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The Invisible Environment Fact Sheet Series

Are Electromagnetic Fields Hazardous to Your Health?

Jackie LaMuth

Leader, Resource Development and Management
Ohio State University Extension

There has been much written in popular magazines about the possible health hazards of electromagnetic fields (EMFs). Consumers are bombarded by quasi-scientific reports, many of which are more confusing than accurate. This fact sheet will examine current scientific evidence and offer some insight into the various claims.

What are electromagnetic fields?

Electrical currents cause electromagnetic fields. Common household current is alternating current (AC), which reverses its direction (its charge) then switches back. One complete cycle per second is a hertz (Hz). For example, if a hair dryer operates at 60 Hz, its current changes direction 60 times per second. This cycle creates electric and magnetic fields at the same frequency. The fields created by power lines that distribute power throughout the country are power frequency fields.

Electrical fields, magnetic fields, and power frequency fields can be high or low in intensity, continuous or brief in duration. None of them linger in the environment. The moment the power is turned off, the fields and induced currents disappear. At low frequencies, the electric and magnetic fields are separable; at high and super high frequencies, the fields are inseparable.

Electromagnetic fields are divided into several categories:

- Appliances and power lines—extremely low frequencies (ELF)

- AM radio transmission—high and low frequencies (HF and LF)
- TVs and video display terminals—very low frequencies (VLF)
- TV and FM radio transmissions—very high frequencies (VHF)
- Microwaves—super high frequencies (SHF)

The super high frequencies can affect molecules. When microwave energy passes through something containing water, it causes the water molecules to vibrate and produce heat. Infrared and the different frequencies of visible light (which produce the different colors of the rainbow) occupy only a small portion of the electromagnetic energy spectrum. EMFs at frequencies higher than the visual light range are called ionizing radiation because they have enough energy to strip electrons from atoms. X-rays, for example, have enough energy to break apart molecules that contain genes. Excessive exposure to ionizing frequencies can cause cancer.

How are humans exposed?

Pinpointing a single source of exposure is difficult because humans may be exposed to a multitude of possible sources. Electromagnetic fields are found naturally in the environment, such as in lightning and in the earth's magnetic field, which causes a compass needle to point north. The natural electromagnetic fields in the human body allow messages to flow through the nervous system.

Electric and magnetic fields are produced by distribution or power lines, the electrical wires inside the walls of homes, and a wide assortment of electrical appliances. While electric fields do not pass through building materials, magnetic fields do. Magnetic fields can also be found near buried electric lines.

Electromagnetic fields are commonly found around:

- High voltage power lines
- Neighborhood transmission lines
- Grounding systems that protect residents from lightning
- Grounding systems that protect residents from electric shock that can result from faulty appliances
- The operation of common electrical appliances, including microwave ovens
- Ovens, electric ranges, aquariums, table fans, electric space heaters
- Computer monitors, electric clocks, clock radios, heated waterbeds
- Electric blankets, hair dryers, cellular phones

Recently, video display terminals (VDTs) have been a source of concern because many people are spending a significant amount of time close to them. Although evidence suggests that continuous exposure to VDTs can aggravate some health conditions, there is insufficient information linking EMFs directly to these health conditions. As computer manufacturers build computers that use less electricity more efficiently, lower EMFs are generated.

How much are we exposed?

The amount of exposure is difficult to determine. Exposure to forces produced by external sources is generally constant, but the structure of a building determines how much of the final field strength can be found inside the building. EMFs produced inside a home can widely vary depending upon the wiring system and appliance usage. These variables cloud efforts to determine the relative importance of local power lines as opposed to the use of appliances or to internal house wiring.

What are the effects of exposure?

Most of the research—especially research focusing on the relationship between exposure to EMFs and cancer—has focused on public health issues. In most cases, the findings are difficult to trust because of the difficulty in controlling the amount of exposure and other variables,

including socioeconomic status, nutrition, lifestyles, genetics, occupation, and exposure to other cancer-causing factors. Many study designs lack validity, which causes further doubt about their value.

Given these limitations and shortcomings, the research nevertheless does suggest the need for further investigation of the association between EMFs and some cancers. These include childhood brain cancer and female breast cancer. Occupational concerns related to EMFs include adult brain cancer, adult leukemia, and male breast cancer.

A review of occupational studies examined the occurrence of malignant melanoma, colon cancer, lung cancer, bladder cancer, and non-Hodgkin's lymphoma and found questionable evidence linking those cancers with EMFs or with working in an "electrical" job.

A number of studies examined the relationship between parental "electrical" occupation and childhood central nervous system cancers and found little to suggest a link. The evidence for adult central nervous system cancers, male breast cancer, and leukemia is also very weak. Many respected scientists critique the studies as being flawed.

In spite of limited evidence concerning the link between EMFs and cancer, a weak connection between the two appears to exist. Further, valid studies are needed to determine the specific nature of this link.

Are there any measurable negative effects?

Currently, the only known measurable negative effects of EMFs are related to quality-of-life issues. Local power lines, poles, substations, and high voltage transmission lines are aesthetically displeasing. A possible reduction in property values and a deterioration of community may occur as families choose to relocate to avoid EMFs. Those who live in areas selected for new EMF facilities may be resentful and resistant to them being built.

In woodlands and farmlands, several rare but easily explained occurrences result from electromagnetic fields. Damaged conifer needles growing close to power lines serve much the same function as a lightning rod in discharging electricity build-up in the air. Power lines sometimes create stray voltage effects that cause constant low-level electric shock. Decreased milk production in dairy cows and other minor problems can be avoided by properly grounding equipment and buildings.

The placement of distribution towers that produce EMFs into recreational areas and natural areas are said to have a negative effect, although no quantifiable data are available and there appears to be no noticeable decrease in the use of those areas.

Generally, scientists on both sides say they are dealing at most with rare diseases and an increased risk that is almost infinitesimal, especially compared with life's other everyday risks.

Are there any regulations governing EMFs?

Both state and federal legislation concerning EMFs, the construction of power lines, and the siting of such lines in residential areas have been introduced. The National Energy Policy Act of 1992 called for an EMF research study of \$65 million. The Ohio Power Siting Board believes that electric transmission facilities should be designed and sited in ways that prudently address EMF issues until more conclusive studies on the possible health effects of EMFs are completed.

What can someone do?

In spite of the absence of valid evidence based on solid scientific research, the effects of EMFs on the health of individuals and environments may still be of concern to some people. Until research data suggests a need for more extreme action, those who want to do something may wish to consider the following suggestions:

- Stay away from the EMF sources. The strength of a magnetic field drops quickly just a few feet from the source. Do not sleep or sit for long periods of time near electrical devices, especially those with motors.
- Stay a minimum of 18 inches away from a video display terminal (VDT). Turn it off when not in use. Don't sit

close to the back or sides of the monitor even when it is in another room or behind a partition.

- Where feasible, turn off or unplug waterbed heaters and electric blankets before going to bed. Unplugging and turning these appliances off removes the electric field.
- Stay several feet away from all sides of a television including TVs located in another room against a wall.

Other suggestions:

- Don't place beds or cribs against a wall with major appliances nearby or on the other side of the wall.
- Move electric clocks, clock radios, and telephone answering machines at least 4 feet away from the head of the bed.
- Fluorescent bulbs generate stronger fields than incandescent lamps. Estimate 1 foot for incandescent bulbs and 3 feet for fluorescent lamps.
- Avoid using electric blankets and hair blow dryers.
- Check the background field in your home. You can purchase an EM meter for \$30 to \$150 or call a utility company to install one.

Conclusion

No scientific data support definitive answers to questions about the existence or nonexistence of health risks related to electromagnetic fields. More research to produce more reliable information is needed before any conclusions can be drawn.

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Keith L. Smith, Ph.D., Associate Vice President for Agricultural Administration and Director, Ohio State University Extension
TDD No. 800-589-8292 (Ohio only) or 614-292-1868