



Earth Currents

Earth currents are well understood electrical phenomena. They are caused by both natural and man-made sources. There is no identified linkage between earth currents and any human disease.

Key Points

- Earth currents arise from both natural and man-made sources, including the magma in the earth's core, solar flares and the normal distribution and use of electricity.
- The Public Service Commission of Wisconsin (PSCW) has concluded that most measurable earth currents are the result of local electrical loads by the end consumer of electrical power.
- We are all exposed to earth currents from the day we are born. No studies have indicated a linkage between our exposures to earth currents and any human disease.
- Earth currents that result from faulted customer or utility equipment may cause very localized electrical system problems. When this occurs the problems are easily detected and can be properly addressed.

Questions and Answers

What are earth currents?

Earth currents are very low-density electrical currents that can be detected in the soil. Man-made currents can be DC (direct current) or AC (alternating current), depending on the source. The magnitude of these currents away from the points where they enter or leave the earth (metal conductive objects connected to an electrical source) are generally very low. While humans cannot detect these currents, specialized and sensitive equipment can measure the voltage gradient that results on the surface of the earth. These voltage measurements can be used to quantify the presence and strength of earth currents in a specific area.

How are earth currents produced?

We know that earth currents are the result of both natural and human activities. The movement of molten magma deep inside the earth is believed to create some earth currents, while solar flares are another source. The earth's magnetic field, which causes a compass to point north, is evidence of earth currents. Since electrical systems are connected to the earth for safety reasons, man-made sources of earth currents include high voltage electrical transmission systems, multi-grounded electrical distribution systems, house, farm or business wiring systems, and cathodic protection systems. Other sources include electromagnetic broadcast signals from radio, television and communication systems. The PSCW has concluded that most measurable earth currents are the result of local electrical loads and grounding systems by the end consumer of electrical power.

How do we measure earth currents?

We can't measure earth currents directly. However, as the currents pass through the soil they encounter electrical resistance. This results in very small voltage differences at the surface of the earth. These are called earth surface voltage gradients. These voltage gradients can be easily measured with a standard voltmeter. The magnitude of the voltage and the distance between the measurement points allow for a meaningful analysis of the presence and amount of earth currents.

Am I exposed to earth currents?

Exposure might be too strong a word, but in fact earth currents, both natural and man-made, surround us. With the exception of very unusual situations, such as an electrical fault, we generally are not aware of earth currents. We have lived in the presence of earth currents since our birth, and man-made earth currents have existed for over a century beginning with the widespread use of electricity.



Why do electrical systems use the earth as a ground?

Electrical codes require that all conductive objects, including electrical systems, that may become accidentally energized, are grounded (or connected to the earth) for safety. These include cable systems, plumbing, barn metal, television antennas, street lights and household appliances, to name a few. The electrical system in the United States uses a four-wire distribution system that includes a grounded wire directly connected to the soil. This connection to the earth is a safety measure that has been used for over 100 years to provide a high level of protection from accidental contact with currents that could result in electrocution. The PSCW requires Wisconsin's utilities to follow stricter grounding requirements than nationally recognized standards. Three-pronged electric cords and the ground fault interrupter receptacles that we commonly have in our bathrooms or kitchens are a reminder of the life-saving value of this ever present grounding system.

Do earth currents cause problems?

Generally these currents are not a problem because we are rarely exposed to them at levels known to be harmful. The large mass and three-dimensional nature of the soil quickly dissipate the current and keep earth current density low. At this time no research has documented any health effects from earth current exposures.

Do I need to worry about or avoid earth currents?

It is impossible to avoid earth currents. However, you can take precautions to avoid creating very localized situations at your home, farm or business by ensuring that any new installation or modification of existing wiring conforms to the National Electric Safety Code (NESC). All electrical system work should be performed by a state certified electrician to ensure the proper placement and connection of ground rods and grounding conductors.

What are MREC member utilities doing?

MREC member utilities continue to support research for improving the efficiency and maintaining the safety of our distribution system. All distribution upgrades follow both PSCW and NESC requirements to minimize the potential creation of earth currents. Finally, we provide guidance to customers who have a question, concern, or potential problem arising from abnormal localized earth currents.

How can I obtain more information?

If you have specific questions about earth currents, contact your electric utilities directly or visit our website at www.mrec.org.

