EIRGRID

EMF & YOU

General Information about
Electric & Magnetic Fields in Ireland

GRID25

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PUBLIC
INFORMATION
GUIDE

EIRGRID REGARDS THE PROTECTION OF THE HEALTH, SAFETY AND WELFARE OF ITS STAFF AND THE GENERAL PUBLIC AS A CORE COMPANY VALUE.

ABOUT EIRGRID

EirGrid, a state-owned company, is the operator of the national electricity grid in Ireland.

The national grid is an interconnected network of high-voltage power lines and cables, comparable to the motorways, dual-carriageways and main roads of the national road network.

It is mainly operated at three voltage levels (400 kilo Volts (kV), 220 kV and 110 kV) and is approximately 6,400 km in overall length.

The national grid is vital to ensuring that all customers; industrial, commercial and residential from both rural and urban areas to cities have a safe, secure, reliable, economic and efficient electricity supply.

EirGrid regards the protection of the health, safety and welfare of its staff and the general public as a core company value.

EirGrid designs and operates the transmission network to the highest safety standards and complies with the most up-to-date national and international guidelines.

This brochure is designed to provide general information on electric and magnetic fields, commonly referred to as EMF, which are associated with, but not unique to, transmission lines and underground cables. This brochure also suggests sources for further detailed information in relation to EMF.

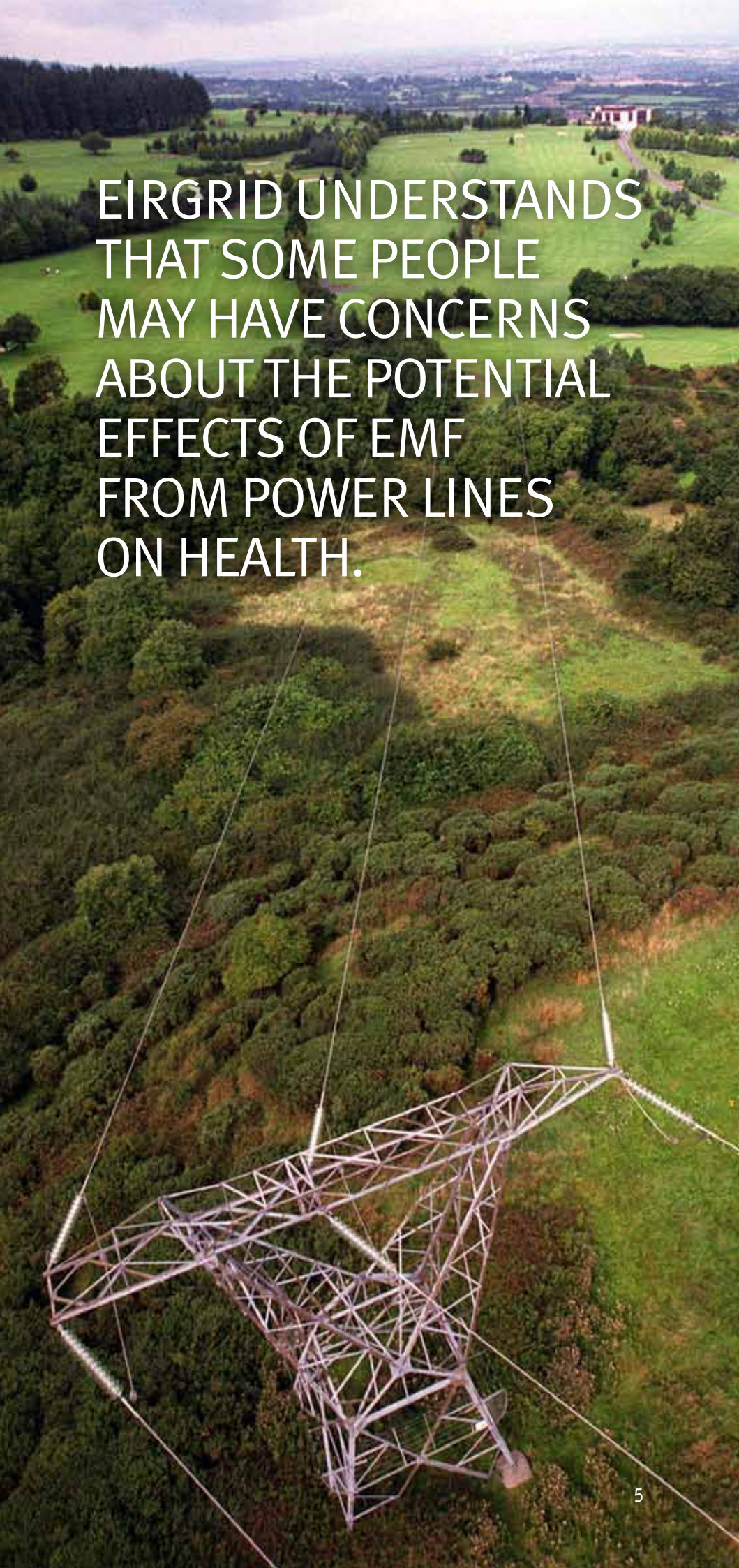
WHAT ARE ELECTRIC AND MAGNETIC FIELDS?

The existence of electric and magnetic fields has been recognised since electricity was discovered and their characteristics have been the subject of thousands of scientific studies around the world. Research conducted over the past 30 years has significantly enhanced our knowledge of EMF.

EirGrid understands that some people may have concerns about the potential effects of EMF from power lines on health. There has been considerable public debate surrounding EMF and this has generated many questions. For example:

- Are there risks to human and animal health?
- Should people take any special precautions against them?
- What studies have been carried out?
- What is EirGrid's position on this issue?
- What is the national and international guidance on this issue?

These questions deserve clear and well-supported answers, giving people the information that they need to draw informed conclusions.



EIRGRID UNDERSTANDS THAT SOME PEOPLE MAY HAVE CONCERNS ABOUT THE POTENTIAL EFFECTS OF EMF FROM POWER LINES ON HEALTH.

EMF occur both naturally and from man-made sources.

All electricity both natural and man-made produces two types of fields: electric fields and magnetic fields. EMF are produced by natural phenomena which have been a constant part of the environment throughout human evolution. For instance, the earth has a natural electric field and a magnetic field.

The most common source of EMF that we encounter is electricity.

The man-made sources include all electrical systems including house wiring, electrical appliances and overhead and underground power lines. In Ireland the voltage in homes is 230 V. Electricity in Ireland is transmitted at voltages of up to 400,000 V (400 kV).

THE ELECTRIC FIELD

The electric field depends on voltage. The higher the voltage, the stronger the electric field. You can imagine it as being like pressure in a water pipe. A 400 kV line would have higher electric fields than a 110 kV line.

The magnitude of an electric field is expressed in volts or kilovolts (thousands of volts) per metre. This is written as V/m or kV/m.

Electric fields are strongest closest to an electricity line and their level reduces quickly with distance. Electric fields are blocked by buildings, trees etc.

Therefore, inside a typical house the dominant sources of electric fields are typical household appliances such as microwave ovens, hair-dryers and electric blankets.

THE MAGNETIC FIELD

The magnetic field is produced by moving electric charges and so the strength of the magnetic field varies directly with the current flows on lines. As a result, the magnetic field can vary at different times during the day. You can imagine this as being like the flow rate of water in a water pipe. Magnetic fields are measured in units of microtesla (μT). Unlike electric fields, magnetic fields are not blocked by buildings, trees etc.

Appliances that use a lot of power, such as electric heaters or cookers, generate higher levels of magnetic fields than lower powered appliances. Like electric fields, magnetic fields are highest closest to an electricity line and their level reduces quickly with distance from the line.

Q WHY DOES A FLUORESCENT TUBE LIGHT UP UNDER A HIGH VOLTAGE POWER LINE?

There is a well-known phenomenon whereby a fluorescent tube will glow dimly if placed below a high voltage power line. This effect is caused by the electric field. The electric field causes a tiny current measured in millionths of an ampere to flow through the gas inside the tube, which causes a very weak glow.

This observation also shows how the electric field only has an effect very close to the power line. The moment you move the flourescent tube away from the line, the light goes out. There are no health effects from this observation.

WHAT IS THE ELECTROMAGNETIC SPECTRUM?

Electromagnetic energy travels in waves and these waves span a broad range from static frequency (fields that do not change with time) at one end of the spectrum to very high frequency (fields that change billions of times per second) at the other end of the spectrum.

This electromagnetic spectrum in figure 1 describes the various types of electromagnetic energy based on their frequency.

The earth's magnetic and electric fields are largely constant and therefore are termed static fields. Their frequency is very low or zero.

The earth's static magnetic field (which acts like a giant bar magnet) causes a compass to align north-south.

Most man-made sources of electric and magnetic fields fluctuate in direction and intensity. They are called time varying or alternating current fields (AC).

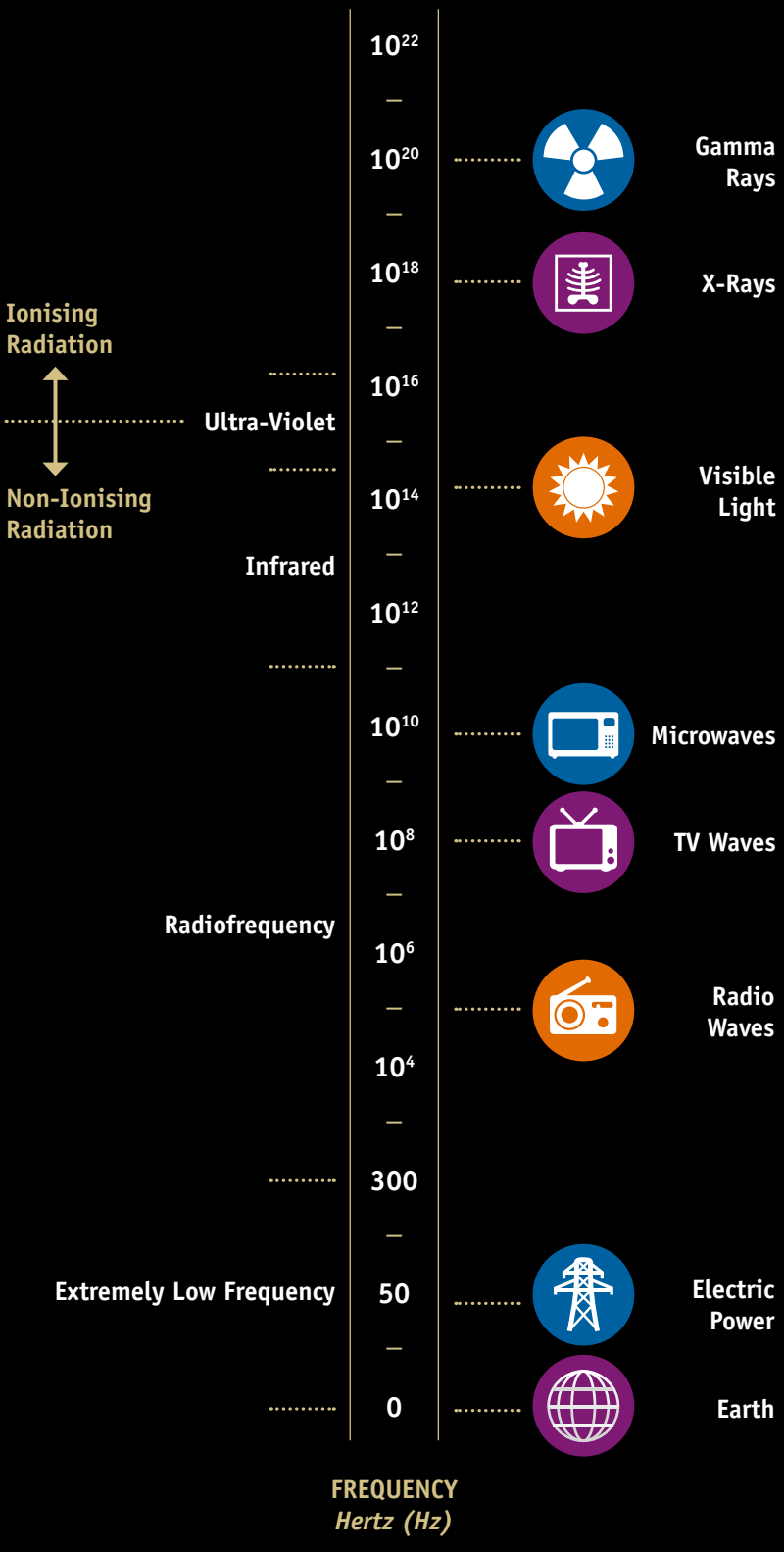
Time varying or alternating current fields come from anything that runs on electricity, from electrical installations to household appliances.

Their frequency is expressed in hertz (Hz). Hertz is the rate at which the field alternates back and forth per second.

The electric power system operates at 50 Hz in Ireland and Europe and 60 Hz in some other countries such as North America and thus is a source of EMF at these frequencies. Such frequencies are in the extremely low frequencies ranges, 0-300 Hz.

THE ELECTROMAGNETIC SPECTRUM

FIGURE 1



ARE ELECTRICITY EMF THE SAME AS RADIATION?

No. Electricity EMF and radiation are not the same. The fields resulting from the use of electricity are fundamentally different from x-ray and gamma ray radiation.

Whilst these are all forms of electromagnetic energy there are important fundamental differences between the two.

The term radiation is usually used to refer to ionising energy. Ionising means that, if the radiation is sufficiently strong, it can break bonds in molecules and therefore damage biological molecules including the DNA of cells. Only the high frequency portion of the electromagnetic spectrum is ionising. This includes x-rays and gamma rays.

The energy in visible light, radio frequency and fields in the static and 50 Hz ranges including electricity are all classified as non-ionising.

It is very important to realise that 50 Hz fields, i.e. electricity, are non-ionising. They have insufficient energy to ionise molecules.

Examples of non-ionising energy includes electric power, radio waves, TV waves and microwaves. See figure 1.

WHAT STUDIES HAVE BEEN CARRIED OUT?

Since 1979 many scientific studies have been carried out on the possible effects of EMF on people.

To determine if something is harmful to health, scientists evaluate three different types of studies.

1. EPIDEMIOLOGY STUDIES

Epidemiology is the study of patterns of disease in populations. It searches for statistical links or associations between exposure to EMF and disease in human populations. It is often difficult to draw definitive conclusions from these studies because of what are known as confounding factors. For example, just because persons with some health conditions might live near electric power sources does not mean that the fields from these power sources affect their health. Other factors including pollution from adjoining roads, industrial or socio-economic factors and perhaps genetics would have to be ruled out.

2. EXPERIMENTAL STUDIES – PEOPLE AND ANIMALS

These studies involve exposing people or animals to EMF and looking for biological changes.

3. EXPERIMENTAL STUDIES – CELLS AND TISSUES

These studies involve exposing tissues and cells to EMF in laboratory conditions.

WHAT DO HEALTH AND SCIENTIFIC AGENCIES SAY ABOUT EMF HEALTH RESEARCH?

National and international health and scientific agencies have reviewed more than 30 years of research including thousands of studies.

None of these agencies has concluded that exposure to EMF from power lines or other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health. However, agencies have recognised a statistical association between estimated higher long-term exposures to magnetic fields and childhood leukaemia in epidemiological studies but have not been able to rule out the contribution of chance, selection bias and confounding factors to these associations with reasonable confidence. Neither long-term studies of animals nor studies of cellular mechanisms have confirmed a biological basis for such an association. This explains why no health agency has concluded that there is a causal relationship between magnetic fields and health effects.

The International Radiation Protection Association (IRPA), which had been addressing EMF and developing exposure guidelines since 1974, set up an independent scientific commission called the International Commission on Non-Ionising Radiation Protection (ICNIRP) in 1992. This independent scientific commission was established to advance non-ionising radiation protection for the benefit of people and the environment. It provides science-based guidance and recommendations including independent international guidelines and recommended limits of exposure. ICNIRP is the formally recognised non-governmental standard setting body for EMF by the World Health Organisation (WHO) and the European Union.

In June 2001 IARC (International Agency for Research on Cancer) assembled a panel of scientists to review research to evaluate the potential relationship of EMF to cancer. The panel classified magnetic fields into a category called 'possibly carcinogenic'. Other common exposures given a similar classification by IARC include coffee and pickled vegetables. For this category, IARC stated[1] 'there is limited evidence of carcinogenicity in humans and inadequate evidence in animals'. Electric fields were considered to be 'not classifiable as to their carcinogenicity to humans' due to insufficient data.

None of these agencies has concluded that exposure to EMF from power lines and other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health.

[1] 2002 IARC Volume 80 Non-Ionizing Radiation, Part 1: Static and Extremely Low-Frequency (ELF) Electric and Magnetic Fields.

In 2007, the World Health Organisation updated the IARC report with the publication of its comprehensive review of EMF health research.[2]

THE CONCLUSIONS OF THE WORLD HEALTH ORGANISATION REPORT CAN BE SUMMARISED AS FOLLOWS:

- The research does not establish that exposure to EMF of the nature associated with power lines causes or contributes to any disease or illness.
- There are no substantive health issues related to electric fields at levels generally encountered by members of the public.
- While epidemiology studies have reported a weak statistical association between childhood leukemia and long-term exposures to magnetic fields greater than 0.3-0.4 μT, this association is not supported by the laboratory studies and has not been considered a causal relationship.
- The animal studies as a whole do not show any adverse effects, including cancer, among animals exposed to high levels of magnetic fields.
- The laboratory studies on cells and tissues have not confirmed any explanation as to how weak magnetic fields could cause disease.
- Because the epidemiology studies have limitations and the experimental studies provide little or no support for an association with cancer or mechanisms to cause cancer, the World Health Organisation did not conclude that magnetic fields cause childhood leukaemia. Thus, considering all of the research together, the reviewers for the World Health Organisation did not conclude that magnetic fields cause any long-term, adverse health effects.

[2] http://www.who.int/peh-emf/publications/elf_ehc/en/index.html

To date, the whole body of scientific research has not proven any adverse effect to human health from EMF.

The independent international health and scientific agencies are continuing to review and monitor the possibility of health effects from exposure to EMF. They are doing this not because they have identified a problem but to ensure that even the smallest possibility of a health risk has not been overlooked, given that everyone in the developed world is exposed to EMF. The findings of these agencies carry considerable weight, as they reflect the judgements of groups of multiple scientists rather than the views of individuals.

The World Health Organisation stated that the scope of any actions we may take to reduce EMF exposure, either personally or as a society, should be proportional to the strength of the science. The actions to reduce exposure should be very low in cost and should not compromise the health, social and economic benefits of electricity to our society.

WHAT IS THE VIEW OF THE IRISH GOVERNMENT?

In March 2007, Ireland's Department of Communications, Marine and Natural Resources (DCMNR) assembled a panel of independent scientists to review EMF and Radio Frequency research. The conclusions are summarised in the Q&A document entitled "Health Effects of Electromagnetic Fields". The conclusions of this report were consistent with those of IARC, the World Health Organisation and other national and international agencies. In relation to EMF, the report states:

'No adverse health effects have been established below the limits suggested by international guidelines.'

This position was re-stated by the Office of the Chief Scientific Adviser in a report into possible health effects of exposure to electric and magnetic fields completed in July 2010:

'It is simply not possible for the level of energies associated with power lines to cause cancer. The World Health Organisation, ICNIRP (International Commission on Non-Ionising Radiation Protection), the Irish authorities, and several other international and national radiation authorities consider that the evidence for increased risk of all other types of cancer, as a result of exposure to power frequency electric and magnetic fields, to be scientifically unconvincing.'[3]

WHAT IS THE VIEW OF THE EUROPEAN UNION?

In 1999, the Council of the European Union adopted a recommendation in relation to public and occupational exposure to magnetic and electric fields. This recommendation applies the exposure guidelines advocated in 1998 by ICNIRP, to locations where people spend significant time.

The 1998 ICNIRP guidelines specify limits on the allowed current density in the body produced by EMF, which are called 'basic restrictions'. To make sure that these basic restriction limits are not exceeded, 'reference levels' for both electric and magnetic field exposure are provided. For the general public these reference levels are 5 kV/m and 100 μT.[4] If EMF exposure level is less than the reference level, compliance with the basic restriction is assured. If exposure exceeds the reference level, the circumstances of the exposure need to be examined more closely to confirm compliance.

[3] A Review of Recent Investigations into the Possible Health Effects of Exposure to Electromagnetic Fields (EMF) from Power Lines by Prof. Denis O'Sullivan *www.eirgridprojects.com/yourhealth/*

[4] In 2010 ICNIRP updated its EMF guidelines, which included the recommendation for a 200 μT reference level for exposure of the general public, but these have not yet been adopted by the EU.

DO POWER LINES AFFECT LIVESTOCK?

Studies have been carried out on livestock. The studies found that, as in humans, there was little evidence to suggest that EMF affect the health of animals including cows, pigs, chickens and horses.

Long term studies have been carried out on cattle in pens directly below power lines, with no evidence of harmful effects.

Occasionally, farm animals in barns may experience very small electric shocks. This can be a result of faulty insulation on the farm or poorly earthed equipment and is unrelated to electric and magnetic fields.

Such shocks are easily avoided – for example, by ensuring that electric farm equipment is properly earthed and in good condition, drinking troughs are properly earthed and low voltage lines and distribution lines are properly earthed.

ARE THERE ANY PRECAUTIONS THAT NEED TO BE TAKEN?

The precautionary principle is a framework for public health policy decisions in areas of scientific uncertainty, which states that where uncertainty exists about the possible effects of a particular exposure, measures should be taken that are proportional to the weight of the scientific evidence.

The European Commission recommends[5] that the 'precautionary principle' be applied when "there are indications that the possible effects on the environment, or human, animal or plant health may be potentially dangerous."

The Commission decided[6] not to apply the 'precautionary principle' in the case of its EMF guidelines on the basis the it would be inappropriate to do so "as there are no clear scientific indications that the possible effects on human health may be potentially dangerous."

In Ireland, because of our low population density (1/4 of our more heavily industrialised European neighbours) we have a much lower exposure to EMF from power lines. Even directly underneath the largest power lines the EMF levels are below the ICNIRP guidelines.

In 2010 ICNIRP issued new guidelines and increased the reference level to assess exposure of the general public to magnetic fields from 100 μT to 200 μT and the electric field reference level remains at 5 kV/m.

In Ireland the electricity transmission system fully complies with the ICNIRP and EU guidelines.

[5] Communication from the Commission on the Precautionary Principle – COM/2000/0001

[6] Implementation report on the Council Recommendation limiting the public exposure to electromagnetic fields (0 Hz to 300 GHz) *http://ec.europa.eu/health/archive/ph_determinants/environment/emf/implement_rep_en.pdf*

WHAT IS EIRGRID'S POSITION?

EirGrid's position on EMF and health is based on the authorative conclusions and recommendations of established national and international health and scientific agencies which have reviewed the body of scientific research and studies.

These panels have consistently concluded that the research does not indicate that EMF cause any adverse health effects at the levels encountered in our everyday environment and that compliance with the existing ICNIRP standards provides sufficient public health protection.

EirGrid recognises that some individuals are genuinely concerned about issues regarding EMF and health. EirGrid is committed to addressing these concerns by continuing to:

- Design and operate the transmission system in accordance with current international guidelines on EMF (ICNIRP), as reviewed by the World Health Organisation and endorsed by the EU and the Irish Government.
- Closely monitor engineering and scientific research in this area.
- Provide information to the general public and to staff on this issue.

Where can I find more information on this topic?

THE WORLD HEALTH ORGANISATION – INTERNATIONAL EMF PROJECT (2007)

http://www.who.int/mediacentre/factsheets/fs322/en/index.html

THE EUROPEAN HEALTH RISK ASSESSMENT NETWORK ON ELECTROMAGNETIC FIELDS EXPOSURE (2010)

http://efhran.polimi.it/docs/EFHRAN_D2_final.pdf

HEALTH PROTECTION AGENCY

http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/ElectricAndMagneticFields/HealthEffectsOfElectricAndMagneticFields/

OFFICE OF THE CHIEF SCIENTIFIC ADVISER

www.eirgridprojects.com/media/Office%20of%20the%20Chief%20Scientific%20Adviser%20Review%20on%20EMF%20&%20Power%20Lines.pdf

DEPARTMENT OF COMMUNICATIONS ENERGY AND NATURAL RESOURCES

www.dcenr.gov.ie

EUROPEAN COMMISSION

http://ec.europa.eu/enterprise/sectors/electrical/documents/lvd/electromagnetic-fields/

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ELECTRIC FIELDS:

The table opposite shows some examples of different sources of electric fields and how they compare to typical electric field strength from electricity lines or cables that make up part of the electricity grid in Ireland.

The table also references the ICNIRP guidelines for exposure to electric fields set to ensure public health and safety.

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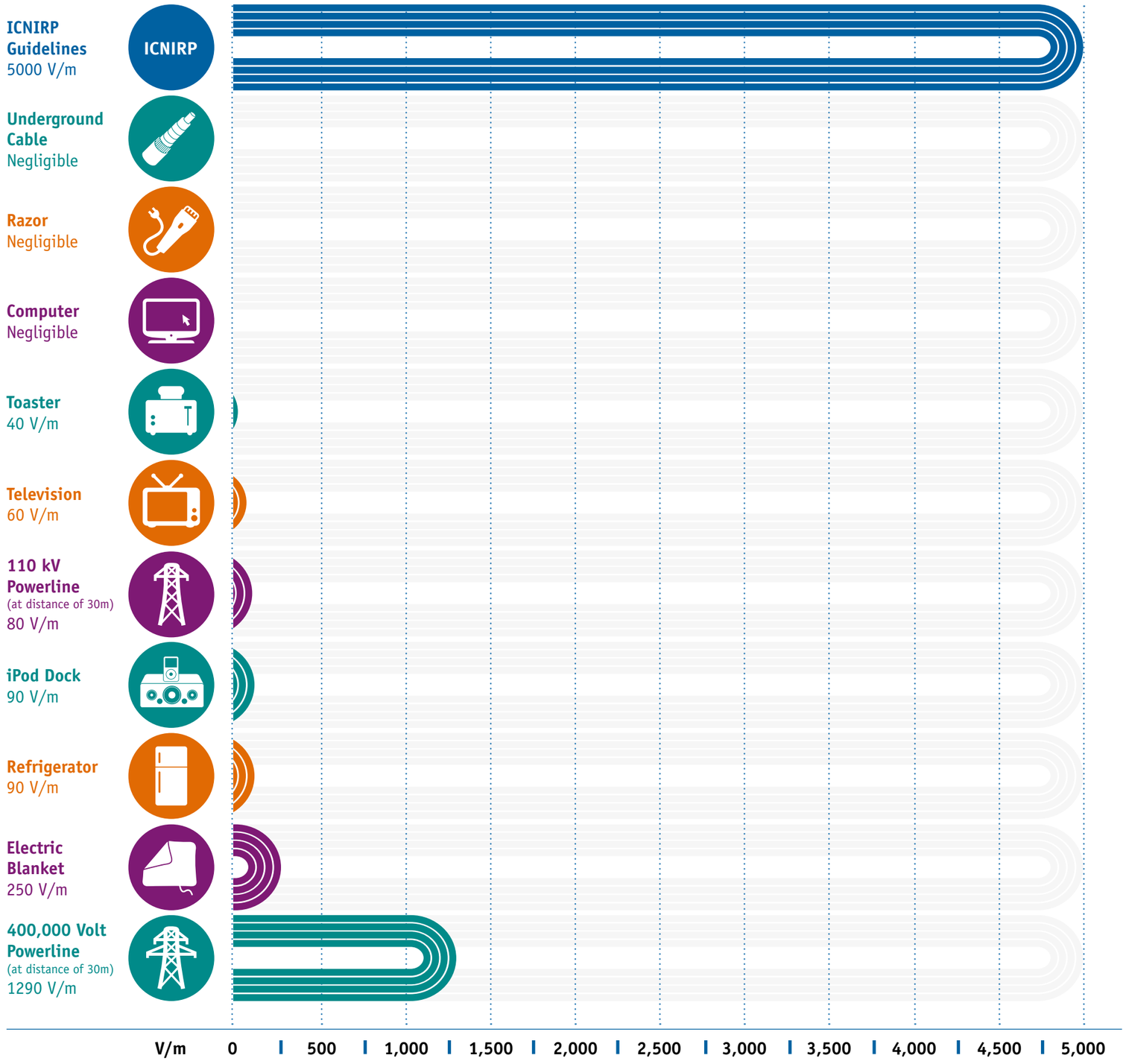
COMPARISON OF DIFFERENT SOURCES OF ELECTRIC FIELDS (V/m)



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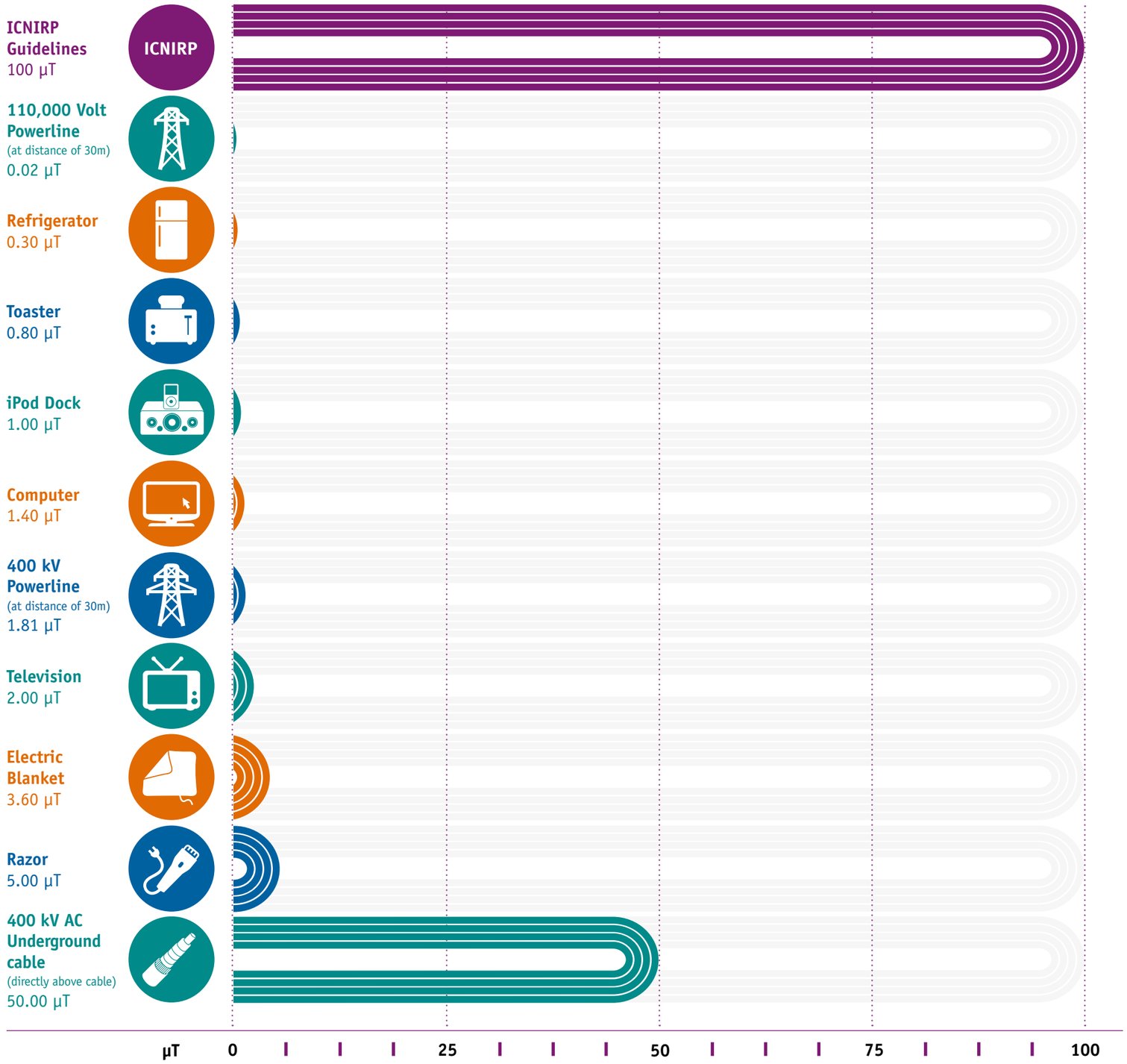
COMPARISON OF DIFFERENT SOURCES OF MAGNETIC FIELDS (μT)



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