Submarine Cables and Marine Life in the Choptank River and Chesapeake Bay

The Mid Atlantic Power Pathway (MAPP) has proposed to transmit power between southern Maryland and the Delmarva Peninsula over submarine transmission cables. Each of the two planned circuits will consist of two cables. The cables will be buried to a depth of approximately 6 feet under the bed of the Chesapeake Bay and Choptank River for a total distance of approximately 39 miles. This section of the proposed MAPP project is similar to other submarine power cable installations, such as the Cross Sound Cable in the Long Island Sound between New Haven, Connecticut and Brookhaven, New York that has been in operation since 2002. There are currently about 20 such submarine cables in operation today throughout the world. Studies of a variety of marine life have not found any adverse impacts resulting from the operation of submarine transmission lines, even in waters that are home to sensitive species.

Static Fields from Submarine Cables

Although the electricity that flows to our homes and offices is transmitted as alternating current (AC), for a variety of technical reasons the preferred method to transmit electricity over long distances and in submarine applications, such as that proposed by MAPP, is as direct current (DC). Electricity transmitted as direct current is termed such because the frequency of electricity produced does not fluctuate much over time or direction; the fields produced are therefore commonly called 'static' fields. There are natural sources of static fields in the marine environment. The primary source of static magnetic fields is the earth's magnetic field, the intensity of which varies with distance from the equator. It is this field that accounts for the orientation of a compass needle. The movement of water currents through the earth's magnetic field also creates static electric fields whose intensity varies with the velocity of the currents.

Static Electric Fields

No electric field is introduced directly into the environment by submarine cables because these cables are surrounded by multiple layers of insulation contained in a metallic sheath that protects them from damage and through which the electric field cannot pass. The movement of water currents and fish through the magnetic field of the earth and that of DC submarine cables induces a static electric field but it is very, very weak.

Static Magnetic Fields

Static magnetic fields occur naturally as the result of the earth's magnetic field. The lowest levels of approximately 300 milligauss (mG) are measured near the equator and the highest levels are measured near the north and south poles. In Maryland, the earth's magnetic field is approximately 525 mG. The magnetic field level of the proposed submarine transmission cables will influence the level of the earth's magnetic field for only a short distance around the cables because the cables of each circuit of the MAPP project are proposed to be bundled and buried together in a trench. The current flows in opposite directions in these cables so the resulting magnetic field is partially "neutralized." Additionally, magnetic field levels decrease significantly with increased distance from the cables. The combination of bundled cables and the burial depth of the cable thus will result in a very small change in the background geomagnetic field at the seabed. Figure 1 shows that the cables under the seabed will affect the background magnetic field for only a limited distance, roughly within 20 feet of the cable.

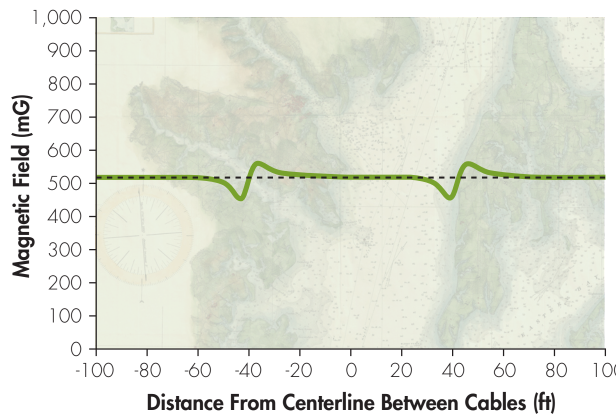

Figure 1. Magnetic field at the seabed produced by cables in east-west orientation buried 6 feet below the Chesapeake Bay and the Choptank River.

Static Magnetic Fields and Marine Life

Some marine organisms use electrosense in prey detection or magnetosense for navigation and are capable of detecting electric and magnetic fields. Research suggests that of the species typically found in the proposed project area of the Chesapeake Bay and the Choptank River, only eels and turtles appear to use static magnetic fields for navigation, although blue crabs might have such a capability based on an analogy to another crustacean, the lobster. Other species in the project area including the skate, cownose ray, sandbar shark, eel, catfish, sturgeon, and lamprey are reported to detect electric fields.

A 2011 review of potential effects of submarine cables on marine life prepared for the federal government did not identify any adverse effect of static magnetic fields (or induced electric fields) at levels associated with the proposed cables or even at higher levels. As for behavioral effects, e.g., orientation and migration, the report concluded that "Behavioral responses to electro- or magnetic fields are known for some species but extrapolation to impacts resulting from exposure to undersea power cables is speculative." [1]

For over 98.5% of the submarine portion of the project, the maximum increase in the background static magnetic field at the seabed directly above the cable is limited to 66 mG, a small fraction of the background magnetic field (518 mG), and the horizontal component of the magnetic field believed to provide a cue for multiple migrating species is hardly changed (0.5 degrees at 10 feet). Within a distance of approximately 20 feet from the cable, the static magnetic field returns to natural background levels. Thus, effects on migratory species, including blue crab, eels, striped bass, herring, and shad, and turtles would not be expected.

Actions Being Taken by PHI

PHI is consulting with engineering design firms, cable manufacturers and installers, engineers, and scientists who specialize in the study of electric and magnetic fields, as well as educational institutions, watermen, environmental groups, and state and federal agencies, to ensure that environmental considerations are carefully and properly addressed.

[1] Normandeau, Exponent, T. Tricas, and A. Gill. 2011. Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09, p. 143.

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