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ENVIRONMENTAL IMPACT REPORT – The NEMO LINK

NON-TECHNICAL SUMMARY

Elia Asset SA

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Non-technical summary – The Nemo Link

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NON-TECHNICAL SUMMARY

The Nemo Link

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1 PURPOSE AND PROPOSED ACTIVITY

National Grid Nemo Link Limited and Elia Asset SA intend to connect the high voltage grid systems of the United Kingdom and Belgium through an electrical interconnector with an approximate capacity of 1,000 MW, the Nemo Link-project. The power would be able to flow in either direction at different times, depending on the supply and demand in each country. This system provides a rapid response to changes in electrical power production, where the power flows can be adjusted in a short time.

Initiators of the entire Nemo Link-project are National Grid Nemo Link Limited and Elia Asset SA. The applicant for the permits for the section of the route of the HVDC interconnector located in the Belgian part of the North Sea, is Elia Asset SA.

In order for the environmental interests to be taken fully into account in the license granting, an environmental impact report (EIR) has been drafted. This EIR will be used to underpin the consents process and describes the construction, exploitation and dismantling of the HVDC interconnector for the Belgian Part of the North Sea (BPNS). For those parts located in British and French waters, the environmental impacts are described in separate reports. The coastal zone, inland from the MLLWS (mean low low water spring line), is under regional (Flemish) authority, including environmental protection. This has the consequence that the scope of this EIR is limited to the marine areas (i.e. from the mean low low water spring line).

2 PROJECT DESCRIPTION

2.1 General description of the activity

Overall, the activities of the project are defined as follows:

- The study phase (2006 → 2014):
  - Realization of a feasibility study to identify all potentially suitable routes between the United Kingdom and Belgium (2007);
  - Route-engineering study using a desktop study and a marine survey;
  - Engineering of the interconnector;
  - Consult with licensees of crossing cables and pipelines to obtain 'letters of no objection';
  - Drawing up the EIR and permit applications;
  - Completion and signing of 'crossing agreements' with licensees of crossing cables and pipelines;

- The construction phase (2014 → 2017):
  - The installation of the cable system is preceded by some preparatory work:
    - Potential local removal of out-of-service telecommunications cables that cross the cable route;
    - Deposit of protective measures, bridging and separation structures at crossings of the interconnector with present cables and pipelines;
    - Local leveling or 'pre-sweeping' of the route, with local removal of sand waves;
    - Clearance of the seabed, to expose and remove undetected obstacles before the cable is unrolled.

- Offshore installation of the interconnector, consisting of two operations: unrolling & laying the cables and burying the cables. These two operations are performed simultaneously or not;
- Offshore connection between the cable sections;
- Landfall installation.

The start of the work depends on several factors including the delivery of the cables and the availability of ships. In general, installations in European waters are typically undertaken in the summer season, broadly between April and October. This period is determined primarily by the high probability of adverse weather occurring outside of this period. The duration of the offshore construction works of the interconnector in Belgium is estimated at approximately 2 months.

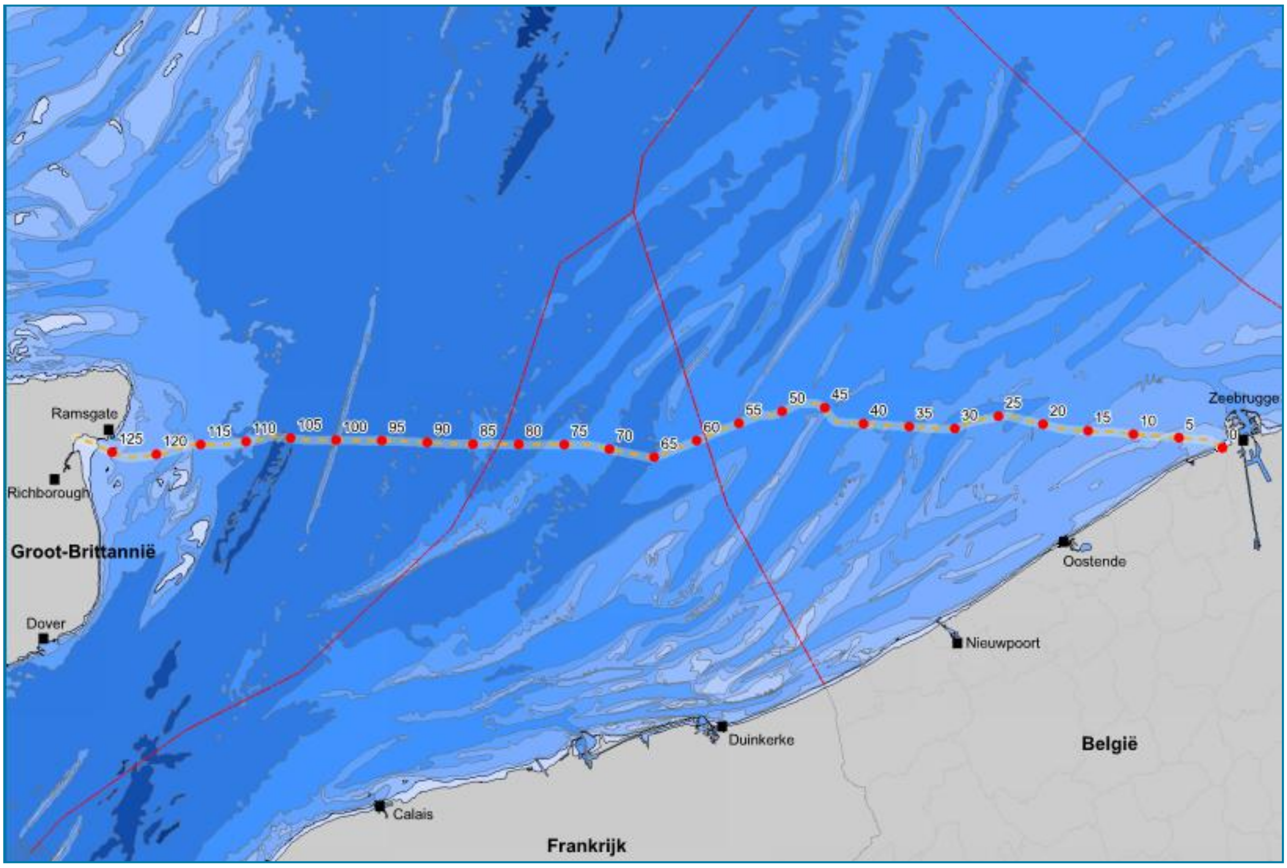
- The operational phase (2017 → 2036):
  - During the operational phase, electrical power flows from the Belgian high voltage grid system to the British high voltage grid system, or vice versa;
  - Regular preventative maintenance and inspection will be performed in order to keep the installation in optimum condition and to avoid interferences;
  - If necessary repair work will be performed;
  - After the operating period, which is set at 20 years, a renewal of the permits will be requested. Otherwise, the cables will be taken out of use (decommissioning phase).

- The decommissioning phase:
  - Currently it is not yet certain whether the interconnector, after it has been taken out of use, will remain in situ or will be removed.

2.2 Location of the cable route

The location of the HVDC interconnector between the United Kingdom and Belgium (shortly: Nemo Link) is shown in the figure below. The cable runs from Richborough (UK) to Zeebrugge. A French section of the North Sea is also being crossed.

The cable route was initially established on the basis of a feasibility study, at which the route between Richborough (Kent) and Zeebrugge West was identified as the most suitable route between the United Kingdom and Belgium, mainly because of availability of land (including for the construction of a new converter station), length of the cable route and licensing and permit issues. Subsequently, a preliminary route engineering study was carried out to identify the most suitable offshore cable route between Richborough and Zeebrugge. The route engineering study consisted of a desktop study, at which existing data and knowledge of the proposed cable route were studied and analyzed, and a marine survey, in which certain aspects on site were verified (mainly geophysical, geotechnical and limited benthic features). Where necessary, adjustments to the route were carried out to mitigate potential impacts or risks in order to minimize both cable and installation costs and disruption of the marine ecosystem and its users. In the present EIR, the cable route resulting from the route engineering study is considered.



2.3 Description of the cable system

2.3.1 System: bipolar direct current connection

For the interconnector between UK and Belgium the HVDC (High Voltage Direct Current) technology will be used. The portion situated in the Belgian Part of the North Sea, is about 59 km long. The base case of the interconnector between UK and Belgium is a bipolar HVDC system, with an approximate capacity of 1,000 MW. Bipolar systems transmit power through two high voltage conductors of opposite polarity (e.g. +500 kV and -500 kV). These cables each have a diameter of approximately 150 mm and a conductive copper or aluminum core surrounded by electrical insulation and protective coating. In the base case of the interconnector between UK and Belgium the two cables are bundled together and installed in the same trench. Other configurations are not excluded (see 'Alternatives').

The cable system is buried up to a depth of 1 to 3 m, depending on local soil properties. Burying too shallow can over time lead to exposure of the cables, while burying too deep can impede heat dissipation. The soil conditions also affect the burial depth in another way: a stable soil (e.g. clay) requires less burial depth than for example a sandy soil to maintain protection of the cable. Moreover, for the determination of the buried depth, the guidelines developed by Maritime Access (Department of Transport and Public Works) and other competent authorities shall also be taken into account. In case suitable burial depth can't be reached, it may be necessary to provide additional protection from anchors and fishing activities.

The subsea cable system is jointed to its corresponding land cable in a joint pit located above mean high water mark. To connect the interconnector, that uses direct current, and the high voltage grid systems of National Grid and Elia, that both use alternating current, HVDC needs to be converted to HVAC in a converter station, both in Belgium and the UK. On the Belgian side, a new converter station will be built in Zeebrugge.

2.3.2 Cable type

Several types of electrical insulation for the cables exist. In the base case of the interconnector between the UK and Belgium the mass-impregnated (MI) cable is used. The MI cable has one copper or aluminum core surrounded by layers of paper that serve as electrical insulation. The paper layers are impregnated with high viscosity mineral oil. The core is contained in a lead sheath to protect the insulation from water ingress and a polyethylene sheath is extruded over this to protect it from corrosion. One, and sometimes two, layers of galvanised steel armour wires are applied in a helix to provide mechanical strength during cable handling and installation and protection from external damage. The armour wires are bedded into a layer of bituminised jute strings and a layer of polypropylene string is applied over them to bind them in and provide abrasion resistance and to improve handling. Such cables have a diameter of approximately 150 mm.

2.3.3 Electromagnetic fields, induction phenomena and heat

Electromagnetic fields, induction phenomena and heat generation are some energetic aspects specific to submarine HVDC connections that will be discussed briefly in following paragraphs. Potential effects due to these specific energetic aspects are discussed in Chapter 4 (‘Description and evaluation of the environmental impact per discipline’) as well as non-specific environmental aspect related to the construction, operation and decommissioning of submarine HVDC connections (increased shipping, increased turbidity, etc.).

2.3.3.1 Electromagnetic fields and induction phenomena

An important characteristic of high voltage cables in operation is the production of electromagnetic fields. When an object is subject to high-voltage, such as a conductor, an electric field around that object will be created. Field strength increases with increasing voltage. A magnetic field is created when current flows through a conductor. The strength of this field is determined by the current.

The electric field of the interconnector is almost completely shielded by the lead sheath and other external metallic components of the cables. Magnetic fields on the other hand are able to pass through most materials.

The magnetic fields around the individual cables can be largely neutralized by installing the two cables of the bipolar system close together. By the opposite flow direction of both individual cables, both magnetic fields will also be opposed so that they cancel each other largely. The smaller the distance between both cables, the smaller the resulting magnetic field.

Burying the cable does not fully mitigate the magnetic field, but it can be assumed that exposure of organisms susceptible to magnetic fields will be greatly reduced by the creation of a physical barrier. Moreover, the field strength rapidly decreases with distance from the cables.

Because seawater flows through the magnetic field of the cable, induced electric fields arise. However these induced electric fields are very small. Especially when magnetic fields are largely neutralized by bundling of the cables and with a buried depth of 1-3 m, the induced voltages in the seawater will be negligible.

2.3.3.2 Heat generation

In transporting electrical energy, losses occur as a consequence of the internal resistance in the conductor. The energy that is lost is converted primarily into heat. The amount of heat that is released is small and is determined by the cable system (DC or AC, mono-or bipolar, bundled or not, insulation type, thickness and material of the conductor, depth at which the cable is laid), the voltage and the characteristics of the environment (thermal conductivity and resistivity) (OSPAR, 2009a).

3 ALTERNATIVES

3.1 To location of the route

The cable route was initially established on the basis of a feasibility study in which a detailed comparison and assessment of the possible routes and landing points was performed, and which showed that the route between Richborough (Kent) and Zeebrugge West offers significant advantages. In a subsequent route-engineering study, the selected route was further optimized, in which the physical and biological aspects and aspects related to human activity were studied in more detail. It was attempted to outline the route so that both cable and installation costs and distortion of the marine ecosystem and it's users are minimized. Given the already very advanced optimization, no alternatives to the location of the route will be studied in the present EIR, and the one remaining route will be considered as the most suitable route.

3.2 To cable type

In the base case of the interconnector between UK and Belgium, the MI (mass-impregnated) cable type is used. Alternatively the XLPE type of cable can be applied. This type is made with extruded and cross linked polyethylene (XLPE) as insulation. XLPE cables are essentially structured similarly to MI cables, but XLPE serves as insulation instead of oil-impregnated paper.

XLPE HVDC cables are more robust compared with MI HVDC cables and can therefore better withstand the stresses of submarine installation. A disadvantage of XLPE cables is that there is no technology available yet for use at very high voltages such as +/- 500 kV DC. XLPE has already been applied up to 200 kV DC. New developments go in the direction of 320 kV DC.

3.3 To cable configuration

The base case consists of two cables that are bound together (bundled). The bundled cables are placed and buried together in one trench. This configuration can be considered as the technically and financially most feasible alternative.

An alternative cable configuration consists of an unbundled system, with a small installation distance of 0.5 to 2 meters between both cables. The cables are laid in one single operation and are buried simultaneously with one excavator in two narrow trenches (i.e. in one large, wide trench in which a partition between both cables is created).

If both cables are installed at more than 2 meters apart, two separate lay and burial operations will be required. The cables are then installed in two separate trenches. According to the safety regulations set out in annex of the Royal Decree of 12 March 2002, the distance between the two cables has to be at least 50 m in this case.

3.4 To offshore installation procedure

Installing the interconnector implies a combination of two operations: the unrolling and laying of the cables on the one hand and burying the cables on the other. Following alternatives to the offshore installation procedure are possible:

Burying the cable	Number of ships to deploy	Alternative
Simultaneously with unrolling and laying → one operation	1 → the cable laying vessel is provided with burial equipment	Alternative 1
	2 → cable laying vessel + separate vessel with burial equipment	Alternative 2
Non-simultaneously with unrolling and laying → two operations	2 → cable laying vessel + separate vessel with burial equipment	Alternative 3

The procedure ultimately used will depend on the contractor that shall carry out the installation of the Nemo Link, and the availability of vessels at this contractor.

3.5 To burial technique

A number of alternative methods are available for cable burial; however, the options are determined by the characteristics of the seabed into which the cables are to be buried. A combination of techniques is also an option. Most generic types of equipment for installing cables into the seabed are ploughs and jetting machines:

- Ploughing: with a plough a large trench is created in the seabed in which the cable can sink
- Jetting: jetting implies fluidization of the seabed to the appropriate burial depth with water jets. In this way, a trench is created in which the cable can sink.

3.6 To landfall technique

The landfall installation of the cable can be carried out with basically two techniques that optionally can be used in combination:

- Open cut trenching, with the use of mechanical excavators. This technique is applicable mostly above the high water line. When combined with a cofferdam, the technique can be used beyond the low water line;
- Horizontal directional drilling (HDD) implies drilling an underground borehole from the dry to a point in the direction of the sea. Then the cables are pulled through the borehole.

4 IMPACT DESCRIPTION AND ASSESSMENT

In this paragraph most important results of the impact assessment are summarized per discipline.

Given the difficulties to quantitatively describe certain effects, a semi-quantitative approach has been chosen. The effects are described as a relation between their size, their range (dimension) and their temporary or permanent character. The described effects are presented as a plus-minus assessment.

The following definitions have been applied:

Symbol	Definition	Description	Assessment environment/ organisms
++	Significant positive effect	Measurable positive effect, large range (BPNS[1]), temporarily or permanent character	Very positive
+	Moderate positive effect	Measurable positive effect, limited range (project area), temporarily or permanent character	Positive
0/+	Small positive effect	Measurable small positive effect, limited range (project area), always temporarily character	Neutral
0	(almost) no effect	Non-measurable effect or not relevant	No
0/-	Small negative effect	Measurable small negative effect, limited range (project area), always temporarily character	Negligible
-	Moderate negative effect	Measurable negative effect, limited range (project area), temporarily or permanent character	Acceptable
--	Significant negative effect	Measurable negative effect, large range (BPNS), temporarily or permanent character	Not acceptable

In the impact assessment distinction has been made between effects during construction, exploitation and potential decommissioning. Knowledge gaps and possible mitigating (effect reducing) measures have also been indicated. Attention has been given to both the negative and possible positive environmental effects.

In Chapter 3 several alternatives are described (for cable type, cable configuration, burial method...). In many cases these alternatives are not distinctive for their effects. Therefore, the various alternatives will only be discussed when a difference is expected in the relevant effects.

4.1 SOIL

4.1.1 Reference situation and autonomous development

The Nemo Link runs from Richborough (UK) to Zeebrugge. A French section of the North Sea is also being crossed. The interconnector enters the Belgian Part of the North Sea southwest of the 'Westhinder' sandbanks. Then the interconnector runs eastward, almost completely parallel to the northern boundary of the 'Vlaamse Banken' (KP[2] 15-58), and passes from west to east the 'Oostdijck', 'Buitenratel', 'Kwintebank',

[1] Belgian Part of the North Sea
[2] KP = kilometer point

‘Middelkerkebank’ and ‘Oostendebank’. The eastern part of the route (KP 0-15) crosses the area of the ‘Kustbanken’ near the ‘Wenduinebank’.

At several locations along the route various sand waves are located, rising up to 6 m above the surrounding seafloor. The sand waves are usually covered with smaller ripples.

The shallow geology (Quaternary and/or partially Tertiary) along the cable route is composed of sand with a thickness of 0 to 6 meters, on top of clay. Occasionally, a thin gravel layer was found on the sea floor (up to 37 cm).

The ‘Vlaamse Banken’ appear to be quite stable. For the autonomous development in the project area it can be assumed that it would undergo only few changes over the next few decades.

Due to climate change, changes will occur in the flow characteristics and the morphology of the Belgian Part of the North Sea (BPNS). Even within the period of operation changes will already be noticeable. Besides changes in the overall average values of sea level, temperature, etc., an increase in extreme climatic events is expected.

4.1.2 Impact description and assessment

4.1.2.1 Construction phase

Pre-sweeping involves local dredging of (tops) of sand waves and thin layers of sand, followed by the dumping of the dredged sand in the vicinity of the works or at the designated disposal sites for dredged material in the BPNS. It is estimated that an amount of approximately 100,000 m³ of sand shall have to be moved. This will include an increased turbidity and sedimentation in the vicinity of the works. Because of the limited volume of sand to be moved and because of the high mobility and dynamics that sand waves already naturally own, the impact of pre-sweeping on the soil is assessed as small negative (0/-).

At crossings with other cables and pipelines, protective measures and bridges are installed. In the Belgian Part of the North Sea five existing cables and one pipeline need to be crossed. In most cases, these protections are installed by placing special mattresses that are subsequently covered with rock armour to stabilize. The protective measures disturb the original geological structure. However, given the very limited size of the protective measures, this effect is very limited (0).

The thickness of the Quaternary cover along the route of the Nemo Link varies between less than 0.5 m and 17 m, so that the cables will be buried partially in Quaternary and Tertiary sediments. The degree of increase in turbidity and sedimentation here depends on the burial method. The effect of burial of the cables to the overall sediment transport, sedimentology and morphology of the seabed and the original geological structure is assessed as small negative (0/-). The nature and significance of the impact on geology are completely similar (not significant) for the various configuration options and burial techniques.

No effect (0) is expected on soil quality due to accidental discharges from ships and machinery during construction or due to loss of pollutants from the cables or from crossing infrastructures.

4.1.2.2 Operational phase

The HVDC interconnector between the UK and Belgium will be installed in such a way that the coverage of the cables will be guaranteed for the longest possible period. In addition, periodic inspection along the cable route is provided so that insufficient coverage of the interconnector can be noticed in time. The chance that the cables will become exposed is thus quite low. A possible effect due to local erosion at which the cables appear as obstruction on the seabed, is therefore assessed as small negative (0/-).

The scour protection applied at the crossings with other cables and pipelines minimizes the creation of extensive scour holes around the crossing infrastructure. The erosion shall move to the border area between the seabed and scour protection (secondary erosion). The effect of erosion near the crossing infrastructure is assessed as small negative (0/-).

As with the construction phase it is not expected that the operation will lead to contamination of the soil (no effect, 0).

It can be assumed that the increased temperature in the seabed decreases rapidly with the distance from the cables. On the basis of a study in the context of the Nemo Link-project it was calculated that at a cable depth of 3 m the warming-up at the surface would be less than one degree. Using a cable depth of 1 m, this could increase to a heating of the surface by 2 to 3° C. Given the limited volume of the seabed that therefore may be affected by the warming of the cables, the effect is considered negligible (0 / -), irrespective of the type of cable and the configuration alternatives.

4.1.2.3 Decommissioning phase

If the cables are removed, non-significant effects may occur, similar to the effects that will occur during the construction phase (0/-). If the cables are not removed, no effects occur (0). When removing protective measures and associated scour protection at the crossings with other cables and pipelines, the original geological structure and morphodynamics will be restored. In both cases, the impact on the soil is considered as very limited (0).

4.1.3 Mitigating measures

As no significant adverse effects are expected, no mitigating measures are required.

4.2 WATER

4.2.1 Reference situation and autonomous development

The project area, from the landfall in Zeebrugge to about KP 15, is determined by average water depths of 0 to approximately 10 m. At the rest of the route in the BPNS the average water depth is 20 to 30 m. The water level in the project area will vary by the tide (low tide, high tide) and under the influence of wave action and wind.

The currents of the North Sea water in Belgium mainly come from SW to WSW, driven by the tides and prevailing winds.

The turbidity or clarity of the seawater is determined by the amount of suspended (particulate) matter in the water. Satellite images that measure the amount of particulate matter in the upper water column, show a clear spatial variation in concentrations with a decrease from the Belgian coast into the sea. There is always a lower concentration at the sandbanks than near the coast (e.g. Zeebrugge, where the highest concentrations occur) because of the sandy sediment.

The mean water temperature in the BPNS is about 11 °C. Seasonal variations occur with a magnitude of 8 to 9 °C above the mean temperature.

For the project area it can be assumed that the natural concentrations of heavy metals in the water are relatively low. The main organotin compound is tributyltin (TBT). The 'Quality Status Report 2010' by OSPAR demonstrates that concentrations of certain hazardous substances in the seawater have decreased, although problems remain in many coastal areas. With regard to eutrophication, large areas of the North Sea coasts remain problem areas.

Due to climate change, changes will occur in the flow characteristics and chemical properties of the seawater. Even within the operation period changes will already be noticeable. Besides changes in overall mean values of sea level, temperature, etc., an increase in the occurrence of extreme climatic events is expected.

It can further be expected that the anthropogenic impact on water quality in the marine environment will continue to drop. For example, the concentrations of TBT, heavy metals, nutrient supply via rivers, etc., should show a positive downward trend in the future.

4.2.2 Impact description and assessment

4.2.2.1 Construction phase

During the construction phase an impact is possible on water quality resulting from pre-sweeping operations and from burying the cables, by release of heavy metals and organic pollutants from the sediment. As the pre-sweeping involves removal of coarse sediments with a low percentage of fine and organic material and consequently low concentrations of heavy metals, this effect can be regarded as a negligible (0/-). As the burial activities for the present project are very local, temporary and progressive in nature, this effect of burial of the cables is also assessed as negligible (0/-) (OSPAR, 2008).

During the construction phase, a local increase in turbidity will occur, primarily due to pre-sweeping operations and to a lesser extent due to the burying of the cables. Normally all works will be carried out in quiet (low flow) weather conditions, so when the natural turbidity is low. This also means that the sedimentation of the churned sediment will occur relatively quickly and within a small radius around the activities. It is expected that the concentrations of suspended material during construction activities shall occur in the same order of magnitude as the natural levels in stormy weather (Royal Haskoning, 2005; BMM, 2006a; OSPAR, 2008). The preparatory work and actual laying of the Nemo Link will have a local and temporary increase in turbidity with only a small negative effect (0/-), regardless of the burial method and the applied configuration alternative, especially compared to turbidity levels that naturally occur during storms and compared with dredging and commercial sand and gravel extraction operations that are already present in the BPNS (OSPAR, 2008). No long-term effect is expected.

4.2.2.2 Operational phase

No effect on water quality is expected (0) due to accidental discharge during inspection or repair work or due to the release of substances present in or around the cables.

The electric fields generated in the seawater are negligible (0/-), as the strength of the electric field caused by the cables decreases rapidly with distance from the cables and the cables are buried to a depth of 1-3 m, and especially when the magnetic fields are largely neutralized by bundling the cables.

No measurable increase in temperature of the seawater is expected (effect 0) due to heating of the cables.

Only if the cables over time would become exposed at a particular place, a local and temporary increase in turbidity can occur when re-burying the cables. This effect is negligible (0/-).

4.2.2.3 Decommissioning phase

The effects that may occur during the decommissioning phase shall be similar to those in the construction phase (slightly negative, 0/-, to nonexistent, 0).

4.2.3 Mitigating measures

As part of the overall safety system, there will be a clear procedure available which describes how and by whom actions are taken when an emergency should arises that could adversely affect water quality (e.g. oil spill) during the installation, operation or decommissioning.

4.3 CLIMATE & ATMOSPHERE

4.3.1 Reference situation and autonomous development

4.3.1.1 Climatic factors

Belgium generally has a temperate maritime climate. The maritime climate is characterized by relatively high rainfall and wind and small temperature variations between seasons. It has a cool summer and mild winter. The climate characteristics that prevail on land also largely prevail for the climate at sea. At sea however there is generally a more constant wind climate and a higher wind speed. At 10 km from the coast, the wind speed at sea can be 25 % higher than at the coast.

Following future climate changes are expected on a global scale (IPCC, 2007):

- During the next two decades a warming of 0.2 °C per decade is forecasted for many of the scenarios;
- The expectations of the average global warming by 2100 are highly dependent on the emission scenario considered; compared to the period 1980-1999, the expected warming is estimated at 1.8 [1.1 to 2.9] °C to 4.0 [2.4 to 6.4] °C (depending on the scenario);
- The average global warming 'in balance' expected at a doubling of CO_2 concentrations probably lies between 2 and 4.5 °C, with a best estimate of 3 °C. It is highly unlikely that the temperature rise will be below 1.5 ° C. A temperature rise far above 4.5 °C is not excluded.

- A sea level rise between 0.18 and 0.80 m (depending on the scenario) is expected by 2100 relative to the period 1980-1999.

4.3.1.2 Atmosphere

With respect to air quality following parameters are relevant: CO, NO_x, SO_2 and PM_{10} (dust). The air quality near the Belgian coast amply meets the quality objectives for these parameters.

For the autonomous development of the atmosphere it can be stated that the emissions that result from the construction, operation and eventual removal of the cable system will not occur. Therefore, there will be no temporary influence on the local air quality.

4.3.2 Impact description and assessment

4.3.2.1 Climatic factors

During the installation of the Nemo Link the global climate won't encounter relevant impacts (0). During the operation, the local temperature climate in the vicinity of the cable can be influenced by heating of the cables. It can be assumed that the heating of the cables will only cause a limited and very local warming of the sea floor, that is assessed as non-significant (0/-).

During the decommissioning phase, the global climate will encounter no relevant effects, whether the cable is removed or not (0).

4.3.2.2 Atmosphere

The installation of the cable system is associated with only a limited number of vessel movements, spread over a relatively long period. The channel between the UK and the mainland is one of the busiest shipping routes so it is expected that the emissions from vessels used during the construction phase of the Nemo Link only will have a negligible impact on local air quality (0/-).

During the operational phase limited emissions will occur due to inspection and maintenance and potential repair work. It is not expected that these limited emissions will have a noticeable impact on local air quality (0).

The impact on air quality resulting from emissions of vessels that would be used in the potential removal of the interconnector is similar as in the construction phase (negligible, 0/-).

4.3.3 Mitigating measures

Since relevant effects are expected neither the discipline atmosphere, nor for the discipline climatic factors, mitigation measures related to these disciplines are not applicable.

4.4 NOISE

4.4.1 Reference situation and autonomous development

The natural underwater background noise level lies between 90 and 100 dB (re 1 µPa) at frequencies ranging from 100 Hz to a few kHz. The noise of ship engines is one of the major noise sources of human origin. The noise and vibrations from the engine, propeller noise and noise from the currents cause an increase in ambient noise underwater. The channel between the UK and the mainland is in literature considered as a 'hot spot' for underwater noise, caused by the high density of shipping. Dredging, seismic investigation of the soil and piling in the construction of wind turbines are also major anthropogenic sources.

Above water, at sea level, the background noise level is estimated to be 35 + 5 dB(A).

Wind and waves dominate the noise level at the beach. According to data found in literature, it seems that near the shore the background noise level lies between 50 and 65 dB(A) at 25 m from the shoreline.

As far as noise is concerned, no significant change is to be expected in the autonomous development of the area from a global point of view. Though an increase of shipping on the route towards the ports of Zeebrugge and Oostende may cause an increase in the underwater and above water noise.

4.4.2 Impact description and assessment

4.4.2.1 Construction phase

The relevant noise sources that will occur during the construction phase, include vessels and machinery with their own characteristics and capabilities depending on the task for which they are used: specialized vessel for the installation of protective measures on existing cables and pipelines, rock dumping vessel, dredger, cable laying ship (equipped with an excavator), support ships.

Effects on the underwater sound

It is not expected that the activities during the construction phase, and the deployed ships and machinery, will produce sounds a high noise level, as is the case with for example seismic investigation or the 'impulsive' noise produced by piling monopile foundations for wind turbines. Noise produced during the construction phase of the Nemo Link will however often be similar to other already existing underwater noise of anthropogenic origin, such as dredging, sand extraction, etc. (OSPAR, 2008). Moreover, the channel between the UK and the mainland is considered as a 'hot spot' for underwater noise, caused by the high density of shipping. Therefore it is expected that the limited number of additional shipping movements and the activities for preparation work and installation of the Nemo Link (which are all temporary and progressive in nature), will cause no significant noise disturbance, regardless of the equipment used (small negative impact, 0/-).

Effects on the sound above water

Given the limited number of vessels to be deployed during the construction phase and as the installation works are progressive in nature, the increased noise above water is considered to be generally negligible compared to the normal shipping traffic (0/-), regardless of the equipment or type of cable laying ship used.

4.4.2.2 Operational phase

The presence of the Nemo Link will not result in noise production.

As can be assumed that the inspections and repairs to be carried out during the operational phase will occur rather sporadic and very locally, and as the noise from such works (worst case) will be similar as during the construction phase, the effect of noise disturbance during the operational phase both above and under water is assessed as negligible (0/-).

4.4.3 Mitigating measures

From the aspect of noise, no mitigating measures are considered necessary, as no significant noise disturbance due to the project is expected.

4.5 FAUNA, FLORA & BIODIVERSITY

The discipline Fauna and Flora deals with four different groups of organisms, namely the benthos (macro- and epibenthos), the fish, the birds (avifauna) and the sea mammals.

4.5.1 Reference situation and autonomous development

4.5.1.1 Benthos and fish

Marine organisms that live in or on the seabed, or benthos, are an important part of the food chain (dominant prey for demersal fish) and the ecosystem. They contribute to the biodiversity and the productivity of the sea. In this study we focus exclusively on the epibenthos (> 1 mm; on the seabed) and the macrobenthos (> 1 mm; in the seabed). Due to its limited mobility the presence of macrobenthos is an important indicator for the 'health' of marine systems. As regards the fish we focus only on fish living on or near the seabed (demersal fish) as they are the ones that will probably be affected most by the planned activities.

Four general occurring macrobenthic communities can be distinguished in the subtidal mobile substrates of the Belgian part of the North Sea, named after the most dominant species in the community. In between, another 6 transition-communities are identified. These are characterized by typical species, diversity and density and each are observed within a specific and well-defined environment.

Generally it can be assumed that the coastal zone is characterized by the *Macoma* and *Abra* community (De Backer *et al.*, 2010). The offshore samples are usually only characterized by *Nephtys* and *Ophelia* communities (De Backer *et al*., 2010). In addition, the samples in the coastal zone are generally characterized by a smaller grain size and a higher silt concentration than the offshore samples.

In the epibenthic communities significantly different density and biomass were observed between the coastal and the offshore zone, with significantly higher density and biomass in the coastal zone. With regard to species diversity, there are no significant differences between coastal and offshore.

Analogous to the epibenthos, the coastal zone is clearly richer in demersal fish (in biomass and density) than the more distant areas. Regarding species diversity, there is an overall increase from the coast further offshore, with the highest value at the 'Vlaamse Banken'. The main groups of demersal fish at the BPNS are the Perciformes (e.g. lesser weever, gobies…), the Pleuronectiformes (e.g. dab, plaice, sole…).

As regards the autonomous development it can be said that the benthic communities and the demersal fish fauna would not really change if the HVDC interconnector between the UK and Belgium would not be installed and operated. Other activities such as fishing, aggregate extraction, dumping, etc., can have a certain impact on the benthos and fish communities. Further it can be expected that the benthic and fish communities will undergo changes due to climate change (changes in flow characteristics, chemical properties of the sea water, temperature, storm frequency, etc.). At present there is still much uncertainty about the quantification of the impacts of climate change on the marine environment, especially on the scale of the BPNS. Moreover, the effects induced by climate change cannot always be separated from effects due to other human influences.

4.5.1.2 Birds

At the BPNS the highest densities of seabirds are reached in winter (average density of approximately 11.5 birds/km²) (Vanermen & Stienen, 2009). The species of seabirds occurring at the BPNS, can be divided into species that occur in the coastal zone and species that occur further offshore. Further from the shore the water is clearer, which for some seabirds is a condition to be able to catch prey, such as Common Guillemots, Auks and Northern Gannets. These species besides Red-throated Diver, Little Gull and Black-legged Kittiwakes appreciate the presence of sandbanks, because the concentration of food is apparently high. There are also true offshore species that rarely or never can be observed at the coast; these are Northern Fulmar and Great Skua. As regards the terns, Common Tern and Sandwich Tern forage near the coats mainly during breeding season, and especially around the ports of Zeebrugge, Oostende and Nieuwpoort.

The densities of Common Tern, Sandwich Tern and Little Gull are generally lower at the western part of the cable route than at the eastern part of the route. The highest densities are observed during the breeding season around the ports of Oostende, Zeebrugge and Heist, with highest densities located around the breeding colony of terns in the port of Zeebrugge.

If the Nemo Link is not installed, it can be assumed that the populations occurring on the Belgian part of the North Sea won't be affected in any way and consequently the ornithological value will remain the same.

4.5.1.3 Marine mammals

Until 2003 sea mammals were only sporadically observed during seabird counting in the BPNS. Since spring 2003, sea mammals are however increasingly found in the Belgian and Dutch part of the North Sea, whereby Harbour porpoises and White-beaked dolphins are the main species. This is probably not an actual increase in numbers, but a shift of the foraging areas of sea mammals from more northerly areas, although other reasons cannot be excluded (Courtens *et al*., 2006; Depestele *et al.*, 2008; Haelters & Camphuysen, 2009).

Due to the mobility of sea mammals, the large area in which populations occur and the unpredictable nature of their occurrence, it is currently very difficult to determine migration corridors or areas that are more or less important for sea mammals (Di Marcantonio *et al.*, 2007; Degraer *et al.*, 2009b).

Four sea mammal species are considered as indigenous in Belgium; the Common seal, Grey seal, Harbour porpoise and Bottlenose dolphin (Haelters, 2009; 2010). As the Harbour porpoise occurs in much larger numbers than the other sea mammal species in the BPNS and as the Harbour porpoise turns out to be very sensitive to disturbance, the focus for the impact assessment is set on the Harbour porpoise.

During migration a large part of the Harbour porpoise population of the North Sea uses the Belgian part of the North Sea. Therefore the Belgian part of the North Sea is considered as seasonal important for the Harbour porpoise within Europe, namely at late winter and early spring (February to late April), with densities between 2000-4000 animals throughout the BPNS (Haelters, 2009; Haelters & Camphuysen, 2009; Degraer *et al.*, 2010b; Haelters *et al*., 2011; Rumes *et al*., 2011).

If the Nemo Link is not installed, it can be assumed that the value of the route of the HVDC interconnector between UK and Belgium will remain the same. Apart from existing (semi)-natural fluctuations in marine mammals stocks (for example by changes in food availability, or by shifts in the wintering areas) there are no indications that significant changes occur in the area. The main threats to marine mammals are overfishing, incidental catch, pollution (including noise and waste), climate change and collision with ships.

4.5.2 Impact description and assessment

4.5.2.1 Benthos and fish

Construction phase

Both during the preparatory work and during the laying of the cables, temporary and local habitat disturbance will occur. Permanent habitat loss doesn't occur during both the construction and operation phase as the cables are laid completely into the soil at a minimum depth of 1 m and the benthic communities mainly occur in the first 20 cm of the soil. As the disturbance may be regarded as limited in size in comparison to the entire surface of the BPNS (i.e. 0.005 % to 0.034 % of the BPNS) and the work is temporary in nature, the effect of habitat disturbance on benthos is assessed as negligible, regardless of the applied burial method or cable configuration. It is assumed that after the work a natural recovery of the benthic community will occur. Moreover fish are mobile organisms, so the effect of habitat disturbance during the construction phase will be even less pronounced.

During some preparation work (leveling or pre-sweeping, clearance of the seabed) and during the laying of the cables increased turbidity and sedimentation will locally occur. As the present life community is well adapted to a sandy surface that is naturally in motion, given the high mobility of fish and given the limited size of the impact zone with increased turbidity and sedimentation (both in time and space), the impact is assessed as negligible, regardless of the applied burial method or cable configuration.

Also on the specific habitat type 'gravel beds' no significant impact is expected, as the 'Hinderbanken', where the most important gravel beds and valuable refugia are situated, are not crossed, since there is not an indication of the occurrence of valuable gravel beds along the route in the BPNS on the basis of the marine survey, and since there will be no removal of sediment in areas where gravel fields may be present. The exact location of the (valuable) gravel beds in the BPNS is nevertheless an important gap in knowledge.

During the installation of the cable, underwater noise disturbance will occur. Because of the temporary nature and the type of work (with no impulsive noise with a high sound level being produced), the effect of noise disturbance on epibenthos and fish fauna is assessed as slightly negative (0/-).

Operational phase

During the operational phase, a magnetic and induced electric field will be generated around the HVDC interconnector. The impact of electromagnetic fields on benthos is expected to be minimal as the electromagnetic fields created by the Nemo Link cable will be within the natural range of the North Sea. There is no doubt that the electromagnetic fields generated by the HVDC interconnector between the UK and Belgium can be detected by some fish. The sensitivity to electromagnetic radiation appears to be species-specific and likely even individual-specific (Gill *et al*., 2010). The occurrence of effects and the significance of these potential impacts at individual and population level is very uncertain, so that more fieldwork is required. All recent literature (Boehlert & Gill, 2010; Gill *et al*., 2009; Tasker *et al*., 2010; Wilhelmsson *et al*., 2010) indicate the impact of electromagnetic radiation on marine organisms as a gap in knowledge. Given the very local nature of the generated electromagnetic fields, as the field strength decreases rapidly with distance from the cables and as the exposure of organisms that are susceptible to electromagnetic fields is greatly reduced by burying the cables (which creates a physical barrier of some thickness), the potential negative effects are assessed as small negative (0/-).

When transmitting electrical energy, the cables itself and the surrounding seabed shall warm up. As most benthic organisms occur in the upper layer of the seabed (about 20 cm from the surface) and the temperature rise in the upper 20 cm is rather low, and as the potential effects will occur very locally, the effect of warming of the seabed on macrobenthos is assessed as small negative (0/-), regardless the chosen cable configuration (bundled or not) or the selected type of cable (XLPE or MI). Based on the fact that the temperature of the seabed at the surface remains unchanged by the rapid removal of heat due to the moving sea water, it can be concluded that there will be no effect (0) on epibenthos and fish.

As part of the operational phase regular inspection of the Nemo Link will take place. If damage is found or parts of the cable are exposed, they will be repaired and/or buried again. This work may cause a potential habitat disturbance and disturbance from sedimentation, but are temporary and limited in size, so the effects on benthos and fish as a result of this work can be regarded as negligible.

Decommissioning phase

If it is chosen to remove the cables, the effects during the decommissioning phase are expected to be of the same kind as those during the construction phase (small negative, 0/-). If the cables stay in the seabed, no effects on benthos and fish fauna shall occur (0).

4.5.2.2 Birds

Construction phase

During the preparatory work and actual laying of the Nemo Link, a local increase in water turbidity and an increased sedimentation may occur. Seabirds occurring at the BPNS are however accustomed to foraging in turbid water, and most species feed in the upper meters of the surface. Therefore, the effects of increased turbidity and sedimentation on avifauna are assessed as small negative (0/-).

Furthermore, the increased presence of vessels and machinery can cause a temporary disturbance of avifauna, especially at the landfall. Because of the proximity of the port of Zeebrugge, however, busy shipping is already present in the landfall area of the Nemo Link. This disturbance effect is therefore also assessed as negligible (0/-).

Operational phase

During the operational phase (repair or inspection work), no direct effects is expected on the avifauna present at the BPNS (0).

Decommissioning phase

If a dismantling is chosen at which the cables are re-excavated, the effects during the decommissioning phase are expected to be of the same kind as those during the construction phase (small negative, 0/-). If the cables stay in the seabed, no effects on the avifauna shall occur (0).

4.5.2.3 Marine mammals

Construction phase

Installation and preparation work can cause to disturbance of marine mammals by underwater movements, the presence of vessels (busy shipping traffic) and machinery, a change in water turbidity, noise, etc. Given the limited number of additional shipping movements compared to the current number of shipments already present in the BPNS (mainly near the shipping lanes), given the local and non-permanent effect of the installation and given the high mobility of marine mammals, no significant and long-term adverse effects in the form of disturbance (including noise) are expected due the installation of the HVDC interconnector between the UK and Belgium (BERR, 2008; OSPAR, 2008). It is expected that the noise will not affect the echolocation capabilities of marine mammals (DIFRES, 2000). Marine mammals shall probably temporary avoid the area of the construction activities and its surroundings. Given the preceding and very local nature of the cable installation activities, no impact on the migration movements of marine mammals is expected. Disturbance and other potential impacts resulting from construction work is assessed as small negative to negligible (0/- to 0).

Operational phase

The magnetic field generated by the Nemo Link could potentially interfere with the orientation mechanisms of sea mammals (BERR, 2008; OSPAR, 2008; Tasker *et al*., 2010). The strength of the electromagnetic fields generated decreases rapidly with increasing distance from the cables. As the cables are additionally buried up to a minimum depth of 1 m and as marine mammals do not have the habit to swim close to the seabed surface, it is very unlikely that marine mammals will be exposed to the electromagnetic fields generated by the cables. Therefore it seems unlikely that the electromagnetic fields generated by the Nemo Link cable will affect marine mammals (0).

When transmitting electrical energy, the cables itself and the surrounding seabed shall warm up. The temperature of the sea floor at the surface, however, will remain equal to the temperature of the seawater by the rapid removal of heat due to the moving sea water. Therefore, marine mammals won't be affected by the heating of the cables (0).

Inspections, maintenance or repair during the operational phase can disturb marine mammals. The effect of disturbance is considered as small negative (0/-) given its temporary nature, given the limited area on the Belgian part of the North Sea that will be affected and given the limited additional ship movements compared to the existing traffic in the Belgian part of the North Sea.

Decommissioning phase

If it is chosen to remove the cables when they are out of use, the effects during the decommissioning phase are expected to be of the same kind as those during the construction phase: there will be a slight, temporary and local disturbance of marine mammals (small negative impact, 0/-). If the cables are left in situ, there will be no effect at all (0).

4.5.3 Mitigating measures

Uncertainty remains about the exact location of (valuable) gravel beds in the Belgian part of the North Sea. A marine survey conducted in the summer of 2010 in the context of the Nemo Link-project along the proposed route of the Nemo Link, gives however no indication of the presence of valuable gravel beds and their associated fauna. This is in contrast to the British territory where this habitat type was found. Mitigating measures are therefore only proposed in the British part of the North Sea with respect to the gravel beds and their sensitive species (such as herring).

4.6 SEA SCAPE & CULTURAL HERITAGE

4.6.1 Reference situation and autonomous development

The sea and the beach are regarded as positive by the population. In Belgium the coast is an important tourist attraction, for day trippers as well as holiday makers. In contrast to the sea view, the coastal view in the inland direction is characterized by a range of high-rise buildings. Movement in the landscape by freighters, fishing boats, pleasure boats, surfers, etc., are part of the perception of the landscape for people on the dikes. Especially near the seaports there is a continuous coming and going of ships. A development that shall change the seascape in the future is the (further) construction of the currently permitted wind farms.

Along the coast there are many heritage sites, either protected or not. The most important ones are a number of dune areas and polders, piers, lighthouses, the fort of Napoleon, etc. At sea the cultural heritage consists mainly of wrecked ships. Several wrecks are located along the cable route.

4.6.2 Impact description and assessment

4.6.2.1 Construction phase

During the preparation work and the actual installation of the Nemo Link there will be a temporary visual change of the seascape due to passage of several vessels. The landscape at the landfall could also be altered temporarily. The perception of these activities can be assessed as negative (disturbance) or positive (touristic attraction). Because of the very temporary nature of the works the impact of the construction of the HVDC inter connector on the sea sight is assessed as negligible (0/-).

When setting out the cable route for the Nemo Link, avoidance of shipwrecks was used as a basic principle. For this purpose, the existing data of the location of shipwrecks was studied and taken into consideration. Then the position of the known wrecks along the proposed route has been verified using a Side Scan Sonar at the marine survey. With the Side Scan Sonar it was also possible to capture the location of yet unknown wrecks. So as avoidance of shipwrecks is pursued maximally, the effect on the maritime cultural heritage is limited to a minimum (0).

The construction of the HVDC has no direct or indirect impact on the cultural heritage along the coast from Knokke-Oostende (0).

4.6.2.2 Operational phase

Inspections along the cable route and possible cable repairs shall only slightly increase the shipping movements at sea and are of short duration. Therefore, the impact of the activities during the operational phase on the sea sight are assessed as practically nonexistent (0).

The operation of the Nemo Link will have no direct or indirect effects on the (maritime) cultural heritage (0).

4.6.2.3 Decommissioning phase

If the HVDC inter-connector is removed after the period of exploitation, the effects on the sea sight will be similar to those during the installation phase (negligible, 0/-). If it is chosen to leave the interconnector in situ, there are no effects at all on the sea sight (0).

In the preliminary investigation and during the installation of the Nemo Link, the location of all (possibly hitherto unknown) shipwrecks is identified. Therefore, possible removal of the cables will have no impact on the maritime cultural heritage (0). If it is chosen to leave the interconnector in situ after it has been taken out of use, there will also be no effects at all on the maritime cultural heritage (0). The cultural heritage along the coastline is not expected to be affected as well (0).

4.6.3 Mitigating measures

With regard to the sea scape it can be appropriate to inform the general public in advance, for example trough information panels at the dike, especially during the work in the intertidal zone and at the beach. In this way the acceptance of the temporary change in the landscape are strongly encouraged.

A general rule for the cultural heritage when constructing the interconnector is preferable avoidance of shipwrecks. If during the installation of the Nemo Link a wreck should still be 'discovered', the competent authorities must be informed as soon as possible, and avoidance of this wreck should be pursued as far as possible.

4.7 HUMAN ACTIVITY

4.7.1 Reference situation and autonomous development

4.7.1.1 Fishery

Most important species supplied are shrimps and demersale fish species, mainly sole, ray and flounder (Tessens & Velghe, 2010; Dienst Marien Milieu, 2009; Vanderperren & Polet, 2009). The intensity of the fishery (namely trawling) is carried out predominantly in the gullies between the sandbanks. Shrimp fishers on the other hand will look for their catch on the sand banks, mostly nearer the coast. On an international and national scale the fishing sector is faced with socio-economic problems by a steady decline of the existing biomass in the higher trophic levels in the North Atlantic since 1950 and increased fishing intensity during the 1950-1975 period. Researchers have found that the current fish exploitation cannot carry on and that the higher trophic level of fish in the North Atlantic will disappear completely in the next few decennia in view of present trends (Christensen *et al*., 2002). This is also evident from the fact that the stocks of nearly all species are specified as being 'outside safe biological limits'.

Developments in the European Fisheries policy lead us to believe that further quota restrictions and accompanying measures (such as technical measures and restricting the days at sea) will mean that the trends described above will only grow stronger in the short and medium term.

4.7.1.2 Shipping

The reference situation of the professional shipping is described in the chapter 'Safety aspects'.

4.7.1.3 Sand and gravel extraction

The exploration and exploitation of sand and gravel now takes place in three 'control zones' and one 'exploration zone'. The Nemo Link runs north of the control zones 2c and 2a, but stays outside of these designated areas. Control zone 2c is located outside 'Buiten Ratel' and 'Oostdyck' and is open for exploitation throughout the year. Division 2a is located on the 'Kwintebank' and is open for exploitation for a period of 3 years alternatingly with sector 2b (rotation system).

4.7.1.4 Military activities

The Nemo Link crosses any of the areas designated for military activities on the BPNS, but passes nearby two military zones:

- A relatively small military zone where war munitions and training mines are detonated. These activities occur ≤ 10 days a year on average.
- A zone in which shooting exercises are performed from the beach of Nieuwpoort - Lombardsijde towards the sea. The number of shooting days in this area is ≤ 9 per year.

4.7.1.5 Cables and pipelines

The HVDC interconnector between the UK and Belgium shall cross a total of six communication cables, one electric power cable and a pipeline in the BPNS. One of the communication cables is yet no longer in use; the Hermes South.

4.7.1.6 Tourism and recreation

Along almost the entire Belgian coast, associated with the dikes and dunes, recreation and tourism plays an important role. The landfall of the Nemo Link is provided west of the western breakwater of the port of Zeebrugge. The beach of Zeebrugge west of the western breakwater is a very wide beach. The dike of Zeebrugge is relatively short (approx. 850 m). The eastern section runs into the dune area 'De Fonteintjes', which is designated as a Special Protection Area. At the most easterly point of the dike, the Animal surf club is located. A swimming area and a (kite)surf zone are situated in front of the surf club.

4.7.1.7 Biodiversity and nature conservation areas

Based on observed biodiversity patterns, different types of protected areas are identified in Belgian marine waters, mainly focusing on the west coast. The cable route of the Nemo Link passes through the special protection area SPA3 'Zeebrugge' and runs in close proximity to the special protection area SPA2 ‘Oostende’. In addition, the cable route crosses the recently approved special area of conservation (SAC) ‘Vlaamse Banken’ (RD 16/10/2012).

4.7.2 Impact description and assessment

In the following sections (socio-economic) impact of the construction and operation of the Nemo Link on relevant aspects is discussed. As a possible removal of the Nemo Link implies similar activities to be carried out and similar machinery to be used as during the construction phase, it is expected that similar effects will occur. The decommissioning phase is therefore not discussed separately.

4.7.2.1 Fishery

The expected impacts during installation of the Nemo Link are assessed as negligible. There is no loss of traditional fishing grounds and disturbance of fish by the work will only be very temporary and limited. During the installation of the Nemo Link the construction area will nevertheless be temporarily inaccessible to fishing vessels. A security zone of maximum 2 x 1 km will be provided, where fishing is prohibited during the work.

The main potential impacts during the operational phase are the changes in the fish behavior caused by electromagnetic radiation emitted by the Nemo Link. For a discussion of these effects, see the chapter ‘Fauna and Flora’.

If the Nemo Link would become exposed during the operational phase, fishing gear could get entangled with the cables. However, the interconnector is installed so that the coverage will be maximally guaranteed for the longest possible period. In addition, periodic inspections along the cable route are provided so that an insufficient coverage of the interconnector can be noticed in time. Therefore, the probability that the interconnector can be entangled in fishing gear is minimal.

4.7.2.2 Shipping

Safety aspects (risk of accidents, oil spills) of the professional shipping is discussed in the chapter ‘Safety aspects’.

4.7.2.3 Sand and gravel extraction

The Nemo Link is installed in the vicinity of the control zones 2c and 2a, but stays completely out of these zones, so no conflicts are expected between the construction, operation and potential decommissioning of the interconnector on the one hand and the sand and gravel extraction on the other.

4.7.2.4 Military activities

Given the limited military activities (maximum 10 days per year per zone) at the military zones and the fact that the Nemo Link crosses none of these zones, no significant effects are expected due to the construction, operation and possible decommissioning of the Nemo Link. When approaching these military zones during the construction it remains advisable to maintain proper communication with the competent services of the Ministry of Defense, so they are aware of the activities in the vicinity of the military zones.

4.7.2.5 Cables and pipelines

At crossings with cables and pipelines, structures are made that form a safe bridge or separation between the Nemo Link and the existing cable or pipe. In most cases, these protections are created by placing special mattresses subsequently covered with armour rock to stabilize. In accordance with the provisions of the Royal Decree of 12 March 2002 (Art. 15, 8°), the initiators shall close a ‘crossing agreement’ with all licensees of the crossed cables or pipes individually, in which specific agreements are recorded with regard to the work to be performed and the manner of crossing with the relevant cable or pipeline. If all contractual agreements are respected, and every precaution is taken to avoid damaging the existing cables and pipelines, it can be assumed that there will be no impact on the existing cables and pipelines due to the construction, operation and possible decommissioning of the Nemo Link. The Nemo Link-project has initiated discussions on crossing agreements for all cables/ pipelines to be crossed.

4.7.2.6 Tourism and recreation

Outside the coastal zone no negative effects are anticipated for tourism and recreation due to the construction of the Nemo Link given the low number of ships to be used. In the shallow coastal zone a temporary disturbance is possible. By recreational boats, windsurfers, kite surfers, swimmers, etc., a safety zone may be used. Since the construction of the Nemo Link however is temporary and the prohibition of entering the safety zone will be monitored, the effect on tourism and recreation is assessed as small negative. Good communication with the Coast Guard during the execution of the work is necessary at this point.

During the operational phase no effects on tourism and recreation are expected at the marine part of the interconnector.

4.7.2.7 Biodiversity and nature conservation areas

Generally it can be stated that the construction will cause a certain disturbance by both the presence of vessels and the movement of the sediment. No significant impact is expected due to the construction work on the special protection areas SPA3 and SPA2 and the recently approved SAC ‘Vlaamse Banken’ (RD 16/10/2012). Given the temporary and local nature of the installation of the Nemo Link, also no significant adverse effects on the quality of the habitat of porpoises are expected, so the provided conservation objectives are not significantly affected. Exploitation and possible decommissioning of the Nemo Link are also expected to have no significant impact on the protected areas and species.

4.7.2.8 Other activities

Because of the large distance (at least 5 km) from areas where mariculture is allowed to the Nemo Link, no effects are expected on the mariculture activities that may develop in the future.

The entire route of the interconnector has no overlap with the designated area for the construction of wind farms. Consequently, no effects on the existing and planned wind farms are expected due to the construction, operation and possible decommissioning of Nemo Link.

4.7.3 Mitigating measures

Proper communication with the Ministry of Defense and the Coast Guard during the installation of the Nemo Link in the vicinity of the designated military areas is advisable. During the installation of the various crossing infrastructures, all necessary precautions need to be taken to avoid damage to existing cables and pipelines. If several initiatives in which cables are laid, including the future construction of wind farms, are permitted in a limited period of time, it should be attempted to align the different projects (grouped implantation). During the construction of the Nemo Link proper communication with the Coast Guard is required for ensuring the safety of recreational vessels and particularly in the coastal area where windsurfers, kite surfers, swimmers, etc., can be present. Since the work will take place mainly in the summer, this communication is of great importance.

4.8 SAFETY ASPECTS

4.8.1 Reference situation and autonomous development

4.8.1.1 Shipping

A total of approximately 150,000 vessels navigate through the Belgian marine areas, of which about 15 % tankers (oil, chemicals and gas tankers), and nearly half (approx. 50 %) container ships and RoRo's (roll- on roll-off vessels). Loads of oil and other harmful or (environmentally) hazardous substances are mainly transported on board of tankers, container ships and RoRo's. The project area is located near one of the busiest shipping routes in the world (FPS Health, Food Chain Safety and Environment, 2010).

4.8.1.2 Marine pollution

Since the project area is situated in the North Sea, it is covered under the regulations applicable to the MARPOL 'special zones', Appendix I. The discharge of oil containing liquids is thereby prohibited. A loss of oil from ships can have several causes: a collision between two ships, ships that collide with a stationary or floating obstacle, cracks in the hull, sinking, fire on board, severe negligence, intentional (criminal) discharge activity. Should an (accidental) discharge take place, it will spread and a potentially threat the marine ecosystem and coastal areas.

Despite the increase in maritime transport a clear downward trend in the annual number of detected oil pollutions in Belgian waters is being determined. The total volume of discharges also declines. The reason for the overall downward trend can be found in the stricter policy and legislative framework for safety and pollution on the one hand and by the deterrent nature of the current control means (FPS Health, Food Chain Safety and Environment, 2010).

4.8.2 Impact description and assessment

4.8.2.1 Shipping

Construction phase

During the preparatory work and during the actual construction of the cables collision with a cable laying vessel and the accompanying ships may occur. The cable laying vessel navigates at a slower speed than usual traffic (about 300 m per hour), and temporarily comes to a complete standstill when a joint between two interconnector sections is made. To prevent collision with the installation vessels, other vessels need to adjust their course or speed. The risk of collision is greatest near the locations where the cable route crosses the various shipping lanes. Given the very limited number of vessels to be deployed during the construction phase and as all the work is only temporary and local in nature, the chance of a collision is low. Moreover, different measures are provided to keep disturbance to shipping and risk of collision to a minimum. The risk of collision is considered to be negligible (0/-).

Operational phase

During inspections and possible repair work, potential collision with other vessels can occur. Given the very low frequency of these works, their temporary and local character and the very limited number of additional shipping movements in comparison to the total present shipping traffic in the BPNS, no significant increase in the risk for shipping safety is expected in relation the current situation (negligible impact, 0/-).

The magnetic field of the Nemo Link can locally cause compass deviation. The magnetic field around the interconnector is however very small and the field strength decreases rapidly with distance from the cables. The impact of the magnetic field of the HVDC interconnector to shipping and navigation is therefore considered to be negligible (0/-).

Decommissioning phase

If it is decided to remove the cables once they are out of use, the operations to be performed and the vessels to be deployed will be similar to those during the construction phase (negligible impact, 0/-).

4.8.2.2 Marine pollution

Given the very limited number of ships to be deployed during construction, operation and possible decommissioning of the HVDC interconnector between the UK and Belgium and as the work is only of short duration, the probability of the occurrence of oil pollution is small (negligible effect, 0/-).

The effect of loss of oil or other substances from the cables is zero (no effect, 0).

4.8.2.3 Radioactivity

Out of use telecommunication cables that cross the cable route are usually locally removed (cut) near the location where the interconnector crosses this cable. These cables can contain signal amplifiers with radioactive substances. It is therefore advisable to collect in advance all possible information on the signal amplifiers present in the cable that needs to be cut. If the section of the out of use telecommunication cable that should be removed effectively contains a signal amplifier with radioactive substances, the necessary security measures to protect humans and the environment must be provided.

4.8.2.4 Damage to the cables

The main threats to the Nemo Link are bottom fishing, with heavy weights to be pulled across the cable, and anchors of ships. This can cause damage to the cables, possibly resulting in short circuit between the cable core and the sheath. The current is then shortly returned through the sheath and/or the soil. This is recorded in the converter station, and within a few tenths of a second the voltage on the cable is disconnected. As a result damage or injury to infrastructure or persons is prevented.

Given the small risk of occurrence of damage to the cables, and as security mechanisms in the converter station almost immediately would stop the occurrence of possible effects, no safety risks due to the occurrence of damage to the cables are expected (0).

4.8.3 Mitigating measures

During the construction, operation and possible decommissioning work several safety measures should always maximally be used to minimize hindrance and risk of collision.

5 CUMULATIVE EFFECTS

The potential effects arising from the construction, operation and possible decommissioning of the HVDC interconnector between the UK and Belgium (shortly: Nemo Link) can lead to the accumulation of effects when it is combined with the construction, operation and decommissioning of other offshore power cables. The number of electric power cables in the North Sea does indeed increase rapidly (HVDC interconnectors, export cables from wind farms). At the time of the preparation of the present EIR, following planned or already in use electric power cables are known in the Belgian Part of the North Sea:

- The export cables from the C-Power wind farm are two 3-phase 150 kV AC submarine cables of XLPE type. These export cables run from the C-Power wind farm to Oostende and cross the planned route of the HVDC interconnector between the UK and Belgium near kilometer point 20 (KP 20).
  The export cables from the wind farms Belwind and Northwind (formerly Eldepasco) don’t traverse the planned route of the Nemo Link, but all land on the beach of Zeebrugge. Only one of the two export cables from the Belwind wind farm is currently installed and in use, the second export cable will be constructed during the second construction phase of this wind farm (planned for launch during 2013). These export cables are all the same type as the export cable of C-Power. Based on the currently known planning of the various projects, there is a chance that the construction of the export cables of Belwind and Northwind will coincide (partially) with the construction of the HVDC interconnector between the UK and Belgium. Given the short duration and the progressive nature of construction work for electricity cables, this chance is however rather small.
- During the preparation of this EIA, a permit was also licensed to the North Sea Power wind farm (MD 01/18/2012). The export cables from the North Sea Power (250 MW to 470 MW) wind farm will be landing at Zeebrugge. These export cables are of the same type as the export cables C-Power, although the North Sea Power wind farm can also opt for a 220 kV AC cable. The export cables will cross the planned route of the Nemo Link near KP1. Again there is a chance that the construction of the North Sea Power wind farm partly overlaps with the construction of Nemo Link.
- For the planned wind farm Rentel was the licensing procedure for the construction and operation recently started. Recently domain concessions have also been granted for the projects Seastar and Mermaid in the designated area for wind farms. The location and characteristics of the export cables of all these future wind farms are not yet known.
- It is important to note that the situation described in previous sections, in which always one or more export cables depart from each separate wind farm to a power station on the coast, the situation is as it was common until now. Currently, however, a concept is developed to build an offshore meshed network

step by step, where the different wind farms are linked to each other at sea, in power stations on platforms that lie close to the various concessions. This network will then be connected to the grid on the mainland through a limited number of cables connected. Currently, this concept has not yet been worked out concretely enough to give an exact estimate of the number of high voltage cables (and their location and characteristics) that finally will be constructed between the designated area for wind farms and the mainland.

- The park cables of the various wind farms (33 kV cables interconnecting the wind turbines and offshore high-voltage stations) will not be considered in this impact assessment, as the occurrence of cumulative effects is ruled out by the large distance of these cables (all located within the designated area for wind farms) to the route of the Nemo Link.

Besides potential cumulative impacts resulting from construction, operation and decommissioning of several power cables, cumulative effects may also result from the construction, operation and decommissioning of the HVDC interconnector between the UK and Belgium in combination with other human activities at sea that (partly) cause similar effects (such as sand and gravel extraction). When relevant, this type of cumulative effects is also discussed.

Only those effects that have at least a small positive or small negative impact on a particular discipline, are discussed, since it is assumed that a certain aspect that has (almost) no effect on the environment for each power cable separately, will also cause no cumulative effect.

5.1 SOIL

Construction phase

The cumulative effect of the construction of several power cables on the soil is considered to be negligible, as the disruption is very limited compared to the size of the Belgian Part of the North Sea.

The route of the HVDC interconnector between the UK and Belgium runs along the northern edge of the sand and gravel extraction areas 2a and 2c. Pre-sweeping and burying the Nemo Link cause similar effects on the seabed as these extraction activities. The differences in scale of both activities are though so large that it can be expected that the construction of the Nemo Link won’t reinforce the existing effects, and more likely will blend into the existing high sediment dynamics in this region.

Operational phase

The probability that the various power cables in the BPNS will become exposed simultaneously and for long periods is small given the performance of periodic inspections. Therefore, the cumulative effect on the overall morphodynamics and erosion is considered to be less than the sum of the effects of the individual cables.

The cumulative effect on the seabed of the warming of several cables scattered about the BPNS is negligible given the very limited volume of the seabed that will suffer from warming in comparison with the size of the total BPNS and taking into account the naturally occurring temperature variations.

Two power cables can come close enough together only at the crossings (separated only by crossing infrastructure) so that a further temperature increase of the seafloor (amplified effect) may occur. This effect is highly localized (only a few meters in length) and is therefore considered to be insignificant.

5.2 WATER

Construction phase

Even if multiple cables would be built simultaneously within the landfall zone, it is expected that the effects on the turbidity of the sea water will be completely disappeared after a few tidal cycles. The cumulative effect is at worst equal to the sum of the individual effects, and – compared to the naturally occurring turbidity levels during storms – still acceptable. On the other hand, if there is no overlap of the construction work of several cables, the cumulative effect is smaller than the sum of the effects of the individual cables.

Operational phase

During the operational phase electromagnetic fields occur around power lines. The magnetic fields generated by the Nemo Link are static and districts in this respect from the magnetic fields of export cables from wind farms, operating on alternating and hence changing ('pulsating') magnetic fields. Therefore, the combined magnetic and induced electric field of the HVDC interconnector and an export cable are considered to be complex and almost unpredictable. Interaction between two power cables will however only occur at the point of crossing of two cables, as in both AC and in DC the magnetic field strength decreases rapidly with increasing distance from the cable and because submarine power cables are obliged to be laid at a distance of at least 50 meters apart. In the Belgian Part of the North Sea, the Nemo Link crosses two pair of power lines, namely the export cables from the C-Power wind farm and the North Sea Power wind farm. At this crossing a magnetic and induced electric field in the seawater can thus be generated that is different from the fields generated in the vicinity of the individual cables. It is impossible to predict whether the cumulative effect will be larger (amplified) or smaller (weakened) than the sum of the individual effects. However, it is evident that the cumulative effect takes place to locally to be significant.

5.3 CLIMATE & ATMOSPHERE

During the construction, operation and possible decommissioning of several power cables, the air quality will be affected by emissions from shipping movements. The cumulative effect is negligible.

The impact on the local temperature climate in the seabed by warming of multiple cables in operation is also negligible (see § 5.2).

5.4 NOISE

Even if the construction of multiple cables would simultaneously take place, the cumulative impact on the sound climate (caused by ships, dredging, plowing and/or jetting...) will be negligible.

5.5 FAUNA & FLORA

No relevant cumulative effects on birds and marine mammals are expected.

A possible strengthening of the effects on benthos and (demersal) fish communities during the construction phase will only occur if the construction work of two cables will take place at the same time, and furthermore only in regions where cables will be installed close together, i.e. in the area near the coast to the west of the port of Zeebrugge (landfall area). In this hypothetical case, the cumulative effect equals the sum of the individual effects, and is still acceptable given the small size and duration of the effects. If there is no overlap of the construction work of several cables, the cumulative effect will be smaller than the sum of the effects of the individual cables.

During the operational phase, the electromagnetic fields of two power cables can cause a stronger or weaker combined electromagnetic field at the point of their crossing. Each impact is however localized and therefore no cumulative effect on the benthos community and the fish fauna is expected.

On the other hand, the presence of multiple power cables scattered in the BPNS can exert effects on sensitive species by the frequent and widespread presence of electromagnetic fields, which also differ from each other in orientation, strength and physical appearance (static or pulsing). This can have an impact on fish fauna, with some species using electromagnetic fields for orientation, migration or detection of their prey. Since the impact of the electromagnetic field of one separate power cable on the demersal fish fauna is already a gap in knowledge, the potential impact of multiple electromagnetic fields with different characteristics and scattered on the seabed is not known at all. Further research is therefore appropriate.

No cumulative effect is expected from the heating of the seabed by several cables.

5.6 SEA SCAPE & CULTURAL HERITAGE

No relevant cumulative impact on the sea sight and the (maritime) cultural heritage is expected.

5.7 HUMAN ACTIVITY

The effects on the fishery during the construction works are temporary and local. Given the small chance of simultaneous occurrence of the work of several cables, the cumulative effect is negligible. Potential cumulative effects on fishing during the operation phase are caused by the presence of electromagnetic fields. Currently there great uncertainty concerning the impact of these fields on fish. Further research is therefore appropriate.

Cumulative impacts on tourism and recreation in the coastal zone will only occur when the construction of several power cables in the landfall area will take place simultaneously. Even then, the disturbance is acceptable if a proper communication with the authorities is maintained during execution of the works and if the construction close to the beach takes place outside the tourist season (holidays).

5.8 SAFETY ASPECTS

If no overlap occurs in the construction of the various cables, the cumulative impact on shipping safety will be less than the sum of the individual effects. If there is an overlap of activities, the risk of collision will increase. The cumulative effect is acceptable given the short duration of the works and given the limited number of vessels to be deployed.

6 MONITORING

Given the large sediment dynamics at the BPNS, the cables can become exposed over time. Therefore, periodic inspection of cable burial will take place, including potential erosion around infrastructure at crossings with other cables and pipelines.

Since no significant impact on fauna and flora is expected, no project-specific monitoring is required. The gaps in knowledge are though important to note, where research on the effects of electromagnetic radiation on the marine ecosystem is appropriate. The necessary research on spawning and nursery areas for fish fauna should additionally be noticed.

7 CROSS-BORDER EFFECTS

As in the present EIR no significant negative environmental impacts for the Belgian Part of the North Sea were identified due to the Nemo Link-project, it is evident that there will also be no significant adverse transboundary environmental effects. Significant cumulative effects due to the Nemo Link-project in combination with projects abroad are also excluded because of the short duration and the local nature of most effects.

8 SUMMARY AND CONCLUSIONS

First, it should be noted that the route of the HVDC interconnector between the UK and Belgium has already been mitigated largely at the phase of the design, as various physical, biological and human aspects have already been taken into account maximally during the route engineering study of 2011 to determine the most appropriate offshore cable route between Richborough and Zeebrugge. Where necessary, adjustments to the route were already carried out to mitigate potential impacts or risks in order to minimize both cable and installation costs and disruption of the marine ecosystem and its users.

The impact assessment and discussion of the present EIR show that all effects that can occur during the construction phase are limited in size as all construction activities take place locally and preceding and are always of short duration. The potential impacts during the construction phase are therefore all assessed as small negative (0/-) to nonexistent (0).

For many potential impacts during the operational phase, only a (very) low frequency of occurrence is expected. Moreover, these effects are all temporary and limited in size. Other, more permanent effects (electromagnetic radiation, heating...) are always too limited in size to be significant. All potential impacts during the operational phase are therefore assessed as small negative (0/-) to nonexistent (0).

With regard to the cumulative effects, the probability of simultaneously occurring construction phases of multiple power cables in the BPNS is rather small, given the short duration and the progressive nature of such construction work. The probability of occurrence of cumulative effects during the construction phase is therefore also very small, given the very local and non-permanent nature of the potential impact of the individual cables. Even then, these cumulative effects are still negligible (0/-).

As during the operational phase for the separate power cables only a very low frequency of occurrence for the diverse effects is expected (inspections, repair work) and given the local and temporary nature of these effects, the possibility that the effects of these individual cables will coincide (resulting in potential cumulative effects) is very small. Even then, these cumulative effects are negligible (0/-). Other, more permanent effects during the operational phase (such as warming of the sea floor) take place too locally to cause significant cumulative effects (0/-). The cumulative impact of electromagnetic fields of several power cables in the BPNS on the fish fauna is a gap in knowledge.

Finally it is expected that the construction, operation and decommissioning of the Nemo Link between the UK and Belgium will have no significant impact on the Good Environmental Status and the environmental targets as defined under the Marine Strategy Framework Directive 2008/56/EC.

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