

## FACTS ABOUT DIRECT CURRENT ELECTRIC AND MAGNETIC FIELDS

### What are Electric and Magnetic Fields (EMF)?

Electric and magnetic fields (EMF) are invisible lines of force generated by natural phenomena such as the earth's magnetic field or lightning. EMF are also produced by electricity and other man-made sources that we are exposed to in our daily lives like household appliances, computers and cell phones. In fact, EMF surrounds all things electrical.

When electric current flows through a conductor, it produces both an electric field and a magnetic field. The frequency of the field is defined by the frequency of the source and stated in cycles/second or hertz (Hz). Electric fields are measured in kilovolts per metre (kV/m) and magnetic fields are measured in milligauss (mG).

Both electric and magnetic field levels decrease rapidly as you move away from the source.

### The Difference Between AC and DC Fields

The modern electric power system operates using alternating current (AC) almost exclusively. AC changes polarity or "cycles" 60 times a second. Its fields also cycle at 60 Hz and are referred to as Extremely Low Frequency (ELF) fields.

Direct current (DC) is constant, like current from a battery. Its electric and magnetic fields are also constant (frequency of zero) and are referred to as static fields.

### Static EMF in the Environment

We are surrounded by natural and man-made static fields. The earth's core produces a static magnetic field on the earth's surface at a level similar to that found under a 500 kV DC line. Storm fronts create static electric fields. And anyone who has walked across a carpet and received a shock from a doorknob has produced and experienced a static electric field.

Some other sources are listed in the following tables:

Static Electric Fields	
Friction walking across a carpet	Up to 500 kV/m
Computer screens (at 30 cm away)	10 -20 kV/m
Within a typical 500 kV DC transmission line right-of-way	17-30 kV/m

Static Magnetic Fields	
MRI machines	15-40 million mG
Battery operated appliances	3000-10000 mG
Electrified railways	Up to 1000 mG
Earth's natural field	300-700 mG
Typical 500 kV DC transmission line (within the right-of-way)	100-570 mG

### Should I Be Concerned About Static EMF?

Static electric and magnetic fields associated with DC transmission lines are not viewed as a health concern. Their levels are very low and similar to the naturally occurring static fields we are exposed to in our daily lives. For that reason, there has been little or no scientific study of the effects of long term exposure to static fields at these levels. Instead, scientific study has focused on workplace exposure to man-made static magnetic fields with much higher field strengths such as those produced by medical imaging devices.

Public exposure guidelines for static magnetic fields have been established by reducing workplace guidelines by up to 80%. The International Commission on Electromagnetic Safety, which has one of the lowest levels for public exposure, recommends a public exposure guideline of 1,180,000 mG. By comparison, the static magnetic field produced by a typical 500 kV DC line is estimated at up to 570 mG directly beneath the line.

The public exposure guidelines for static electric fields are not directly related to health concerns. Static electric fields cannot penetrate animal or plant tissues; they can only create a static charge on the surface. The guideline of 25 kV/m suggested by the UK Health Protection Agency (HPA), (formerly the National Radiation Protection Board) is described as the threshold value where an individual may notice the static charge and if touching a grounded object could receive a static shock similar to a carpet shock.

### Corona Effects

Corona occurs on a high voltage transmission line when water droplets, insects or debris are present on the conductor. The electric field near these irregularities becomes more concentrated which breaks down the air near the surface of the conductor, resulting in small energy releases that produce the audible noise sometimes heard close to a transmission line.

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High voltage transmission lines are designed so that they produce little or no corona unless these irregularities are present.

Air ions are electrically charged molecules that are also produced when corona is present on a high voltage transmission line. Some of these air ions remain near the conductors and increase the strength of the static electric field when corona is present. Others are neutralized or flow to the ground. Some attach to aerosols (solid or liquid particles, including ambient pollutants) in the air. Air ions are also produced by electrical storms, gas flames, candles and room ionizers.

Some researchers hypothesize that when aerosols become charged they may increase human exposure to ambient pollutants, but there is no empirical evidence to support this idea. In an independent investigation, the HPA concluded that air ions are not likely to contribute to significant health effects.

### Investigating the Research on Static EMF

When investigating the scientific research on static EMF, check for some important qualifications in the information.

Ensure that the research or information is on static fields from a DC source, not extremely low frequency (ELF) fields from AC sources. The bulk of scientific research on electric and magnetic fields has focused on AC or higher frequency fields generated by microwave communications and X-rays. Their characteristics are very different from those of static fields.

Check that the information has been reviewed or published by a reputable scientific organization or journal. Some of the most reliable and comprehensive sources are national and international organizations such as Health Canada, the World Health Organization (WHO) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The sole purpose of these organizations is to evaluate and report on public and

occupational health issues using comprehensive and unbiased weight-of-evidence reviews of the research available. Their reviews have concluded that the risk to human health from static electric and magnetic fields produced by DC lines is very low.

### What is ATCO Electric Doing About EMF?

ATCO Electric has adopted the conclusions and recommendations of Health Canada, WHO and ICNIRP with respect to EMF for both AC and DC power lines. We act responsibly by building and operating our transmission facilities within industry accepted engineering and safety standards. Nevertheless, we recognize that some people may have concerns, therefore we strive to route new facilities away from residences and built-up areas. We are also committed to monitoring EMF research and sharing this information with customers, employees, government officials or any other interested parties.

Further information on static EMF is available at:

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

**International Commission on Non-Ionizing Radiation Protection:** [www.icnirp.de](http://www.icnirp.de)

**Health Canada:** [www.hc-sc.gc.ca](http://www.hc-sc.gc.ca)



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