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Electric & Magnetic Fields

Introduction

Electric and magnetic fields (EMFs) are invisible areas of energy, often referred to as radiation, that are associated with the use of electrical power and various forms of natural and man-made lighting. EMFs are typically characterized by wavelength or frequency into one of two radioactive categories:

- Non-ionizing: low-level radiation which is generally perceived as harmless to humans
- Ionizing: high-level radiation which has the potential for cellular and DNA damage

Radiation Type	Definition	Forms of Radiation	Source Examples
Non-Ionizing	Low to mid-frequency radiation which is generally perceived as harmless due to its lack of potency.	<ul style="list-style-type: none"> • Extremely Low Frequency (ELF) • Radiofrequency (RF) • Microwaves • Visual Light 	<ul style="list-style-type: none"> • Microwave ovens • Computers • House energy smart meters • Wireless (wifi) networks • Cell Phones • Bluetooth devices • Power lines • MRIs
Ionizing	Mid to high-frequency radiation which can, under certain circumstances, lead to cellular and or DNA damage with prolonged exposure.	<ul style="list-style-type: none"> • Ultraviolet (UV) • X-Rays • Gamma 	<ul style="list-style-type: none"> • Ultraviolet light • X-Rays ranging from $30 * 10^{16}$ Hz to $30 * 10^{19}$ Hz • Some <u>gamma rays</u>

Can EMFs be harmful to my health?

During the 1990s, most EMF research focused on extremely low frequency exposures stemming from conventional power sources, such as power lines, electrical substations, or home appliances. While some of these studies

showed a possible link between EMF field strength and an increased risk for childhood leukemia, their findings indicated that such an association was weak. Now, in the age of cellular telephones, wireless routers, and portable GPS devices (all known sources of EMF radiation), concerns regarding a possible connection between EMFs and adverse health effects still persists, though current research¹ continues to point to the same weak association.

Additionally, the few studies that have been conducted on adults show no evidence of a link between EMF exposure and adult cancers, such as leukemia, brain cancer, and breast cancer. Nevertheless, NIEHS recommends continued education on practical ways of reducing exposures to EMFs.

Does my cell phone emit EMF radiation?

Measured in units called hertz, cell phone emissions, a form of radiofrequency radiation, exist at the lower end of the non-ionizing radiation spectrum at the 900-1900 megahertz range. At present, the weight of the current scientific evidence has not conclusively linked cell phone use with any adverse health problems, though scientists admit that more research is needed. To that end, the National Toxicology Program (NTP), headquartered at NIEHS, is leading the largest laboratory rodent study, to date, on cell phone radiofrequency exposure. The complete findings are expected to be released in fall 2018.

To learn more about the NTP cell phone radio frequency radiation rodent studies, visit the NTP webpage on [cell phones](https://ntp.niehs.nih.gov/results/areas/cellphones/)  (<https://ntp.niehs.nih.gov/results/areas/cellphones/>).

What if I live near a power line?

It is important to remember that the strength of a magnetic field decreases dramatically with increasing distance from the source. This means that the strength of the field reaching a house or structure will be significantly weaker than it was at its point of origin, as you can see below. For more information, see the NIEHS educational booklet, "[EMF: Electric and Magnetic Fields Associated with the Use of Electric Power](#). (/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf)". This booklet, prepared in 2002, contains the most recent NIEHS research on health and powerline electric and magnetic fields. The [World Health Organization](http://www.who.int/peh-emf/publications/elf_ehc/en/)  (http://www.who.int/peh-emf/publications/elf_ehc/en/) website has information prepared in 2010. For example, a magnetic field measuring 57.5 milligauss immediately beside a 230 kilovolt transmission line measures just 7.1 milligauss at a distance of 100 feet, and 1.8 milligauss at a distance of 200 feet.

/health/assets/images/emf_chart.jpg

How can I find out if I'm being exposed to EMFs?

If you are concerned about EMFs emitted by a power line or substation in your area, you can contact your local power company to schedule an on-site reading. You can also measure EMFs yourself with the use of a gaussmeter, which is available for purchase online through a number of retailers.



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What is NIEHS Doing?

NIEHS Research Efforts

- [NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields: Prepared in Response to the 1992 Energy Policy Act \(PL 102-486, Section 2118\)](#)
([/health/assets/docs_p_z/report_powerline_electric_mg_predates_508.pdf](#)) (751KB) - Prepared in Response to the 1992 Energy Policy Act (PL 102-486, Section 2118)

Further Reading

Additional Resources

- [Electromagnetic Fields and Cancer](#) [↗](#) (<https://www.cancer.gov/cancertopics/factsheet/Risk/magnetic-fields>) - National Cancer Institute
- [Extremely Low Frequency Fields](#) [↗](#) (http://www.who.int/peh-emf/publications/elf_ehc/en/index.html) - Environmental Health Criteria Monograph No.238 from the World Health Organization (WHO)
- [IARC Classifies Radiofrequency Electromagnetic Fields as Possibly Carcinogenic to Humans](#) [↗](#)
(http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf) - The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer¹, associated with wireless phone use.
- [Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields](#) [↗](#) (https://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf) - Federal Communications Commission Office of Engineering & Technology
- [Radiofrequency Background](#) [↗](#)
(<https://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116338.htm>) - U.S. Food and Drug Administration
- [RadTown](#) [↗](#) (<https://www.epa.gov/radtown/power-lines.html>) - Learn about radiation in your town: where it is and how it's used. Explore the Burbs, Countryside, Downtown or Waterfront. Just pick and click! From the U.S. Environmental Protection Agency
- [Workplace Safety and Health Topics: EMF \(ELECTRIC AND MAGNETIC FIELDS\)](#) [↗](#) (<https://www.cdc.gov/niosh/topics/emf/>) - The National Institute for Occupational Safety and Health (NIOSH)

Related Health Topics

- [Cell Phones](#) ([/health/topics/agents/cellphones/index.cfm](#))

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File Assistance: Downloads for viewing files

- [Adobe Reader](#)   (<https://get.adobe.com/reader/>)
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