



## Alternating 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 AC electricity transmission.

### WHAT ARE ELECTRIC AND MAGNETIC FIELDS?

EMF are produced through the generation, transmission, and use of electric power. We encounter AC EMF throughout our daily activities at work and at home. Common sources of EMF in our homes include fields generated by appliances, the home wiring that brings power to those appliances, and the nearby distribution lines that supply electricity to our homes. Because the fields associated with AC electric power are at the very low end of the electromagnetic spectrum, they are called “extremely low frequency” (ELF) fields.

**Electric fields** are produced by voltage. Voltage is the pressure behind the flow of electricity and creates electric fields around any electrical device that is plugged in—even if it is not operating. Electric fields are strongest closest to the source, decrease rapidly within a short distance from the source, and are naturally shielded by walls, roofs, trees, and vegetation. Therefore, certain appliances within homes and workplaces are the major source of electric fields indoors, while power lines are the major source of electric fields outdoors.

**Magnetic fields** are produced by current, which is the flow of electricity to and within electrical devices like a light or motor when turned on. Like electric fields, magnetic fields also diminish as you move away from the source, but unlike electric fields, they are not naturally shielded by common materials. The strength of a magnetic field at any point also depends on characteristics of the source, including (in the case of power lines) the arrangement of conductors and the amount of current flow.

### WHAT IS THE DIFFERENCE BETWEEN AC AND DC ELECTRICITY?

DC electricity flows consistently in one direction. AC electricity does not flow steadily in one direction—it alternates back and forth—60 times per second; that is, with a frequency of 60 hertz (Hz). The electrical grid in the United States is constructed primarily of 60 Hz AC transmission and distribution lines. These lines deliver electricity into our homes, businesses, and beyond.

### HOW IS NORTHERN PASS ADDRESSING EMF?

Currently, there are no federal or New Hampshire state requirements regarding occupational or residential exposure to AC (60-Hz) EMF. However, Northern Pass is taking a number of steps to respond to public concerns about exposure to EMF, including:

**Project Design**—During the project’s development, Northern Pass engineers will evaluate design practices that minimize electric and magnetic field levels at and beyond the edges of AC transmission line rights-of-way that may be adjacent to residential or other public use areas. Design practices include conductor positioning and proximity of adjacent lines—all of which must be consistent with other environmental, safety, and engineering factors. These practices are consistent with recommendations by the World Health Organization (WHO).

**Taking Measurements**—The Northern Pass project team will be taking EMF measurements along the proposed route at specified locations before and after construction.



**FOR MORE INFORMATION, CONTACT:**  
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## Alternating Current

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### ARE THERE ANY ADVERSE HEALTH EFFECTS ASSOCIATED WITH EMF FROM AC TRANSMISSION LINES?

Given the widespread presence of AC electric-powered devices in our homes and the associated electrical system infrastructure, scientific interest in this question about the possible health effects from exposure to EMF near AC power lines, electric appliances, and other sources began several decades ago. Over the past 35 years, many scientific studies have been conducted to determine whether EMF—principally, magnetic fields—affect biological systems and health. Much of the scientific research examining potential health effects of long-term EMF exposure has focused on childhood leukemia and other cancers. Following a research program authorized by the U.S. Congress and managed by the National Institute of Environmental Health Sciences (NIEHS), the Director of the NIEHS reported to the U.S. Congress in 1999 that:

*“The probability that ELF-EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm.”* ([http://www.niehs.nih.gov/health/assets/docs\\_f\\_o/niehs-report.pdf](http://www.niehs.nih.gov/health/assets/docs_f_o/niehs-report.pdf))

Over the years, other agencies around the world have assembled groups of scientists to review published scientific studies regarding potential EMF health effects. For example, in 2007, the World Health Organization (WHO) released a review of research on EMF and health that was consistent with the findings of NIEHS and other national and international research reviews. The WHO report concluded that the cumulative evidence was not sufficient to indicate a causal relationship between EMF and any disease, including cancer. The WHO advised a general policy approach for AC ELF fields as follows:

*“...given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, and the limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear. Thus, the costs of precautionary measures should be very low.”* ([http://www.who.int/peh-emf/publications/elf\\_ehc/en/index.html](http://www.who.int/peh-emf/publications/elf_ehc/en/index.html))

In 2015, a Scientific Committee commissioned by the European Union updated its previous review on EMF that included reviews of both AC and DC fields. The conclusions of this European review are consistent with those of the NIEHS and WHO reviews mentioned above. The European report did not conclude that the available scientific evidence confirms a causal link between any adverse health effects (including both cancer and non-cancer health outcomes) and EMF exposure. With respect to childhood leukemia epidemiologic results, the review concludes that:

“...no mechanisms have been identified and no support is existing from experimental studies that could explain these findings, which, together with shortcomings of the epidemiological studies prevent a causal interpretation.” ([http://ec.europa.eu/health/scientific\\_committees/emerging/docs/scenih\\_r\\_o\\_041.pdf](http://ec.europa.eu/health/scientific_committees/emerging/docs/scenih_r_o_041.pdf))

### ARE THERE GUIDELINES FOR EXPOSURE TO HIGH LEVELS OF AC ELECTRIC AND MAGNETIC FIELDS?

Yes. Although there are no federal limits in the United States, nor state limits in New Hampshire, several international organizations have recommended limits on high levels of 60-Hz AC electric and magnetic fields. The 60-Hz electric and magnetic field levels associated with the operation of the Northern Pass line will be much lower than these guidelines.

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### WHERE CAN I GET MORE INFORMATION?

The Northern Pass project [www.northernpass.us](http://www.northernpass.us)

National Institute of Environmental Health Sciences  
[www.niehs.nih.gov/health/topics/agents/emf/](http://www.niehs.nih.gov/health/topics/agents/emf/)

World Health Organization: International EMF Project  
[www.who.int/peh-emf/en/](http://www.who.int/peh-emf/en/)

Northeast Utilities  
<http://www.transmission-nu.com/residential/YourSafety.asp>

Northeast Utilities EMF Video  
[http://www.transmission-nu.com/transcommon/media/Transmission\\_EMF\\_An\\_Intro\\_548.aspx](http://www.transmission-nu.com/transcommon/media/Transmission_EMF_An_Intro_548.aspx)

European Commission, Scientific Committee on Emerging and Newly Identified Health Risks  
[http://ec.europa.eu/health/scientific\\_committees/consultations/public\\_consultations/scenih\\_r\\_consultation\\_19\\_en.htm](http://ec.europa.eu/health/scientific_committees/consultations/public_consultations/scenih_r_consultation_19_en.htm)