

Bipole III

Bipole III Transmission Project: A Major Reliability Improvement Initiative Alternating Current Electric and Magnetic Fields (EMF)

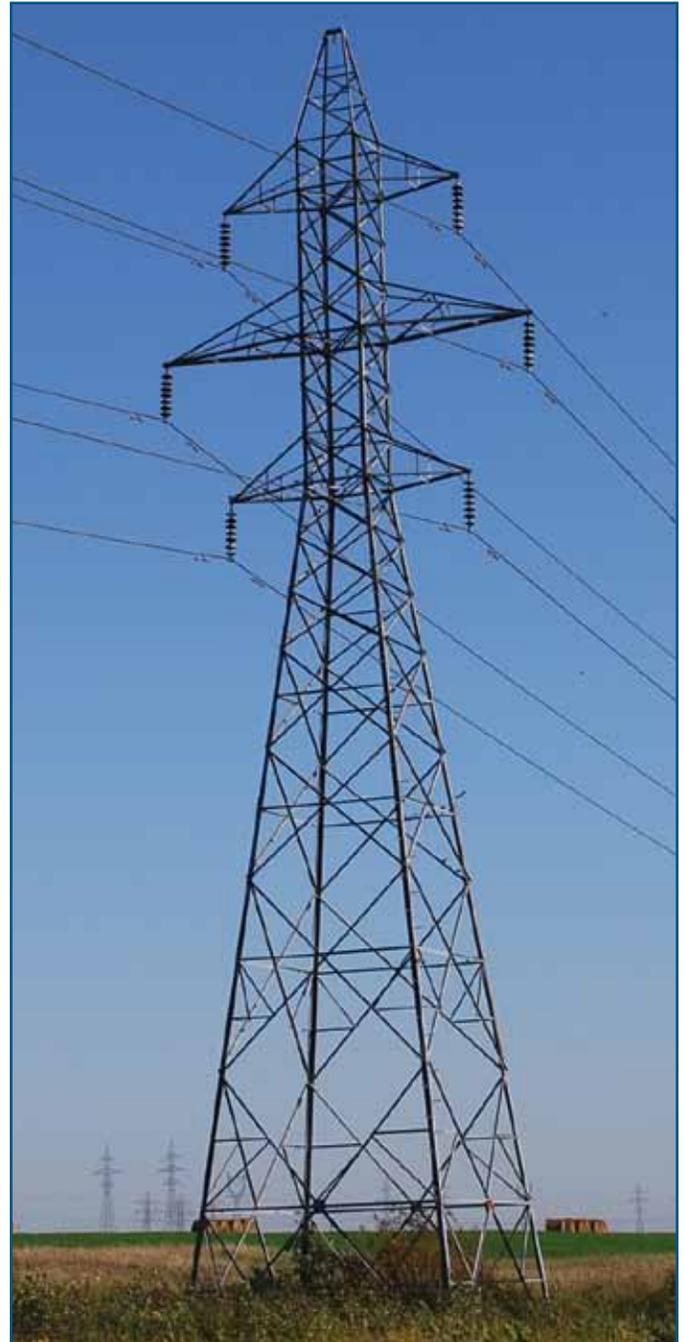
Manitoba Hydro is proposing to build a new direct current (DC) transmission line, known as Bipole III, to improve system reliability. The new line will link the northern power generating complex on the Lower Nelson River with the delivery system in southern Manitoba. In addition to the DC transmission line, the Bipole III Transmission Project will include the construction of a 230 kV alternating current (AC) transmission line between the existing 230 kV switchyard at Long Spruce Generating Station and a new 230 kV switchyard at the site of the new northern converter station; and two 230 kV AC transmission lines to connect the existing 230 kV switchyard at Henday Converter Station to the new 230 kV switchyard at the new northern converter station.

The proposed AC transmission lines will produce AC electric and magnetic fields (EMF) that oscillate at a frequency of 60 Hertz (Hz). This brochure describes electric and magnetic fields, the health research that has been conducted, and the conclusions offered by various scientific agencies on AC EMF and effects on human health.

What are AC electric and magnetic fields?

Our electrical system carries power from generating stations to our homes by way of transmission lines, substations, and distribution lines. Each component of this system – from the transmission lines that carry the electricity, to the appliances that use the electricity – produces electric and magnetic fields in the extremely low frequency (ELF) range that includes 60 Hz¹. A field describes the properties of the space surrounding an object due to the characteristics of the object. A temperature field, for example, surrounds a hot object, just as electric and magnetic fields surround electrical objects.

¹ELF EMF is different from radiofrequency fields, such as those produced by mobile phones and radio and TV stations.



There are differences between electric fields and magnetic fields. Electric fields are due to a system's voltage and are measured in kilovolts per meter (kV/m). Magnetic fields are due to the flow of electrical current and are measured in milligauss (mG). Most objects partially block electric fields, including trees, cars and buildings, while magnetic fields are not shielded by these objects. Since magnetic fields are more pervasive, magnetic fields have been the focus of health research.

The EMF levels measured near any source depend on a number of factors, but largely on the distance at which the measurement is taken. Both electric and magnetic field levels decrease with increasing distance from the source, just as the heat from a candle or stove decreases as you move farther away. The box below describes the general properties of different EMF sources.



Some EMF sources and their general properties

Appliances. Appliances, such as microwave ovens, vacuum cleaners, and hand-held appliances tend to produce the highest EMF levels indoors. Compared to power lines, EMF levels from appliances drop off more rapidly with distance. A microwave oven, for example, produces a magnetic field of approximately 200 mG at 6 inches and 4 mG at 1 foot.

Power lines. The EMF levels associated with an AC power line depend on the configuration of the line's conductors, the line's voltage, the amount of current the line is carrying, distance from the

conductors, etc. The EMF levels under AC transmission lines are higher than the levels under the distribution lines that run down local streets. Transmission lines are located on dedicated right-of-ways, and are typically farther away from residences.

Substations. Similar to appliances, substation equipment is configured in such a way that field levels drop off quickly with distance. At the fence surrounding a substation, the EMF levels associated with the substation's equipment are typically within the range of background levels, except where the transmission lines connect to the substation. Background levels are the EMF levels typically measured in homes or offices away from appliances and other major EMF sources.

What levels of magnetic fields are most people exposed to?

The answer to this question is difficult to answer precisely because, in our modern day society, we are all exposed for varying amounts of time to innumerable sources of magnetic fields throughout the day. The highest levels are recorded very close to electrical sources which range from dozens to hundreds of milligauss (mG). It is generally agreed, that if the average of a person's magnetic field exposures throughout an entire day is measured, most persons are exposed to levels in the range of 1 to 2 mG. While this is our average level of exposure, we are exposed to both higher and lower field levels throughout the day.

Has research been conducted on the potential for AC electric and magnetic fields to affect health?

Yes. A large body of research has been conducted in Canada and other countries for almost 40 years on a wide variety of topics. This research includes:

- **Epidemiology studies.** Observational studies of people, which evaluate the relationship between estimated magnetic field exposures and diseases.
- **Experimental studies.** This includes studies of laboratory animals exposed to high EMF levels for long periods of time and studies of cells and tissues exposed to EMF in the laboratory.

What have scientific agencies concluded about the research on AC electric and magnetic fields and human health?

Numerous scientific and health agencies have evaluated this body of research, including the World Health Organization (WHO), the International Agency for Research on Cancer (IARC), and the Health Protection Agency (HPA) of Great Britain. In Canada, the topic has been evaluated by the Federal Provincial Territorial Radiation Protection Committee (FPTRPC). The FPTRPC is an intergovernmental, Canadian committee assembled to harmonize the standards and practices for ELF EMF within federal, provincial and territorial jurisdictions. Health Canada refers to the FPTRPC as the authority on issues related to EMF. The FPTRPC established an ELF Working Group to carry out periodic reviews, recommend appropriate actions and provide position statements that reflect the common opinion of intergovernmental authorities.

The conclusions of these scientific agencies have been generally consistent. Overall, they concluded that the research does not show that electric or magnetic fields are a known or likely cause of any disease, including cancer. They also concluded that some statistical data suggests a relationship between childhood leukemia and rare exposure to high magnetic field levels, although the uncertainty associated with these findings and the lack of support from experimental studies does not support a true relationship. Please consult the documents listed at the end of this handout for more details on the agencies' conclusions.

What specifically did the FPTRPC conclude?

The Canadian committee concluded that, "there is insufficient scientific evidence showing exposure to EMFs from power lines can cause adverse health effects such as cancer" (<http://hc-sc.gc.ca/ewh-semt/radiation/fpt-radprotect/emf-cem-eng.php>). Also, the Manitoba Clean Environment Commission developed a Health and EMF Expert's Consensus Statement on the Human Health Effects of ELF EMF in 2001, which concluded that "The weight of scientific evidence does not support the conclusion that extremely low frequency EMFs such as those produced by power lines are a cause of adverse effects on human health." (http://www.cecmanitoba.ca/Reports/PDF/CEC_EMF_Consensus_Report.pdf).

Are there any standards or guidelines to limit exposure to AC electric and magnetic fields in Canada?

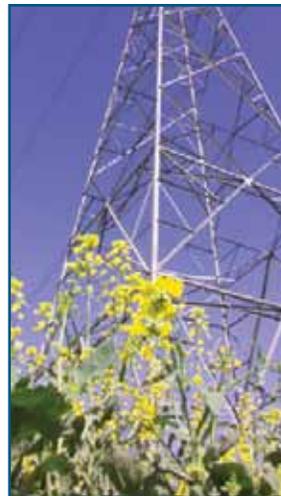
Canada does not have any national, territorial or provincial standards or guidelines related to EMF. However, Canada supported the application of the precautionary principle in the assessment of environmental factors in the late 1990s, at about the same time as

Europe. The principle states that, in areas of scientific uncertainty, steps should be taken to reduce exposures that are proportional to the perceived level of risk. This principle has been supported by the WHO, which recommends low-cost measures to reduce EMF exposure such as constructing electrical infrastructure in ways that reduce EMF levels. Such measures might include adjusting the design of adjacent lines to minimize magnetic fields.

What does Health Canada recommend?

Health Canada states the following: "You do not need to take action regarding typical daily exposures to electric and magnetic fields at extremely low frequencies. There is no conclusive evidence of any harm caused by exposures at levels normally found in Canadian living and working environments." (<http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/magnet-eng.php>).

Do AC electric and magnetic fields affect animals or plants?



Numerous research programs have been conducted to study the effects of EMF on wild and domesticated animals; the largest of these research programs was conducted with cows at the University of McGill in Quebec. Overall, this research has not found any relationship between EMF and the health, behavior or productivity of animals, including cows, pigs and sheep. Furthermore, studies of crops and other plants have reported no adverse effects on growth or viability.

Can AC EMF cause audible noise or radio/TV interference?

Yes, these effects may be noticeable, particularly when crossing underneath a transmission line. These occur when the strength of the electric field at points on the conductors' surface locally exceeds the insulating properties of air and tiny amounts of energy are released. This may be noticeable for AM radio or analog television pictures, but not for FM radio or cable television. Adherence to Canadian and Manitoba electrical codes and standards will minimize such effects.

For more information, please visit the following websites:

Canadian

Health Canada:

<http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/magnet-eng.php>

BC Centre for Disease Control:

<http://www.bccdc.ca/healthenv/Radiation/ElectromagRadiation/PowerLines.htm>

Canadian Cancer Society:

http://www.cancer.ca/Canada-wide/Prevention/Specific%20environmental%20contaminants/Electromagnetic%20fields.aspx?sc_lang=en#exposure

International

World Health Organization:

<http://www.who.int/peh-emf/about/en/>

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