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European Subsea Cables Association (ESCA)

Statement on Electromagnetic Fields (EMF) and Subsea Cables

February 2026

Introduction

Electromagnetic fields (EMF) are naturally present in the marine environment, primarily due to the Earth's geomagnetic field. Human activities, including the use of subsea cables for power transmission and telecommunications, can generate additional EMFs. This statement by the European Subsea Cables Association (ESCA) provides a clear and concise explanation of what EMFs are, how they relate to different subsea cable types, and the relevant environmental considerations. It draws on the latest scientific literature and the OSPAR Commission's guidance to set out the current understanding.

What Are EMFs?

EMFs consist of electric and magnetic fields. Electric fields (E-fields) arise from voltage, and magnetic fields (B-fields) are created by current flow. Subsea cables do not emit electric fields into the water directly, as they are shielded by their cable insulation. However, magnetic fields can extend beyond the cable, and in certain cases induce secondary electric fields (iE-fields) in the surrounding water which may interact with some marine organisms, or induce effects in other closely located or crossed submerged plant. Lastly, every living organism emits a very small bioelectric field itself, caused by electrically charged atoms in cells and tissues.

EMFs from Subsea Telecommunications Cables

Where there is a need to convey data traffic across long distances, some subsea telecommunications cables feature powered devices called repeaters. However, many subsea telecommunications cables do not require such power and are termed unrepeatered systems.

- Unrepeatered telecom cables carry no electrical current and therefore do not generate any EMFs.
- Repeatered telecom cables do carry current to power repeaters that maintain the optical signal. However, the electric field is fully contained within the cable's metal shielding. The magnetic field is extremely weak — at the surface of the cable, it is around 30 to 38 microtesla (µT), lower than the Earth's natural geomagnetic field (about 60 µT). At a distance of 1 metre, it drops to around 0.30 to 0.38 µT, which is roughly 1/100th of the surface level.

Because these fields are so weak and localised — and further diminished when cables are buried due to increased physical distance — telecom cables are not considered a source of environmental concern with regard to EMF. As stated in the OSPAR background document on technical considerations and environmental impacts of subsea cables[1]:

"Given the very low levels of EMF in a repeatered telecommunications cable, and no EMF produced by unrepeatered telecommunications cables, they do not require further consideration." (OSPAR, 2023, p.18)

[1] [1] Subsea Cables within the OSPAR Maritime Area: Background document on technical considerations and potential environmental impacts https://www.ospar.org/documents?v=52457

This has been reinforced by various studies including Albert et al. (2020), which found EMF emissions from telecom cables to be significantly lower than those from power cables — lower than emissions from a typical laptop computer.

EMFs from Subsea Power Cables

Subsea power cables generate stronger EMFs and thus are the primary focus of environmental consideration related to subsea cables. Power cables operate using either Direct Current (DC) or Alternating Current (AC), and the characteristics of the EMF they produce differ accordingly.

- DC Cables generate a static magnetic field. The field's strength depends on system configuration, current flow, and how closely cables are bundled. Bipole systems, where the cables are laid together, allow some magnetic cancellation. For example, a bundled bipole cable at ±500 kV and 2000 MW can produce a field of 126.8 µT at the seabed if buried 1 metre deep. If spaced apart (e.g. 30 metres), the field can rise to over 400 µT which has the potential to affect some magnetically sensitive equipment or animals. Additionally, whilst a constant current is flowing, DC cables do not induce voltages, but transient events such as rapid energisation or de-energisation can create momentary induced voltages in for instance other crossed or parallel submerged plant.
- AC Cables generate a fluctuating magnetic field (50 or 60 Hz), which can induce electric fields and voltages in surrounding conductive materials such as seawater, animals and closely located or crossed submerged plant. The field diminishes rapidly with distance and is affected by conductor configuration, lay-length (degree of magnetic cancellation), cable armouring, burial depth and crossing angle.

Both DC and AC fields decline steeply with distance from the cable — often to background levels within 5 to 20 metres depending on conditions.

Environmental Considerations

Marine species such as sharks, rays, some fish, turtles, and crustaceans can sense magnetic and electric fields. Research has focused on understanding whether anthropogenic EMFs from subsea power cables affect their behaviour, orientation, or migration.

According to the OSPAR Background Document (2023)[2]:

"EMFs from telecommunications cables are considered negligible and this is only a topic relevant to subsea power cables."

***"At the current scale (number and transmission rates) of subsea power cables, ecological impacts are thought to be very limited or absent."* (p.69)**

Multiple field and lab studies reviewed by organisations such as OSPAR and cited research (e.g. Sherwood et al., 2016; Love et al., 2017) support this conclusion, showing little or no evidence of adverse behavioural effects on fish, crustaceans, or electro-sensitive species near cables in real-world settings. Where effects are observed, they are highly localised and minor.

Nonetheless, research is ongoing as some uncertainties remain, and as the number and capacity of subsea power cables increase, and with the introduction of new technologies such as floating offshore wind.

[2] Subsea Cables within the OSPAR Maritime Area: Background document on technical considerations and potential environmental impacts https://www.ospar.org/documents?v=52457

Collaboration between the subsea cable industry, academic researchers and regulators will continue to ensure that the latest scientific evidence can effectively inform decision making.

Induction effects between closely located and crossed subsea cables and pipelines

EMF effects are not only reviewed from an ecological perspective, but also in relation to impacts on other assets on the seabed. Where subsea power cables run close and parallel to, or cross other subsea cables and pipelines, electromagnetic coupling can occur, with the potential to induce voltages and currents in the other nearby subsea asset.

Subsea HVAC power cables can induce voltages mainly through magnetic fields (induction) or electric fields (capacitive coupling). HVDC cables don't generally create significant induction except during rapid transient events, but they can cause DC stray current effects. The risk in both cases is highest for long parallel runs, or due to crossings at acute angles. Induced voltages can create safety hazards and interfere with electrically sensitive systems such as pipeline corrosion protection or some telecommunication repeaters, so mitigations such as vertical separation, crossing at right angles, earthing systems and cable bonding are often implemented.

From a health and safety perspective, both asset operators should be aware of the potential for electromagnetic coupling without any direct physical contact needing to be made between closely located subsea assets. Appropriate risk assessments and safety precautions should be taken whenever personnel are conducting maintenance and repair activities and there is potential for induction effects to occur.

Key Points and Conclusions

- Telecommunications cables do not produce significant EMFs, with unrepeatered systems producing no EMFs at all. Repeatered systems produce only extremely weak, localised magnetic fields, which are lower than Earth's natural field and diminish rapidly with distance. They do not require further environmental assessment for EMF[3].
- Power cables do generate magnetic fields which vary depending on cable type, current, configuration, and installation depth. Fields are strongest at the cable surface and quickly decrease with distance.
- Current scientific understanding, supported by the OSPAR Commission (2023), concludes that there are no significant ecological impacts from EMF associated with subsea power cables at present levels of deployment.
- While EMFs can be detected by some marine species, observed effects are minimal, highly spatially constrained, and have not demonstrated broader ecological consequences in real-world field studies at current scale of development of offshore infrastructure. Noting that knowledge gaps remain as development increases and technology changes.
- All cable operators should be conscious of potential induction effects involving closely located or crossed submerged plant.

For Further Reading

- OSPAR Commission (2023) *Subsea Cables within the OSPAR Maritime Area: Background document on technical considerations and potential environmental impacts*. https://www.ospar.org/documents?v=52457
- Albert et al. (2020) *A review of electromagnetic field effects from subsea cables on marine life*
- Sherwood et al. (2016) *Installation and operational effects of a HVDC submarine cable in a continental shelf setting*
- Love et al. (2017) *Multiple field studies on marine organisms around power cables*

[3] UNEP-WCMC and ICPC. (2025). Submarine cables and marine biodiversity: https://www.unep-wcmc.org/en/news/keeping-connected-submarine-communications-cables-and-ocean-life

- Normandeau et al. (2011) *Effects of EMFs from power cables on marine life: A review*
- Current state of knowledge Electromagnetic fields : Electromagnetic fields and the Marine Strategy Framework Directive Descriptor 11 – Energy: https://open.rijkswaterstaat.nl/@180353/current-state-knowledge-electromagnetic/
- UNEP-WCMC and ICPC. (2025). Submarine cables and marine biodiversity: https://www.unep-wcmc.org/en/news/keeping-connected-submarine-communications-cables-and-ocean-life

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