Navigation Hazard Review Workshop

Neart na Gaoithe Offshore Wind Farm

Appendix 17.2

Prepared by:	Anatec Limited
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1 Introduction

This appendix presents the Hazard Log for the navigational risks associated with the proposed Neart Na Gaoithe offshore wind farm in the outer approaches to the Firth of Forth off the east coast of Scotland.

The workshop was held in Rosyth on 4th November 2011 attended by local maritime stakeholders, as outlined in Table 1. Other marine stakeholders such as the Cruising Association (CA), Chamber of Shipping and a number of shipping operators were also invited but could not attend. However, shipping and navigational issues were represented by the local representatives who attended the meeting.

Table 1 Hazard Review Workshop Attendees

Attendee	Position	Company/Organisation
Peter Douglas	Navigation Manager	Northern Lighthouse Board (NLB)
Pete Thomson	Offshore Energy Liaison Officer	Marine Coastguard Agency (MCA)
Ian Miller	Fife Sea Kayak Club	Scottish Canoe Association (SCA)
Rob Burgess	Lothian Sea Kayak Club	Scottish Canoe Association (SCA)
Bill Hughes	Manager of Fisherman's Mutual Association (FMA) (Pittenweem) Ltd	Kingdom Seafood/FMA Ltd
Sandy Ritchie	Secretary	Anglo-Scottish Fisherman's Federation
John Watt	Fishing Industry Advisor	Scottish Fisherman's Federation
Paul Jennings	Divisional Inspector (Scotland)	Royal National Lifeboat Institute (RNLI)
Paul Wibberly	Lifeboat Operations Manager & Forth Pilot	RNLI – Kinghorn Lifeboat
Ashley Nicholson	Assistant Marine Manager	Forth Ports Plc.
Leanne Fisher	Marine Officer	Forth Ports Plc.
Graham Russell	Planning and Environment Officer	Royal Yachting Association (Scotland)
Alison Duncan	Senior Consultant	EMU
Zoe Crutchfield	Offshore Environmental Manager	Mainstream Renewable Power
Ewan Walker	Environmental Developer	Mainstream Renewable Power
Ali MacDonald	Senior Risk Analyst	Anatec
Robert Jones	Risk Analyst	Anatec

The approach taken in this assessment is in line with the "Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms" produced by The Department of Energy and Climate Change (DECC), in association with the Marine Coastguard Agency (MCA) and the Department for Transport (DfT). This provides a template for developers in preparing their navigation risk assessments. The methodology is centred on risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions.

The key maritime hazards associated with the wind farm development were identified and associated scenarios prioritised by risk level. Within each scenario, vessel types were considered separately to ensure the risk levels were assessed for each and the control options were identified on a type-specific basis, e.g., risk control measures for fishing vessels differ to those for commercial ships.

The ranking of the risks associated with the various hazards was carried out following the workshop based on the discussions at the workshop, using a risk matrix with the frequency and consequence categories shown below.

Other general hazards associated with the construction, decommissioning and maintenance phases, such as dropped object and man overboard, were also identified for the site but were not discussed in detail.

2 Hazard Log Methodology

The hazards were recorded systematically using Anatec's Hazard Management software. The main information logged by the system is presented in Table 2.

Table 2 Hazard Log Field Description

Category	Definition
Hazard ID	Unique Hazard Identification number generated by the software.
Title	Title of hazardous event.
Date Recorded	Date the hazard was logged in the system.
Responsible Person	Person with responsibility to manage the hazard.
Review Period	Minimum time period that hazard should be reviewed.
Event Description	Description of the hazardous event.
Category	General hazard category, e.g., General Navigational Safety.
Sub-Category	Hazard sub-category, e.g., collision.
Area	Location of Hazardous event, e.g., Inside or Outside of wind farm
Phase	Phase(s) of operation e.g. Pre-Installation, Construction, Operation, Maintenance and Decommissioning. (Can be more than one.)
Causes	List all the potential causes of the hazard.
Probable Outcome Description	Description of the probable (or most likely) outcome should the hazard occur.
Worst Credible Outcome Description	Description of the 'worst credible' outcome should the hazard occur.
Frequency (Probable Outcome)	Estimates the frequency of the probable outcome occurring.
Frequency (Worst Credible Outcome)	Estimates the frequency of the worst credible event occurring.
Consequence (Probable Outcome)	Estimates the probable outcome should the event occur in terms of consequence to People, Environment, Asset, Business and overall average.
Consequence (Worst Credible Outcome)	Estimates the worst credible outcome should the event occur in terms of consequence to People, Environment, Asset, Business and overall average.
Risk Estimate (Probable Outcome)	Combines the frequency and (average) consequence to estimate the risk level for probable event.
Risk Estimate (Worst Credible Outcome)	Combines the frequency and (average) consequence to estimate risk level for the worst credible event.

Category	Definition
Risk Reduction Measures	Documents the potential mitigation measures which will aid in the reduction of risk or in the management of the hazardous event.

The following frequency and consequence categories were applied.

Table 3 Frequency Bands

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

The consequence bands (Table 4) estimate the result should the event occur in terms of probable and worst case outcomes to people, environment, asset, business and overall average occurrence.

The environmental ranking is based on the International Petroleum Industry Environmental Conservation Association (IPIECA) concept of a tiered preparedness and response arrangement as summarised below:

- Tier 1 spills are generally small, causing localised damage, usually near the company's own facilities. In most cases, this type of spill occurs as a result of the company's own activities;
- A Tier 2 spill is larger than a Tier 1 spill, but is still one that occurs in the area of the producing company's facilities. Tier 2 spills usually require the aid of other companies and resources, including the government. (It is noted that in terms of the consequence bands the difference between a Rank 3 and Rank 4 is limited/local external assistance would be present for Rank 3 and regional assistance would be required for Rank 4); and
- Tier 3 spills are the most severe; and cannot be contained with the resources of the producing company and require substantial external resources to deal with them.

Table 4 Consequence Bands

Rank	Description	Definition			
		People	Property	Environment	Business
1	Negligible	No injury	<£10k	<£10k	<10k
2	Minor	Slight injury(s)	£10k-£100k	Tier 1 Local assistance required	£10k-£100k

Rank	Description	Definition			
		People	**Property**	**Environment**	**Business**
3	Moderate	Multiple moderate or single serious injury(s)	£100k-£1M	Tier 2 Limited external assistance required	£100k-£1M Local publicity
4	Serious	Multiple serious injury(s) or single fatality	£1M-£10M	Tier 2 Regional assistance required	£1M-£10M National publicity
5	Major	More than 1 fatality	>£10M	Tier 3 National assistance required	>£10M International publicity

The four consequence scores were averaged and multiplied by the frequency to obtain an overall ranking (or score) ranking which determined the hazard's position within the risk matrix shown below.

Table 5 Risk Matrix

Consequence						
	5					
	4					
	3					
	2					
	1					
		1	2	3	4	5
		Frequency				

where:

	Broadly Acceptable Region (Low Risk)	Generally regarded as insignificant and adequately controlled. None the less the law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
	Tolerable Region (Intermediate Risk)	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate control measures are in place, residual risks are as low as is reasonably practicable (ALARP) and that risks are periodically reviewed to see if further controls are appropriate.
	Unacceptable Region (High Risk)	Generally regarded as unacceptable whatever the level of benefit associated with the activity.

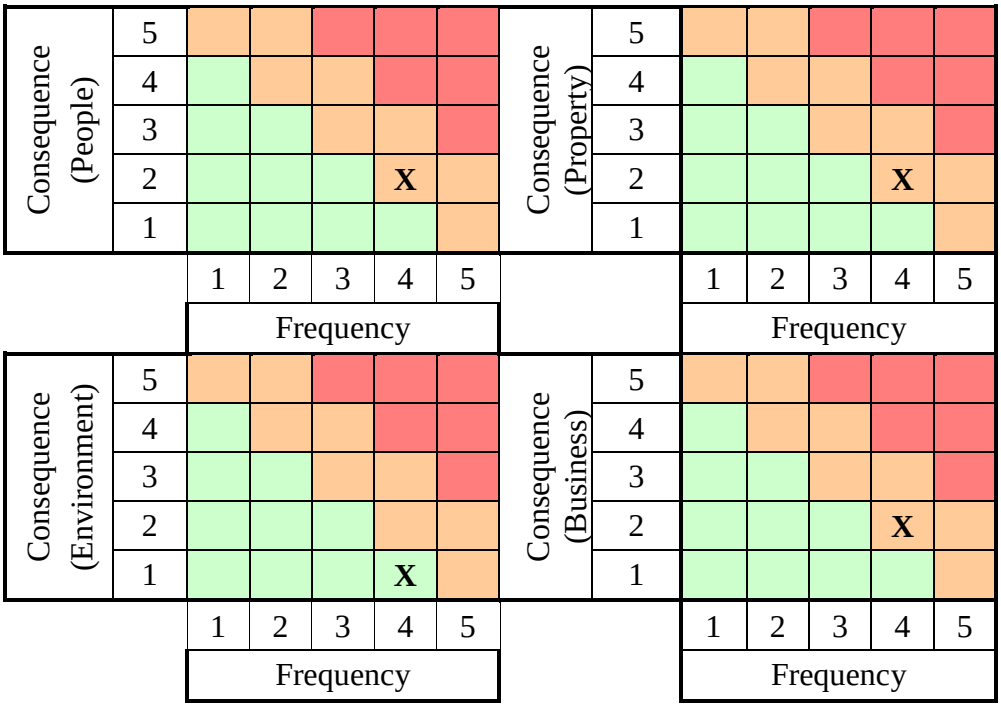
As well as ranking the hazard by expected risk, based on the estimated frequency versus consequence, the worst case risk was also ranked in order to capture scenarios with a particularly high worst-case risk.

The worked example overleaf illustrates the method of ranking hazards.

Hazard Title	Attendant vessel collision with wind farm structure.
Possible Causes	Poor Visibility; Manoeuvring error; Machinery Failure; Lack of Passage Planning; Lack of experience; Lack of awareness; Human error; Fatigue; Engine Failure/ Blackout; Bad weather.
Probable Consequence	Minor bump leading to minor damage to vessel and structure. Vessel most likely to be damaged.
Frequency of Probable Outcome	Reasonably probable (1 to 10 years) based on experience of attendant vessel collisions visiting offshore platforms.
Worst Credible Consequences	Moderate speed collision with significant damage to vessel, holed and vessel sinks, potential fatalities, damage to tower.
Frequency of Worst Credible Outcome	Extremely unlikely (100 to 10,000 years) in terms of significant consequences, i.e., loss of vessel with fatalities.

Table 6 presents the risk ranking of this hazard for the probable (most likely) outcome.

Table 6 Risk Matrix: Attendant Vessel Collision with Structure (Probable Outcome)



The risk for the hazard is calculated by averaging the four consequences, i.e., (2+2+1+2)/4 = 1.75) and multiplying by the frequency, i.e., 4, to obtain a risk ranking of 7 (i.e. 1.75 x 4). A score of 7 puts this hazard in the Tolerable region.

The worst credible risk was also ranked using a similar methodology.

The potential mitigation measures for this event were logged as follows:

- Adverse weather working policy and procedures;
- Control of work procedures;
- Fenders/bumper bollards installed on turbines;
- Emergency Response Cooperation Plan;
- Marine Coordinator on site during works;
- Marine operating procedures;
- Marking and lighting;
- Passage plan to and from the site;
- Planning of major activities;
- Site personnel trained in fire fighting, first aid and offshore survival;
- Safety Management Systems for all vessels working in the site;
- Sharing of information within the industry.

3 Results

The following list of hazards were reviewed, with the information recorded using Anatec's Hazard Log Software.

- Fishing vessel collision
- Commercial ship (powered) collision
- Recreational vessel collision
- Drifting ship collision
- Fishing gear interaction with subsea equipment (within the wind farm)
- Vessel anchoring on or dragging anchor over subsea equipment/cables
- Vessel-to-vessel collision due to avoidance of site or work vessels in area
- Fishing gear interaction with export cable
- Attendant vessel collision with structure
- Man overboard during work activities at site
- Dropped object during work activities at site
- Deliberate unauthorised boarding or mooring to structure (and damage to device)

The overall breakdown by tolerability region was assessed for the identified hazards and is presented in Figure 1.

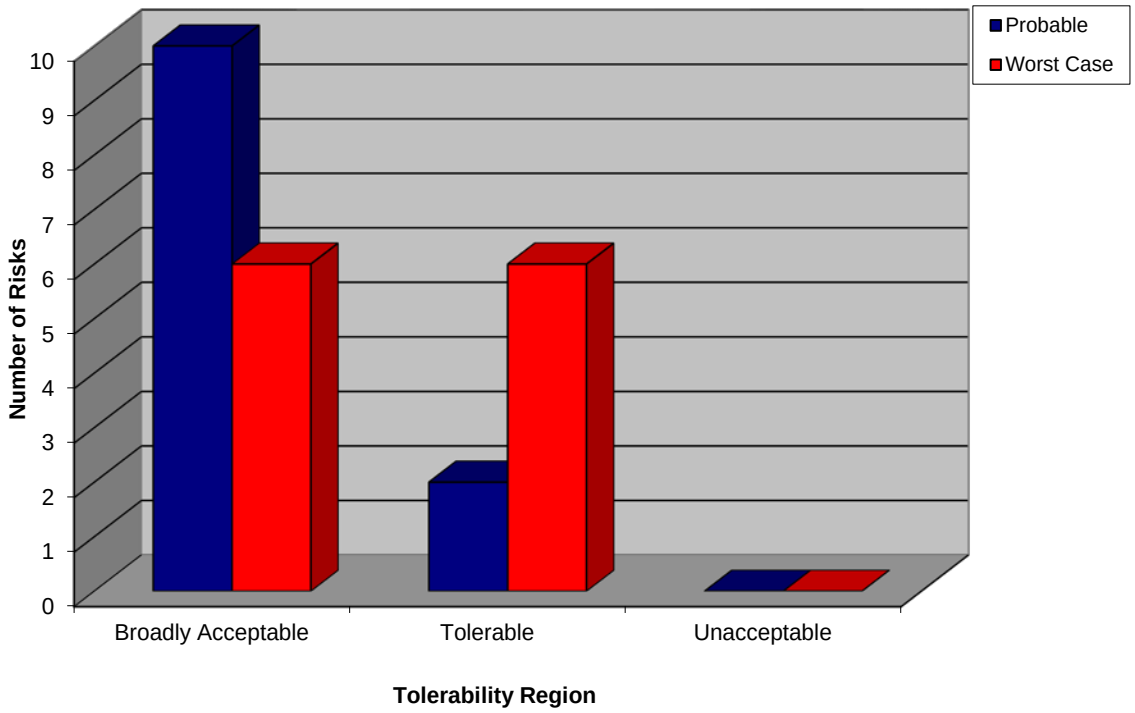


Figure 1 Neart na Gaoithe offshore wind farm Risk Ranking Results

No risks were assessed to be unacceptable. As shown in the above figure, two risks were ranked within the Tolerable (As Low as Reasonably Practicable, ALARP) region based on

the probable outcome whilst ten were ranked as Tolerable (ALARP) based on the worst case outcome.
The hazards ranked as tolerable based on probable outcome were:

- Attendant vessel collision with wind farm structure; and
- Man overboard during transfer to/from turbine or working alongside turbine.

As well as the two hazards above, the four additional hazards ranked as tolerable based on worst case outcome were:

- Dropped object during construction, decommissioning or major maintenance;
- Vessel-to-vessel collision due to avoidance of site;
- Anchor on or dragging over subsea equipment; and
- Fishing vessel collision.

Several of the tolerable and worst case outcomes involve third party vessels, but these incidents have a lower likelihood of occurring. In addition, it is not known at this stage if there will be guard vessels used during construction/decommissioning phases.

It was noted that many of the causes are general maritime accident causation factors outside the control of the Developer.

Full details of the logged and ranked hazards are summarised in Table 7, sorted by descending order of risk ranking (probable followed by worst credible outcome).

Table 7 Neart na Gaoithe Offshore Wind Farm Development Hazard Ranking Results

Phase	Category	Hazard Title	Hazard Detail	Possible Causes	Most Likely Consequence	Worst Case Consequence	Most Likely						Risk Reduction	Residual						Notes
							Frequency	People	Environment	Property	Business	Risk		Frequency	People	Environment	Property	Business	Risk	
All	Navigation	Attendant vessel collision with structure	Vessels will be working in proximity to the wind farm structures, e.g., during construction and maintenance. Mis-judgement, weather or equipment failure could lead to a collision due to limited time to take preventative action.	Watchkeeper failure; Steering Gear Failure; Poor Visibility; Manoeuvring error; Machinery Failure; Human error; Fatigue; Engine Failure/ Blackout; Bad weather.	Minor bump leading to minor damage to vessel and structure. Vessel most likely to be damaged.	Moderate speed collision with significant damage to vessel, holed and vessel sinks, potential fatalities, damage to turbine or substation structure.	4	2	1	2	2	7	Site personnel trained in fire fighting, first aid and offshore survival.; Marine Operating Procedures; Marine Coordinator on site during works; Emergency Response Cooperation Plan.	2	5	2	4	4	7.5	
All	Marine Renewables	Man overboard during work activities at site	Man overboard during transfer to/from turbine or working alongside wind farm structure.	Structural Failure; Personal injury (slips, trips, falls, heart attack); Lack of experience; Lack of awareness; Human error; Fatigue; Bad weather.	Person in water recovered by transfer or support boat crew.	Loss of life. Person lost at sea.	4	3	1	1	2	7	VHF Carriage; Site personnel trained in fire fighting, first aid and offshore survival.; Safety Management System; Procedures for all vessels working in the site; Personnel Training; Personal Protective Equipment's (PPE); Offshore Survival Training; Emergency Response Cooperation Plan; Control of Work Procedure; Adverse weather working policy and procedures.	3	4	1	1	4	7.5	Personal Locator Beacons (PLBs) are a possibility. vessel working on their own could report to coastguard - procedures to capture this.
All	Navigation	Fishing vessel collision	Fishing vessel collides with wind turbine and/or offshore substations.	Watchkeeper failure; Steering Gear Failure; Radar interference; Poor Visibility; Navigational Aid Failure; Machinery Failure; Lack of Passage Planning; Lack of experience; Lack of awareness; Human error; Fatigue; Engine Failure/ Blackout; Displacement of traffic; Bad weather.	Vessel collides with structure with minor damage.	Vessel collides with structure and results in vessel being holed and sinking resulting in men overboard and potential fatalities.	3	3	2	2	2	6.8	Promulgation of information to local users; Notices to Fishermen| Notices to Fishermen; Notice to Mariners; Navigational information broadcasts; Marking and Lighting; Marine Coordinator on site during works; Kingfisher publications; Fisheries Liaison; Compliance with Colregs; Chart Markings.	2	5	2	3	4	7	Damage to fishing vessel as apposed to turbine, likely to be glancing vessel collision. Operational plan to liaise with fishing vessels regarding the operational issues for vessels so that they don't interfere with fishing vessels. i.e. channels in and out of ports, areas where vessels lay up.
All	Marine Renewables	Dropped object during work activities at site	Dropped object during construction, maintenance, decommissioning or lifting operations. Could also occur during an incident which results in a dropped object.	Structural Failure; Personal injury (slips, trips, falls, heart attack); Manoeuvring error; Lack of experience; Lack of awareness; Human error; Communication failure; Bad weather.	Dropped object into sea, falling onto the seabed. Financial loss, potential for damaging wind farm structure and/or the dropped object.	Dropped object onto vessel with fatality of persons working on the lifting operation. Damage to vessel.	4	2	1	2	1	6	Site personnel trained in fire fighting, first aid and offshore survival.; Sharing of information within Industry; Safety Management System; Planning of major activities; Personnel Training; Marine Operating Procedures; Inspection and maintenance procedures; Control of Work Procedure; CDM Regulations; Adverse weather working policy and procedures.	3	4	1	2	4	8.2	
All	Navigation	Anchor on or dragging over subsea equipment	Vessel drops anchor over subsea equipment or a nearby vessel drags anchor over a subsea cable. Vessel may drop anchor over cable(s) in an emergency, i.e. machinery failure when changing over engines when approaching port.|	not designed to be high holding and go deeper. conventional stockless anchors.	Poor Holding Ground; Machinery Failure; Lack of awareness; Human error; Engine Failure/ Blackout; Dragged anchor.	Damage to cable(s).	Serious damage to cable(s), loss of anchor, major business interruption.	3	1	1	3	3	6	Chart Markings; Cable protection, e.g., burial.	2	3	2	5	4	7	Hound Point and/or Braefoot Bay tugs available on permanent standby. MCA should be notified and a broadcast to shipping sent for tugs in the area. Vessel could drop anchor to slow down and reduce drift (2 anchors on board). Breakdowns happen relatively frequently in and around the eastern limit of the Forth Ports. If wind is strong from SW then vessel could drift towards the windfarm. On approaching port limits vessels will have anchors prepared as per port regulations.
Operation	Marine Renewables	Deliberate unauthorised boarding of/or mooring to structure and damage to device	Structures designed to allow access for inspection, maintenance and repair. There is potential for 'trespassers' to attempt to moor to or board a structure. This has the potential to lead to a member of the public falling into the sea or being stranded on a structure.	Vandalism; Protest.	Vessel moors alongside the structure or person climbs onto the structure in good weather and no damage. Possible for person to get stranded on structure or take part in protest requiring the emergency services. Potential for minor vandalism, e.g., graffiti.	Person is stranded / maintains protest on structure or falls into the sea as a result of climbing on the structure resulting in a fatality. Potential for more serious vandalism such as equipment damage.	4	1	1	1	3	6	Safety Management System; Promulgation of information to local users; Inspection and maintenance procedures; Emergency Response Cooperation Plan.	2	4	1	2	3	5	Noted that would have to be serious industrial sabotage and unlikely given the distance from shore.

Phase	Category	Hazard Title	Hazard Detail	Possible Causes	Most Likely Consequence	Worst Case Consequence	Most Likely						Risk Reduction	Residual						Notes
							Frequency	People	Environment	Property	Business	Risk		Frequency	People	Environment	Property	Business	Risk	
All	Navigation	Vessel-to-vessel collision due to avoidance of site or work vessels in area	Displaced traffic increases congestion outside of the site. This can lead to an increase in vessel-to-vessel encounters and ultimately collisions.	Watchkeeper failure; Steering Gear Failure; Radar interference; Manoeuvring error; Lack of Passage Planning; Human error; Failure to comply with Colregs; Displacement of traffic; Communication failure.	Damage to vessel(s) and possible injuries to crew(s).	Loss of vessel(s), pollution and potential loss of life.	2	3	2	3	3	5.5	VTS Coverage of area; Routeing Measures - New or Amended; Marking and Lighting; Continuous Watch by multi-channel VHF, including DSC; Compliance with Colregs.	2	4	3	4	4	7.5	NnG development relatively benign from a commercial shipping perspective. More concerned that ship-to-ship encounters will be an issue with cumulative impacts of other Forth and Tay projects.
All	Navigation	Commercial ship powered collision	Commercial vessel powered collision with the turbines or offshore substation.	Watchkeeper failure; Steering Gear Failure; Radar interference; Poor Visibility; Personal injury (slips, trips, falls, heart attack); Navigational Aid Failure; Manoeuvring error; Human error; Fatigue.	Glancing blow off turbine or substation structure, significant damage to structure and damage to the vessels hull.	Turbine or substation structure collapse, vessel holed and sinks, potential fatalities and pollution.	2	2	2	3	4	5.5	Monitoring system; Guard Vessel during Construction; Compliance with Colregs; Chart Markings.	1	5	5	5	5	5	Tugs are stationed within the Firth of Forth and Offshore support/anchor handlers pass through the area. Mainstream to discuss with other developers and Forth Ports the possibilities of joint vessel monitoring in the area. Forth ports VTS monitoring, may pick up vessels on collision course. Have picked up errant vessels headed towards the coastline in the past and can recommend areas to shelter e.g. St Andrews Bay.
All	Navigation	Recreational vessel collision	Recreational vessel collides with wind farm structure.	Watchkeeper failure; Vessels attracted to site - curiosity; Steering Gear Failure; Poor Visibility; Personal injury (slips, trips, falls, heart attack); Lack of Passage Planning; Lack of awareness; Human error; Fatigue; Engine Failure/ Blackout; Bad weather.	Vessel looses power and collides with wind farm structure resulting in minor damage.	Vessel looses power and collides with wind farm structure and results in vessel being holed and sinking resulting in men overboard and fatalities.	3	2	1	2	2	5.2	Promulgation of information to local users; Notice to Mariners; Navigational information broadcasts; Minimum Blade Clearance; Marking and Lighting; Chart Markings.	2	4	1	3	4	6	Recreational vessels pass through the area from Scandinavia and can get into trouble when navigating, i.e., headed for Northern and Eastern Scotland. Local RNLI stations to be provided with charts of the field with turbines identified, numbering system. Liaison with local harbour masters on developments to share information.
All	Navigation	Drifting vessel collision	Commercial vessel (tanker or cargo vessel) looses power and drifts into turbines/substations.	Steering Gear Failure; Machinery Failure; Human error; Fire/ Explosion; Engine Failure/ Blackout.	Glancing blow off turbine or substation structure, significant damage to offshore structure and damage to the hull of the vessel.	Significant damage, potential collapse of wind farm structure. Likely to be significant damage to the ships hull and injuries to crew.	2	2	2	3	3	5	Tug Availability; Emergency Response Cooperation Plan; Anchoring by drifting vessel.	2	3	2	3	3	5.5	Nearby Tug availability.
All	Navigation	Fishing gear interaction with subsea equipment	Fishing vessel gear is snagged on subsea equipment or J-tube.	Lack of awareness; Gear snagging; Fishing vessels attracted to site; Cable becomes exposed (unprotected cable).	Loss of fishing gear, minimal damage to subsea equipment.	Fishing vessel capsizes with loss of life, loss of vessel and pollution.	3	1	1	2	2	4.5	Notices to Fishermen\ Notices to Fishermen; Notice to Mariners; Navigational information broadcasts; Installation procedures; Inspection and maintenance procedures; Fisheries Liaison; Chart Markings; Cable protection, e.g., burial; Abandon gear.	2	5	2	2	4	6.5	Vessels should contact the coastguard to report they have lost their gear. Inter array cables may be more exposed as sea bed is harder to trench in the NnG site.
All	Navigation	Fishing gear interaction with export cable	Fishing vessels drags gear over export cable(s), e.g., scallop dredger or trawler.	Lack of awareness; Human error; Gear snagging; Cable becomes exposed (unprotected cable).	Loss of fishing gear, minimal damage to cables.	Fishing vessel capsizes with loss of life, loss of vessel and pollution.	3	1	1	2	2	4.5	Notices to Fishermen\ Notices to Fishermen; Inspection and maintenance procedures; Fisheries Liaison; Chart Markings; Cable protection, e.g., burial; Abandon gear.	2	5	2	2	4	6.5	Export cable route sea bed area is predicted to have good burial properties. If a problem is identified with a cable, then this needs to be reported to the fishing industry. Potentially look at AIS coverage of cable route to alarm for vessels anchoring within a certain distance. Burial depths likely to be 1-2m.

4 Summary of Key Findings

This section summarises the key findings of the Hazard Log workshop for the navigational risks associated with the proposed Neart Na Gaoithe wind farm in the outer approaches to the Firth of Forth off the east coast of Scotland.

From the hazard ranking several of the tolerable and worst case outcomes involve third party vessels and it is considered these incidents have a lower likelihood of occurring due operator procedures and Safety Management Systems (SMS).

The key information summarised from the workshop relative to the proposed Neart na Gaoithe wind farm and wider region is presented below.

Search and Rescue/Emergency Response:

- Tugs are on 24 hour stand-by (5-10 minute call out time with a 120 tonne bollard pull) at the Hound Point and Braefoot Bay marine terminals.
- Tugs in the Firth of Forth can steam at approximately 13 knots with the possibility of responding to a drifting or ship collision incident at the proposed offshore wind farm within approximately two hours of mobilisation.
- In terms of a man overboard incident at the proposed wind farm, the use of Personal Locator Beacons (PLBs) could be investigated.

Commercial Vessels

- Drifting and machinery failures east of the Forth Ports limit were highlighted during the workshop as they can be a frequent event.
- As noted above, tugs are station at the Hound Point and Braefoot Bay marine terminals and could potentially be used during a drifting incident.
- During a south westerly wind a drifting vessel could be blown towards the proposed Neart na Gaoithe wind farm area.

Recreational Vessels/Activities:

- A number of incidents in the area (for example, machinery failures and during adverse weather conditions) involved foreign recreational craft from Scandinavian that had sailed off course when heading to Northern and Eastern Scotland.
- Liaison should be carried out with local harbour masters on developments to share information amongst smaller ports and non-commercial vessel users.

Fishing Issues:

- An operational plan could be formed to liaise with fishing vessels regarding the operational issues for vessels so that they don’t interfere with fishing gear including nets and static gear/pots. For example, channels in and out of ports, and areas where vessels lay-up.

- The expected export cable route was initially identified (during the workshop) as posing higher risk to fishing gear interaction; however good burial properties are predicted for the export cable area due to more favourable sea bed type.
- The inter-array cables are likely to be more difficult to protect due to harder sea bed conditions within the proposed wind farm.
- Around turbines and substation(s) there are J-tubes where the cables come out of the substrate. J-tubes could be protected by rock dumping or mattresses when protecting against scour.
- Fisherman noted a preference for rock dumping as mattresses can pose greater risk to gear. There will be 500M safety zones proposed around the major installation/construction vessels, excluding fishing vessels from the area and reducing the risk of vessels interacting with exposed J-tubes.
- If a problem is identified with cable burial during surveying (for example cable movement) this should be reported to the fishing industry.

Vessel Monitoring:

- Combined vessel monitoring in the area could be explored, with the possibility of other developers collaborating with Forth Ports.

Cumulative Issues:

- Smaller merchant vessels and coastal tankers re-routeing east of the Round 3 Zone 2 are likely to be operating to tight time and fuel margins and need to take the shortest routes (for example west of the wind farm developments).