

ELECTRIC POWER FREQUENCY (60 Hz) ***ELECTRIC AND MAGNETIC FIELDS (EMFs)***

WHAT ARE EMFs?

Electrical power lines, wiring, transformers and appliances (computers, coffeemakers, shavers, telephones, hair dryers, etc.) all produce electric and magnetic fields (EMFs). EMFs are invisible lines of force which surround *any* electrical wire or electronic device. Both fields weaken rapidly with increasing distance from the source of the fields.

WHAT IS MEANT BY ELECTRIC POWER EMFs?

Electric power fields in the U.S. are in the extremely-low-frequency (*ELF*) range (*at 60 cycles per second = 60 Hz*). That means that the power for your electrical appliances has alternating current (AC) at 60 Hz. The lower the frequency of the electromagnetic waves, the greater the wavelength (the distance between one electromagnetic “wave” and the next), and the lower the amount of energy.

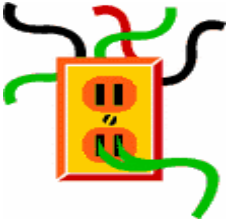
Microwave ovens produce electromagnetic energy with a wavelength of about 5 inches; microwaves have enough energy to cause heating in foods. X-rays, which have wavelengths on the order of one-billionth of an inch, have enough energy to break atomic and molecular bonds. In comparison, a power frequency field at 60 Hz has a wavelength of more than 3000 miles – about the distance from Los Angeles to New York! These fields are of such low energy that they are incapable of producing heating effects or breaking atomic or molecular bonds. They can generate *very* weak electric currents in the bodies of humans and animals. That is why they have the potential of producing health effects.

CAN I AVOID EXPOSURE TO EMFs?

This would be nearly impossible. Even if you moved as far away as you could from electric appliances and power lines, you would still be exposed to EMFs from cellular telephone, radio and television signal transmissions. These sources produce higher frequency fields than do electric power sources.

WHAT TYPES OF APPLIANCES PRODUCE LARGE EMF EXPOSURES?

Electric shavers, blenders, hair dryers, and other electrical devices which have motors that include rotating or oscillating components can produce sizable EMFs immediately adjacent to them. The field strengths are normally reduced considerably at 1 foot from the appliance.



WHAT UNITS ARE USED TO MEASURE EMF FIELD STRENGTHS?

Electric fields are measured in units of volts per meter (V/m). Magnetic fields are usually measured in units of Gauss or milligauss (mG), which is one-thousandth of a Gauss (*this is actually the magnetic flux density but it is the unit by which magnetic fields are normally characterized*).

WHAT ARE TYPICAL EMF EXPOSURE LEVELS AT WORK AND AT HOME?

A report published in 1992 indicated that the average EMF exposures on-the-job for non-electrical workers in Los Angeles were as follows:

Electric Field Strength: 5.5 V/m

Magnetic Field Strength: 1.7 mG

A study of EMFs in nearly one thousand homes in the U. S. determined that the average electric and magnetic field readings were about 3 V/m and 1 mG, respectively.

DO EMFs CAUSE SERIOUS HEALTH EFFECTS?

Electric fields which are commonly found in work and home environments have not been shown to cause any measurable health effects. Several studies performed in Europe have demonstrated very weak links between exposures to magnetic fields above 2 or 3 mG and a *very* slightly increased likelihood of childhood leukemia and brain cancer.

Most recent scientific reviews have concluded that existing evidence is not sufficient to show that EMFs cause cancer or any other detrimental health effects. In the words of Edward W. Campion, M.D. (New England Journal of Medicine, 337:44, July 3, 1997): "There is no convincing evidence that high-voltage power lines are a health hazard or a cause of cancer".

ARE THERE EXPOSURE STANDARDS OR GUIDELINES FOR EMFs?

There are no Federal or State regulations/standards for exposures to EMFs in either the work or home environments. However, the American Conference of Industrial Hygienists (ACGIH) has established guidelines for exposures of workers to EMFs. According to this organization, it is believed that nearly all workers can be exposed to EMFs for 8 hours a day, 40 hours per week for a working lifetime to these levels or below without adverse health effects:

Electric Field Strength: 25,000 V/m

Magnetic Field Strength: 10 G (10,000 mG)

CAN I REDUCE MY EXPOSURE TO EMFs?

Yes, but most scientists do not think that this is necessary to preserve health. Increase the distance between yourself and the EMF source by sitting at arm's length from your computer, etc. Avoid unnecessary proximity to high-intensity EMF sources (power lines, power transformers, etc.). Reduce the amount of time you spend in elevated EMF fields - turn off computers and other electrical appliances when you are not using them.



GOOD SAFETY PRACTICES

The ACGIH occupational exposure guidelines above are quite high and are primarily intended for electrical workers and other personnel who routinely can be exposed to very high EMFs in their jobs. *Good practice for all personnel is to reduce exposures to EMFs to the extent possible such that we can still complete our work responsibilities.*

For non-electrical workers, such as those who work in office environments, it is a good practice to keep exposures to EMFs at no more than 1% of the ACGIH guidelines. Thus, it is recommended that exposures not exceed those below:

Electric Field Strength: 250 V/m

Magnetic Field Strength: 0.10 G (100 mG)

Optimally, no desk or workstation at which employees spend a considerable amount of time should have EMFs that exceed these reduced exposure levels. Brief, transient exposures to higher EMF levels are not a problem as long as they do not exceed the much higher levels intended for electrical workers.



COMPUTER MONITOR "JITTER"

Computer monitor distortion or "jitter" is often noticeable above 5 mG; for some monitors this doesn't occur until the magnetic field exceeds 10 mG. This problem is caused when the ambient magnetic field interferes with the images on the monitor such that they are moving about or are otherwise unreadable/unacceptable.

Generally, there are four solutions to the problem of computer monitor magnetic interference:

- 1) Increase the distance between the source of the elevated magnetic field (electrical transformer, circuit box, etc.) and the monitor
- 2) Shield the monitor
- 3) Shield the source of the elevated magnetic field
- 4) Change the vertical scan frequency of the monitor (the refresh rate)



Typically, increasing the distance is the least expensive and source shielding with magnetic field shielding (*often with so-called Mu-metal*) is the most expensive. Changing the refresh rate is sometimes technically feasible and inexpensive, but this sometimes creates a new "flicker" problem. Monitor shields are widely available at different costs and effectiveness. See these websites for more information:

http://www.fms-corp.com/resources_pubs_deptofenergy97.php4

<http://www.mushield.com/faq.html>

<http://www.lessemf.com/computer.html>



CONCLUSION

Keep in mind that electric power frequency electric and magnetic fields have not been shown to cause negative health effects in almost all of the scientific studies that have been performed to date. **Thus, there is no need to fear EMFs.** But if you are concerned about your exposure to them, contact EH&S to have electric and magnetic field readings taken in your work area.

(Electric and magnetic field readings in your work area will be recorded on the following page, when requested.)



Date: _____

Meter used in survey: **Holiday Industries Model HI-3604 ELF Field Strength Measurement System**

MY MEASURED EXPOSURES:

Building: _____

Room#: _____

Average electric field reading: _____ **V/m**

Average magnetic field reading: _____ **mG**

Highest electric field reading: _____ **V/m**

Highest magnetic field reading: _____ **mG**

Comments/Notes/Recommendations:



If you have any additional questions or concerns regarding EMFs, please contact Rick Mannix in the UC Irvine EH&S Office at 949-824-6098 or rcmannix@uci.edu.