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C21 Decommissioning

C21.1 Introduction

The following chapter provides an overview of the potential environmental effects associated with the decommissioning of marine device installations. This section does not attempt to provide details of all the different techniques that could be applied to decommissioning as this can vary considerably on a case by case basis.

Decommissioning is the process whereby operation of a device ceases and the device is then removed from site, with any associated waste disposed of accordingly. Decommissioning also involves the notification and marking of any remains and future monitoring, maintenance and management of the site once decommissioning is complete. (DTI, June 2006)

C21.2 Background to Decommissioning

The legal requirement for decommissioning was introduced under the Energy Act 2004. This Act was introduced to respond to the UK's international obligations for decommissioning as set out under the United Nations Convention on the Law of Sea (UNCLOS). This requires abandonment and disused installation or structures to be removed to ensure safety of navigation, taking into account generally accepted International Maritime Organisation (IMO) standards that were adopted in 1989. (DTI, June 2006)

Relevant work was also undertaken under the OSPAR Convention, which guides international cooperation on the protection of the marine environment of the North-East Atlantic. OSPAR Decision 98/3 sets out binding requirements for the disposal of disused offshore oil and gas installations. Whilst there is no equivalent Decision for offshore renewable energy installations, OSPAR has produced guidance documents on offshore wind farms, incorporating ideas on their decommissioning.

Prior the introduction of the Energy Act 2004, developer decommissioning liabilities were met through compliance with The Crown Estates consenting process whereby provisions for decommissioning had to be set out in seabed lease applications. Developers were also expected to comply with decommissioning provisions set out under consents given under Section 36 of the Electricity Act. However, provisions to ensure that decommissioning was undertaken to the required standards were limited.

The Energy Act, places a legal obligation on developers to carry out decommissioning to the required standards and set out their financial provisions to ensure that decommissioning can be carried out appropriately. The Secretary of State can approve, modify or reject a programme, including any financial security provisions which the responsible person proposes to provide. The Secretary of State is required to review the programme from time to time. (DTI, June 2006)

The requirements of the new decommissioning scheme in Sections 105 to 114 of the Energy Act 2004, have to date, not been applied to any new installations. The Department for Trade and Industry (DTI) has recently produced guidance on the application of the Energy Act decommissioning scheme. This guidance document 'Decommissioning Offshore Renewable Energy Installations' sets out the scope of the decommissioning scheme, decommissioning standards, information on financial security, the process for submitting a decommissioning programme and what they should contain, residual liability and industry corporation and collaboration.

With regard to wave and tidal devices, the decommissioning scheme applies to all energy installations in territorial waters (whatever their generating capacity) that are not yet consented or operational.

C21.3 Decommissioning Standards

The DTI guidance sets out general requirements for the removal of installations. These requirements identify that to meet the UK's international obligations, decommissioning should ideally involve the complete removal of disused installations and structures to ensure that the marine environment can be used again for other purposes including safe navigation. However the guidance does recognise that in some situations complete removal of disused installations and structure may not be the best solution. Situations in which leaving devices in place or partially removing devices may be considered include:

- The installation or structure will serve a new use, such as enhancement of a living resource, or serves a purpose beyond that of renewable energy generation, and would not be detrimental to other aims such as conservation;
- Entire removal would involve extreme costs (although it is considered that design decisions should, as far as possible, result in installations that are affordable to remove);
- Entire removal would involve an unacceptable risk to personnel;
- Entire removal would involve an unacceptable risk to the marine environment;
- The installation or structure weighs more than 4000 tonnes in air (excluding any deck or superstructure) or is standing in more than 100m of water and could be left wholly or partially in place without causing unjustified interference with other uses of the sea.

In certain locations, though, the IMO standards specify than an installation or structure should be entirely removed (without any exception). These locations include 'approaches to or in straits used for international navigation or routes used for international navigation through archipelagic waters, in customary deep-draught sea lanes, or in, or immediately adjacent to routeing systems that have been adopted by the Organisation'. (DTI, June 2006).

The DTI guidance includes examples of objects that may be allowed to remain on or in the sea-bed or be only partially removed. However the list does not apply to all cases and is not exhaustive. Such examples include:

- Structure that serve a purpose beyond renewable energy generation e.g. breakwaters
- Foundations and structure below sea-bed level providing they are at a depth where they are guaranteed not be become uncovered by prevailing sea-bed conditions and currents
- Cables buried under the sea-bed providing that they are likely to be uncovered
- Scour protection materials providing they do not have detrimental effects on conservation interests, safety of navigation and other users of the sea.

The area of debris clearance should be decided on a case by case basis. (DTI, June 2006)

C21.4 Methods of Decommissioning

The main works required for decommissioning include:

- Structure/device removal
  - Deployment of vessels to transport machinery required to deconstruct devices and device components to land for appropriate disposal or recycling
  - Mechanical operations to remove devices/device components from the water
  - Mechanical operations to remove structures attached to the sea-bed
- Waste and debris clearance and disposal
- Sea-bed restoration
- Maintenance, monitoring and management of the sea-bed/site

A number of the main areas of work involved in decommissioning, and the scale of that work, is similar to the scale of works and mechanical operations undertaken during the construction and installation of the marine devices. Consequently, the effects of decommissioning on the marine environment are also similar.

The following section of this decommissioning chapter is split into two distinct parts:

- Part 1 – Potential of effects of decommissioning that are similar to installation effects
- Part 2 – Effects of removing structures that are attached to the seabed (mainly piles)

C21.5 Part 1: Effects of Decommissioning that are Similar to Installation

Table C21.1 below highlights the key similarities between the processes of device construction, installation and decommissioning and provides an overview of the effects that they have on the marine environment. Specific details of the potential environmental effects associated with decommissioning and installation that are identified in Table C21.1 are provided in the relevant SEA assessment chapters (C1 to C20) of the Environmental Report.

Table C21. 1: Similarities between decommissioning and installation

Development Phase	Potential Effect	Cause of Effect	Key Receptors and Reference Chapter
Installation Decommissioning (except piling)	**Marine Noise**	▪ Noise from vessels, construction/deconstruction activities and piling (installation only)	▪ Seals and cetaceans (Chapter C9) ▪ Birds (Chapter C8) ▪ Fish and Shellfish (Chapter C7)
Installation Decommissioning (except piling)	**Physical disturbance of marine species and other marine users**	▪ Physical presence of vessels and machinery/equipment used in the construction and removal of devices ▪ Noise from vessels, construction/deconstruction activities and piling (installation only)	▪ Seals (Chapter C9) ▪ Birds (Chapter C8) ▪ Fish and Shellfish (Chapter C7)
Installation Decommissioning	**Collision Risk**	▪ Collision with vessel used in transportation of devices or device components ▪ Collision with machinery and equipment used in the construction and removal of devices	▪ Navigation and shipping (Chapter 15) ▪ Seals and cetaceans (Chapter C9) ▪ Birds (Chapter C8) ▪ Fish (Chapter C7) ▪ Recreational cruisers (Chapter C16) ▪ Commercial fishing
Installation Decommissioning (except piling)	**Increased Turbidity**	▪ Sea-bed disturbance caused by the attachment and removal of devices from the sea-bed (piles (installation only), anchors, clump weights) and the installation of cables	▪ Seals and cetaceans (Chapter C9) ▪ Birds (Chapter C8) ▪ Fish and Shellfish (Chapter C7) ▪ Benthic Ecology (Chapter C6)
Installation Decommissioning (except piling)	**Disturbance of contaminated sediments**	▪ Disturbance of contaminated sediments caused by the attachment and removal of devices from the sea-bed (piles (installation only), anchors, clump weights) and the installation of cables	▪ Seals and cetaceans (Chapter C9) ▪ Birds (Chapter C8) ▪ Fish and Shellfish (Chapter C7) ▪ Benthic Ecology (Chapter C6)
Installation Decommissioning (except piling)	**Smothering**	▪ Smothering of species located on the sea-bed from the re-deposition of sediment disturbed during device installation and removal	▪ Benthic Ecology (Chapter C6) ▪ Fish and Shellfish (Chapter C7)
Installation Decommissioning (except piling)	**Species Displacement**	▪ Displacement of species due to disturbance caused by presence of and noise from vessels and machinery/equipment used in the construction and removal of devices	▪ Seals (Chapter C9) ▪ Birds (Chapter C8) ▪ Fish and Shellfish (Chapter C7) ▪ Wildlife Watching Industry (Chapter C16)

C21.6 Part 2: Effects Associated with the Removal of Structure from the Seabed

In addition to the information presented in Table C21.1, the key aspect of decommissioning that requires assessment out with installation is the removal of structures that are attached to the seabed.

C21.6.1 Removal of Structures Attached to the Sea-Bed

There are four main methods used to attach devices to the sea-bed. These all vary in terms of cost and difficulty of installation. In descending order of installation difficulty these include:

- Piling
- Gravity bases
- Anchors
- Clump weighs

Each of these methods of attachment to the sea-bed has different requirements in terms of their removal and consequently different effects on the marine environment. A description of these removal techniques and associated environmental effects is provided below:

C21.6.2 Piled Devices

As with installation, the devices that using piling as the method of attached to the sea-bed are also the most difficult to remove once they have reached the end of their useful life. At the time of writing there was only one known piled wave device, although there are a number of tidal devices that use piles, the majority of which are set on mono-piles. The piles used to secure and mount commercial scale renewable devices are approximately 4m in diameter and are typically driven to some 20m below the sea-bed.

C21.6.3 Methods of Removal – Piled Devices

There are a two recognised techniques that can be used to remove a pile from the sea-bed:

- Cutting
- Pile excavation

C21.6.3.1 Cutting

This involves cutting a pile at the point at which it meets to sea-bed to enable its detachment. This is the least intrusive of the two methods and results in minimal disturbance to the sea-bed. The main issue associated with the cutting of piles is the potential for the section that is buried beneath the seabed to become uncovered. The potential for this to occur depends on sea-bed conditions and currents. Piles that protrude from the sea bed pose potential risks to navigation safety and can affect fishing (net entanglement) and other marine users.

C21.6.3.2 Pile Excavation

As mentioned previously, piles are often driven to 20m beneath the sea-bed. This makes their extraction very difficult. One technique that is used is to excavate the seabed around the pile to a depth from which the pile can be removed. This method is far more intrusive than the cutting approach but ensures that there are not future risks to navigation safety or other marine uses. The requirements of the DTI decommissioning scheme are to place a responsibility on the developer to ensure that they consider as part of the design process how a pile will be removed from the sea-bed at the end of the devices useful life.

C21.6.3.3 Other Techniques for Pile Removal

In addition to the approaches discussed above there is also the potential for using explosives to remove piles. In situations where excavation cannot be used to remove piles e.g. where sea-bed conditions and local marine geology make costs prohibitive, explosions have been identified as a possible alternative technique. However, this approach, whilst being potentially more cost effective is highly intrusive and is highly likely to have significant impacts on the marine environment. It is therefore considered likely that consent will difficult to achieve for projects which propose to use explosives as a means of decommissioning. The potential effects associated with the different techniques for pile removal are discussed in the following sub-section.

C21.6.4 Gravitational Bases

Gravity bases are widely used by a number of both wave and tidal stream technologies. By their very nature they are bulky and heavy, although some designs may be ballasted down after they have been set on the seabed. In size they may be 20m to 40m square or oblong with a variable aspect ratio from device to device.

Good design of gravity bases involves the inclusion of features that will assist their removal at the end of their useful life. For example, they may be designed with internal piping installed that enables connection of an air pump to jet out the mud below the gravity base and allow it to be lifted more easily for removal.

C21.6.5 Anchors

A large proportion of wave devices and a small number of tidal devices are moored with anchors attached to chains or wires. In terms of the removal of these attachments, it is very similar to the process used when raising a ships anchor. The potential effects of these methods of attachment, and their removal, on the marine environment are limited to very small, localised areas of seabed disturbance, and are considered to be of negligible significance.

C21.6.6 Clump Weights

Clump weights vary from steel blocks at the smaller end of the size range to fabricated steel baskets that are loaded with large link chain to provide weights of several tonnes. The level of seabed disturbance associated with these attachments, and their removal, is similar to that for anchoring and is incurred only in the areas where the weights are placed.

C21.6.7 Environmental Effects Associated with the Removal of Structure Attached to the Seabed

The following section provides an overview of the potential effects associated with the removal of piles and gravity bases. The effects of removing anchors and clump weights are likely to be negligible and are therefore not discussed in detail in this section. The main potential effects of the removal of piles and gravity bases using the techniques identified above include:

- Noise
- Physical disturbance
- Species mortality
- Habitat loss
- Collision risk
- Increased turbidity
- Disturbance of contaminated sediments
- Smothering

Unless stated otherwise, all potential effects of the removal of piles from the sea-bed on the marine environment are either temporary or short term (3 to 4 months).

C21.6.7.1 Noise

There is potential for all techniques of pile removal to generate noise. In terms of the two recognised methods of pile removal, excavation activities are likely to create higher levels of noise than cutting, although this will depend very much on the techniques used.

Noise generated by activities involved in the removal of piles from the sea bed can cause both acoustic disturbance and have physiological impacts. In terms of acoustic disturbance this can affect the behaviour of marine mammals (e.g. feeding, breeding, and social interaction) by interfering with communication calls or masking prey signals. Noise can also affect marine birds whilst underwater, causing them to become disorientated and affecting their foraging success (Chapter C8: Birds). With regard to fish, noise is thought to be associated with alarm calls and social behaviour by stimulating avoidance or attraction reactions (Chapter C7: fish and shellfish). The potential physiological effects of marine noise range from slight hearing damage to damage of internal organs depending upon the pressure levels generated.

Although not a recognised or promoted method of pile removal, the use of explosives is likely to generate very high levels of noise. Information presented in Chapter 9: Marine Mammals identifies that seals and cetaceans can potentially hear noise from piling activities up to a distance of 80km. The levels of noise generated by explosives are likely to be much greater than those produced during piling and therefore could potentially cause acoustic disturbance over a much wider area. Precise details on noise generation from explosions are unknown.

Continuous acoustic disturbance or high pressure noise e.g. explosions, can lead to species displacement. This can potentially increase population pressures in other locations and force species into the habitats of predators. This applies to marine mammals, sea birds and fish. The displacement of fish, marine mammals and birds could also have an indirect effect on the commercial fishing industry and the wildlife watching industry.

C21.6.7.2 Physical Disturbance

As with installation, the presence of the vessels and machinery involved in the removal of the piles can potentially disturb marine mammals, sea birds and fish. For example there is potential that hauled out seals can detect the presence of vessels at a distance of up to 1500m and vessel situated less than 900m from seal haul out sites are likely to evoke a flight reaction amongst the seals. This is of particular importance during the breeding season as seals exhibiting flight reactions could temporarily abandon their young, leaving them vulnerable to prey (Chapter 9: Marine Mammals).

In terms of sea birds, disturbance associated with the decommissioning activities can lead to the avoidance of affected area. This can have implications on foraging and breeding success, and can place stress on individuals and energy budgets. Whilst the source of the impact – the decommissioning activities is temporary in nature, it is recognised that disturbance may have longer term effects on bird populations if breeding is disrupted or if disruptions to feeding have fitness impacts. (Chapter C8: Birds)

Prolonged or high levels of disturbance can, in some cases lead to species displacement which can have adverse effects on breeding successes and population dynamics of both marine mammals and seabirds. As with the effects on noise, the displacement of fish, marine mammals and birds could also have an indirect effect on the commercial fishing industry and the wildlife watching industry (Chapters C10: Commercial Fisheries and C16: Recreation and Tourism).

C21.6.7.3 Species Mortality

There is a possible risk that, in the absence of appropriate mitigation, the use of explosives to remove piles can lead to the mortality of marine mammals (particularly seals and cetaceans), marine birds, fish, shellfish, and other protected species. The potential for the use of explosives to have a major significant adverse impact on the marine environment is a key consideration in appropriateness of using this technique for the removal of piles.

C21.6.7.4 Habitat Loss

Both the excavation of piles and use of explosives are likely to result in habitat loss, specifically benthic habitats, due to sea-bed disturbance. The significance of any effects of habitat loss on benthic ecology will depend upon the location of the devices and proximity to sensitive habitats and habitats of high value. The excavation of piles and use of explosives could also results in the temporary loss of fish spawning areas and shellfish habitat.

C21.6.7.5 Collision Risk

The presence of vessels and machinery involved in the removal of the piles pose a possible risk in terms of collision. This is likely to affect shipping and navigation (Chapter C15), commercial fishing activities (Chapter C10), recreational sailing (Chapter C16) and also poses a risk to seabirds, marine mammals and basking sharks (Chapters C7, C8 and C9).

Shipping collision is a recognised cause of marine mammal mortality worldwide, the key factor influencing the injury or mortality causing collisions being ship size and ship speed. Ships travelling at 14 knots (~7 m.s-1) or faster are most likely to cause lethal or serious injuries. (Chapter C9: Marine Mammals). Vessels involved in the removal of structures from the sea bed are likely to be either stationary or travelling considerably slower therefore the risk of collision is likely to be lower than that posed by commercial shipping activities.

Existing evidence from collisions with shipping activity indicates that whilst birds are generally more manoeuvrable than marine mammals they may also be at risk of collision with vessels and machinery involved in the removal of piles, especially at night. Collision can typically occur in two situations – flying birds colliding with the surface structures of ships or ships colliding with birds rafting on the surface. As with marine mammals, the vessels involved in the removal of structures from the seabed will either be stationary or travelling considerably slower than commercial ships. The risk of collision is therefore expected to be lower. (Chapter C8: Birds).

There is a risk that in cutting the piles to remove them from the seabed, the section that remains below the seabed will over time start to protrude above the seafloor, due to changes in seabed conditions and tidal currents. Any unmarked structures on the seafloor present a safety risk in terms of shipping and navigation. Protruding pile sections can also cause problems to commercial fishing due to nets being snagged or becoming caught up on the structure.

C21.6.7.6 Increased Turbidity

Activities involved in the excavation of piles from the sea-bed could potentially lead to the disturbance and subsequent suspension of high quantities of fine particles (sediment). This can reduce visibility, affecting the foraging and social activities and predator/prey interactions of a number of marine species including marine mammals, fish and sea birds. However, given that the wave and tidal turbines will be placed in high energy environments, it is likely that any suspended sediment released into the water column will be rapidly dispersed. (Chapter C9: Marine Mammals). However, depending on the techniques used and the sensitivity of marine mammals, fish and seabirds to reduced visibility, these effects could still be of minor to moderate significance.

Explosions are likely to generate high levels of suspended sediment. Depending upon the force of the explosions, the area over which the sediments are dispersed could be quite extensive and could therefore have significant effects on the wider marine environment. The cutting of piles is likely to have a negligible effect on sediment suspension and turbidity. There is potential that the techniques involved in the removal of gravity bases could also affect turbidity when the mud/sediment is pumped out of the base to aid its removal.

C21.6.7.7 Disturbance of Contaminated Sediment

Both the excavation of piles and the use of explosives will result in disturbance of the sea-bed and will therefore have the potential to disturb contaminated sediments. Further information on the potential effects associated with contaminated sediment is provided in Chapter C2: Seabed contamination and water quality.

C21.6.7.8 Smothering

Excavation activities and the use of explosives could lead to the smothering of fish spawning habitat, shellfish habitat, and benthic and intertidal habitats within the immediate vicinity of the devices and decommissioning activities. This is due to the fact that the coarser fraction of the sediment that is disturbed is likely to be re-deposited on the seabed within about 50m of the works. (Chapter C7: Fish and Shellfish). The significance of these effects depends upon the sensitivity of the different species of fish and shellfish and benthic habitats to smothering. The relative sensitivities are discussed in detail in Chapters C6 and C7.

C21.6.8 Summary of Environment Effect Associated with Pile Removal

Table C21. 2: Summary of Effects Associated with Pile Removal

Potential Effect	Cause	Description	Scale/level of effect
Noise	Noise generated by: ▪ cutting of piles ▪ excavation of piles ▪ explosions	▪ Acoustic disturbance amongst marine mammals, sea birds, certain protected species and fish ▪ Physiological damage to marine mammals, basking sharks ▪ Effects on commercial fisheries and wildlife watching industry from the displacement of fish, marine mammals and seabirds due to impacts from noise	▪ Noise levels and area affected increases from low (cutting of piles) to very high and extensive (explosions)
Physical Disturbance	Physical presence of, and noise from, vessels and machinery used in removal of piles Seabed disturbance/ Excavation	▪ Disturbance of marine mammals, seabirds and fish ▪ Loss of benthic habitats, fish spawning habitats and shellfish habitats from pile excavations and explosions ▪ Effects on commercial fisheries and wildlife watching industry from the displacement of fish, shellfish, marine mammals and seabirds	▪ The effects of disturbance increase during seals breeding season and in foraging hotspots ▪ Levels of seabed disturbance, and area affected increases from low (cutting) to very high (explosions).
Species Mortality	Loss of species due to explosions	▪ Marine mammals, birds and fish could be killed if caught by debris and shock waves generated by explosions.	▪ The number of individual marine mammals, fish and birds affected will depend on the size of the explosion and its location.
Habitat Loss	Loss of habitats due to seabed excavations and explosions	▪ Loss of benthic and intertidal habitats, key fish spawning habitats and shellfish habitats ▪ Effects on commercial fisheries due to the displacement of fish and shellfish as a result of habitat loss.	▪ Area of seabed affected, and habitats affected increases from moderate (excavations) to very high (explosions)
Collision Risk	Risk of collision with vessels, machinery involved in pile removal and with protruding parts of cut piles.	▪ Risk of birds, marine mammals, ships, fishing boats and recreational boats colliding with vessels and machinery involved in removal of piles ▪ Collision risk associated with protruding parts of cut piles ▪ Risk of fishing nets being snagged/caught on protruding part of cut piles.	▪ Most effects will be localised and temporary ▪ Effects associated with protrusion of cut piles will potentially be long term but still very localised.
Increased Turbidity	Sediment suspension caused by excavations, explosions and removal of gravity bases	▪ Reduced visibility caused by turbidity can effect foraging, social activities and predator/prey interactions of marine mammals and seabirds and fish ▪ Increased turbidity can also affect recreational diving activities	▪ The area effected, and levels of turbidity range from low (pile cutting and gravity bases) to very high explosions
Disturbance of Contaminated Sediment	Disturbance of contaminated sediment due to seabed disturbance from excavations and explosions	▪ Potential water pollution caused by release of contaminants ▪ Potential effects on health of marine wildlife (marine mammals, seabirds, fish, shellfish, benthic habitats)	▪ Extent of effect depends on the area of contaminated sediment affected, the nature of the contaminants and the sensitivity of marine wildlife to the contaminants
Smothering	Sediment disturbance caused by excavations, explosions	▪ Smothering of fishing spawning areas, shellfish and benthic habitats caused by the resettlement of suspended sediment	▪ Effects depends on area of seabed disturbed and quantities of suspended sediment produced

Table C21.2 above presents a summary of the potential effects on the marine environment associated with the removal of piles from the seabed during decommissioning. These effects are purely generic and, due to the strategic nature of this study; do not include any information about the sensitivity of key receptors to certain effects and the significance of the effects. Specific details about receptor sensitivity and significance of the effects (potential and residual) arising during the installation and operation of the devices are presented in the relevant assessment chapters.

The key chapters for reference include:

- Chapter C5: Protected Sites and Species
- Chapter C6: Benthic and Intertidal Ecology
- Chapter C7: Fish and Shellfish
- Chapter C8: Birds
- Chapter C9: Marine Mammals
- Chapter C10: Commercial Fisheries
- Chapter C15: Shipping and Navigation
- Chapter C16: Recreation and Tourism
- Chapter C17: Noise

C21.7 Mitigation Measures

Whilst, this chapter does not provided detail on the sensitivity of receptors and the significance of the effects, it does identify key mitigation measures that could be implemented to avoid or reduce the potential effects associated with the removal of piles from the seabed. These mitigation measures are summarised in Table C21.3 below. Topic specific mitigation measures are presented in the chapters listed above.

Table C21. 3: Possible Mitigation Measures

Potential Effect	Mitigation Measures
Noise	▪ Avoid sensitive times of year e.g. breeding seasons ▪ Implement marine mammal 'watching' brief during pile removal so that works can be halted when marine mammals, and sensitive birds, are in area affected by works
Physical Disturbance	▪ Avoid sensitive times of year e.g. breeding seasons ▪ Implement marine mammal 'watching' brief during pile removal so that works can be halted when marine mammals, and sensitive birds, are in area affected by works
Species Mortality	▪ Avoid sensitive times of year e.g. breeding seasons ▪ Implement marine mammal 'watching' brief during pile removal so that works can be halted when marine mammals, and sensitive birds, are in area affected by works
Habitat Loss	▪ Apply least invasive techniques or techniques that will result in minimal habitat disturbance
Collision Risk	▪ Avoid sensitive times of the year e.g. breeding seasons ▪ Increase device visibility ▪ Use protective netting or grids ▪ Do not undertake decommissioning activities at night when birds are more vulnerable to collisions
Increased Turbidity	▪ Release sediment in appropriate tidal conditions to minimise effects ▪ Carry out work in appropriate tidal conditions to minimise effect
Disturbance of Contaminated Sediment	▪ Carry out work in appropriate tidal conditions to minimise effect
Smothering	▪ Avoid sensitive times of year e.g. fish spawning

C21.8 Summary

The main focus of this chapter was to strategically assess the effects that device decommissioning would have on the marine environment. The section has focussed on the impacts of pile removal, as whilst it is not the only component of decommissioning, all other potential effects on the marine environment can be assessed in the same context as device construction and installation, as illustrated in Table C21.1. All effects associated with decommissioning that are similar to device installation are discussed in detail in the relevant SEA assessment chapters (C1 to C20).

The information presented in this chapter identifies that, potentially, the most significant effects associated with the removal of piles during decommissioning will be caused by the excavation of piles from the seabed or the use of explosives.

The use of explosives, by their very nature, is likely to have major effects on the marine environment. These potential effects include possible marine wildlife mortality caused by debris and explosion shock waves, physiological damage to marine mammals, basking sharks and birds caused by high sound pressure levels (expressed as dB re 1µPa for underwater noise), high levels of physical disturbance over a large area, high levels of seabed disturbance and resulting habitat loss over a large area and significant increases in turbidity. It is highly likely that explosions could lead to the long term or permanent displacement of marine species, which will affect population dynamics and predator prey relationships elsewhere in the study area.

For the reasons identified, it is unlikely that explosions will be used to remove piles from within the study area.

The two recognised techniques for pile removal include cutting and the excavation of piles. This high level assessment has identified that excavation activities will remove the seabed from the vicinity of the pile. The size of the area affected will depend on the size of individual piles and the depth to which they were buried, the number of piled devices that are in an array and the area of seabed covered by that array. Seabed removal would result in the temporary loss of any benthic habitat present in the vicinity of excavation operations. Depending upon the types of habitats affected e.g. key fish spawning habitats, shellfish habitat or protected benthic habitats, these effects could potentially be of major significance. The excavation of piles is also likely to result in increased levels of suspended sediment/turbidity which could reduce visibility for seals and seabirds, affecting their ability to forage and interact.

The cutting of piles is likely to have minimal effects on the environment, providing that the pile is cut at a sufficient enough depth beneath the seabed to prevent any remaining structure from protruding above the seabed in the future. Any unmarked structures that protrude from the seabed pose a safety risk in terms of navigation and shipping and can damage fishing nets.

At the time of writing this report, marine renewables were still in the relatively embryonic stages of development. This needs taking into account in terms of decommissioning, as there is a possibility that, in the future, the piles and other structures used to attach devices to the seabed could be reused for new devices (either new technology or general upgrades). This would be a favourable situation as it would reduce the need to remove structures and piles from the seabed, thus avoiding any adverse environmental effects, and it would also reduce the potential cumulative effects of developing the marine energy industry as existing sites could be reused reducing the pressure upon new, undeveloped marine areas. Section D of this SEA looks in more detail of the potential cumulative effects associated with the growth of the marine energy industry.

References

1. DTI, June 2006. Decommissioning Offshore Renewable Energy Installations: Consultation on guidance relating to the statutory decommissioning scheme for offshore renewable energy installations in the Energy Act 2004.