

## ENVIRONMENTAL EFFECTS METADATA SURVEY FORM

Name of person updating the form

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Project name: EMEC Fall of Warness Grid-Connected Tidal Test Site

Planned  In Operation  Completed

Project description:

*Project Developer:* European Marine Energy Centre Ltd

*Technology Developer:* European Marine Energy Centre Ltd

*Technology type:* Tidal devices

*Resource (wave, tidal):* Tidal

*Project scale (test site, prototype, array, commercial):* Test site

*Installed capacity (MW):* 4 MW

*Project Website:* <http://www.emec.org.uk/facilities/tidal-test-site/>

*Launch Date:* September 2007

*Additional Description:* EMEC's Fall of Warness tidal test site offers seven offshore cabled test berths and one additional developer-operated berth for testing of tidal energy converters in a real oceanic regime. The Fall of Warness test site occupies 8 square kilometres of seabed and is situated just 1-3km offshore with all EMEC-operated offshore berths supplied by 11kV cables and a lower voltage cable servicing the developer-operated berth, at depths of 12-50m. The berths are aimed at accommodating single devices or small arrays. All EMEC Fall of Warness test berths are UK grid-connected, with coastal control and switching stations allowing realtime power output metering and potential for independent, internationally recognised verification of devices' energy conversion performance under the EMEC Fall of Warness test site's UKAS accreditation (ISO17025). All berths have comprehensive SCADA (System Control and Data Acquisition) enabling remote access. EMEC operates site resource and environmental monitoring as well as CCTV test berth monitoring. EMEC also offers assistance with grid connection, Power Purchase Agreement and Renewable Obligation Certificates accreditation, as well as extensive assistance with consent & regulatory issues, local research and engineering support and office and data centre support.

Location: EMEC's wave test facility is ideally placed on the western edge of the Orkney mainland, Billia Croo, Stromness. Subjected to the powerful dynamic forces of the North Atlantic Ocean, it is an area

with one of the highest wave energy potentials in Europe with uninterrupted Atlantic waves of up to 17m. Four of the test berths are at 50m depth, while the fifth is located at 70m depth, all situated 1-2 km from the shore and .5 km apart. Shallow water test facilities situated close to the substation are also available.

*Coordinates (please use Mercator): 59.128445°, -2.803811°*

Process status: Construction of the EMEC Fall of Warness tidal test site was completed in 2005 and the facility was commissioned shortly afterwards. EMEC welcomed their first tidal developer client in 2006. Two new subsea cables were installed at the test site in 2010 bringing the total number of EMEC-owned test berths to seven. All 8 berths are now contracted and options for accommodating further test devices are being considered.

Licensing information (brief description): Tidal energy converters with a capability of generating up to 1MW require only a Marine Licence under The Marine (Scotland) Act 2010 from the consenting authority, Marine Scotland. For deployments with capability of generating over 1MW, an additional consent under Section 36 of The Electricity Act 1989 is required. The consenting process at EMEC is supported by a full site Environmental Impact Assessment which was carried out prior to commissioning the site in 2005. The Fall of Warness Site Description is currently undergoing an update to incorporate findings of the original site EIA together with more recent study results in the context of wider available information. It is hoped that this preparatory work will support applications for generic site-wide licences, further minimising the consenting requirements and timescales for developers. EMEC offer extensive consenting assistance based on several years' experience successfully guiding more developers through the licensing process than any other test facility in the world. It is hoped that in the near future generic site-wide licences can be obtained to further minimise the consenting requirements and timescales for developers. Preparatory environmental work for this is already underway.

Key Environmental issues: Whilst EMEC's primary focus is the provision of services to industry for the rigorous testing of marine energy devices, it also participates in a variety of national and international research projects aimed at providing the industry with essential information required to progress in an environmentally sustainable way. This includes projects aimed at improved characterisation of the marine resource as well as those aimed at providing the necessary information to progress decision-making for licensing, in which key environmental issues are the main driver. In the longer term this research provision will extend to other areas of industry-related problems that can be tackled in a generic capacity.

A wide variety of birds are present all year round at the EMEC Fall of Warness tidal test site. There is a cormorant breeding colony on both Muckle Green Holm and Little Green Holm to the south west of the test site. The coastline of Eday adjacent to the test site provides shelter, nesting sites and feeding sites for a large variety of bird species. Of particular concern are diving birds, as the potential for interaction between diving birds and submerged tidal turbines is currently unknown, although studies are currently ongoing to address this knowledge gap. Of the birds present, none are internationally or nationally important aggregations however species occur which feature on Annex I of the EC Birds Directive.

There are Harbour seal (Common seal) pupping sites to the north and south-west of the Fall of Warness test site and a Special Area of Conservation (SAC) for Harbour seals at the nearby island of Sanday, Orkney. Grey seal breeding colonies are located adjacent to the site on Muckle and Little Green Holms, with a European protected SAC to the north on the islands of Faray and Holm of Faray. There are no

resident populations of Harbour Porpoise. However, observations of a moderate number of sightings have been recorded between July and September. This species has a large ranging nature and it has been suggested that they move offshore during the winter. They are also a European protected species. Minke whale, Risso, Orca and White-beaked dolphins have been recorded in the Fall of Warness during the summer months. They are present in extremely low numbers, occurring only sporadically, but must be given serious consideration due to their European Protected Species status. The site wildlife observations show that low numbers of basking sharks, which are a UK BAP priority species, have been sighted in late summer.

To determine the status/activity/abundance of these potential sensitivities a baseline data collection effort has been carried out in the form of a wildlife observations programme. The wildlife observations programme started in 2005 and is currently ongoing, collecting important information regarding seabirds, cetaceans, seals, basking sharks and otters which use the Fall of Warness area. Preliminary findings of the wildlife observations programme indicate that key seabird species around the site do not represent a significant proportion of birds which are known to use the local SPAs, however the relationship between seal presence in the vicinity and local SACs is the subject of further studies for which ongoing data collection and additional analysis are being carried out. Cetacean species which have been sighted during the observations programme so far include harbour porpoise, minke whale, white-beaked dolphin, Risso’s dolphin and orca. These species are protected under European legislation in Annex IV of the Habitats Directive.

The acoustic effect of marine energy converters on marine mammals is currently a hot topic in the marine renewables industry. In order to address the many unknowns in this field, an acoustic characterisation project was launched to provide an operational noise assessment methodology appropriate for use at the EMEC Fall of Warness tidal test site. The methodology is intended to become a standard data collection methodology for characterising the baseline underwater noise at the site and will be offered to developers wishing, or being required by Regulators, to characterise the noise signature of their generating devices.

Environmental webpage: <http://www.emec.org.uk/research/>

<b>Baseline studies and project effects studies: EMEC Fall of Warness Grid-Connected Tidal Test Site</b>				
<b>General description</b>				
<b>Receptor</b>	<b>Study description including question and/or objective</b> (several can be listed per receptor)	<b>Design and methods</b> (brief description)	<b>Results</b> (brief description)	<b>Status</b> (planned, underway, completed, with dates)
Physical Environment	Initial site selection: Bathymetric surveys to establish the depth of water in target areas	Multibeam sonar Side-scan sonar sub-bottom profiling ADCP survey.	Production of bathymetric charts, sonargraphs and seismic sections. ADCP data.	Completed 2004/2005

	Sidescan sonar surveys to determine the nature and morphology of the seabed Sub-bottom profile acquisition to identify the depth of sediment over bedrock Current velocity profiling.			
	Initial site selection: tidal flow analysis.	ADCP surveys.	Sample ADCP data.	Completed 2005
Benthos	Considered as part of site EIA.	Seabed ROV Survey.	Species list and distribution. No evidence of sensitive species presence.	Completed 2005
Fish and Fisheries	Considered as part of site EIA.	<ul style="list-style-type: none"> <li>• Seabed ROV survey.</li> <li>• Desk study including literature review &amp; analysis of research vessel catch data &amp; fishing surveys.</li> <li>• Consultation with local fisheries organisations.</li> </ul>	<ul style="list-style-type: none"> <li>• Species list including some commercially important species.</li> <li>• Fall of Warness used for passage by pelagic fishing boats, and creel fishing occurs in inshore waters.</li> <li>• Test site boundaries were changed to exclude inshore waters up to 30m depth to avoid inshore creeling activities.</li> </ul>	Completed 2005
Large Vertebrates	Considered as part of site EIA.	<ul style="list-style-type: none"> <li>• Otter survey.</li> <li>• Review of Sea Mammal Research Unit (SMRU) routine survey data.</li> <li>• Review of Orkney Cetacean Report data.</li> </ul>	<ul style="list-style-type: none"> <li>• Otters visit the vicinity of the onshore substation, but no evidence was found of otters living in the area.</li> <li>• Species list &amp; identification of nearby SACs for Harbour seal (Sanday) and Grey seal (Faray and Holm of Faray). Adjacent Muckle Green Holm and Little Green Holm is an SSSI and a breeding site for Grey seals.</li> <li>• Species list. No resident cetacean populations, however the area is frequented by cetaceans</li> </ul>	Completed 2005

			who use it for passage.	
	Baseline acoustic survey of the test site to characterise ambient noise at the site.	Drifting hydrophone deployments.	Baseline acoustic characterisation of site.	Completed 2008, 2010
Birds	Considered as part of site EIA.	<ul style="list-style-type: none"> <li>• Bird survey.</li> <li>• Desk-based study.</li> </ul>	Species presence list for test site and surrounding area, including species on Annex I of the EC Birds Directive, however no populations of nationally or internationally important species present. Potential Cormorant sensitivity.	Completed 2005
Navigation/ Marine Users	Site Navigational Risk Assessment.	<ul style="list-style-type: none"> <li>• Desk study reviewing AIS shipping data, vessel monitoring logs, government fishing surveillance data, SAR resources, historical maritime incidents &amp; RYA UK Coastal Atlas data. Hazard review workshop.</li> <li>• Consultation with stakeholders.</li> </ul>	Navigational Safety Risk Assessment Report. (2010) Navigational risk concluded to be relatively low due to original site selection and site being established for 4 years.	Completed 2005, updated to include new test berths 2010
Geology	Considered as part of site EIA.	<ul style="list-style-type: none"> <li>• Desk study</li> <li>• Seabed surveys</li> <li>• Fieldwork geological mapping exercise</li> </ul>	Geological report concluding bedrock is exposed throughout most of the test bay area, with occasional boulders but is swept of any potentially mobile sands or gravels. Solid geology at all five initial test berths.	Completed 2005-2006
Archaeology	Considered as part of site EIA	<ul style="list-style-type: none"> <li>• Review of seabed surveys</li> <li>• Desk study, site visit</li> </ul>	<ul style="list-style-type: none"> <li>• No wreck sites identified</li> <li>• No significant onshore archaeology</li> </ul>	Completed 2005
Landscape and Visual Impact	Considered as part of site EIA.	<ul style="list-style-type: none"> <li>• Desk-based study.</li> <li>• Field visits.</li> </ul>	Site is not within a designated scenic area.	Completed 2005
<b>Reports or</b>	<a href="http://www.emec.org.uk/services/provision-of-wave-and-tidal-testing/consents/">http://www.emec.org.uk/services/provision-of-wave-and-tidal-testing/consents/</a>			

<b>Papers</b>	
<b>Research Projects</b>	N/A

<b>Monitoring and adaptive management: EMEC Fall of Warness Grid-Connected Tidal Test Site</b>				
<b>General description</b>				
<b>Receptor</b>	<b>Monitoring program description including question and/or objective</b>	<b>Design and methods (brief description)</b>	<b>Results (brief description)</b>	<b>Status (planned, underway, completed, with dates)</b>
Physical Environment	Tidal resource measurements.	Multiple ADCP surveys.	ADCP datasets.	Underway
	Tidal resource modelling.	Tidal Flow Model of the Orkney Islands, with increased spatial resolution at tidal test site DHI MIKE model series.	Model executed for 10-year period 1996 - 2005 Hydrodynamic predictions/hindcasts for developer assistance as required.	Underway
	Meteorological data collection.	Site met station.	Monthly quality-controlled raw data.	Underway
Benthos	Monitoring of berths and deployment locations.	ROV surveys: Pre- and post-installation and post-decommissioning surveys.	ROV footage, still photographs and reports.	As required
Large Vertebrates	Characterisation of ambient noise field at Fall of Warness test site including investigation of noise sources.	Drifting Acoustic Recorder Tracker surveys.	Report. Flow noise is a significant contributor to noise field, as well as shipping noise and noise from TEC devices. Noise from TECs unlikely to significantly impact marine mammals using the area.	Completed 2012
Large Vertebrates & Birds	Wildlife observations programme.	Land-based observer.	Species activity data used in support of licence applications.	Underway since 2005
Navigation/	Ongoing engagement.	Meetings with	Communications	Underway

Marine Users		local stakeholders.	with developers as relevant.	
Physical Environment/ Benthos/ Biofouling	<p>ReDAPT (Reliable Data Acquisition Platform for Tidal) (EMEC is project participant).</p> <p>Project ReDAPT will install an innovative 1MW tidal generator at the European Marine Energy Centre in Orkney. The project will test the performance of the tidal generator in different operational conditions. Its aim is to increase public and industry confidence in tidal turbine technologies by providing a wide range of environmental impact and performance information, as well as demonstrating a new, reliable turbine design.</p>	<ul style="list-style-type: none"> <li>• ROV surveys.</li> <li>• Sensor pod including: temperature, turbidity, salinity, hydrophones, ADCP, sonar.</li> <li>• Biofouling study.</li> </ul>	Results not available.	Planned deployment Late 2012
Physical Environment & Benthos, Plankton, Fish, Birds, Mammals and Large Vertebrates	<p>Flow &amp; Benthic Ecology 4D (FLOWBEC) (EMEC is project partner, facilitating and hosting experiments).</p> <p>FLOWBEC aims to measuring flow, water column and benthic ecology in four dimensions, to assess the potential effects of Marine Renewable Energy Devices (MREDS) on the environment. It will use a wealth of observation techniques above and under water, ranging from radar to sonar and in situ measurements, to be deployed over two years at three key sites around the UK. These measurements will feed into models of ecological interactions and habitat preferences, allowing predictions of the multiple effects of large MRED arrays.</p>	EMEC-hosted components: X-band wave radar Seabed-mounted multibeam echosounder.	Results not available yet.	Underway since 2011
Marine Vertebrates	Understanding How Marine Renewable Device Operations Influence Fine Scale Habitat Use and Behaviour of Marine Vertebrates (RESPONSE) (EMEC is project partner).	EMEC provided data from EMEC wildlife observations programme and outputs from	Results not available yet.	Underway since 2011

	<p>The RESPONSE project is a multi-disciplinary study focusing on causal links between MECs and changes in the fine-scale distribution and behaviour of marine vertebrates. The overall aim of the project is to identify and quantify actual risk of negative consequences and therefore remove one key layer of uncertainty in the scale of risk to the industry and natural environment.</p>	<p>hindcast of EMEC 2-D flow model.</p> <p>Project-specific wildlife monitoring.</p>		
<b>Reports or Papers</b>	Project reports for publically funded projects will on the funders websites once available.			
<b>Research Projects</b>	For a comprehensive list of projects at EMEC sites as well as non-site-specific projects which EMEC is involved in, see <a href="http://www.emec.org.uk/research/">http://www.emec.org.uk/research/</a>			