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Guidance

Electric and magnetic fields: sources and exposure

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Electric and magnetic fields are all around us, coming from sources ranging from various electrical appliances to power lines that distribute electricity across the country.

1. What is the key safety message for using electricity?

Each year in the UK, people are injured or killed due to electrical accidents. The important safety message is to avoid electric shocks and fires.

The UK Electricity Safety Council publishes statistics on deaths, injuries and fires due to electricity (http://www.electricalsafetyfirst.org.uk/news-and-campaigns/policies-and-research/statistics/).

2. What are electric and magnetic fields?

Electric and magnetic fields come from the generation, distribution and use of electricity. In the UK electricity is generated at a frequency of 50 Hz, or 50 cycles per second, so electric and magnetic fields are also produced at 50 Hz.

3. What are electric fields?

Electric fields come from the voltage that is used to make electric current flow in a wire. The voltage is like the water pressure which makes water flow in a plumbing system, and the electric current is like the water flow.

Electric fields get bigger as the voltage increases. As the voltage is always present in the mains wiring, the cable to an appliance will always produce an electric field unless the wall switch is off or the appliance is unplugged.

Electric fields can be produced by a lamp plugged into the mains. The electric fields will exist even if the lamp is off, as long as the mains socket switch is on.

4. What are magnetic fields?

Magnetic fields are produced by electricity flowing as the electric current in a wire. The larger the current, the stronger the magnetic field.

5. What are the main sources of electric and magnetic fields?

Electric and magnetic fields are produced in our homes by the electrical appliances we use, the household electrical wiring, and the power lines and substations outside the home. Electric and magnetic fields are also produced from the use of electricity in the workplace and by electric transport.

The large power lines across the UK operate at 400 or 275 thousand volts (kilovolts or kV). Smaller local lines operate at 132 kV, 66 kV, 33 kV, 11 kV and the domestic supply of 230 V. The electric and magnetic fields in homes mostly come from appliances, house wiring, low-voltage distribution circuits including cables carrying electricity into homes, and substations.

6. What are the exposure levels in the home?

Magnetic fields are measured in a unit called tesla. A tesla is a very big unit and the fields usually encountered from power supplies in the UK are measured in millionths of a tesla or microtesla (μT).

The background level measured away from appliances usually comes from the local electricity distribution cables which supply the house. The typical background magnetic field level in homes is usually in the range 0.01 to 0.2 μT. The highest magnetic fields in homes usually occur close to electrical appliances and the electrical wiring, even if it is inside the walls. Magnetic fields of up to a few tens of microteslas can occur very close to appliances. In homes within a few tens of metres of large power lines, magnetic field levels are typically a few microteslas but under the largest lines may sometimes reach up to a few tens of microteslas.

By way of contrast, the static magnetic field produced by planet Earth is roughly 50 μT in the UK.

Electric fields are measured in volts per metre (V m^{-1}). The typical background range in UK homes is 1 to 20 V m^{-1} and this may increase to a few hundred volts per metre very close to domestic appliances and power cables, and up to a few thousand outdoors under large power lines. Most building materials screen out electric fields very effectively and so strong electric fields outside a building do not cause strong fields inside.

6.1 Units of electric and magnetic fields

Field type	Unit
Electric field strength	volt per meter (V m^{-1}) or kilovolt per metre (kV m^{-1}); 1,000 volts per metre = 1 kilovolt per metre
Magnetic flux density	tesla (T); 1 tesla = 1,000 millitesla (mT); 1 millitesla = 1,000 microtesla (μT); 1 microtesla = 1,000 nanotesla (nT)