

Decommissioning Penguin WEC 1 and Mooring Components

EMEC Billia Croo Test Site

Navigation Risk Assessment Addendum



OP286

Purpose

This document is provided as an addendum to and should be read in conjunction with the document 'Billia Croo Wave Site Navigational Risk Assessment (NRA) – REP522'. It describes the key project-specific navigational risks to be addressed in relation to the proposed activities at the European Marine Energy Centre test site at Billia Croo, Orkney Islands, together with proposed mitigation for reduction/elimination of these risks. Site location navigational risks are covered in the site-wide Billia Croo NRA produced by EMEC.

This document has been prepared to support a marine licence application for the Penguin WEC 1 Decommissioning.

Document History

Revision	Date	Description	Originated by	Reviewed by	Approved by
1.0	22.02.20	First issue	A Thomson	D Thomson	D Thomson

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1 Introduction

The Wello Oy WEC 1 “Penguin” is a Wave Energy Converter which sank at its moorings during storm conditions. The WEC 1 “Penguin” is lying upside down on the seabed, it is in the centre of a six point mooring spread with the cable umbilical still attached between the WEC 1 “Penguin” and the EMEC export cable to shore. The mooring components and WEC 1 will be removed from the seabed and transported to a suitable port for decommissioning.

This assessment has been produced as an addendum to the site-wide Navigational Risk Assessment for the Fall of Warness test site (REP315). This document identifies and assesses any project-specific navigational risks and discusses the proposed risk control measures to be implemented in order to reduce the risk associated with the project.

1.1 Contact details

The contact details for the point of contact in relation to the project are as follows:

Point of contact:	Fortum Energy Ltd. Attn: Mikko Muoniovaara St James House Kensington Square W8 5HD London United Kingdom Email: Mikko.Muoniovaara@fortum.com
Local Representative:	Orcades Marine Management Consultants Attn: David Thomson Innovation Centre Orkney KW151ZL Kirkwall United Kingdom Email: david.thomson@orcademarine.co.uk

2 Project overview

2.1 Asset information

The WEC 1 “Penguin” is a Wave Energy Converter that was installed at Berth 5, EMEC Test Site, Billa Croo. The rotational movement of a WEC 1 “Penguin” device is derived directly from wave motion, and is captured by the hull shape, instead of a mechanism. The WEC 1 “Penguin” has no hydraulics or joints and moving components do not come into contact with sea water. The device has direct conversion, which means the waves become electricity and goes straight into the grid.

The asymmetrical shape of the WEC 1 “Penguin” hull creates a gyrating motion which pushes the rotating mass inside the device with each passing wave. The converter captures kinetic energy, turns it into electrical power and immediately transfers it to the grid by a subsea cable.

The key dimensions of the device are as follows:

Hull

- length – 29m
- width – 15.5m
- draft – 7.2m
- freeboard – 1.8m
- overall weight – in excess of 1500t



Figure 1 Photo of WEC 1 "Penguin" before installation

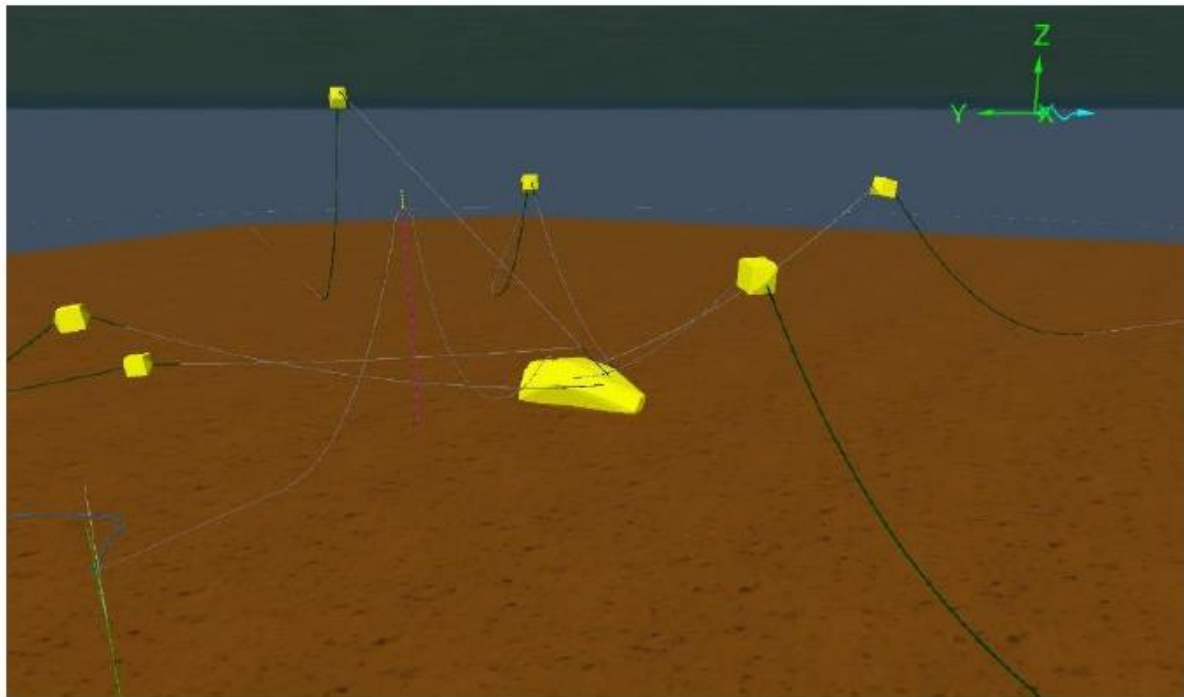


Figure 2 Current Status of Penguin WED 1 “As Found”

Abbrev.	Description	Easting	Northing
WEC 1 - Device (Assumption)			
WEC1	Approx. WEC Device Position	476500	6539324
WEC 1 - Mooring System (ROV Snapshots)			
CW1	Clump Weight 1	476290	6539669
L1-TDP	Touch Down Point Leg-1	476421	6539452
B1-L	10t Subsurface Buoy 1	476448	6539414
B1-U	10t Subsurface Buoy 1	476429	6539400
MAP1	Mooring Attachment Point 1	476506	6539338
CW2	Clump Weight 2	476181	6539578
L2-TDP	Touch Down Point Leg-2	476384	6539418
B2-L	10t Subsurface Buoy 2	476426	6539385
CW3	Clump Weight 3	476161	6539118
L3-TDP	Touch Down Point Leg-3	476367	6539266
B3-L	10t Subsurface Buoy 3	476423	6539294
B3-U	10t Subsurface Buoy 3	476423	6539295
MAP3	Mooring Attachment Point 3	476502	6539308
CW4	Clump Weight 4	476252	6539013
L4-TDP	Touch Down Point Leg-4	476413	6539230
B4-L	10t Subsurface Buoy 4	476444	6539266
B4-U	10t Subsurface Buoy 4	476449	6539270
CW5	Clump Weight 5	476808	6539093
L5-TDP	Touch Down Point Leg-5	476609	6539266
B5-L	10t Subsurface Buoy 5	476566	6539295
B5-U	10t Subsurface Buoy 5	476559	6539299
MAP5	Mooring Attachment Point 5	476510	6539338
CW6	Clump Weight 6	476737	6539651
L6-TDP	Touch Down Point Leg-6	476578	6539445
B6-L	10t Subsurface Buoy 6	476547	6539409
B6-U	10t Subsurface Buoy 6	476541	6539400
WEC 1 - Umbilical System (ROV Snapshots)			
MWA	Mid-Water Arc	476487	6539304
CE	Umbilical Cable Entry	476496	6539341

Figure 3 Positions of Mooring Parts

Abbrev.	Description	Water Depth	Depth from Surface	Depth from Seabed
B1	10t Subsurface Buoy 1	59	21.5	37.5
B2	10t Subsurface Buoy 2	60	24	36
B3	10t Subsurface Buoy 3	60.5	33.5	27
B4	10t Subsurface Buoy 4	61	27	34
B5	10t Subsurface Buoy 5	58	28	30
B6	10t Subsurface Buoy 6	57.5	22	35.5
MWA	Mid-Water Arc Buoys	59.5	15.5	44

Figure 4 Subsurface Buoy - Water Depth under the surface

2.2 Schedule and Marine Operations

The work is expected to start in the early Summer 2020 and will be completed before the end of Summer 2020. The exact schedule will be confirmed when a marine contractor has been appointed for the project.

2.2.1 Operation and maintenance

There is no operational and maintenance required as the WEC 1 “Penguin” and all mooring components are being removed and transported to port for sustainable disposal.

2.2.2 Removal and decommissioning

This section deals with the marine operations required to remove the mooring components and the WEC 1 “Penguin” and dispose of all components in an environmentally friendly and economic manner. The method statement described is high level and is subject to change on appointment of a Marine Contractor.

Phase 1

1. Support vessel proceeds to site and sets its own moorings or sets up on dynamic positioning
2. Vessel makes connection to first Penguin mooring clump
3. Mooring clump weight moved towards Penguin
4. Subsea buoy disconnected
5. Vessel lifts lower catenary chain and clump weight
6. Clump weight and chain recovered to deck or transported to reception facility in Orkney (Lyness or Stromness)
7. Subsurface buoy recovered to deck or transported to reception facility in Orkney (Lyness or Stromness)
8. Process repeated until all clump weights, lower catenary chains and buoys are removed to port
9. Support vessel positions over umbilical mid water arch.
10. Using an ROV the umbilical is cut close to the Penguin hull.
11. Second cut is made in umbilical on other side of mid water arch
12. Buoyed mid water arch section is recovered to surface and brought to port
13. Umbilical end on seabed is capped
14. All recovered items are disposed of in an environmentally sustainable way

Phase 2

1. The primary support vessel proceeds to site and picks up the remaining six upper catenary chains which were left buoyed off
2. A suitable entry point is located or cut into the lowest point of the Penguin hull using an ROV
3. Air is pumped into the Penguin hull to reduce its in water weight
4. The upper catenary chains are transferred to a heavy lift barge
5. The Penguin is lifted above the seabed and transported to shallow waters
6. A submersible barge is ballasted down into the water and the Penguin is lifted onto the deck of the submersible barge
7. The submersible barge is raised with the Penguin on deck and towed to a suitable port for disposal in an environmentally sustainable way

Phase 3

There are other items of mooring equipment and roll plates which have been lost to the seabed over the period of the Penguin operation. That is 6 x 24 tonne (14 tonnes in water) clump weights and three roll plates 122 tonne (74 tonnes in water). Assuming these are safely and environmentally accessible for recovery they will be removed for disposal.

1. The support vessel will position over the first clump weight to be recovered
2. The ROV will be deployed and line attached
3. The clump weight is lifted under the support vessel and recovered to port for disposal
4. The same method is applied to the remaining clump weights
5. The support vessel will position over the first of the roll plates
6. Cables will be attached to the roll plates using the ROV
7. Each roll plate will be lifted under the support vessel and transported to port for disposal

On completion of all phases of decommissioning an ROV survey will be carried out across a radius of 550 metres from the centre position.

2.3 Deployment location

The WEC 1 “Penguin” is currently on the seabed at Berth 5, EMEC Test Site, Billia Croo. Figure 5 shows the location in relation to Orkney and Figure 6 gives details of the Test Site.



Figure 5 Test Site Location

3 Consultation

There are number of stakeholders that may require to be consulted including regulators, fisheries and recreational/leisure stakeholders.

Stakeholders that may require to be consulted:

- Regulators (statutory advisors to Marine Scotland)
 - Maritime and Coastguard Agency (MCA)
 - Northern Lighthouse Board (NLB)
- Fisheries
 - Orkney Fisheries Association (OFA)
 - Orkney Fishermen's Society
 - Orkney Creel Fishermen's Association
 - Scottish Fishermen's Federation
 - Scottish Pelagic Fishermen's Association
 - Local Fishermen
- Recreational and leisure
 - RYA Scotland
 - Cruising Association
 - Orkney Marinas

- Local Sailing Club Representatives
 - Kirkwall Kayakers Club
 - Orkney Sea Kayaking Association
 - Orkney Surf Club
 - Local Dive Boat Owners
- Other
 - OIC Marine Services (including ferries)
 - Chamber of Shipping (CoS)

4 Key navigational themes

In order to complete this project-specific assessment, a comprehensive review of the site-wide NRA for EMEC's Billia Croo test site was conducted. The following navigational themes have been considered during the assessment.

4.1 Vessel routing

The WEC 1 "Penguin" will be towed from Berth 5, EMEC Test Site, Billia Croo to a suitable port for decommissioning, if this is located within Orkney then there will be a requirement to transit through the Hoy Sound and Scapa Flow, which is the traffic route used for local dive vessel, leisure craft, support vessels, survey vessels and the passenger vessel "Hamnavoe". In the summer months cruise liners may use the Hoy Sound to transit to Stromness.

The vessels that will be used during Phase 1 are likely to be a multicat with suitable support vessels with additional vessels being used in Phase 2 and 3, namely heavy lift barge and a submersible barge. During the project the multicat and support vessels are going to be regularly transiting from the Test Site via the Hoy Sound to possibly Stromness or Lyness (See following figures for passage plan). When the larger vessels are working on site, they will be restricted in their ability to manoeuvre, particularly during lifting operations. A Notice to Mariners will be issued to advise vessels within the Test Site that the works to remove the mooring components and device are being carried out, the Test Site is buoyed off to warn vessels not to navigate into the area unless required for access. A permitting system is in place where you have to gain a "Permit to Access" the site, all vessels that request a permit during the operations will be made aware and asked to keep a safe distance from the operation. A Notice to Mariners will also be issued when the WEC 1 "Penguin" is under tow or being transported by heavy lift barge, which will request any vessels in the vicinity of the towing vessel and tow/barge to keep a wide berth.

The below example passage plan shows the possible route from Berth 5, EMEC Test Site, Billia Croo to Stromness. The route will be confirmed when the detailed method statement is provided by the marine contractor.

Berth 5, EMEC Test
Site, Billia Croo

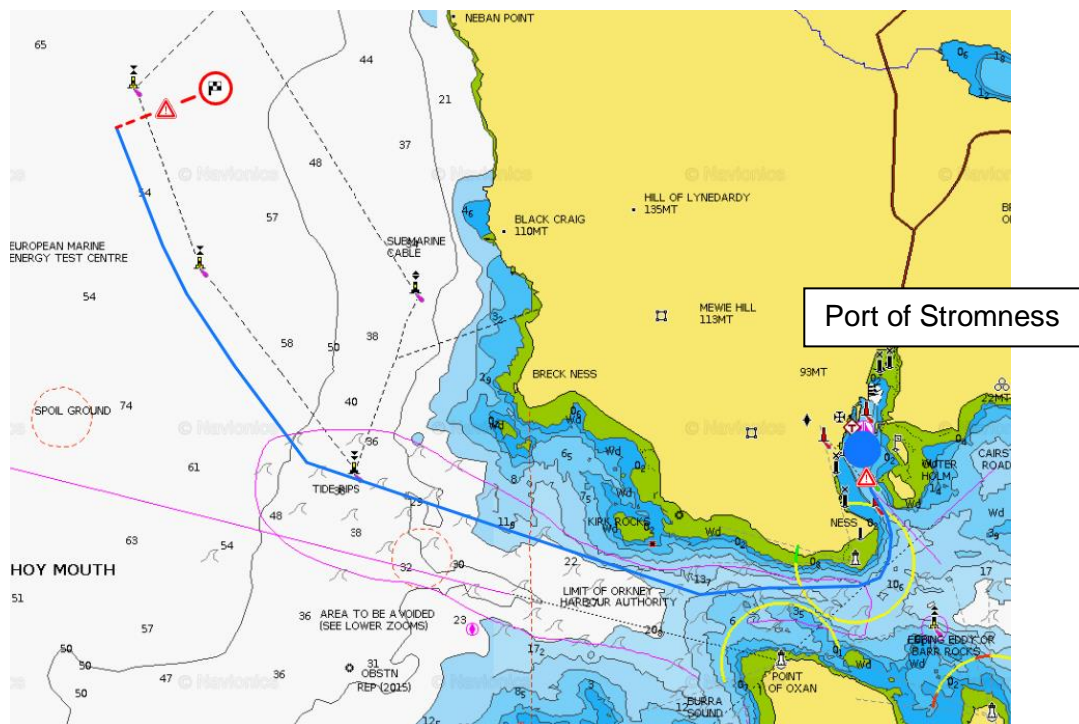


Figure 6 Passage Plan Test Site to Stromness

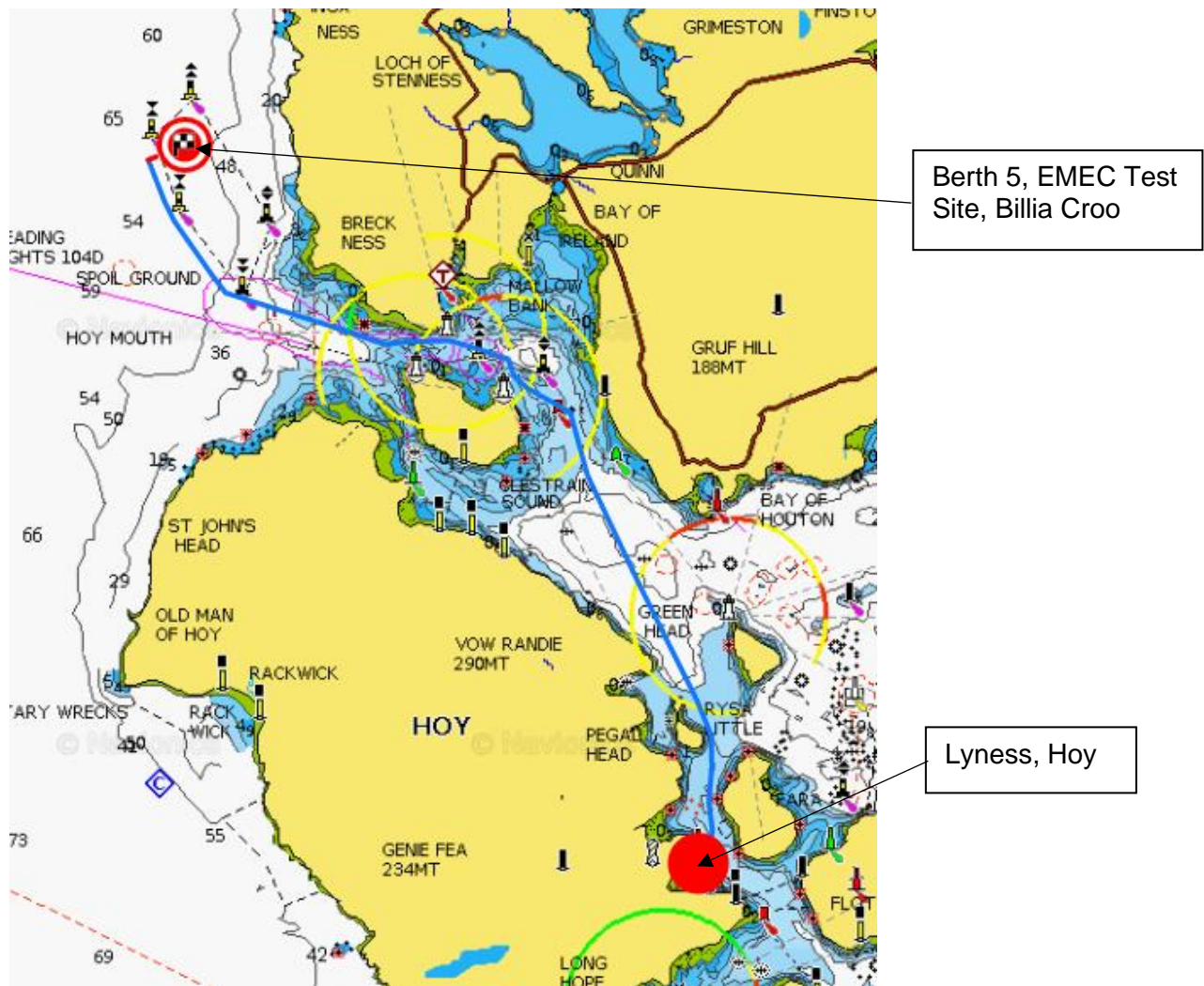


Figure 7 Passage Plan - Test Site to Lyness

4.2 Collision risk and visual navigation

Few vessels navigate within the site and the use of appropriate marking and lighting to alert other mariners to the assets onsite should mitigate the risk of contact. All assets onsite should be charted on the United Kingdom Hydrographic Office (UKHO) charts, this information will be promulgated to the UKHO via Notice to Mariners.

When the vessels transporting the WEC 1 “Penguin” are under way the collision risk will be mitigated by warning other vessels through VHF broadcasts by participating vessels, publishing Notices to Mariners via the Orkney Islands Council Harbour Authority VTS system together with close liaison with OIC Marine Services and EMEC management.

4.3 Fishing activity

Relatively little fishing takes place in the area and fishermen would generally be expected to take precautions in order to avoid any activity across the test site. A Notice to Mariners will be issued for any transit that takes place and this will be broadcast by Orkney VTS on channel 11.

4.4 Recreational activity

There is no racing or small boat sailing at the test site, most recreational vessels are yachts on passage. A Notice to Mariners will be issued for any transit that takes place and this will be broadcast by Orkney VTS on channel 11.

5 Risk controls

5.1 Site-wide risk controls

A number of risk controls are embedded by the processes EMEC has implemented in order to operate the Billia Croo test site. The embedded risk control measures are detailed in Table 1, with any project-specific actions including any divergence from the specified control discussed. An experienced Marine Client Representative will be on site and on board the lead vessel at all times that operations are being undertaken. One of his/her duties is to ensure that the Marine Contractor complies with all navigation risk mitigations and that the works are carried out safely

Table 1. EMEC embedded risk controls for test site

ID	Embedded risk control	Description	Project-specific actions
1.	PPE Requirement	Maintenance teams to wear suitable PPE when working on the assets, including life jackets.	
2.	Training of staff	Staff to be trained to the required standards for their work and have suitable local knowledge of regulations and operations in the Orkney Islands.	Risks to personnel are mitigated by a combination of selection of competent crew; compliance with vessel and project operating procedures
3.	Emergency Response and Cooperation Plan (ERCoP)	ERCoP for site developed and agreed with the MCA and SAR bodies to be consulted.	An Emergency Response Plan will be prepared by the Lead Contractor for each of the operational phases to provide a clear command and control structure and communications plan together with clear definitions of roles and responsibilities. This will cover all unplanned events including major accidents, evacuation escape and rescue and casualty evacuation.
4.	NtM and Promulgation	In addition to NtM, EMEC's Maritime Safety Information Standard Operating Procedures (SOP) ensures that all key navigational consultees are informed prior to any works. Distribution could include HMCG, Orkney Harbours (available via Orkney Islands Council Marine Services website), Orkney	Vessels in transit and restricted in their ability to manoeuvre will be required to broadcast navigation warnings on VHF radio

ID	Embedded risk control	Description	Project-specific actions
		Marina noticeboards (as necessary), Orkney Fisheries Association, Scottish Fisheries Federation and UKHO. Stakeholders are targeted with information about relevant assets based on their activities and location.	
5.	Incident monitoring and reporting	EMEC to encourage incident/near miss reporting and monitor any safety issues at the test site. If necessary, risk control to be reviewed. Risk assessments to be reviewed following any incidents.	The Marine Contractor will be required to report near misses and incidents.
6.	EMEC Procedures	EMEC has a number of SOPs and standards in place to reduce navigation risks, such as: <ul style="list-style-type: none"> • Task risk assessment; • Control of work (permit to access) • Hazard identification reporting; and • Maritime safety information. 	An experienced Marine Client Representative will be on board to ensure marine contractors comply with EMEC requirements
7.	Hydrography	Contractual responsibility for developer to return the site to the original condition post-decommissioning.	A post recovery seabed survey is required with a site radius of 550 m.
8.	Charting	Site is marked on nautical charts including a chart note.	
9.	Site Monitoring	EMEC's SCADA system provides real-time status information, trends, alarms and remote-control access to facilitate a safe working environment, comprehensive assessment and safe operation of the sites.	
10.	CCTV	Billia Croo test site is monitored by CCTV, located at Caldale, EMEC's onshore substation, to satisfy operational requirements for control and monitoring of test site activities, visual checks of the test site environment, monitoring of lone worker safety, effective plant operation and substation security.	
11.	Liaison with local stakeholders	EMEC regularly liaises with key local stakeholders to identify any potential issues as soon as possible. Regular updates include information regarding upcoming deployments and significant operations at the site.	
12.	500m advisory ATBA	A 500m advisory ATBA exists around all test devices located at EMEC test sites.	

5.2 Project-specific risk controls

The following table provides a description of the risk controls that will be implemented during the project.

Table 2. Project-specific risk controls

ID	Project-specific risk control	Description
1.	Radar reflectors	All small target vessels use radar reflectors to improve marking during times of poor visibility.
2.	AIS	All vessels are required to carry AIS during marine operations
3.	Heightened monitoring in adverse metocean conditions	The detailed method statement to be produced by the marine contractor will require stop points at which the project manager will call “go” or “no go” in the proceedings to allow for safe cessation of activities due to a poor weather forecast or other reason.
4.	Marking and Lighting	All vessels will have shapes and lights as required by the International Regulations for the Prevention of Collision at Sea
5.	Tow risk assessment and passage plan	As required under Orkney Harbours Pilotage Directions 4(3) ¹ , prior to conducting a towing operation, a risk assessment and passage plan for the move should be conducted. The plan should account for the size of the tow, maneuverability restrictions, tow arrangements and metocean conditions.
6.	Guard vessels	During this project, a guard vessel may be considered to assist in protecting the devices from contacts with passing vessel traffic. Due to the low density of traffic, this is may not considered necessary except in extraordinary circumstances.
7.	ERCoP	Project-specific annex to be incorporated into site-wide ERCoP.
8	Local Communications	Support vessels will avoid transiting Hoy Mouth coincident with ferry transits. The “Hamnavoe” ferry will be closely advised of activities during transit and arrival departures at Stromness

6 Summary and conclusion

The following lists a summary of the navigational risks associated with the decommissioning of the WEC 1 “Penguin” and its transport from Berth 5, EMEC Test Site, Billia Croo to a nearby port.

During decommissions operations (lifting and moving of equipment):

Risks:

- Proximity of vessels to each other and WEC leading to contact/collision/foundering
- Proximity of 3rd party vessels leading to contact/collision/foundering
- Unexpected severe weather leading to loss of control
- Equipment failure leading to loss of control
- Human error leading to loss of control

¹ Orkney Islands Council Competent Harbour Authority (2016) The Orkney Pilotage Direction 1988 (as amended 2007, 2010 and 2016).

Mitigations:

- Tow vessels, barges, support vessels and crew selected on assessment of capabilities and competence
- Detailed planning of decommissioning procedure in liaison with EMEC Operations
- Notice to Mariners issued plus additional communication with the OIC Harbour Authority, Orkney fishermen's association, and local yacht clubs
- The decommissioning will take place within the designated and charted EMEC Wave Test Site
- Weather forecasting service
- Weather limits defined
- Contingency plans to pull away to safety if decommissioning needs to be aborted
- Additional RHIB/standby vessel to assist if needed
- A Project Emergency Response Plan closely linked to the EMEC Site Operating and Emergency Procedures and existing SAR service will be in place and communicated to HM Coastguard, RNLI and the Port Authority

During transit:

Risks:

- Unexpected severe weather causes foundering or grounding
- Loss of control (loss of power, engine room fire, unexpected weather, loss of navigation systems, human error) causes collision either between the tow vessel and WEC or with a 3rd party vessel
- Proximity of other vessels notably at Hoy Mouth (passenger ferry) and EMEC Test Site (other developers) leads to contact/collision
- Loss of control leads to grounding of tow vessels or WEC
- Cable catenary impacts subsea cables or obstructions
- Instability leads to contact, collision or grounding

Mitigations:

- Towing vessels/support vessels/crew selected on basis of assessment covering design capability, condition, certification and crew competence
- Notice to Mariners issued plus additional communication with the OIC Harbour Authority, Orkney fishermen's association and local yacht clubs
- Customised weather forecasting service
- Weather limits defined for each key task
- Passage plan approved by Marine Warranty Surveyor
- Timing carefully selected to take advantage of tidal flows
- Vessel and project operating procedures complied with
- Detailed plan, task risk assessment and Toolbox talks prior to passage
- Pilot on board from Port Authority
- Close liaison with EMEC Operations
- Stability calculations carried out
- A Project Emergency Response Plan closely linked to the EMEC Site Operating and Emergency Procedures and existing SAR service will be in place and communicated to HM Coastguard, RNLI and the Port Authority