1km; 1km – (2x50m) = 900m). MGN 543 refers to guidance in MGN 372 and identifies certain factors for consideration which are largely left to vessel self-governance. It is therefore likely that vessel traffic will start to pass through the proposed array and, as suggested by Layouts A and B, along the channels created (rather than by a zig-zag route) to maintain a more direct easterly track. The frequency of this would be dependent on the final secured orientation of the array, and in part on the direction of wind at the time of transit, however we consider that such transits cannot be precluded.

- The requirement to join traffic separation schemes (here, the Off Botney Ground TSS close to the south-east of Grove offshore installation) at as small an angle as

possible to the angle of the TSS (i.e. as far from perpendicular to the TSS as possible), is likely to encourage south bound vessels to pass between Spirit Energy assets and the wind farm eastern boundary to join the adjacent traffic separation scheme. Not all vessels choose to join the TSS and the available sea area around Grove is substantially reduced by the proposed area of the windfarm array.

- The assumption that over the Southern North Sea additional vessel displacement, including displacement from adverse weather conditions (in the main to the North) will be small.
- That the frequency of 'adverse weather', causing traffic displacement, is low. In the consideration of the nature of adverse weather for passage planning, a prudent mariner has a range of factors to take into account, including the characteristics of the vessel and the direction of the forecast weather vis-a-vis the route, swell, the nature of the cargo and visibility etc. Consequently, an assumption that the frequency of 'adverse weather' is low, does not begin to cover the full range of situations in which the prudent Master of a vessel may find their selves and may therefore have to divert course.

Given the factors above, we consider that it is impossible to conclude on the basis of the ES, and noting the absence at this time of an ALARP assessment of vessel allision, that there will be no increased risk of vessel allision with Spirit Energy's offshore infrastructure by a vessel impact with a kinetic energy above 5 mega joules. The results of such allision would be catastrophic for life and gas exploitation assets.

3.7 REWS (Radar Early Warning System)

We also note that recent correspondence between Spirit Energy and Ørsted indicate Ørsted's belief that platform J6A has a RACON and AIS that would not be affected by the turbines in the array. Whilst we generally agree with this assessment in relation to the RACON and AIS, platform J6A also has, but as its primary means of detecting approaching and errant vessels (towards itself and its satellite platforms of Grove and Chiswick NUIs), an ARPA (Automatic Radar Plotting Aid) system which we believe will highly likely be affected in its practical operation by the planned array. We can also confirm that, in fact, J6A does not have a REWS system as outlined in the Applicant's documentation. There is, therefore, a further gap in the Applicant's risk assessment and this too is a real concern for safe vessel movement close to the Spirit Energy offshore infrastructure.

3.8 EIA and Marine Hazards/Risks

On the basis of this addendum, it is clear that the information in the EIA submitted is deficient and has gaps, and is not robust in terms of addressing the very real risks arising from increased frequency of traffic, navigation of vessels through and around the windfarm, NUC vessels and provision of a fully functional REWS to enable Spirit Energy to manage the associated risks to ALARP. It is also clear that there has been no ALARP assessment to date by the Applicant in relation to the real potential for vessel allision with Spirit Energy assets. The EIA navigation risk assessment ALARP process is deficient, has gaps, and is not robust in assessing and reducing of ALARP the risk of vessel allision with Spirit Energy assets notwithstanding the clear catastrophic consequences were such risk to crystallise.

Consequently, additional measures, such as additional sea room in terms of a 2nm channel between the eastern boundary of the windfarm and existing Spirit Energy assets, as referenced in and in line with MGN543 (Annex 3 Para 10a(iii) PIANC Assessment), and a fully functional REWS will be required as matters currently stand to ensure the ALARP principle is adhered to. It is considered that this 2 nm channel will also allow for necessary

adequate sea room to ensure safe offshore vessel operations at Spirit Energy's assets at the western periphery of the existing gas exploitation Greater Markham Field.

We note that MGN 543, Annex 2, paragraph 3(c) (Collision Avoidance and Visual Navigation) anticipates a further risk assessment being carried out in respect of proposed layouts in due course:

"Risk assessments for proposed layouts should build on earlier work conducted as part of the Navigation Risk Assessment and the mitigations identified as part of that process. Where possible, this original assessment should be referenced to confirm where information or the assessment remains the same or can be further refined due to the later stages of project development. Risk assessments should present sufficient information to enable the MCA to adequately understand how the risks associated with the proposed layout have been reduced to ALARP. The MCA's *"Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)"* should be followed as part of this assessment."

This being the case, there may be scope for the initial 2nm channel to be reduced or modified following such further risk assessment, subject to ALARP and consultation with Spirit Energy This would be a reasonable and pragmatic approach to addressing the issues identified in this addendum.

3.9 Future Developments

In terms of future developments, Spirit Energy's Full Written Representation dated 7 November 2018 Para 2.2.1 indicated the positions of two planned future wells (C6 and C7) in the Chiswick field in Figure 1 on page 5. The real concerns outlined above, as well as comments in the Marine Review, are also applicable to the planned well locations and so a 2nm clear sea room is also required around those developments.

3.10 Protective Provisions

Spirit Energy has provided draft Protective Provisions that ensure such measures in the interests of maintaining safety from vessel allision with its offshore infrastructure. With those Provisions ensured in the draft DCO, we consider that the safety of the existing offshore infrastructure from vessel allision would be at an acceptable level to enable the IPC to grant the DCO, and the provisions could provide for reduction of the 2nm sea room on the basis of ALARP and consultation with Spirit Energy.

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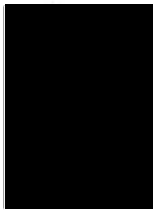

Countersigned:

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Principal Marine Surveyor

Aberdeen, 14.12.2018