Simple Ways to Avoid Electromagnetic Fields

Human exposure to artificial (AC) electric and magnetic fields has increased markedly in the past few decades. Obviously, these oscillating fields and radio waves did not exist on Earth more than a century ago. No conclusive proof yet exists which shows direct health hazards from these fields at levels normally encountered, but studies are ongoing.

Electromagnetic (EM) field risks are difficult to study because fields can exist in many different frequencies and waveforms and can change rapidly. However, reducing exposure to EM fields can be much easier than reducing exposure to other common hazards like chemical pollution. Exposure reduction is accomplished by locating EM field sources and placing often-used furniture a specified minimum distance away from those sources. Inside a typical U.S. home, the AC magnetic field averages about 2 milligauss (somewhat higher in the early evening and lower in the early morning). Electric fields in the home range up to about 2 kilovolts per meter.

AC ELECTRIC FIELDS

Electric fields are not very strong in most parts of a house. High electric-field areas are found near TVs, computer monitors (including laptop computers), fluorescent lights, light dimmer controls, and improperly grounded equipment. Field strength drops off rapidly if at least 3 feet away. Electric fields are high near high-voltage power lines, but these fields rarely penetrate into the house.

POLARIZATION AND GROUNDING

In household wiring, the wall outlet usually has a slot for a large prong and one for a small prong. This type of outlet is said to be "polarized". The small slot is electrically "hot"; in a typical 120 volt system it oscillates 60 times a second between about +170 volts and -170 volts, compared to ground. To get a shock, it is necessary to touch this "hot" slot (or to touch something electrically connected to it), while also touching something which connects to ground. Things that are connected to ground include the larger "neutral" slot, the round "grounding" slot in a 3-prong wall outlet, plumbing pipes, and any metal which is part of a sink or bathtub.

Be cautious with old, non-polarized extension cords (with both prongs the same size). If the cord is plugged in the opposite way that it should be, several types of appliances may become a shock hazard and will have high electric field. If an appliance has a polarized plug, use only a polarized extension cord (with one small and one large prong). The outer case of any plugged-in appliance is supposed to be connected to ground, but sometimes it becomes accidentally connected to the

electrical "hot" if the polarized plug is inserted upside down. Because of the possibility of this improper grounding, you should never touch a plugged-in appliance while taking a bath, or while touching the metal of a sink or the water stream in a sink. Also, plug-in appliances should not be allowed to get wet, because water makes it more likely that the outer case will become at least weakly connected to electrical "hot".
Besides being a shock hazard, an improperly grounded appliance produces AC electric fields, which creates currents in your body by proximity, even if you are not touching the appliance. You can sometimes detect improper grounding by lightly sliding a fingertip across the surface using very little pressure. You will usually feel a weak vibration if the surface is "hot". You can also use an AC voltmeter (connected between a known ground and the appliance case) or an AC electric field meter (like the TriField Meter) to determine if the case is hot.

SHIELDING ELECTRIC FIELDS

Shielding strong electrical fields can be done by using any type of conductive sheet material, such as aluminum window screen,in front of an indoor appliance. The shield should be connected to electrical ground for maximum efficiency.

AC MAGNETIC FIELDS

Magnetic fields are much more common in the home than are electric fields. They don't represent a shock hazard, but, like electric fields, they produce current in the body. Any wire that carries an AC electrical current produces magnetic fields. However, two wires are required to carry power to an appliance, and if the two wires are bundled parallel and very close together, the magnetic field from one will exactly cancel the field from the other. Thus, an extension cord rarely produces much magnetic field.

MAGNETIC FIELD SOURCES

The main sources of AC magnetic fields in a home are transformers, motorized equipment, sloppy wiring inside the house walls, excess current carried by plumbing, and powerlines or underground power cables. Running cars have a strong AC magnetic field especially nearest the front floorboard, even though the system is classified as "DC". Commercial aircraft also have a strong field inside. The fields in cars and aircraft oscillate faster than the 60 times per second typical of household AC power. Wall outlets generally produce no magnetic fields. Any piece of electronic equipment that plugs into the wall, such as a clock radio or answering machine, will have a transformer.

TRANSFORMERS AND MOTORS

This transformer either plugs directly into the wall ("AC adapter"), or is built inside the equipment. The magnetic field is strong up to three feet from this transformer, whenever the power cord or AC adapter is plugged in. This field exists even if the appliance is not turned on, or even if the adapter is not connected. In other words, if an electronic device uses an AC adapter, to avoid high field you should stay three feet away from the adapter, but you need not avoid the electronic device itself. However, if the device has an internal AC adapter and a plain power cord, stay three feet away from the device itself, whenever the cord is plugged in.
Microwave ovens also have a large transformer built in, but they emit magnetic field only while cooking. Ordinary incandescent light bulbs (and electric blankets manufactured since 1992) produce very little magnetic field. However, high-intensity "halogen" desk lamps and floor lamps have a large 12-volt transformer built into their bases and usually produce a strong field up to three feet away. Fluorescent lights use a smaller transformer and usually have little magnetic field past three feet so they are not a field source unless the light is used in close quarters.
Motorized equipment also produces strong magnetic fields. Generally speaking; the higher the power, the stronger the field. The field is low when you're at least three feet away from vacuum cleaners, motorized alarm clocks, and electric can openers; six feet from washing machines and furnace motors; and 18 inches from electric razors, hairdryers, and battery-powered motorized equipment.

NON-LOCALIZED MAGNETIC FIELDS

Non-localized magnetic fields are harder to avoid than the limited fields from appliances. Occasionally a nearby power line will produce this type of field. More often, it is caused by household plumbing carrying current. This situation is more likely to occur when the cold water pipe enters the opposite side of the building from the power line connection. Safety codes require that the indoor plumbing be connected to the neutral wire of the power line. This can result in current flow. A plumber can reduce magnetic field which results from this situation by installing a "non-conductive coupling" on the cold water pipe just outside the building.
In some older homes the hot and neutral power wires are not bundled closely together, but form a large loop with a gap between them. This creates a magnetic field that exists only when certain appliances are on, even if those appliances themselves are low-field. This can usually be corrected by using an extension cord to change to a different wall outlet, so that the current is carried through a different part of the in-wall wiring. Non-localized fields due to household wiring are usually highest in the room next to where the power line connects or where there is a circuit breaker box.

DETECTING MAGNETIC FIELDS

A reliable way to detect the presence of strong fields is by holding a small magnet. When held lightly, it can be felt to vibrate when held in a 500 milligauss or higher field. Transformers and motors produce this much field a few inches away. A TV or computer monitor will start to jiggle or lose sharpness in a 30 milligauss or higher field, so this can be a more sensitive indicator of strong fields. A better indicator is a large coil of wire connected to an AC voltmeter. For the highest degree of accuracy, use an AC gaussmeter, (like the TriField Meter), specifically designed to detect and quantify magnetic fields.

SHIELDING MAGNETIC FIELDS

Shielding magnetic fields is more difficult than shielding electric fields. Sheets of galvanized mild steel work fairly well and are available in any hardware store. Use a sheet that is thin enough to cut with scissors, and note that two thin layers shield more than one thicker layer. Shielding should be placed so it is between you and the high-field source. Simply staying away from high-field areas is easier and more convenient.

MICROWAVES AND RADIOWAVES

The strongest source of microwaves in a home is a microwave oven with a damaged door seal. You should periodically check the door to make sure it is not dented and that it latches shut fully parallel to the oven body. Correctly-functioning microwave ovens emit somewhat less microwave power. Cellular phones also produce microwaves. (Regular radio phones emit a negligible amount of radio power.) Cellphones and other radio sources sometimes produce interference which can cause sensitive equipment, such as computers, to malfunction.

SHIELDING AND DETECTING MICROWAVES

Ordinary screen-door aluminum wire mesh (but not the plastic kind) can shield computers, etc. quite well if the screen is placed between the radio source and the computer. The screen should be connected to ground. The more of the computer's area is covered, the better the shielding. Also, the use of a power-conditioning outlet strip (one which is specified to reduce "EMI" or electromagnetic interference) is recommended to avoid radio waves being picked up from the power line by the computer.