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Direct Current

ELECTRIC AND MAGNETIC FIELDS

Northern Pass Transmission LLC is proposing a transmission project to bring renewable, competitively-priced electricity from Québec to New Hampshire and the New England region. The proposed project includes a direct current (DC) transmission line that will run from the Canadian border to Franklin, New Hampshire (approximately 158 miles), and an alternating current (AC) line that will run from a converter station in Franklin to a substation in Deerfield, New Hampshire (approximately 34 miles).

Electric and magnetic fields are present around any electric power line, whether it carries DC or AC electricity. This fact sheet answers questions about electric and magnetic fields associated with DC electricity transmission.

WHEN ARE DC TRANSMISSION LINES USED?

The electrical grid in the United States (US) is primarily constructed using alternating current (AC) transmission lines. The vast majority of transmission lines in the US transmit AC electricity while only a few carry DC. The transmission of AC electricity varies in direction and magnitude 60 times per second, while DC electricity does not vary appreciably over time (i.e., it is essentially static and flows in one direction). The major drawback of DC transmission is the cost associated with converting to DC at one end of the line and back again to AC at the other end of the line, since the network of distribution lines carries AC electricity to our homes. When electricity is carried over long distances, however, this cost is balanced by savings from the line construction costs and reduced energy losses for DC transmission lines. DC lines also have an environmental advantage over AC lines. Shorter towers and a narrower ROW can be used because DC transmission lines use two, as opposed to three, conductors.

WHAT ARE ELECTRIC AND MAGNETIC FIELDS? ARE THE ELECTRIC AND MAGNETIC FIELDS FROM A DC TRANSMISSION LINE DIFFERENT FROM THOSE ASSOCIATED WITH AN AC TRANSMISSION LINE?

Electric and magnetic fields are present around any electrical circuit, whether it carries AC or DC electricity. But since DC is static and AC varies in direction, fields from DC and AC sources have significant differences. Static fields, for example, do not induce currents in stationary objects, while AC fields do. Another important difference is that static electric and magnetic fields are produced by many natural sources. These natural sources are described further in this fact sheet.

WHAT ARE STATIC ELECTRIC FIELDS AND WHERE ARE THEY FOUND?

Static electric fields are created by the separation of positive and negative electric charges. Natural sources of static electric fields include the earth's atmosphere during stormy conditions, the charge produced by shuffling across a carpet, and the static cling of clothing.

WHAT ARE STATIC MAGNETIC FIELDS AND WHERE ARE THEY FOUND?

Static magnetic fields are created by magnets or by the flow of DC electricity. The earth itself has a natural static magnetic field, which is used for compass navigation. Other common sources of static magnetic fields include permanent magnets (which are found in appliances, toys, and medical devices), battery-powered appliances, magnetic resonance imaging (MRI) scanners, some electrified railway systems, and certain industrial processes.



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Direct Current ELECTRIC AND MAGNETIC FIELDS

HOW DO THE LEVELS OF STATIC ELECTRIC AND MAGNETIC FIELDS PRODUCED BY DC TRANSMISSION LINES COMPARE TO THE LEVELS PRODUCED BY OTHER SOURCES?

The static electric field levels measured directly under DC lines fall in the range of the levels produced by the common sources described previously. Likewise, the static magnetic field levels measured directly under DC lines are similar to or lower than the static magnetic field of the earth.

ARE STATIC FIELDS FROM DC LINES ASSOCIATED WITH ADVERSE ENVIRONMENTAL OR HEALTH EFFECTS?

Scientists have not found any adverse effects of DC transmission lines on the environment, including on animals, plants, and people. This conclusion is supported by more than 100 years of research on static fields.

HAVE ANY SCIENTIFIC AGENCIES EVALUATED THIS RESEARCH?

Yes. In recent years, national and international scientific agencies charged with protecting public health have brought together multidisciplinary groups of scientists to review the research and determine if adverse effects are associated with exposure to static electric and magnetic fields. These agencies include the World Health Organization, the National Radiological Protection Board of Great Britain, and the International Agency for Research on Cancer. These agencies did not conclude that low levels of static electric or magnetic fields, such as those associated with DC transmission lines, produce any adverse effects.

ARE THERE GUIDELINES FOR EXPOSURE TO HIGH LEVELS OF DC MAGNETIC FIELDS?

Yes. Although there are neither federal limits in the United States, nor state limits in New Hampshire, several organizations have recommended limits on high levels of static magnetic fields. The static magnetic field level associated with The Northern Pass line, like that of the earth, would be a thousand-fold or more lower than these guidelines. These guidelines only apply to persons exposed to the very strong magnetic fields produced by MRI scanners and industrial magnets.

ARE CORONA EFFECTS, INCLUDING AUDIBLE NOISE AND RADIO NOISE, A PROBLEM FOR DC TRANSMISSION LINES?

No. The electric field at the surface of the conductor of the high-voltage DC lines can produce “corona effects”, which include audible noise and radio noise, on or near the ROW. Landowner complaints about these issues, however, are very rare. Modern transmission lines, including The Northern Pass project, are designed to minimize corona effects and meet government and industry standards. Another corona effect is the transfer of some electrical charge to air molecules and aerosol particles. This adds to the static electric field but the levels produced by DC transmission lines are within the range of those found in our daily environment. Scientific agencies have not considered this to be of any likely health significance.

WHERE CAN I GET MORE INFORMATION?

Information on the project can be found at:

The Northern Pass project www.northernpass.us

Information on static magnetic and electric fields can be found at:

World Health Organization www.who.int/mediacentre/factsheets/fs299/en/index.html