Torr Head Tidal Energy Array EIA

ES Chapter 19 Water Environment & Accidental Events

April 2015

19 WATER ENVIRONMENT AND ACCIDENTAL EVENTS

19.1 Introduction

This chapter focuses on the assessment of potential impacts on the water environment as a result of accidental events. The EIA process is concerned with "likely significant effects". Accidental events are by their nature not likely. However, despite being unlikely they have been considered as part of this EIA process as they may have a significant effect. The probability or likelihood of such an event must therefore be taken into account when assessing the significance of an accidental event in the context of EIA. It covers all stages of the offshore aspects of the Project from installation to operations and maintenance through to decommissioning. After detailing the nature and potential occurrence for these events, mitigation and management is identified which will remove or reduce the identified impacts.

Where potential accidental or non-routine events have a direct impact on specific EIA receptors, these have been addressed in detail in other topic specific chapters of this ES and are therefore not repeated in this chapter. Specific ES chapters where accidental events have already been considered are listed in Table 19.1 below.

Table 19.1 Relevant ES chapters

ES chapter	Title	Accidental or non-routine impacts assessed
Chapter 9	Benthic and intertidal ecology	Accidental pollution due to leaks and spills from vessels and tidal turbines
Chapter 10	Marine mammals	Accidental pollution due to leaks and spills from vessels and tidal turbines
Chapter 11	Ornithology	Release of drill cuttings & fluid Accidental spillage from vessels Accidental leakage from tidal turbines
Chapter 12	Fish and shellfish ecology	Accidental contamination due to leaks and spills from vessels and tidal turbines
Chapter 16	Shipping and navigation	Source of potential pollution incident as a result of vessel collisions during all phases of the Project

This assessment was carried out by Xodus and is based on results from a desk based study only. No additional studies or surveys have been carried out as part of this assessment.

19.1.1 Area of assessment

The assessment of potential impacts of accidental events on the water environment covers the entire offshore Project area (Agreement for Lease (AfL) area and area of search for the export cable corridor). The assessment also considers impacts on the waters surrounding the Project area. Specific boundaries have not been defined for the overall area of assessment on the basis that the extent of the offshore environment potentially affected depends upon a wide range of factors including type and quantity of pollutant, dispersal rates and patterns, and persistence of a pollutant in the environment.

19.2 Legislation and policy

In addition to the requirements of the Marine Strategy Framework Directive (MSFD) for achieving Good Environmental Status (GES) across the marine environment by 2020 (see Chapter 4: Planning and Legislation) there are a number of other pieces of legislation which focus on protecting specific aspects of the marine and coastal water environment. These are discussed below.

- Bathing Water Directive (BWD);
- Shellfish Waters Directive (SWD);
- Water Framework Directive (WFD);

- The International Convention for the Prevention of Pollution from ships (MARPOL); and
- Pollution Prevention Guidelines (PPGs).

19.2.1 Bathing Water Directive

Bathing Water Directive 2006/7/EC repeals Directive 76/160/EEC. The revised Bathing Waters Directive introduces more stringent but simplified measures of bathing water quality based on at least parameters of (faecal) bacteria. This Directive applies only to recognised bathing waters and has been put in place specifically to protect and safeguard human health.

19.2.2 Shellfish Waters Directive (SWD)

The purpose of the European Commission (EC) directive on the quality required of shellfish waters (the Shellfish Waters Directive) is to ensure a suitable environment for shellfish to grow. The original Shellfish Waters Directive (79/923/EC), adopted on October 30th, 1979, was repealed by the codified Shellfish Waters Directive (2006/113/EC), on December 12th, 2006 (DoENI, 2009).

The Directive sets out measures for the monitoring and assessment of shellfish waters and the setting of water quality standards for shellfish. Under the Directive member states must identify coastal and brackish waters, which need protection or improvement in order to support shellfish.

19.2.3 Water Framework Directive (WFD)

The Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy) - introduces a holistic approach to the management of water quality, and establishes a system for the protection and improvement of all aspects of the water environment including rivers, lakes, estuaries, coastal waters out to 1 nm and groundwater (DoENI, 2014a). The Directive, which is implemented in Northern Ireland through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003, requires all inland and coastal waters to reach at least “good status” by 2015 (DoENI, 2014a). The 2009 - 2015 River Basin Management Plans (RBMPs) prepared by NIEA as part of NI commitment to delivery of the WFD set out a series of proposals and actions for the long term management of the NI water environment.

19.2.4 MARPOL

The International Convention for the Prevention of Pollution from ships (MARPOL) covers pollution of the marine environment by ships from operational or accidental causes. Regulation 37 of Annex I of MARPOL requires that all ships of 400 gross tonnage (GT) or more carry an approved Shipboard Oil Pollution Emergency Plan (SOPEP).

19.2.5 Pollution Prevention Guidelines (PPGs)

Pollution Prevention Guidelines (PPGs) are based on relevant legislation and recommended good practice. They are produced by the Environment Agency (EA), Scottish Environment Protection Agency (SEPA) and Northern Ireland Environment Agency (NIEA) to provide and guide developers on managing their environmental responsibilities, preventing pollution and complying with the law.

PPGs relevant to this Project include:

- PPG 1 - this covers general guidance on the prevention of pollution;
- PPG 5 - provides guidelines for construction and maintenance work, on, in or near water;
- PPG 21 – provides guidance on producing emergency pollution incident response plans to deal with accidents, spillages and fires; and
- PPG 22 – provides guidance for incident response and dealing with spills.

19.3 Scoping and consultation

Although consultation with regulators and key stakeholders has been ongoing since commencement of the Project, no specific issues or comments relating to water quality and accidental events have been raised during the consultation meetings or in response to the Scoping Report. However, as noted in the EIA Scoping Opinion (DoENI Marine Division and DETI, 2014) in accordance with the EIA Directive, the Marine Works (Environmental Impact Assessment) Regulations 2011 and the Offshore Electricity Development (Environmental Impact Assessment) Regulations (Northern Ireland) 2008 there is a requirement to consider potential impacts on water quality as part of the EIA process.

19.4 Baseline description

The following section describes the key characteristics of the water environment that are not discussed in previous chapters of this ES. The baseline description also focuses on key aspects of the marine environment identified under the MSFD and has therefore drawn on information presented in the Northern Ireland State of the Seas Report (AFBI, 2011) on the basis that this is the most comprehensive and up to date report on the current status of the marine environment in Northern Ireland. Where appropriate this report has been supplemented with additional information relating to specific topics not covered in the State of the Seas Report.

Northern Ireland has over 650 km of coastline and its largest towns are associated with ports. The sea provides an important source of recreation and place to work in particular with regard to fishing and shipping (AFBI, 2011).

Marine wildlife in Northern Ireland waters is rich and varied with more than 50% of Northern Ireland's biodiversity lying beneath the sea. This is due to its position at the junction between cold northern waters and warmer waters to the south. While many of Northern Ireland's marine habitat and species are considered to be in a good state, measures are however still required to protect these features from increased use of the sea and conflict between sea users and to restore and enhance habitats that have already been damaged through existing marine activities such as fishing (AFBI, 2011).

Commercial fisheries are also important in Northern Ireland waters. While a detailed description of commercial fisheries is provided in Chapter 13 it is important to note that the health of commercial fisheries is a good indicator of the overall quality of the marine environment. In recent years there have been notable decreases in catches of specific commercial fish species e.g. cod and whiting and some improvements in harvest of other commercial fish species such as haddock and herring (AFBI, 2011). While for most species stock depletion is attributed to unsustainable fishing practices, the implications of fish stock depletions on food webs and other marine wildlife is less clear and is the focus of existing and future monitoring programmes. Further monitoring is also required to better understand the influence of climate change on fish stocks.

In recent years the levels of contaminants in marine sediments has reduced significantly. This is mainly as a result of improved practices, better environmental regulation and a decline in some of the most polluting historical industries. These reductions in levels of contaminants in marine sediments had a positive effect on the environment in particular marine wildlife and shellfish. Most contaminants present in Northern Ireland waters include heavy metals e.g. zinc (Zn), mercury (Hg), lead (Pb) and cadmium (Cd), crude oil and its derivatives such as polycyclic aromatic hydrocarbons (PAHs) (AFBI, 2011). Other contaminants include organophosphates or organohalogens which are carbon based chemicals present in solvents and pesticides. Whiles these are toxic they are not very persistent in the environment.

There are no known or potential areas of sediment contamination present within the Project area (AfL area and the area of search for the export cable corridor). This is mainly due to the high energy nature of the marine environment within the Project area which helps to rapidly disperse any contaminants or pollutants that may be present in the area. Where contaminants are present in sediment these can be released into the surrounding water. Shellfish feeding in areas of contaminated sediment are therefore at risk of the bioaccumulation of contaminants in their flesh as a result of contaminated particles becoming absorbed during feeding. To ensure that there is no risk to human health from the consumption of contaminated shellfish and to monitor environmental quality it is necessary to closely monitor the flesh of shellfish caught in Northern Ireland.

There are no designated shellfish waters within the Project area. The closest designated shellfish waters are located in Larne Lough located approximately 45 km south of the Torr Head AfL area and Lough Foyle, located approximately 60 km west of the AfL area.

There are 23 bathing waters in Northern Ireland identified under the Bathing Water Directive. The closest to the Project area is Ballycastle (approximately 12 km from the AfL area) which in 2013 achieved the mandatory water quality standards of the Directive, with a water quality status of good (NIEA, 2014). The AfL area is located within the Northern Channel coastal waters which within the Glens and Rathlin Local Management Area under the WFD. Current status of North Channel coastal waters is good. Objectives set out in the North Eastern River Basin Management Plan (RBMP) for 2015, 2021 and 2027 are to maintain good status.

19.5 Impact assessment

As discussed previously the focus of this assessment is on accidental events and the impacts on water quality. Potential impacts of changes in water quality on other receptors e.g. marine mammals, fish and shellfish have been assessed in other chapters of this ES and therefore are not repeated in this section.

Table 19.2 lists all direct and indirect impacts to be covered as part of the impact assessment and identifies the relevant Project phases under which each impact will be assessed. This table also identifies where potential interactions between impacts and inter-relationships between receptors and EIA topics are likely to occur. Cumulative and in-combination impacts are discussed in Section 19.10.

Table 19.2 Impacts covered in impact assessment

Potential impact	Relevant phase of Project			Interactions / inter-relationships (refer to relevant EIA topic)
	C/I	O/M	D	
Oil spills from vessels	Y	Y	Y	All impacts also considered in the following chapters: Chapter 9: Benthic and intertidal ecology Chapter 10: Marine mammals Chapter 11: Ornithology Chapter 12: Fish and shellfish ecology Chapter 16: Shipping and navigation
Leaks and spills during support structure installation	Y	N	N	
Loss of inventory from HDD boreholes	Y	N	N	
Leaks from operational turbines	N	Y	N	
C/I = construction / installation, O/M = operations and maintenance and D = decommissioning				

As noted in the baseline description there are no known or potential areas of sediment contamination located within the Project area. Potential impacts relating to sediment contamination and impacts on water quality resulting from the disturbance of contaminated sediment have been scoped out of this assessment.

19.5.1 Assessment criteria

The assessment criteria presented below for sensitivity and value of receptor and impact magnitude are based on the criteria presented in Chapter 8: EIA Approach and Methodology. However, when assessing accidental events it is also necessary to consider the frequency or probability of the event occurring. Additional criteria on event frequency and probability are provided in Section 19.5.3 and Table 19.5 below. This is a departure from the standard approach and method that has been applied to the other EIA topics and impact assessment ES chapters.

19.5.2 Sensitivity and magnitude

The sensitivity and value of the receptor and magnitude of impact criteria specific to the water environment and accidental events are defined in Table 19.3 and Table 19.4 respectively. There is not one standard receptor that can be impacted by accidental events; therefore definitions refer generally to all possible receptors associated with the marine environment including water, marine wildlife, seabed condition etc.

Table 199.3 Criteria for sensitivity and value of receptor

Sensitivity and value of receptor	Definition
Very high	Sensitivity: Receptor has no capacity to absorb change caused by an accidental event without significantly altering its present character with no ability to recover or adapt. Value: Receptor is of very high environmental importance or rarity e.g. protected under international legislation or recognised as being globally threatened.
High	Sensitivity: Receptor has a very low capacity to absorb change caused by an accidental event without significantly altering its present character with low ability to recover or adapt. Value: Receptor is of high environmental importance or rarity e.g. protected under national legislation or recognised as being globally near threatened or vulnerable.
Medium	Sensitivity: Receptor has low capacity to absorb change caused by an accidental event without significantly altering its present character with some ability to recover or adapt. Value: Receptor is of moderate environmental importance e.g. of regional importance or recognised as being globally near threatened or vulnerable.
Low	Sensitivity: Receptor has some tolerance to absorb change caused by an accidental event or will be able to recover or adapt with only small changes to its present character. Value: Receptor is of low environmental importance.
Negligible	The receptor is tolerant of change caused by an accidental event without perceptible detriment to its present character and or receptor is of negligible environmental value.
Note: Value is presented as a component of sensitivity to allow a judgement to be made according to either a receptor's sensitivity to a particular impact or its value under, for example, international, national, or regional legislation. Value should therefore be applied inherently when considering the sensitivity of a receptor to a particular impact. Definitions in this table may not be appropriate for all receptors or impacts, for example there may be a receptor with some tolerance to accommodate an impact (low sensitivity) but it might be designated under regional legislation (medium sensitivity). In such cases expert judgement is used to determine the most appropriate sensitivity ranking and this is explained through the narrative of the assessment.	

Table 199.4 Criteria for magnitude of impact

Magnitude of impact	Definition
Severe	Severe alteration to key elements or features of the baseline conditions resulting in a fundamental change in character, composition or other attributes.
Major	Major alteration to key elements or features of the baseline conditions resulting in a major change in character, composition or other attributes.
Moderate	Alteration to one or more key elements or features of the baseline conditions such that post event character, composition or other attributes will be partially changed.
Minor	Minor alteration in baseline conditions. Impact will be discernible but underlying character, composition or other attributes of baseline conditions will be similar to pre event circumstances and patterns.
Negligible	Very slight change from baseline conditions. Change barely distinguishable, approximating to the no change situation.

19.5.3 Frequency and probability

For the assessment of accidental events the application of frequency / probability is not applied to the magnitude of an impact but is applied after the consequence of an impact has been assessed. This allows the consequence of the impact to be fully understood before the likelihood of the event occurring is applied to the impact. This is particularly important for impacts where the consequence is very high but the probability of such an event occurring is extremely low (i.e. a major oil spill is a high consequence event which has a very low probability of occurrence). In this instance, the magnitude considers the duration, timing, scale and size of an impact. This is then combined with the sensitivity of receptor in the same manner as in Chapter 8 to provide an environmental consequence.

In order to assess the overall impact significance, the consequence is combined with a frequency/probability of the impact occurring as defined in Table 19.5.

Table 19.5 Frequency and probability of an accidental event

Frequency/likelihood	Accidental event (probability)*
Continuous / Likely	10^{-1} to >1 events per year. Event likely to occur more than once on the facility.
Regular / Possible	10^{-2} – 10^{-1} events per year. Could occur within the lifetime of the development.
Intermittent / Unlikely	10^{-3} – 10^{-2} per events per year. Event could occur within the life of 10 similar facilities. Has occurred at similar facilities.
One off Event / Remote	10^{-5} – 10^{-3} events per year. Similar even has occurred somewhere in industry or similar industry but not likely to occur with current practices and procedures.
One off Event / Extremely remote	<10^{-5} events per year. Has never occurred within industry or similar industry, but theoretically possibly.
*Where 10^{-1} = 0.1 or 1 in 10 chance of event occurring each year to 10^{-5} = 0.00001 or 1 in 100,000 chance of an event occurring each year.	

When assessing the significance of accidental events the overall ranking of impact significance also has to take into account information on event frequency / likelihood. Impact significance is therefore derived by combining consequence and likelihood via the matrix presented in Table 19.6 below.

Table 19.6 Significance rankings

Consequence	Likelihood / frequency					
	Continuous / likely	Regular / possible	Intermittent / unlikely	One off event / remote	One off event / extremely remote	Will not occur
Severe	Severe	Severe	Major	Moderate	Minor	Negligible
Major	Severe	Major	Moderate	Minor	Negligible	Negligible
Moderate	Major	Moderate	Minor	Minor	Negligible	Negligible
Minor	Moderate	Minor	Minor	Negligible	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible
Positive	Positive	Positive	Positive	Positive	Positive	Positive

19.5.4 Design envelope

In line with the design envelope approach, this assessment considers the maximum ('worst case') Project parameters. The identification of the worst case scenario for the water environment and accidental events ensures that impacts of greater adverse significance would not arise should any other development scenario be taken forward in the final scheme design. With regards to the assessment of impacts resulting from accidental and non-routine events, the key parameters include:

> The tidal turbines will contain an inventory of fluids (800 to 1,000 litres) including mineral oil, grease, hydraulic fluid, low toxicity biodegradable oil and biodegradable ethanol;

- Total oil inventory for large dynamic positioning (DP) installation vessels is likely to be in the region of 6,000,000 to 8,000,000 litres of marine diesel stored in a number of separate tanks. This is based on information for a standard large DP vessel. Each tank holds approximately 600,000 litres.
- The oil inventory for pin-pile drilling will be approximately 60 litres and approximately 150 litres for monopile drilling;
- Maximum release of drill cuttings from drilled monopiles will be 117.6 m^3 per monopile;
- Cement will be used to grout the piles in place. The maximum amount of cement that will be carried onboard a vessel at any one time will depend on the amount of cement required for the installation of one monopole and weigh capacity of the vessel;
- Where Horizontal Direction Drilling (HDD) required to bring export cable(s) to shore at the landfall this will result in small release of drill cuttings to sea from the HDD at breakthrough;
- Physical presence of installation vessels (DP heavy lift construction barge or specialised deployment barge, offshore small work class tugs, ROV vessels, crew transfer vessels, dive boats and RIBs in year one for 30 weeks (Q2-Q4 2018) and in year two for 35 weeks (Q2-Q4 2019/Q1 2020);
- Physical presence of maintenance vessel. Based on a maximum 100 turbine array it is expected that there will be an average of one maintenance vessel at the site all year during the operational phase. This will be dependent on local weather conditions e.g. vessel numbers may increase during periods of calmer weather and reduce / no be present on site during periods of bad weather; and
- Removal of all underwater infrastructure (tidal turbines, TSSs and cables) at decommissioning.

19.5.5 Data gaps and uncertainties

Given the non-routine nature of accidental events there are a number of uncertainties associated with assessing potential impacts. Where available, Project data on relevant inventories have been used in calculating spillage volumes in the event of an accident. Some relevant published data exists which has also been used in assessing the impacts of accidental events e.g. frequency of vessel collisions and the environmental consequences of this.

Where uncertainty remains over an impact this has been accounted for in the likelihood of an event occurring. However, for most impacts the measures in place to prevent accidents from happening and the frequency of such accidents is well understood.

19.6 Impacts and mitigation during construction and installation

19.6.1 Impact 19.1 Oil spills from vessels

Oil enters the marine environment from ships and ship based activities, through natural seepage and from accidental spills. Oil spills can have a number of environmental impacts. Actual effects will vary depending on a wide range of factors including the volume and type of oil spilt and the sea and weather conditions at the time of the spill. Diesel is considered non-persistent oil that evaporates rapidly from the surface of the sea. An accidental spill of diesel fuel from a vessel would result in a diesel slick on the sea surface. The slick would disperse and degrade rapidly as a result of wave, current, microbial and photolytic action. Effects will also be dependent on the presence of environmental sensitivities in the path of the spill. In a dynamic environment such as the Project location, oil spills will be rapidly dispersed although a spill will never be far from the coast and therefore beaching of oil could occur.

Potential sources of oil spills from installation vessels for the Project include:

- Upsets in the treatment system for bilge water;
- Loss of containment in a storage tank (e.g. of lube oils, fuel oil, or chemicals); and
- Damage to a fuel bunker caused by a collision, grounding or fire.

The best available data indicates that the most frequently recorded spills from vessels offshore is associated with upsets in the bilge treatment systems and the losses are usually small (UKOOA, 2006). This type of loss is likely to result in 10's of litres being lost to the receiving environment.

Sources of data relating specifically to offshore support vessels are few (i.e. the types of vessel that will be used for installation and operation). However it has been estimated by the Joint Group of Experts on Scientific Aspects of Marine Protection (GESAMP) that the volume of oil released into the global marine environment as a result of accidental oil spill from non-tanker vessels (which would include offshore support vessels) is 5,300 tonnes per year (GESAMP, 2007).

The total oil inventory for a standard large dynamic positioning (DP) installation vessels is likely to be in the region of 6,000,000 to 8,000,000 litres of marine diesel stored in a number of separate tanks. Each tank holds approximately 600,000 litres of marine diesel. The worst case spill assumes a single tank rupture which would result in the region of 600,000 litres of marine diesel released into the marine environment.

Impact significance

With regard to this Project the following receptors have been identified as being most sensitive to oil spill:

- Benthic and intertidal ecology (Chapter 9);
- Marine mammals (Chapter 10);
- Fish and shellfish (Chapter 12);
- Seabirds (Chapter 11);
- Coastal processes and seabed condition in particular geological coastal features such as Giant's Causeway World Heritage Site (WHS) (Chapter 14); and
- Bathing beaches (Chapter 19);
- WFD objectives to maintain good water quality of North Coast coastal waters as set out in the North Eastern RBMP.

Specific impacts of oil spill on most of the receptors listed above are described in the relevant ES chapters. For the purpose of this assessment receptor sensitivity takes into account the range of potential receptors in the Project and surrounding area (sea and coast) and has been assessed as being high.

The magnitude of impact is considered minor for a total loss of inventory and negligible for a small loss of oil. The likelihood of the loss of a small (10's of litres) amount of oil being leaked from a vessel associated with the Project is described as unlikely.

The likelihood of a large oil spill from a vessel associated with the Project is even less. Data collected by Xodus Group relating to spill incidents from vessels involved in oil and gas industry found that over a 38 year period the total number of spills per year for large support vessels (> 100 tonnes) is 0.03. For support vessels between 10 and 100 tonnes the total number of spills recorded per year was 0.08 and for vessels less than a tonne the number of spills per year is 0.32. Therefore the likelihood of a spill occurring is described as extremely remote.

The data also shows that although there are a lower number of spills from larger vessels, when spills occur the amount of oil lost tends to be greater e.g. >100 tonnes (100,000 litres) for 100 tonne vessels. In comparison, the volume of spills from smaller vessels (1 to 10 tonnes) was approximately 12,000 litres. Although spills from vessels that are less than 1 tonne occur more frequently, the amount of oil released is in 10's kgs / litres rather than tonnes. It should also be noted that due to the highly dynamic nature of the marine environment within the AfL area it is likely that any accidental release of oil will be rapidly dispersed by fast tidal currents and turbulent waters.

A total loss of inventory is considered to have a moderate and therefore significant impact, whereas loss of a small amount of oil is considered to have a minor impact and therefore not significant impact.

Impact	Sensitivity / value of receptor	Magnitude of impact	Consequence	Frequency/ probability	Significance
Oil spill from vessel (total inventory)	High	Moderate	Major	Extremely remote	**Significant**
Oil spill from vessel (small loss of 10s litres)	High	Minor	Moderate	Unlikely	Not significant

Mitigation relating to Impact 19.1
> An Emergency Response Corporation Plan (ERCoP) will be prepared for the Project in line with guidance set out by the MCA in MGN 371. This will be submitted to MCA for comment and approval; > Notices to Mariners will be issued advising other vessels in the area of activities within the Project area; > Vessels associated with all Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400GT will have on board SOPEP's; > Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits; and > Installation activities will only take place during suitable weather windows.

Residual impacts

Successful implementation of the proposed mitigation measures will further reduce the likelihood and magnitude of impact resulting from a total loss of inventory from a vessel. The residual impact for a total loss of inventory will therefore not have any significant effect on any of the receptors listed above.

Impact	Sensitivity / value of receptor	Magnitude of impact	Consequence	Frequency/ probability	Significance
Oil spill from vessel (total inventory)	High	Minor	Moderate	Extremely remote	Not significant

19.6.2 Impact 19.2 Leaks and pollution from installation of TSSs and turbines

This section focuses on the use of drilled TSS as they require grout and there is the potential for a fluid leak.

Both the monopile and pin-piled TSSs will involve drilling during the installation phase of the Project. The drilling equipment used will have a relatively small inventory of oil used for lubricating purposes. For pin-pile drilling equipment the oil inventory will be approximately 60 litres and for monopile drilling equipment approximately 150 litres.

High strength cement will be used to grout the piles in place. The cement is stored in dry form in large bags with an approximate capacity of 1 ton. The worst case scenario for the amount of cement that will be carried on-board a vessel at any one time is a maximum of 100 tons (enough for the installation of one monopile). There is the potential dry cement could be lost overboard.

In addition, there is the potential during the pile installation operations that liquid cement could be lost to the marine environment. A conductor casing will separate the liquid cement from the open sea. If the coupling were to fail this could result in an approximate maximum loss of cement to the marine environment of 500 litres.

A loss of oil from the drilling equipment will have a localised impact, and be rapidly dispersed in the dynamic conditions in the Torr Head AfL area. The potential loss of cement into the marine environment will also have a localised impact and would be expected to be also rapidly diluted and dispersed in the dynamic conditions of the Torr Head AfL area.

Impact significance

As described for Impact 19.1 the sensitivity of the receptor is considered high. Due to the relatively small inventories, the magnitude of impact is considered minor. Given the novel nature of tidal turbines and therefore the relatively limited experience of using pin piling and monopiling in relation to this type of installation, the likelihood of a leak from the drilling equipment is considered possible. The likelihood of a total loss of cement inventory either overboard or during drilling operations, is however considered remote.

Impact	Sensitivity / value of receptor	Magnitude of impact	Consequence	Frequency / probability	Significance
Leaks during installation – loss of oil inventory from pile drilling equipment	High	Minor	Moderate	Possible	**Significant**
Leaks during installation - loss of cement inventory	High	Minor	Moderate	Remote	Not significant

Mitigation relating to Impact 19.2

- An Emergency Response Corporation Plan (ERCoP) will be prepared for the Project in line with guidance set out by the MCA in MGN 371. This will be submitted to MCA for comment and approval;
- Notices to Mariners will be issued advising other vessels in the area of activities within the Project area;
- Vessels associated with all Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400GT will have on board SOPEP's;
- Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits;
- Installation activities will only take place during suitable weather windows;
- Only recognised marine standard fluids and substances will be used in the drilling equipment; and
- Consideration will be given to CIRIA guidance on the use of concrete in maritime engineering – a good practice guide (C674), July 2010.

Residual impacts

Loss of oil inventory from drilling equipment was identified as a potentially significant impact. Through the implementation of the proposed mitigation measures which aim to reduce the likelihood of such an event occurring and the potential magnitude in the event of such an incident, the magnitude of the impact is reduced to minor thus reducing the impact consequence to minor. Impacts on receptors listed above are therefore a not significant.

Impact	Sensitivity / value of receptor	Magnitude of impact	Consequence	Frequency / probability	Significance
Leaks during installation – loss of oil inventory from pile drilling equipment	High	Negligible	Minor	Possible	Not significant

19.6.3 Impact 19.3 Total loss of inventory from Horizontal Direction Drilled (HDD) boreholes

Where Open Cut Trenching (OCT) is not suitable at either of the landfall options, Horizontal Directional Drilling (HDD) techniques is the alternative method used to install ther export cable(s) from sea to land. The majority of drill cuttings generated from the drilling of HDD bores will be returned to shore and not discharged to sea. It is estimated that the contents of the last 10 m of each bore could be discharged to sea at the seabed breakthrough. During normal operations it is expected that the greatest potential discharge to sea at breakthrough will result in a total volume of 82 m^3 of drill cuttings per bore. However, in the event that the entire inventory of a bore was lost the total volume of drill cuttings that could be discharged to sea is 141 m^3 per bore.

The inventory of a bore is considerably less than the maximum volume expected to be generated during normal drilling operations for the monopile foundations (estimated at 760 m^3) and based on the assessment of the potential impacts from these discharges (Chapters 9, 10, 11 and 12) significant impacts are not expected. The dynamic environment will ensure that any cuttings are dispersed rapidly so that any increases in suspended sediment concentrations are likely to be short lived. It is unlikely that drill cuttings will settle where they are discharged and the strong currents in the area will redistribute the cuttings rapidly away from the Project area.

Impact significance

The sensitivity of the marine environment is described as high. Although increased turbidity/suspended sediment levels may occur in the localised area of the drilling operations the impact is not expected to extend outside the immediate footprint of the wider Project area and recovery is expected to be rapid. Due to the potential inventories of releases involved; the magnitude of impact is considered negligible for loss of the inventory of a single bore. The likelihood of the loss of the full inventory of drill cuttings is considered unlikely.

Sensitivity / value of receptor	Magnitude of impact	Consequence	Frequency / probability	Significance
High	Negligible	Minor	Unlikely	Not significant

Mitigation relating to Impact 19.3
No mitigation measures have been identified for this impact as it was concluded that the impact was not significant.

19.7 Impacts and mitigation during operation and maintenance

19.7.1 Impact 19.4 Oil spills from vessels

Vessels will be used for the maintenance of the turbines. These vessels will be the same size or smaller than the vessels used during installation and will therefore have similar oil inventories. Although fewer vessels will be required during maintenance and the vessels are likely to be at site for shorter periods of time the likelihood of an oil spill occurring and the resulting impact is similar to those identified for oil spills from vessels during installation (Impact 19.1). Through implementation of the mitigation measures listed in Section 19.6.1 any residual impacts on any of the receptors listed above, including WFD objectives, will be not significant.

19.7.2 Impact 19.5 Leak of fluid from turbines

The tidal turbines will contain an inventory of fluids including oil, hydraulic fluid and coolant. The impact from loss of fluids from the tidal turbines will be limited. Leaks will be localised to the immediate vicinity of the turbine and will be rapidly dispersed in the tidal conditions present in the AfL area. The quantities and types of fluids to be used will also be a limiting factor to the overall impact, based on the technology types being considered, largest turbine inventories will be 800 – 1,000 litres. The fluids will be mostly water based, biodegradable and have low aquatic toxicity.

Impact significance

The sensitivity of the receptor is considered high. Due to the limited inventories involved, even in the event of a loss of the entire inventory from a single turbine, the magnitude of the impact is considered negligible. Given that tidal turbine technologies have not been tested in large arrays a leak from a turbine is considered possible.

Sensitivity / value of receptor	Magnitude of impact	Consequence	Frequency / probability	Significance
High	Negligible	Minor	Unlikely	Not significant

Mitigation relating to Impact 19.5
Although no significant impact has been identified, given that tidal turbines have not been tested in large arrays and the high sensitivity of the receptor, mitigation is detailed to ensure that the impact remains not significant: > Only recognised marine standard fluids and substances will be used in the turbine hydraulic systems; > Hydraulic fluids will be mostly water based, biodegradable and be of low aquatic toxicity; and > Turbine sensors will detect loss of fluid pressure and leaks; enabling maintenance operatives to reduce the risk of further leaks.

19.8 Impacts and mitigation during decommissioning

Impacts during decommissioning are considered to be the same as oil spills from vessels during installation. The same likelihood, mitigation and residual impacts are therefore predicted and reference should be made to Section 19.6.1 for the details of these impacts.

19.9 Potential variances in environmental impacts

The assessment has identified all potential accidental events associated with the installation, construction, operation, maintenance and decommissioning of the Project. Although Project design is ongoing and contractors are to be appointed (e.g. vessels, onshore construction) details of oil/fluid inventories etc. may vary to those quoted here, however any variances will not significantly influence the impact predictions made in this assessment.

19.10 Cumulative and in-combination impacts

From the list of Projects agreed with DoENI Marine Division for consideration as part of the Cumulative Impact Assessment (CIA) (presented in Chapter 8, Figure 8.2 and Table 8.4) only the Fair Head Tidal Array Project has been identified as having potential to have cumulative or in-combination impacts in terms of accidental events.

Given the nature of an accidental event i.e. non routine, the likelihood for cumulative impacts caused by accidental events (i.e. an accidental event occurring in the same time period as one or more projects and this Project) is considered to be extremely remote. However, given that installation and operations of both the Fair Head and Torr Head Tidal Arrays will potentially occur simultaneously there will be a slight increase in the risk of some events occurring (e.g. oil spills).

However, it is expected that the Fair Head Tidal Array Project will also have management and mitigation measures in place to reduce the likelihood of an accidental event and have emergency plans which will be activated should an accidental event occur to ensure impacts are minimised. It can therefore be concluded that potential cumulative impacts from both Projects will be not significant.

There is also potential risk of cumulative effects occurring either as a result of collision between vessels involved in the Torr Head Tidal Array Project (during installation or operations and maintenance) and other vessels transiting through the area or as a result of oil spills from other vessels passing through / near to the Project area occurring at the same time as a spill from a vessel involved in specific Project activities. The potential for these events to occur will be included in both management and emergency plans prepared for the Project to reduce the risk of these impacts occurring and to minimise any impacts on the environment should such an event occur.

19.11 Proposed monitoring

All turbines will be monitored during operation to detect leaks etc. Where leaks are detected these will be repaired as required. No other monitoring is required as part of routine operation of the Project. However, in the unlikely event of a pollution incident, appropriate post incident monitoring will be implemented as required and agreed with the regulator and their advisors.

19.12 Summary and conclusions

An assessment has been carried out into the potential accidental and non-routine events that may occur as a result of the Project and the impact of these on a number of sensitive receptors as well as the quality and status of coastal waters off Torr Head in accordance with requirements of the Water Framework Directive (WFD).

The assessment covered all stages of the Project from installation and construction through to operations and maintenance and finally decommissioning. The worst case scenarios were considered for all potential impacts:

- Oil spills from vessels;
- Fluid leaks from TSS installation;
- Loss of inventory from HDD boreholes; and
- Leaks from the turbines.

A number of mitigation measures and management plans will be put in place to minimise the potential for these impacts to occur and in the event they do occur, measures to minimise impacts will be implemented in accordance with recognised guidance and best practice. All residual impacts on sensitive receptors and the quality and status of coastal waters off Torr Head are assessed to be not significant.

19.13 References

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