East Anglia TWO Offshore Windfarm

Appendix 14.2

Hazard Log

Preliminary Environmental Information
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East Anglia TWO Offshore Windfarm

Hazard Log

(Appendix 14.2)

Prepared by	Anatec Limited
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	Aberdeen Office	Cambridge Office
Address	10 Exchange Street, Aberdeen, AB11 6PH, UK	Braemoor, No. 4 The Warren, Witchford Ely, Cambs, CB6 2HN, UK
Tel	01224 253700	01353 661200
Fax	0709 2367306	0709 2367306
Email	aberdeen@anatec.com	cambs@anatec.com

Revision Number	Date	Summary of Change
00	10th August 2018	Initial Draft

Table of Contents

Table of Tables

Abbreviations Table

Abbreviation	Definition
ABP	Associated British Ports
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
BMAPA	British Marine Aggregates Producers Association
CA	Cruising Association
COLREGs	International Regulations for the Prevention of Collision at Sea
CoS	Chamber of Shipping
DfT	Department for Transport
EIA	Environmental Impact Assessment
ERCoP	Emergency Response Cooperation Plan
FSA	Formal Safety Assessment
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
NFFO	National Federation of Fishermen's Organisations
NUC	Not Under Command
PLA	Port of London Authority
RNLI	Royal National Lifeboat Institute
RYA	Royal Yachting Association
SAR	Search and Rescue
SOLAS	International Convention for the Safety of Life at Sea
TH	Trinity House

1 Introduction

1. As per the required Maritime and Coastguard Agency (MCA) methodology (MCA, 2015), a Hazard Log has been created detailing the potential hazards to shipping and navigation receptors that may arise from the construction, operation, and decommissioning of the East Anglia TWO windfarm site.

2. The Hazard Log was created following a Hazard Workshop held in London on the 9th May 2018. This consultation meeting provided both local and national shipping and navigation stakeholders relevant to the project an opportunity to comment on the project and provided the developer the opportunity to gather stakeholder knowledge and experience.

1.1 Attendees

3. The Hazard Workshop attendees are listed in *Table 1.1*, including those parties who were invited but were unable to attend.

Table 1.1 Hazard Workshop Attendees

Stakeholder	Attended
Brown & May Marine	Yes
Chamber of Shipping (CoS)	Yes
Cruising Association (CA)	Yes
Cobelfret Ferries	Yes
DFDS	Yes
James Fisher Everard	Yes
Associated British Ports (ABP)	No
British Marine Aggregates Producers Association (BMAPA)	No
Department for Transport (DfT)	No
Hanson Marine	No
Harwich Haven Authority	No
MCA	No
National Federation of Fishermen's Organisations (NFFO)	No
Port of London Authority (PLA)	No
Rederscentrale (Belgian Fisheries)	No
Royal National Lifeboat Institute (RNLI)	No
Royal Yachting Association (RYA)	No

Stakeholder	Attended
Stena Line	No
Trinity House (TH)	No
VISNED	No

1.2 Hazard Workshop Methodology

4. The objectives of the Hazard Workshop were as follows:

- Identify hazards to shipping and navigation receptors resulting from East Anglia TWO;
- Identify potential hazard causes;
- Assess the consequences of the scenario (most likely and worst case); and
- Discuss potential mitigation measures.

5. Following the Hazard Workshop the Hazard Log was produced presenting all of the hazards identified and ranking each in terms of significance, both pre and post mitigation. The system used to rank the hazards is based upon two factors – severity of consequence and frequency of occurrence. The definitions used within the Formal Safety Assessment (FSA) to define these are presented in *Table 1.2* and *Table 1.3*, respectively.

Table 1.2 Severity of Consequence Definitions

Rank	Description	Definition			
		People	Property	Environment	Business
1	Negligible	No injury	< £10k	< £10k	< £10k
2	Minor	Slight injury(s)	£10k-£100k	Tier 1 Pollution Incident[1]	Minor
3	Moderate	Multiple moderate or single serious injury	£100k-£1M	Tier 2 Pollution Incident[2]	Moderate

[1] Response to incident within the capability of one local authority, offshore installation operator or harbour authority. Tiers defined in the National Contingency Plan (Marine Pollution), (MCA, 2014).
[2] Response to incident beyond the capability of one local authority or requires additional contracted response from offshore operator or from ports or harbours. Tiers defined in the National Contingency Plan (Marine Pollution), (MCA, 2014).

Rank	Description	Definition			
4	Serious	Serious injury or single fatality	£1M-£10M	Tier 2[2] Pollution Incident	Serious
5	Major	More than 1 fatality	>£10M	Tier 3[3] Pollution Incident	Major

Table 1.3 Frequency of Occurrence Definitions

Rank	Description	Definition
1	Negligible	< 1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

6. The significance of each impact was then assessed as either "**Broadly Acceptable**", "**Tolerable**", or "**Unacceptable**" based on the tolerability risk matrix presented in *Table 1.4*. Definitions of these significance rankings are presented in ***Error! Reference source not found.***. Where an impact is assessed as being of "**Unacceptable**" significance, additional mitigation is required to reduce the significance of the impact to within the "**Broadly Acceptable**" or "**Tolerable**" ranges. The impact is then considered to be As Low as is Reasonably Practicable (ALARP).

[3] Incident response requires national resources coordinated by the MCA for a shipping incident and the operator for an offshore installation incident. Tiers defined in the National Contingency Plan (Marine Pollution), (MCA, 2014).

Table 1.4 Tolerability Risk Matrix

Consequence						
	Major	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
	Serious	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
	Moderate	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	Minor	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
		1	**2**	**3**	**4**	**5**
		Frequency				

Table 1.5 Significance Ranking Definitions

Broadly Acceptable	Risk ALARP with no additional mitigations or monitoring required above embedded mitigations.
Tolerable	Risk acceptable but may require additional mitigation measures and monitoring in place to control and reduce to ALARP.
Unacceptable	Significant risk mitigation or design modification required to reduce to ALARP.

7. A ‘draft’ Hazard Log was distributed to the relevant stakeholders for comment prior to finalisation. The final Hazard Log is presented in full in Section 5.

2 Mitigation Measures

8. Those measures assumed to be embedded mitigation are listed below. The Environmental Impact Assessment (EIA) has been undertaken on the understanding that these measures will be in place.

- Application for and use of safety zones during construction, major maintenance work during operations and decommissioning;
- Cable Burial Risk Assessment undertaken pre-construction, including consideration of under keel clearance. All subsea cables will be suitably protected based on risk assessment, and the protection will be monitored and maintained as appropriate;
- Compliance from all vessels associated with the proposed project with international maritime regulations as adopted by the relevant flag state (most notably International Convention for the Prevention of Collision at Sea (COLREGS) (IMO, 1972) and International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974));
- Consideration of Marine Guidance Note (MGN) 543 – including the Search and Rescue (SAR) annex;
- An Emergency Response Cooperation Plan (ERCoP) will be developed and implemented for the construction, operational & maintenance and decommissioning phases. The ERCoP is based on the standard MCA template and would consider the potential for self-help capability as part of the ongoing process;
- Information relevant to the proposed project will be promulgated via Notice to Mariners and other appropriate media;
- Marine traffic coordination;
- Suitable lighting and marking of the East Anglia TWO windfarm site complying with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendations O-139 (IALA, 2013), to be finalised in consultation with TH and the MCA;
- Use of guard vessels when deemed appropriate following risk assessment;
- Wind turbines will have at least 22m clearance above Mean High Water Springs (MHWS); and
- Wind turbines, cables and substations marked on Admiralty Navigational Charts and Admiralty Sailing Directions.

3 Hazard Log

Table 3.1 presents the East Anglia TWO Hazard Log in full.

Table 3.1 East Anglia TWO Hazard Log

Phases	Hazard Title	Hazard Detail	Possible Causes	Embedded Mitigation Measures	Most Likely Consequences	Most Likely						Worst Case Consequences	Worst Case						Potential Risk Reduction Measures	Remarks
						People	Environment	Property	Business	Frequency	Risk		People	Environment	Property	Business	Frequency	Risk		
C/O/D	Displacement of vessels	Activities within the East Anglia TWO windfarm site may lead to the displacement of established commercial vessel routes and third party marine activity.	Presence of construction major maintenance or decommissioning activities, buoyed construction/ decommissioning areas and safety zones.	Promulgation of information, marine coordination.	Increased journey time and distance for vessels using affected routes and minor reduction in sea space for existing third party marine activity.	1	1	1	2	5	Tolerable	Increased journey time and distance for vessels using affected routes leading to an effect upon operator schedules (for commercial ferries) and permanent loss of area used by third party marine activity during the operational phase.	1	1	1	3	2	Broadly Acceptable	Ensure buoyed construction/ decommissioning area is appropriate size.	Hazard primarily applies to commercial ferries on timetabled routes.
C/O/D	Displacement of vessels during periods of adverse weather	Activities within the East Anglia TWO windfarm site may lead to the displacement of established commercial vessel adverse weather routes.	Presence of construction, major maintenance or decommissioning activities, buoyed construction/ decommissioning areas and safety zones.	Promulgation of information including charting of development, marine coordination.	Increased journey time and distance for vessels using affected routes.	1	1	1	2	4	Broadly Acceptable	Inability to transit since no safe adverse weather route can be found.	1	1	1	4	1	Broadly Acceptable	No further mitigation required.	Hazard primarily applies to commercial ferries on timetabled routes.
C/O/D	Increased collision risk between two third party vessels	The displacement of vessels due to activities within the East Anglia TWO windfarm site may lead to an increasing number of encounters between third party vessels and therefore an increase in vessel collision risk between third party vessels.	Presence of construction, major maintenance or decommissioning activities, buoyed construction/ decommissioning areas and safety zones, navigational error, human error and adverse weather.	Compliance with international flag state regulations (COLREGs and International Convention for the Safety of Life at Sea (SOLAS)), MGN 372, promulgation of information.	Increased encounters between third party vessels resulting in increased collision avoidance action but no collision incurred.	1	1	1	1	4	Broadly Acceptable	Collision between third party vessels resulting in loss of vessel (smaller vessels), potential loss of life and pollution.	5	5	5	5	1	Tolerable	Ensure buoyed construction/ decommissioning area is appropriate size, increased level of promulgation of information to ensure all vessels can effectively passage plan.	Worst case consequences primarily apply to smaller vessels (except environmental effects which apply to tankers).

Phases	Hazard Title	Hazard Detail	Possible	Embedded	Most Likely	Most Likely						Worst Case	Worst Case						Potential Risk	Remarks
C/O/D	Increased collision risk between a third party vessel and project vessel	The displacement of vessels due to activities within the East Anglia TWO windfarm site may lead to an increasing number of encounters between a third party vessel and project vessel and therefore an increase in vessel collision risk between a third party vessel and project vessel.	Presence of construction major maintenance or decommissioning activities, buoyed construction/ decommissioning areas and safety zones, navigational error, human error and adverse weather.	Compliance with international flag state regulations (COLREGs and SOLAS), MGN 372, promulgation of information, vessel health and safety requirements including competency assessments and audits.	Increased encounters between third party and project vessels resulting in increased collision avoidance action but no collision incurred.	1	1	1	1	5	Tolerable	Collision between a third party vessel and project vessel resulting in loss of vessel (smaller vessels), potential loss of life and pollution.	5	5	5	5	1	Tolerable	Ensure buoyed construction/ decommissioning area is appropriate size, increased level of promulgation of information to ensure all vessels can effectively passage plan.	Worst case consequences primarily apply to smaller vessels (except environmental effects which apply to tankers) during construction and decommissioning phases. Noted that recreational vessels passing north-south to the west may be at risk from project traffic.
C/D	Creation of allision risk associated with partially constructed/ decommissioned windfarm structures	The presence of a partially constructed or decommissioned windfarm structure may create an allision risk.	Navigational aid failure (or absence), navigational error, human error, adverse weather and lack of experience/ awareness.	Implementation of safety zones, buoyed construction/ decommissioning areas, compliance with international and flag state regulations (COLREGs and SOLAS), marine pollution contingency planning, marine coordination, MGN 372, promulgation of information, use of guard vessels.	Near miss with an unmanned windfarm structure and/or infringing a safety zone.	1	1	1	1	4	Broadly Acceptable	Allision resulting in loss of vessel (smaller vessels), potential loss of life, pollution and loss of windfarm structure.	5	5	5	5	1	Tolerable	Tolerable with embedded mitigation.	Worst case consequences primarily apply to smaller vessels (except environmental effects which apply to tankers).
C/D	Creation of allision risk for vessels Not Under Command (NUC) associated with partially constructed/ decommissioned windfarm structures.	The presence of a partially constructed or decommissioned windfarm structure may create an allision risk for vessels NUC.	Machinery failure.	Implementation of safety zones, buoyed construction/ decommissioning areas, compliance with international and flag state regulations (COLREGs and SOLAS), marine pollution contingency planning, marine coordination, MGN 372, promulgation of information, use of guard vessels.	NUC vessel is on a closing point of approach with a partially constructed/ decommissioned windfarm structure but regains power or takes evasive action to avoid an allision.	1	1	1	1	2	Broadly Acceptable	Allision resulting in loss of vessel smaller vessels), potential loss of life, pollution and loss of windfarm structure.	5	5	5	5	1	Tolerable	Tolerable with embedded mitigation.	Worst case consequences primarily apply to smaller vessels (except environmental effects which apply to tankers).

Phases	Hazard Title	Hazard Detail	Possible	Embedded	Most Likely	Most Likely						Worst Case	Worst Case						Potential Risk	Remarks
O	Creation of allision risk for commercial vessels associated with unmanned windfarm structures	The presence of windfarm infrastructure may create an allision risk for passing commercial vessels.	Navigational error, human error, navigational aid failure, adverse weather and lack of experience/ awareness.	Compliance with international and flag state regulations (COLREGs and SOLAS), marine pollution contingency planning, marine coordination, MGN 372, monitoring by Automatic Identification System (AIS), permanent aids to navigation, promulgation.	Near miss with an unmanned windfarm structure on the periphery of the windfarm sites.	1	1	1	1	3	Broadly Acceptable	Allision resulting in significant vessel damage, serious injury, pollution and loss of windfarm structure.	4	5	4	4	1	Broadly Acceptable	No further mitigation required.	
O	Creation of allision risk for commercial vessels NUC associated with unmanned windfarm structures	The presence of wind farm infrastructure may create an allision risk for commercial vessels NUC.	Machinery failure.	Compliance with international and flag state regulations (COLREGs and SOLAS), marine pollution contingency planning, marine coordination, MGN 372, monitoring by AIS, permanent aids to navigation, promulgation of information.	NUC vessel is on a closing point of approach with an unmanned windfarm structure but regains power or takes other evasive action to avoid an allision.	1	1	1	1	2	Broadly Acceptable	Allision resulting in significant vessel damage, serious injury, pollution and loss of windfarm structure.	4	5	4	4	1	Broadly Acceptable	No further mitigation required.	
O	Creation of allision risk for commercial fishing vessels associated with unmanned windfarm structures	The presence of windfarm infrastructure may create an allision risk for commercial fishing vessels.	Navigational error, gear snagging, human error, navigational aid failure, adverse weather and lack of experience/ awareness.	Compliance with international and flag state regulations (COLREGs and SOLAS), marine coordination, marine pollution contingency planning, MGN 372, monitoring by AIS, permanent aids to navigation, promulgation of information.	Near miss with an unmanned windfarm structure.	1	1	1	1	4	Broadly Acceptable	Allision resulting in loss of vessel, potential loss of life, pollution and damage to windfarm structure.	5	2	3	4	1	Broadly Acceptable	No further mitigation required.	

Phases	Hazard Title	Hazard Detail	Possible	Embedded	Most Likely	Most Likely						Worst Case	Worst Case						Potential Risk	Remarks
O	Creation of allision risk for recreational vessels associated with unmanned windfarm structures	The presence of windfarm infrastructure may create an allision risk for recreational vessels.	Navigational error, tidal stream, human error, navigational aid failure, adverse weather and lack of experience/ awareness.	Minimum 22m blade clearance, compliance with international and flag state regulations (COLREGs and SOLAS), marine coordination, marine pollution contingency planning, MGN 372, monitoring by AIS, permanent aids to navigation, promulgation of information.	Near miss with an unmanned windfarm structure.	1	1	1	1	4	Broadly Acceptable	Allision resulting in loss of vessel, potential loss of life, pollution and damage to windfarm structure.	5	1	3	2	1	Broadly Acceptable	No further mitigation required.	
C/O/D	Creation of allision risk for project vessels associated with unmanned windfarm structures	The presence of windfarm infrastructure may create an allision risk for vessels associated with the project and operating in proximity to structures.	Human error, adverse weather and machinery failure.	Compliance with international and flag state regulations (COLREGs and SOLAS), marine coordination, marine pollution contingency planning, MGN 372, monitoring by AIS, permanent aids to navigation, promulgation of information, vessel health and safety requirements including competency assessments and audits.	Near miss with an unmanned windfarm structure.	1	1	1	1	4	Broadly Acceptable	Moderate speed allision resulting in loss of vessel, potential loss of life, pollution and damage to windfarm structures.	5	2	3	5	1	Broadly Acceptable	No further mitigation required.	
O	Creation of allision risk associated with a manned platform	The presence of manned accommodation platforms may create an allision risk.	Navigational error, human error, navigational aid failure, adverse weather and lack of experience/ awareness.	Compliance with international and flag state regulations (COLREGs and SOLAS), marine coordination, marine pollution contingency planning, MGN 372, monitoring by AIS, permanent aids to navigation, promulgation of information.	Near miss with a manned platform.	1	1	1	1	3	Broadly Acceptable	Allision resulting in loss of vessel, potential loss of life on vessel and platform, pollution and damage to platform.	5	5	5	5	1	Tolerable	Tolerable with embedded mitigation.	Worst case consequences primarily apply to smaller vessels (except environmental effects which apply to tankers).

Phases	Hazard Title	Hazard Detail	Possible	Embedded	Most Likely	Most Likely						Worst Case	Worst Case						Potential Risk	Remarks
C/O/D	Anchor interaction with subsea cables or structures during normal anchoring operations	A vessel may drop anchor or drag anchor over subsea structures including a subsea cable.	Uncharted subsea structures, human error, poor holding ground, cable exposure due to sediment transportation and lack of experience/ awareness.	Implementation of safety zones (during construction/ decommissioning), Cable Burial Risk Assessment, compliance with international and flag state regulations (COLREGS and SOLAS), monitoring by AIS, permanent aids to navigation (during operation), promulgation of information, use of guard vessels.	Vessel drops anchor or drags anchor in an area of exposed/ partially buried cable or subsea structure but no interaction occurs.	1	1	1	1	3	Broadly Acceptable	Anchor interacts with subsea cables resulting in damage to the anchor and/or subsea cables.	1	2	4	3	2	Broadly Acceptable	No further mitigation required.	Tankers anchor for transhipment area close to the East Anglia TWO windfarm site. Given limited restrictions on anchoring in the area vessels are likely to be safely displaced.
C/O/D	Anchor interaction with subsea cables during emergency anchoring operations	A vessel may drop anchor or drag anchor over subsea structures including a subsea cable in an emergency situation.	Machinery failure, adverse weather and lack of experience/ awareness.	Implementation of safety zones (during construction/ decommissioning), Cable Burial Risk Assessment, compliance with international and flag state regulations (COLREGs and SOLAS), monitoring by AIS, permanent aids to navigation (during operation), promulgation of information (charting and KISORCA), use of guard vessels.	Vessel drops anchor or drags anchor in an area of exposed/ partially buried cable or subsea structure but no interaction occurs.	1	1	1	1	2	Broadly Acceptable	Anchor interacts with subsea cables resulting in damage to the anchor and/or subsea cables.	1	2	4	3	1	Broadly Acceptable	No further mitigation required.	
C/O/D	Diminished emergency response capability within the region	The increased activity associated with the projects may lead to an increase in incidents requiring an emergency response resulting in a reduction in SAR resources available within the region.	Increased vessel activity associated with the project.	ERCoP, marine coordination, MGN 543, self-help capabilities, vessel health and safety requirements including competency assessments and audits.	Limited reduction in SAR resources.	1	1	1	1	2	Broadly Acceptable	Multiple incidents requiring an emergency response in a short time period resulting in a deficit of requiring SAR resources and consequently loss of vessel and potential loss of life.	5	5	5	5	1	Tolerable	Tolerable with embedded mitigation.	