



ATLANTIS  
RESOURCES CORPORATION

## AK-1000™ Environmental Monitoring Programme

**3004**

Environmental Monitoring Programme for the AK-1000™ at  
EMEC's Tidal Test Facility, Falls of Warness, Eday, Orkney

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25/02/2011

Commercial in Confidence

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## 1 INTRODUCTION

### 1.1 Background

To demonstrate its compliance with environmental monitoring related conditions of the licences granted for the installation and testing of the AK-1000™ tidal turbine at the EMEC tidal test site, Eday, Orkney, Atlantis has produced an Environmental Monitoring Programme (EMP).

Atlantis deployed the AK-1000™ tidal turbine at the location illustrated in Figure 1 in August 2010. The nacelle was recovered in November 2010 leaving the Gravity Base System (GBS) in-situ. The MkII nacelle will be installed on the same GBS in the spring of 2011.

This document outlines Atlantis's monitoring plans for the AK-1000™ tidal turbine.

- Licence issued under the Food and Environment Protection Act (FEPA)
- Consent under the Coast Protection Act (CPA)
- European Protected Species (EPS) Licence

Specific licence conditions relevant to each element are shown at the start of each section and summarised in Appendix 1.

The EMP covers the following:

- Marine Mammal Observations (MMOs) during installation
- Marine wildlife collision monitoring during operation/testing
- Underwater noise impacts from the operation of the AK-1000™ tidal turbine
- Marine wildlife displacement due to the presence of the AK-1000™ tidal turbine
- Seabed monitoring, pre installation, post installation and post decommissioning

Due to the evolving nature of the marine renewables industry and the ongoing need to develop appropriate environmental monitoring techniques, Atlantis will review the EMP on a regular basis throughout their testing programme at EMEC. Specific monitoring methodologies will be reviewed and updated as necessary. This review process will include consultation with relevant stakeholders.

This environmental monitoring programme forms part of the wider Atlantis environmental monitoring strategy that it is considering for future commercial scale developments.

Each of these elements of the monitoring programme are described in the following sections and the specific monitoring procedures provided as Annexes.

Licence	Licence Condition
EPS	4) That prior to any works taking place, an Environmental Monitoring Plan (EMP) outlining the specific monitoring protocol must be developed and agreed, in writing, with Marine Scotland and SNH.
FEPA	14) The licensee will ensure that they comply with the agreed monitoring plans submitted in support of the FEPA application as described in the document 'AK-1000 Environmental Monitoring Programme'. Prior to installation the MMO protocol annex must be signed off and held by Marine Scotland. Prior to device commissioning and operation the



	collision monitoring protocol and underwater noise monitoring protocol annex must be signed off and held by Marine Scotland
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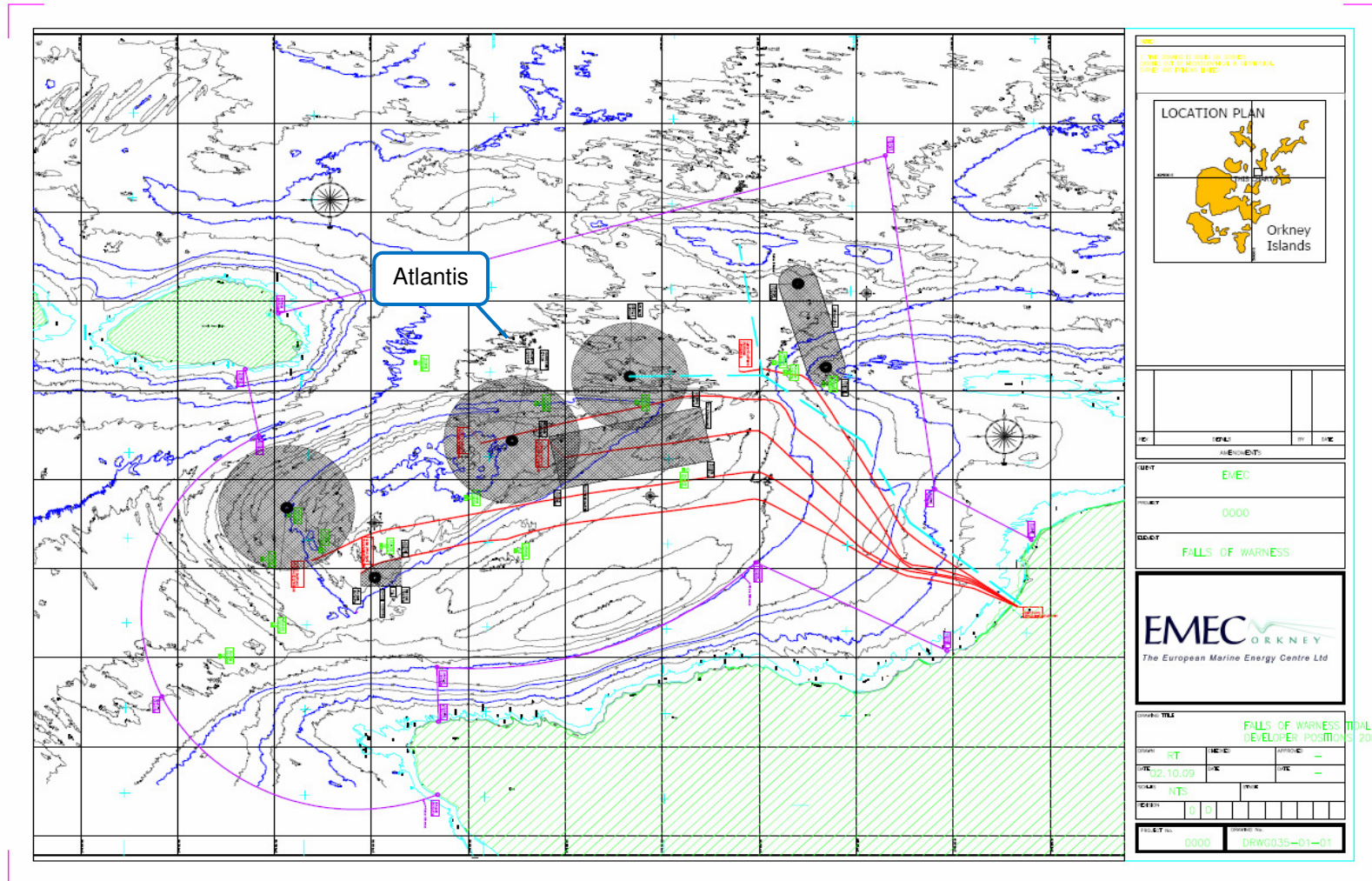


Figure 1: Chart showing location of proposed site at EMEC

## 1.2 Consultation

The development and preparation of this monitoring plan has included consultation with the following:

<b>Organisation</b>	<b>Meeting and date</b>	<b>Notes/issues raised</b>
Scottish Natural Heritage (SNH)	Meeting @ SNH in Kirkwall 24 November 2009	Initial discussion about consenting issues for installation and testing of the AK-1000™ tidal turbine at the EMEC tidal test site, included initial discussion of likely environmental monitoring requirements.
Scottish Natural Heritage (SNH)	Conference call meeting 19 January 2010	Meeting to discuss the environmental monitoring requirements for the AK-1000™ tidal turbine at the EMEC tidal test site.
Marine Scotland and Scottish Natural Heritage (SNH)	Conference call meeting 7 September 2010	Meeting to discuss the Environmental Monitoring Programme version 1.1.
Marine Scotland and Scottish Natural Heritage (SNH)	Conference call meeting 19 January 2011	Meeting to discuss the proposed changes to Environmental Monitoring Plan in light of the need to reinstall the Mark 1 nacelle and comments feed back from SNH in September 2010.



## 2 MARINE MAMMAL OBSERVATIONS DURING INSTALLATION

Licence	Licence Condition
EPS	4)...Considering the sensitive period during which the installation will take place, the EMP should provide details regarding the use of a Marine Mammal Observer (MMO) and utilisation of 'soft start' techniques. We recommend the use of EMEC's MMO protocol. This MMO protocol should be in place during all operations using a DP vessel, the noise from which is likely to cause disturbance. We also advise that considering the sensitive period it would be best practise to have a general lookout for cetaceans during all other operations. If it is necessary to work at night then work should commence during daylight hours when an MMO is in place and not during the hours of darkness when an MMO would not be viable;
FEPA	15) The licensee will ensure that a Marine Mammal Observer (MMO) is in place on the installation vessel during periods when noisy operations are likely to cause disturbance
FEPA	17) The licensee must ensure that the DP-vessel operator follows the 'soft-start' protocol. To ensure that any basking sharks within the vicinity of the noisy works have sufficient time to move outside the 500m buffer zone.

Atlantis is required to employ a Marine Mammal Observer (MMO) during all operations using a DP vessel. The MMO protocol is based on the EMEC developed protocol and will utilise vessel based observers.

The DP vessel will utilise 'soft-start' procedures when arriving on site, in line with the EMEC MMO protocol.

Installation of the turbine will be restricted to periods when the flow is less than 2 knots. During peak flows the vessel will seek more sheltered, deeper water and align itself to the flow to minimise engine and thruster use. The vessel thrusters will be in continuous operation to control the vessels position and heading.

The precise conditions in which construction activity will be carried out will depend on the results of the DP trials, conducted when the vessel first arrives on site. The vessel will be tested in different tidal conditions and in different positions, so that the particular environment is understood before operations begin. The vessel will not move too far off site, as it will need to be able to utilise each tidal slack window.

Atlantis proposes that there is a designated operational area that the vessel can move within during operations. This operational area will not encroach waters within 500 m of harbour seal haul outs in the Fall of Warness. If the vessel moves outside of this area, for whatever reason (e.g. for maintenance or an emergency), then the MMO protocol is to be used to cover its return.

The full MMO protocol is provided in **Error! Reference source not found.**document 3004-ARC-ER-021-MMOpotocol.



### 3 MARINE WILDLIFE COLLISION MONITORING DURING OPERATION/TESTING

Licence	Licence Condition
EPS	5) The EMP must also outline a strategy to mitigate the risk of collision impacts on cetaceans. The strategy should include: i) monitoring of collisions, ii) triggers for implementing mitigation and iii) mitigation measures such as shut-down or deployment of acoustic deterrent devices.
FEPA	19) The licensee will ensure that all video footage is downloaded, the data must be reviewed weekly and a report submitted to Marine Scotland on a monthly basis as outlined in the "EMEC Marine Wildlife Collision Monitoring Protocol". The licensee must also ensure any collision events recorded must be reported to Marine Scotland immediately.

The EIA for the AK-1000™ tidal turbine indicated the potential for marine wildlife (comprising birds, fish, mammals and cetaceans) to collide with the underwater tidal technology. Due to the lack of data presently available it was not possible to determine the significance of such impacts and therefore environmental monitoring needs to be undertaken to help inform impact significance.

There is as yet no standard accepted methodology or technology for the monitoring of wildlife collision with tidal energy devices. To this end Atlantis is investigating the options available during turbine testing to ascertain their suitability for collecting the data required to identify marine mammal collision events. SNH has indicated that due to the lack of accepted monitoring technology/methodology the use of a combination of two different techniques initially might be appropriate.

Atlantis will use the testing of the AK-1000™ tidal turbine as an opportunity to trial marine wildlife collision risk monitoring methodologies and establish the most effective and practical methodology, in addition to establishing the potential marine wildlife collision risk.

The use of the following has been considered for the monitoring of collision risks:

- Passive and active sonar systems
- Infrared systems
- Strain gauges
- Underwater video
- Visual observations

It should also be noted that after lengthy discussions with EMEC, SNH, Marine Scotland and other industry experts, it is generally agreed that monitoring technology has not kept up the pace with the development of tidal turbine technology.

Passive and active sonar monitoring systems are known to have their drawbacks as well as potentially negative side-effects and infrared monitoring systems are also limited in their range and ability to accurately identify the various species of marine wildlife.

A combination of strain gauges and a video camera will be used to monitor potential collision risk events.

If any collision events are identified, Atlantis will:

- Notify Marine Scotland and SNH;
- Undertake further analysis of the video data collected, together with the EMEC marine wildlife observations covering the same period; and
- Enter into discussions with Marine Scotland and SNH on whether mitigation measures need to be implemented.

This initial proposal for marine wildlife collision monitoring has been developed taking into account technologies presently available. It is the intention of Atlantis to ensure that initial results are quickly analysed to allow early determination of the suitability of the proposed methodology.

The proposed collision monitoring protocol is provided in document 3004-ARC-DL-020-EMECCollisionMonProt.

### 3.1.1 Potential future collision monitoring opportunities

Atlantis is aware that EMEC is speaking to SNH and the Scottish Government about the potential use of short range active sonar to ascertain collision events. It is understood these discussions are only at an early stage, but Atlantis would be happy to consider involvement in any associated research once further details are available.

Atlantis is also aware of EMECs ongoing initiative to investigate the use of Passive Acoustic Monitoring (PAM) buoys for monitoring cetacean presence at the Fall of Warness tidal test site. If and when PAM generated data becomes available, Atlantis will consider its potential use as part of their ongoing environmental monitoring.

## 4 UNDERWATER NOISE IMPACTS ON MARINE WILDLIFE

### 4.1 Underwater noise monitoring during installation

Once the schedule and specific vessel details for the Mark 1 nacelle reinstallation and installation of the Mark 2 nacelle are known, consultation with Marine Scotland and SNH will establish the need for underwater noise monitoring during installation. Underwater noise monitoring maybe required during the sensitive moulting period for common seals and if a DP vessel is used for installation. Its requirement will also be dependent on the results of the underwater noise monitoring undertaken at the tidal test site during 2010.

### 4.2 Underwater noise monitoring of the turbine

The EIA for the AK-1000™ tidal turbine indicated the potential for marine mammals to be impacted by underwater noise from the AK-1000™ tidal turbine. Due to the lack of data presently available it was not possible to determine the significance of such an impact and therefore environmental monitoring needs to be undertaken to help inform impact significance.

In order to be able to ascertain the potential significance of underwater noise generated from the AK-1000™ tidal turbine there is a need to establish the underwater acoustic signature of the device.

Atlantis is in the process of appointing a contractor suitable to undertake the required underwater noise monitoring. Prior to the commencement of this work the proposed monitoring methodology will be sent to Marine Scotland and SNH for review.

Once the acoustic signature of the turbine has been established, the results will be considered by an underwater noise specialist in order to understand the potential significance of impacts from underwater noise. This would include comparison of the data collected with baseline measurements already collected by EMEC.

A short report summarising the results of the work will be produced and distributed to EMEC, SNH and other relevant stakeholders.

The proposed underwater noise monitoring protocol will be provided as a separate document once a specialist contractor has been appointed.

## 5 MARINE WILDLIFE DISPLACEMENT

Licence	Licence Condition
EPS	6) Considering the continuation of the EMEC wildlife monitoring programme at the Falls of Warness is subject to additional Scottish Government funding, we advise that the applicant must provide suitable contingency monitoring, covering all periods from pre-installation to decommissioning of the device. This monitoring programme should be detailed within the EMP and must be agreed, in writing, with Marine Scotland and SNH, prior to any works commencing.

The EIA for the AK-1000™ tidal turbine indicated the potential for marine wildlife (primarily marine mammals and cetaceans) to be displaced by the presence of the AK-1000™ tidal turbine. Due to the lack of data presently available it was not possible to determine the significance of such an impact and therefore environmental monitoring needs to be undertaken to help inform impact significance.

EMEC has an ongoing marine wildlife observation programme at the Fall of Warness tidal test site which commenced in 2005. The analysis of the initial data has been identified as a critical first step. Analysis of these data is presently ongoing and will inform the future monitoring strategy on marine wildlife displacement issues. It is understood that marine wildlife displacement monitoring will be a topic of discussion for the EMEC Monitoring Advisory Group (MAG). Feedback from these discussions will inform the Atlantis strategy with regards to marine wildlife displacement monitoring.

### 5.1.1 EMEC Supplementary Monitoring of Seal Skerry

Atlantis has agreed with EMEC to contribute to the supplementary monitoring of the local harbour seal population at Seal Skerry in the Fall of Warness during installation activities in 2010. The monitoring has been designed to monitor potential disturbance impacts on harbour seal during the pupping season. Atlantis has agreed to help EMEC so that its programme continues during Atlantis' planned installation period; this will then give supplementary data on the harbour seal moulting season. This monitoring programme has been designed and is being co-ordinated by EMEC. Data analysis will be undertaken as part of the EMEC co-ordinated marine wildlife monitoring programme.

The proposed marine wildlife displacement monitoring protocol will be provided as a separate document once developed.

## 6 SEABED MONITORING

### 6.1 Seabed monitoring requirement

The surveys will comply with EMEC's REP167-02-02 ROV Survey Guidelines and will include inspection of the following:

- Location at which the AK-1000™ tidal device will be installed.

The results of the site survey undertaken in November 2009 to inform the final location of the tidal device also meet the requirements of the pre installation survey as defined by EMEC.

### 6.2 Survey methodology

#### 6.2.1 Pre installation survey

Atlantis undertook a visual survey of the proposed turbine location to ascertain the nature of the seabed in November 2009. The method used to survey the seabed is described below.

The survey was undertaken by an ROV. An observation class Seaeye Falcon ROV with a high resolution Seaeye camera. Positioning of the ROV was carried out using an USBL (Ultra Short Baseline) acoustic positioning system that comprises of a transponder mounted on the ROV that communicates acoustically with a receiver mounted on the vessel that is aligned to a GPS also mounted on the vessel.

An area 100m x 100m was surveyed at the proposed deployment location. The survey site was divided into 10 ROV runs at 10m spacing roughly at a bearing of 165/345 degrees from north. This represents the general direction of the tidal flow at the site.

Figure 2 shows the lines intended to be surveyed (white lines). Conditions proved difficult for the ROV due to the prevailing currents which made the ROV difficult to control and maintain line. The coloured lines in the figure show the actual tracks of the ROV during each run.

During the survey the surface vessel was unable to be moored as it had to be able to drift above the ROV due to the size of the area surveyed being too large to accommodate the ROV umbilical. EMEC's ROV survey methodology was written in the context of carrying out a ROV survey at a mooring location which encompasses only a small survey area. Conforming to these guidelines was not possible. Atlantis was advised by Keith Bichan (survey contractor) that he had spoken to EMEC in regards to this issue and EMEC had no issues with carrying out the survey with the vessel under drift.

#### 6.2.2 Post installation and post decommissioning surveys

Post installation and post decommissioning surveys are expected to follow a similar survey methodology as the pre installation survey, supplemented if necessary with still images. The exact survey methodology will be agreed with Marine Scotland prior to subsequent surveys taking place.

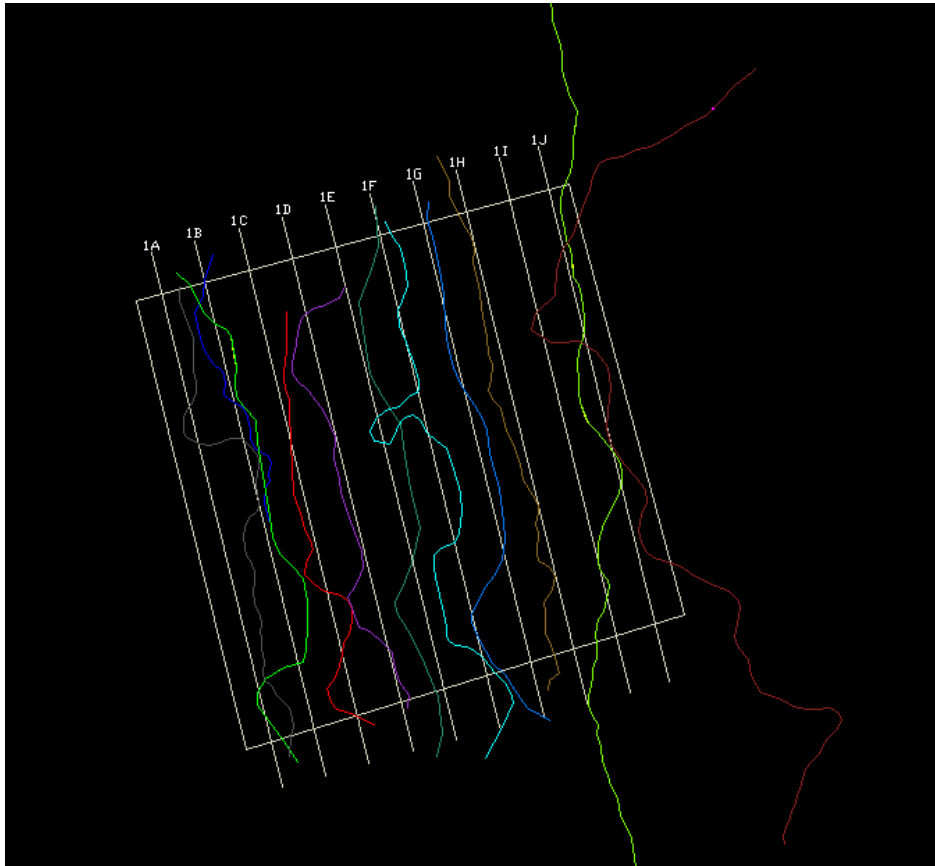


Figure 2: Seabed survey coverage

### 6.3 Reporting

On completion, each survey will be summarised in a report containing the following information:

- Coordinate file showing ROV track
- Still photographs of key features and any debris or anomalies identified
- Identification of any Annex 1 or UKBAP habitats or species
- Biotopes described in line with JNCC Marine Habitats Classification system
- Record of length of survey and plot extremes i.e. minimum and maximum coordinates
- Survey reference number
- Pilot name/ID
- Vessel name / ID
- ROV name / ID including camera lens details
- Record of weather conditions sea state etc.

The report of each survey will be submitted to Marine Scotland and EMEC following completion of each survey. A combined pre and post installation survey report will be submitted to Marine Scotland and EMEC within 3 months of completion of the post installation survey and the post decommissioning report submitted within 3 months of the post decommissioning survey. The staggering of report submissions will allow for review and intervention if any adverse impacts are identified.

All analysis and reporting will be undertaken by an appropriately qualified marine biologist(s).

The proposed seabed monitoring protocol will be provided as a separate document once developed.

## APPENDIX 1: RELEVANT LICENCE/CONSENT CONDITIONS

<b>EPS Licence</b>
<p><b>Condition 4</b> That prior to any works taking place, an Environmental Monitoring Plan (EMP) outlining the specific monitoring protocol must be developed and agreed, in writing, with Marine Scotland and SNH. Considering the sensitive period during which the installation will take place, the EMP should provide details regarding the use of a Marine Mammal Observer (MMO) and utilisation of 'soft start' techniques. We recommend the use of EMEC's MMO protocol. This MMO protocol should be in place during all operations using a DP vessel, the noise from which is likely to cause disturbance. We also advise that considering the sensitive period it would be best practise to have a general lookout for cetaceans during all other operations. If it is necessary to work at night then work should commence during daylight hours when an MMO is in place and not during the hours of darkness when an MMO would not be viable.</p>
<p><b>Condition 5</b> The EMP must also outline a strategy to mitigate the risk of collision impacts on cetaceans. The strategy should include: i) monitoring of collisions, ii) triggers for implementing mitigation and iii) mitigation measures such as shut-down or deployment of acoustic deterrent devices.</p>
<p><b>Condition 6</b> Considering the continuation of the EMEC wildlife monitoring programme at the Falls of Warness is subject to additional Scottish Government funding, we advise that the applicant must provide suitable contingency monitoring, covering all periods from pre-installation to decommissioning of the device. This monitoring programme should be detailed within the EMP and must be agreed, in writing, with Marine Scotland and SNH, prior to any works commencing.</p>
<b>FEPA Licence</b>
<p><b>Condition 2</b> The licensee shall ensure that all substances or articles deposited during the execution of the works are inert and do not contain toxic elements which may be harmful to the marine environment, the living resources which it supports or human health.</p>
<p><b>Condition 3</b> The licensee shall ensure that any debris or waste materials arising during the course of the works are removed from the site of the works for disposal at an approved location above the tidal level of Mean High Water Springs.</p>
<p><b>Condition 14</b> The licensee will ensure that they comply with the agreed monitoring plans submitted in support of the FEPA application as described in the document 'AK-1000 Environmental Monitoring Programme'. Prior to installation the MMO protocol annex must be signed off and held by Marine Scotland. Prior to device commissioning and operation the collision monitoring protocol and underwater noise monitoring protocol annex must be signed off and held by Marine Scotland.</p>
<p><b>Condition 15</b> The licensee will ensure that a Marine Mammal Observer (MMO) is in place on the installation vessel during periods when noisy operations are likely to cause disturbance.</p>
<p><b>Condition 16</b> The licensee will produce a monitoring report, within 8 weeks of all monitoring being completed at the EMEC site; this will include a review of the data collected through the monitoring plan to determine any associated impacts. This report will be submitted to the licensing authority (Marine Scotland).</p>
<p><b>Condition 17</b> The licensee must ensure that the DP-vessel operator follows the 'soft-start' protocol. To ensure that any basking sharks within the vicinity of the noisy works have sufficient time to move outside the</p>



500m buffer zone.
<p>Condition 18 The licensee will undertake monitoring in accordance with the document "AK-1000 Environmental Monitoring Programme".</p>
<p>Condition 19 The licensee will ensure that all video footage is downloaded, the data must be reviewed weekly and a report submitted to Marine Scotland on a monthly basis as outlined in the "EMEC Marine Wildlife Collision Monitoring Protocol". The licensee must also ensure any collision events recorded must be reported to Marine Scotland immediately.</p>
<p>Condition 20 The licensee will continue the EMEC supplementary monitoring of Seal Skerry.</p>
<p>Condition 21 If it is determined that the device has an unacceptable impact on wildlife then further mitigation measures may be required at the discretion of Marine Scotland.</p>
<p>Condition 22 Additional monitoring may be required for the works associated with the installation of the Mark2 nacelle dependant on the results obtained from the monitoring during 2010.</p>
<b>CPA Licence</b>
No specific environmental conditions attached to the CPA licence.