Powerfrequency Protection for you and your family

This article is a 'work in progress' incorporating new information whenever time permits.

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1. Are you and your family being exposed to powerfrequency radiation?

The answer to this, of course, is "yes" as we all use electricity, and are surrounded by equipment which is powered by electricity, at home, at work, at school and when we go out and about pursuing our daily activities and leisure time.

Since the beginning of the twentieth century, we have been increasingly exposed to EMFs at levels millions of times higher than those experienced by our predecessors 100 years ago. Over time, human beings, like all forms of life, evolve to adapt to changes in the environment. However, it is unlikely that human beings, interacting continuously with the environment, have had time to adapt physiologically to these new electromagnetic stimuli. Biological responses vary from individual to individual and within one individual over time; responses are also non-linear. Anticipating how one person will respond to a given stimulus is like trying to base a long-range weather forecast for the UK upon one drop of rain in East Anglia. The weather is an example of a non-linear system. Despite the addition of a battery of very expensive equipment, weather forecasters still get it wrong, sometimes very wrong. With regard to potential powerfrequency biological effects, we are trying to predict future health outcomes many ***years*** into the future. Many serious cancers are triggered up to 20 years before they are detected by doctors, or even by the patient themselves.

The way we experience the electromagnetic energy that interacts with our bodies is complex. From our evolutionary experience, our sense organs react more to a changing stimulus than to one which stays the same, as originally one that changed would have been more related to 'threat'. Our nervous system, for example, expresses this bias for change by tiring of sensing the same old thing. A lot of research and scientific theory is based on averaging out our exposure, reducing it to the 'same old thing'. This is likely to reveal less than if we look at the changes.

If an incoming signal is appropriately 'tuned,' it could interfere with our bodies' normal function, causing them to 'resonate' at this man-made imposed signal and that this could lead to our naturally functioning biology departing from a healthy homoeostasis. Despite being surrounded by EMF radiation, we do not have the complexity needed in epidemiology to discover whether our health is being damaged by that exposure.

We can minimise our exposure to many of the sources of EMF radiation; house wiring, electrical appliances in the home, etc. We can keep our distance from visible sources of EMFs; powerlines, substations, etc. We can, using the appropriate equipment, detect and measure the fields from sources we cannot see, such as underground cables.

We can learn what to look for in the environment and check for EMFs for example when travelling, in cars, trains, planes, etc. and at workplaces where we may be surrounded by machinery giving off EMFs, e.g photocopiers, welding and other machinery, all sorts of equipment powered by electricity.

When it comes to our personal environment we have more choice over the products we choose. This is similar to choosing, for example, a fridge with a high energy efficiency rating rather than a low one. We have some possibility of choosing equipment that give off low levels of powerfrequency EMFs rather than high ones, where the information is available.

We have produced some detailed articles about some of these EMF sources which you may want to look at. The list of articles, which is updated whenever we have the time to do so, is on the EMFields website.

The article "Powerfrequency EMFs and Health", in 11 sections, is also available in the library with information about the research that has been done into the links between EMFs and cancer, depression, dementia, miscarriages, motor neurone disease, heart disease, genetic and other cellular changes, neurological effects, immune system damage, etc. Some research has shown that powerfrequency EMF exposure can enhance the effects of radiation and chemicals. EMFs have also been found to interact with prescribed drugs, causing some (e.g. tamoxifen, doxorubicin) to be less effective. Light (a type of electromagnetic energy) at night has also been found to affect health.

If you think your exposure may be high enough for it to be responsible potentially for health problems, it is worthwhile measuring the field levels where you and your family spend a lot of time, such as the bedrooms, sitting and play areas, the kitchen and home office/computer room, so that you are happy about where you and your children spend their time. Minimise the use of appliances which give off high fields, or stop using them altogether. You may also want to move some pieces of equipment so that they do not expose anyone to fields that are too high. You can also check out appliances in the showroom, using an appropriate meter (see below, page 9) before you decide to buy.

2. Powerfrequency sources outside the home and what you can do to minimise your exposure

The most obvious powerfrequency EMF sources are pylons, powerlines, substations and transformers; there are also less obvious ones such as underground cables. If you are looking to buy or rent a property, or are concerned about these structures in the home you are already in, you may want to look at "Buying an EMF Safe Property", in 6 sections, to address your particular circumstances. Our publications contain information that will help you to minimise your EMF exposure where possible. "Buying an EMF Safe Property" also has information about properties near to electrified railway lines.

If your property is affected by electric fields from a powerline running close to a window, you can screen electric fields with earthed curtain material. EMFields has a range of materials suitable for curtains, blinds, etc.

The article "Electronic surveillance" (Section 6, Powerfrequency EMFs and Health) has information about the familiar security pillars at the entrance/exit to many shops, which can expose people nearby to high magnetic fields. They are also in libraries, and are increasingly being used for other security purposes.

Some devices also use radiofrequency (RF) transmissions, and terahertz frequencies are used for security detection, police and airport surveillance, wireless communication, pharmaceutical purposes, food safety issues and for medical imaging (Wallace 2008, Shen & Ying 2009).

The use of this new technology has been linked to an increase in risk of cancer (Korenstein-Ilan 2008) and DNA damage (Titova 2013).

It is worth avoiding exposure to these EMF sources wherever possible.

Cars, buses, trams, trains & planes

Our article on 'Transport' in 2 sections discusses the different types of EMF exposure in modern and older vehicles. Buses, trams and trains can also give off quite high levels of EMFs. It is worth avoiding sitting over the wheel arches in buses, the control equipment in trams, and the part of

the train where overhead power cables run down to the wheels. If in doubt, sit on an inside seat, which tends to be less exposed than the window seats.

High magnetic field levels can be experienced in planes from the online entertainment facilities fitted to the back of seats. The seat with the inbuilt screen will be the one affected, not the seat of the person watching; though they may be affected by the screen in their seat, which the person behind them is watching. When travelling by plane, choose 'no frills' airlines, with fewest facilities on offer. Many airlines are now offering the use of mobile phones whilst in flight. It is worth finding out in advance, and avoiding these planes if you may also be sensitive to RF radiation.

Gardens and garden equipment

Electric fields from powerlines, etc. can be reduced considerably by shrubs, bushes and trees. Trees that lose their leaves in winter will provide less protection when bare, but people are likely to be outside for shorter periods of time then, on the whole.

It is important not to allow babies to sleep in prams in high field levels and to discourage convalescing children to be out in them. It is a good idea to measure garden EMFs to see if any areas need to be avoided. Avoid planting trees and bushes that will make good 'dens' or 'tree houses' for children in EMF exposed areas. If you have an area which is highly exposed, try planting it with something with thorns, such as roses!

As far as we know no detailed research has been done to look into the effect of EMFs on plants and vegetables growing in gardens near substations or under powerlines, though the soil quality is likely to be less than optimal, which would affect the findings. However, EMFs affect the polarisation of water molecules and cellular communication, so we would assume that it will affect any growing thing. It is unclear what the effect may be of eating a diet entirely composed of food grown in these conditions.

Garden equipment such as electric lawn mowers and power tools (drills, hedge trimmers, strimmers, sanders, patio cleaners, etc.) give off EMFs; those with motors close to your body will give you high magnetic and electric field exposure whilst they are in use. There is nothing you can do about this and short term occasional exposure should not cause any EMF related problems, unless you are particularly sensitive. The motors of some tools and lawn mowers are further away from your body when in use and so the fields your body is exposed to are lower. The evidence seems to show that occupational exposure when you are moving about is less of a risk than prolonged exposure when you are stationary (i.e. in a chair or bed).

Satellite dishes and digital TV receptors

Satellite dishes and receivers can give off high electric fields if the TV system or satellite decoder is not 'earthed' to the mains electricity safety earth. Most TVs and satellite systems are not earthed when you buy them, as they only have two-wire mains leads. Walls will give some protection from the electric fields; windows are less effective at screening them. It is important that these systems are earthed. People who are electrically sensitive may be affected by electric fields coming in through the windows.

Digital TV receptors for both satellite and terrestrial signals can be thought of in exactly the same way as satellite dishes and receivers. There is only a subtle difference in the way the information is coded into the signal. However, some electrically sensitive people seem to react differently to such signals for reasons which are not yet known. One person we know who is very sensitive

indeed, found it easier when she ensured that the television set was between her and the aerial. If she sat between the TV and the aerial, her symptoms were worse.

Solar heating systems etc.

Solar heating systems are being promoted these days as they are based on a renewable source of energy and can save the householder money in the medium-term. The system itself will not be an EMF hazard, except for the electric pump used to pump the water around. This could be outside or inside the house. Keep chairs, beds, etc. on the other side of the wall, at least one metre away from the pump.

Photovoltaic panels generate direct current (DC) power that can be used to charge batteries. The DC (12, 24 or 48 volts usually, up to about 120 volts in some large systems) can then be used directly for lighting, etc. or can be fed to an 'invertor' that converts it to 230 volts AC. Cheap invertors use a square-wave and are very efficient, but do generate quite a lot of EMF noise because of the sharp switching waveform edges. They are used for supplying washing machines, motors and other high-ish powered loads. These switching transients may be very biologically active and should be generally fed around the house wiring. More expensive, and less efficient, invertors try to approach a sine-wave. These should be used where you want AC lighting or need AC to supply TVs and sensitive electronic equipment. The sine-wave power may be fed around the house wiring if necessary.

The pocket PF5 meter (see page 9) will measure the powerfrequency from solar panel invertors, one of very few affordable meters to do so. The invertors can also add dirt electricity to the house mains, which can also affect people who are sensitive quite badly. DE meters can help check the level of dirty electricity and DE filters can reduce dirty electricity to acceptable levels.

If you intend to install photovoltaics, then we would strongly recommend that DC is used for lighting and that lights are Light Emitting Diode (LED) or AC/DC high-frequency fluorescents and that square-wave AC is only used for high-power loads away from where people spend time.

Home wind turbines

These are increasingly popular, but as they become more so there will be problems with respect to feeding surplus electricity into the grid. The Grid has not been developed to accept small *ad hoc* inputs. The electricity supply is likely to have difficulties as these new sources are added in a random fashion to the national system.

Small windmills situated on top of buildings have been known to create a 'strobe' effect as the sun is seen behind the revolving blades. This could induce epileptiform seizures in those who may be susceptible.

There is more information about larger wind farms in our publication "Wind Turbines".

3. Neighbours

It is unlikely that you will be affected by powerfrequency EMFs from your neighbours, though occasionally the magnetic fields from TVs, computers, storage radiators, aquarium pumps etc. could travel through the walls affecting a localised part of an adjoining room.

In multiple occupancy buildings, such as flats, the lower floors can have wires to upper floors running past their rooms, which can result in high fields in the lower flats. Where a building has

a lift, whether it is a standard lift in a block of flats, or whether it is a stairlift for people with a mobility problem, there will be high levels of magnetic fields from the machinery powering the motor. When considering a flat, it is worth looking at how far away the machinery is from the living space. It is probably advisable to measure field levels in bedrooms and sitting areas. With a stairlift, the benefits are likely to outweigh the disadvantages to the person who is the primary user, but caution should be used in allowing eager children or grandchildren to 'hitch' rides.

Unless you have been involved in 'subversive activities,' as a result of which you have been targeted by official agencies, it is almost certain that you will not be being 'zapped' intentionally. This would be an extremely expensive operation for the authorities or an individual to be involved in, and they would not undertake it unless they considered you a ***very*** important target. Most people would not have access to the sort of equipment necessary to focus harmful radiation on to a particular individual. If you feel you are being affected in this way, it is most likely that you have developed electrical or chemical hypersensitivity, and you are reacting to a source of chemicals or EMFs that most people would not react to.

4. Schools

There are schools where the buildings or games areas are near to powerlines. We do not know what the effect on the health of children attending such schools may be. They will be exposed potentially to two types of EMFs; an average background level and also transient exposures, especially if the field levels are only high in the playgrounds or games areas. The research into EMFs suggests that there may be a small proportion of the school population who are sensitive to such fields.

Despite the worldwide acknowledgement of the link between powerfrequency magnetic fields of 0.4 microtesla and an increased risk of childhood leukaemia, schools are still being built too close to powerlines. This may well be because the land is relatively cheap to a local authority that is strapped for cash. You may feel that this would influence your choice of school, if you have one, for your child.

Schools are beginning to use WiFi for many of their lessons, and pupils may have been given tablets for school and home work. These use wireless communication with the internet and we think it is VERY risky for our children to be so exposed. For further information see 'Your low EMF home section 5. WiFi', and also 'Schools and Wireless Technology'.

5. Work

Many pieces of equipment can be found in modern offices. It is often difficult to modify the work environment, over which employees may have little control. It is worth making note of precautionary distances and implementing them where possible. You may choose to use a meter (see below, page 9

) to check the fields and to position chairs in the least exposed places.

In warehouses and factories with heavy machinery, it may be worth measuring the field levels you are exposed to and attempting to keep a precautionary distance from power cables, etc. where possible.

6. Powerfrequency sources inside the home and what you can do to minimise your exposure

The main sources of powerfrequency EMFs in the home are 1) house wiring and 2) electrical appliances.

Buildings are wired to conform to the Institute of Electrical and Electronics Engineers (IEEE) regulations, which do not take account of potential health effects from low levels of electromagnetic field exposure. They are only intended to protect against electric shocks. However, the common method of wiring buildings in the UK, using ring mains, can result in high levels of EMFs. Enthusiastic DIY-ers may also unwittingly, be responsible for creating high EMF levels. The plaster used to finish walls is hygroscopic, i.e. it attracts water molecules from the surrounding environment, and thus is conductive to electricity. If there is a slight fault in the screening of wiring cables in the wall, the whole wall can re-radiate electric fields. Many people who suffer from electrical hypersensitivity feel worse when exposed to the levels of electric fields that this can result in. Often, the only way to find out if your home has a house wiring fault is to measure the electric and magnetic field levels.

The EMFields library has an article "Your low EMF Home 1. House Wiring" which explains how elevated levels of EMFs are produced, and what can be done to reduce them. It is intended more for electricians than people without that level of training, as most of the work needed is not DIY, and re-wiring is subject to Part P checks. Radial wiring is now likely to be recommended by the Government for new-build houses for low EMF exposure. Radial wiring is the standard in Europe. The UK is unusual in having predominantly ring main wiring.

Two increasingly common sources of powerfrequency radiation, at different frequencies to the main frequencies are CFLs (energy saving bulbs) and induction hobs (for cooking). Field levels can be measured with the pocket powerfrequency meter or PPF5 (page 9). There are very few affordable meters which will do this.

Grounding beds and computer chairs

We believe that it is important not to expose yourself to higher than normal electric fields where you sleep or spend quite a lot of time. To avoid exposure to electric fields from house wiring under the floor, when you are in bed, you may want to ground yourself using a grounding sheet, or ground yourself whilst using a computer if you spend a lot of time on one.

Laptop protection

Laptops can give off high electric field levels from the keyboard. You may want to consider a laptop electrical earthing lead which screens against RF fields.

Neither of these 2 people is protected from electric fields or RF fields from a WiFi enabled laptop. Earthing laptops is especially important for men wanting to preserve their fertility and women, especially whilst pregnant, wanting to protect their unborn child from unnecessary exposure to EMFs.

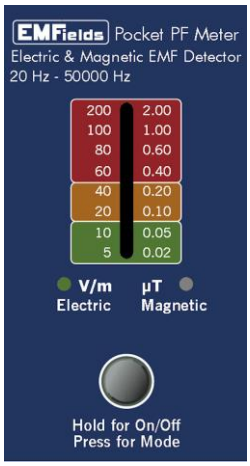
Our article "In your home" in 8 different sections lists most commonly encountered electrical appliances, whether they are likely to emit high levels of EMFs and what can be done to reduce the user's exposure. This may mean changing one appliance for another of a different type, or checking different appliances in store first and determining which is better from an EMF point of view. It may mean using them in a different way, e.g. sitting further away from them whilst they are working, using them at a different time of day, or earthing ones which are usually supplied unearthed and thus can generate high electric field levels. The article gives instructions as to how this can easily be done.

The wires for all appliances give off electric fields whether the appliance is working or not. When it is working, the cables also radiate magnetic fields. If you are sensitive to electric fields, you may want to switch appliances off at the wall rather than a more localised switch near to the appliance, when not in use, to avoid accidental electric field exposure from the cable.

If you think your exposure may be high enough for it to be responsible potentially for health problems, it is worthwhile measuring the field levels where you spend your time. You may want to check the field levels in kitchens, play areas and bedrooms, so that you are happy about where your children spend their time. Minimise the use of appliances which give off high fields, or stop using them altogether. You may also want to move some pieces of equipment so that they do not expose anyone to fields that are too high. You can also check out appliances in the showroom before you decide to buy.

7. Equipment for measuring electric and magnetic fields

ELF (PF4) meter (to hire)



Pocket PF5 (PPF5) (to buy only)

To measure both electric and magnetic fields, you can hire or buy the ELF (PF4) power-frequency meter. Both instruments have been designed by Alasdair Philips (Powerwatch) and Andrew Cohen (EMFields). The PPF5 will measure CFLs, solar panel invertors and induction hobs; the PF4 will not do so, as its range does not include the range used by these devices.

The ELF meter measures 1 - 2000 V/m electric fields and 0.01 - 19.99 microtesla magnetic fields.

The pocket PF meter or PPF5 measures 5 - 200 V/m and 0.02 – 2.00 microtesla (µT) (0.2 – 20 milliGauss (mG)) magnetic fields. If measured fields are over 200 V/m or 2µT or 20mG, they should be reduced to avoid the risk of adverse health effects.

With these meters you can measure the EMFs in your property or the property you are considering buying, outside in the garden, inside your car and in other places of concern (schools, nurseries, workplaces, etc.) from pylons and other external and internal sources of power frequency EMFs.

Dirty electricity meter (to hire or buy)

Dirty electricity filter

Contact: EMFields, 12, Mepal Road, Sutton, Ely, Cambs. CB6 2PZ www.emfields-solutions.com 01353 778814; meters are usually sent by 1st class recorded delivery.

8. Body voltage

Some people have suggested that a way of determining personal exposure to EMFs is to measure the body voltage of the individual. Measuring this presents some practical problems. Generally speaking, the lower the electric field, the lower the body voltage will be. However, any measuring instrument gives the field between the user's hand and the surrounding environment. If you are standing above cables (say lighting cables under the floor for a lower floor in the building) then some of those fields travel up your legs and through the meter looking for a lower field (ideally Earth). If you held the instrument towards, say a light switch on the wall, then the reading you get will be lower and will show the electric field voltage gradient you are being subject to – it does not read the voltage to Earth! If you hold the meter near an earthed metal radiator, the reading will rise. The reason is that it is the voltage gradient that is important and should be minimised.

The lowest reading on a meter is not necessarily the lowest place of electric fields with respect to Earth.

Body-voltage is measured between the person and Earth. Especially upstairs in a building this could be very misleading as the lowest voltage to Earth does not represent, nor is even directly related to, the electric field exposure of the person. If a person attaches an earthing leg or arm strap to themselves, the person who is now Earthed will be the focus for all electric fields in the vicinity which will 'aim' towards the person as the 'best Earthed surface' in the vicinity and the person would always be far more highly exposed than before!

9. What you can do

Computers

- When you buy a new computer monitor, switch it on in an unused well-ventilated room for ***at least*** two weeks, to 'burn it in'. This allows the plastic casings to 'outgas' the chemicals used in manufacture, as the casing heats up in use. People who are chemically sensitive may need this time period to be longer.
- Always sit at least 50 cm from the front of the screen, and more than 1 metre from the rear of a VDU, at home, at school or in the office. Magnetic fields travel through walls, so be aware of any monitors in the room next to you if you sit next to a wall.
- Ideally take a 15 minute break every hour when using a VDU, leaving the desk area for at least 5 minutes.
- Make sure that the vertical refresh rate is between 72 and 96 times each second. How to do this is contained in the article "In your home 3 Computers".
- Spider plants are one of the plants recommended by NASA to 'mop up' toxic chemicals from the environment. They thrive on a degree of neglect, so most people will be able to grow them, and they will manage fine when you go on holiday. NASA was less informative as to how long the plants can transform the chemicals before they become exhausted and need replacing. Cactuses can be useful in a room where there is a computer, as the spines can attract positive ions. However, cactuses need to be earthed to discharge them.
- Keep the room in which you have a computer as free from dust as possible, having a clean desk and floor. Electric fields act as a 'magnet', attracting all sorts of unwanted particles, including bacteria and toxins to the computer monitor screen. It is important to keep the

screen clean using an anti-static wipe, and to avoid pollutant materials, including all chemicals (air fresheners, perfume, spray polish etc.).

Televisions

- Clean the TV screen with an anti-static cloth reasonably frequently, as the electric fields cause a build-up of static which attract pollutant particles to the screen.
- Children should sit at a reasonable distance from a TV screen, at least a metre, to avoid inhaling any particles adhering to it as a result of the static electric fields referred to above.
- Position the television set so that people do not sit near or frequently pass near the side or rear of the television. Remember that magnetic fields can pass through walls.
- Ensure that you use the main switch on the set to switch off the television set. Some types of remote control leave your TV on standby and it continues to consume up to a quarter of the energy it uses when fully switched on.

Bedrooms

- If you cannot do without a light by your bed, choose a low-wattage light, using the red-end of the spectrum as this has the least effect on the production of melatonin overnight.
- Choose a bed-base with an unsprung mattress, preferably made with natural materials.
- If you have a waterbed, warm it during the day, and unplug it before going to bed. Use a thick covering on top of the waterbed to retain its heat at night.
- Do not leave an electric blanket on when you are in bed.
- Keep all electrical equipment, clock radios, televisions, etc at least a metre away from the pillow of the nearest person.
- Ensure adequate ventilation.

Diet

Curcumin (an ingredient in turmeric) has important roles in the anti-inflammatory and phagocytic process. He (2014) found that curcumin helped reduce damage done to these processes by EMFs.

'Protective devices'

Increasing numbers of devices are being sold which claim to 'protect' us from the harmful effects of EMFs. Most of these claims are scientifically unverifiable. All of the ones we have tested (by no means all of the ones that are available) have done nothing to reduce the EMFs. There may be a subtle effect on the immune system, for which there is no scientific measuring equipment available, but this will not help much if you remain highly exposed to EMFs.

10. Will copper or lead sheeting or mumetal reduce electromagnetic fields?

Power-frequency magnetic fields will not be reduced by copper or lead sheeting. If the sheets are earthed, they will reduce electric fields.

Magnetic fields can only be effectively shielded using high permeability steel sheeting. It is very difficult and expensive to shield large areas such as living or working spaces. It is almost always better to prevent the fields from being generated in the first place.

Mumetal is an alloy of nickel, iron, and various other trace metals which is magnetically permeable, meaning that it is a good conductor of magnetic lines of force. The percentage of each element in the mumetal affects its performance, as does the thickness and method of manufacture. While mumetal can reduce magnetic fields if installed properly, it cannot block all the radiation in the same way that lead blocks out X-rays.

11. Aluminium Foil

Electric fields can be greatly reduced by pasting strips of *earthed* aluminium cooking foil onto walls and ceilings, and laying them underneath bedroom carpets, near wiring runs. You can decorate over, or lay carpet over, these earthed foils. However, it may cause a condensation and / or mould problem if the foil is used on an outside wall, as it does not allow the wall to 'breathe'.

Aluminium foil is quite fragile and can be damaged easily, and can wear over time. It is necessary to check it every now and again, to see if it has degraded beyond its ability to give adequate screening.

Silvascreen http://www.emfields-solutions.com/shielding/silvascreen.asp is ideal for screening ceilings, walls and floors and is far stronger than aluminium foil. An earthing kit is available as an optional extra to be ordered at the same time as the material. It also screens against RF radiation.

12. Paint

Special paint such as the sort sold by EMFields will reduce electric fields. It is water based and allows the walls to breathe. You need to earth it in the same way as the foil or material.

13. Litovitz devices

Ted Litovitz, a renowned researcher into EMFs and their biological effects, found in the early 1990s that adding a random ELF field reversed the negative effects caused by exposure to low frequency electromagnetic fields. His findings were confirmed by Farrell (1998).

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