Appendix 5-1

EMF Transmission Systems Booklet - Eirgrid 2014

EIRGRID

EMF & YOU

Information about Electric & Magnetic Fields and the electricity transmission system in Ireland

Revised July 2014

GRID25

www.eirgridprojects.com

PUBLIC INFORMATION GUIDE

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.

EirGrid operates power lines at three voltage levels (400 kilo Volts (kV), 220kV and 110kV) and is approximately 6,400km in overall length.

WELCOME

The national grid is vital to ensuring that all customers, – industrial, commercial and residential – have a safe, secure, reliable, economic and efficient electricity supply.

In developing the grid we look to international and national best-practice guidelines regarding public health and safety, ensuring that the system complies with them at all times.

We know that some people have questions and concerns when there is a grid development proposed in their area.

This publication was developed to give an overview of the electricity transmission system in Ireland and the Electric and Magnetic Fields (EMF) associated with it.

We aim to provide you with factual information on EMF, in relation to both underground and overhead technologies.

For more information, including evidence-based studies that include detailed EMF readings from Irish transmission lines, we recommend you review reports published on our website at www.eirgridprojects.com along with links to other sources of information.

EirGrid remains committed to designing and operating the transmission system to the highest standards.

We will not compromise on the health and safety of the public and our staff in designing or operating the national grid.

We welcome your feedback and recommendations for the inclusion of further information on our website.

Fintan Slye
CHIEF EXECUTIVE

WHAT ARE ELECTRIC AND MAGNETIC FIELDS?

The existence of electric and magnetic (EMF) fields has been recognised since electricity was discovered and these 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:

- What are EMF?
- What studies have been carried out?
- Are there risks to human health?
- What is the national and international guidance on EMF exposure?
- Do power lines affect animals?
- Should people take any special precautions against EMF?
- What is EirGrid's position on EMF exposure?

This publication provides information about the current scientific, regulatory, and company perspectives and sources of additional information on EMF to answer these questions.

Electric and Magnetic Fields 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 man-made 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 230V. Electricity in Ireland is transmitted at voltages of up to 400,000V (400kV).

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 400kV power line produces a higher electric field than a 110kV power 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 a power 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.

There are no external electric fields associated with underground cables. This is because the electric field produced is contained within the cable.

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 in lines or cables. 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. Like electric fields, magnetic fields are highest closest to an electricity line or cable and their level reduces quickly with distance from the line or cable.

Appliances that use a lot of power, such as electric heaters or cookers, generate higher levels of magnetic fields than lower powered appliances.

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

There is a well-known phenomenon whereby a fluorescent light 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 mercury vapour inside the tube which casts a weak glow.

The moment you move the fluorescent light away from the line, the electric field weakens and the light goes out. This phenomenon has no impact on people or other organisms.

WHAT IS THE ELECTROMAGNETIC SPECTRUM?

Electromagnetic energy travels in waves. These waves span a broad range of frequencies from static frequency (fields that do not change direction 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.

The electromagnetic spectrum shown in *Figure A* identifies the various types of electromagnetic energy based on their frequency. The earth's magnetic field is largely constant and therefore is described as a static field. Its 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.

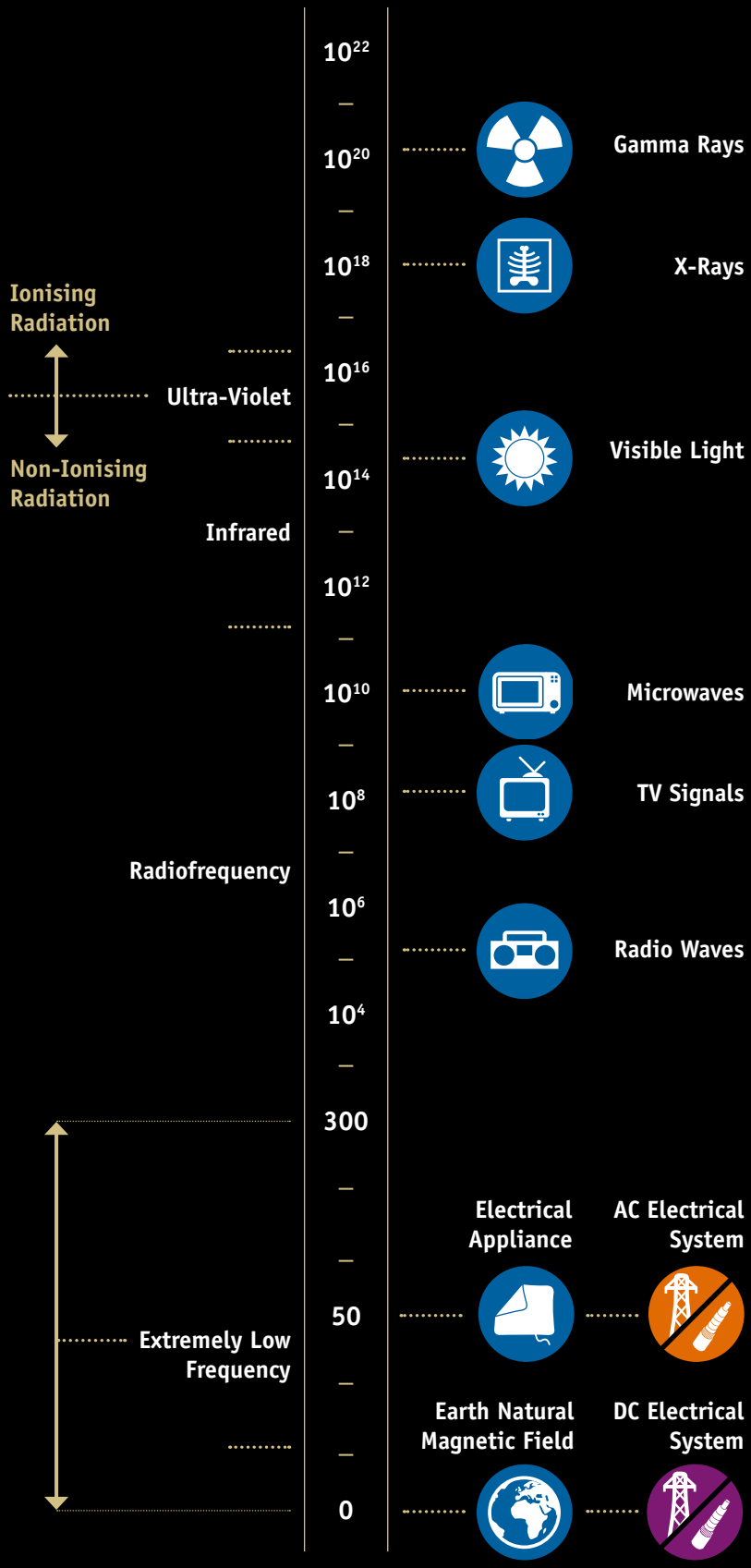
Most man-made sources of electric and magnetic fields fluctuate in direction and intensity. They are called time-varying or alternating current fields (AC). Time-varying or AC fields come from anything that runs on electricity, from electrical installations to household appliances.

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 50Hz in Ireland and Europe and 60Hz in some other places such as North America and thus is a source of EMF at these frequencies. Such frequencies are in the extremely low frequency (ELF) range, 0-300Hz. The ELF-EMF from all electrical equipment are time-varying fields with a dominant frequency of 50Hz in Ireland/Europe.

The strength of the EMF or field depends on how close you are to the equipment. Hence the EMF a person can experience from a household appliance can be similar or higher than that from transmission lines because you can be much closer to the household appliance than an overhead transmission line, which is usually several metres or more away from you.

THE ELECTROMAGNETIC SPECTRUM

FIGURE A



ARE EMF ASSOCIATED WITH ELECTRICITY THE SAME AS RADIATION?

No. The fields resulting from electricity are fundamentally different from x-ray and gamma ray radiation.

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

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, gamma rays and ultraviolet light.

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

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

Examples of non-ionising energy include EMF from the earth and electric power sources, radio waves and TV waves, microwaves, and most frequencies of visible light. See *Figure A*, page 9.

WHAT SCIENTIFIC STUDIES ON THE HEALTH IMPACT OF EMF 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 the results from three different types of studies.

1. EPIDEMIOLOGICAL STUDIES

Epidemiology is the study of patterns of disease in populations. It searches for statistical links or associations between exposures, such as EMF, and disease in human populations. Epidemiological studies are usually observational, meaning that researchers investigate, but do not try to change, what happens as people go about their daily lives. As a result, epidemiological studies are susceptible to certain kinds of errors that lead an exposure and a disease to be associated even when one does not cause the other. For example, the positive association between number of doctors per capita and mortality rates arises not because doctors increase mortality, but rather because of social and economic factors such as industrialisation and job opportunities. Likewise, just because persons with a certain health condition live near electric power sources does not mean that the fields from these power sources caused the condition. Other environmental and behavioural causes would have to be ruled out, as would the possibility that some people moved to the area after already developing the health condition.

2. EXPERIMENTAL STUDIES – PEOPLE AND ANIMALS

These studies involve exposing people or animals to EMF in controlled laboratory conditions and looking for biological changes. For practical reasons, human experimental studies of EMF are usually short-term. Experimental studies generally study effects of short-term exposures.

3. EXPERIMENTAL STUDIES – CELLS AND TISSUES

These studies involve exposing isolated tissues and cells to EMF in controlled laboratory conditions to investigate potential mechanisms of interaction.

TWO TYPES OF TECHNOLOGY

Transmission systems worldwide are typically constructed as overhead lines and in some cases underground cables are used.

Two types of technology can be used to transmit electricity. Both AC and DC power lines produce electric and magnetic fields. AC lines produce AC electric and magnetic fields and DC lines produce static electric and magnetic fields.

When electricity transmission cables are placed underground, the metallic shielding of the cables block the electric field from the cables above the ground, but this shielding does not block the magnetic field from the cables.

EirGrid operates approximately 6,400 km of high-voltage transmission lines that carry AC electricity at voltages of 110kV, 220kV and 400kV. EirGrid also owns and operates the East-West Interconnector which is a 260km high voltage direct current (HVDC) Interconnector. This carries DC electricity from a converter station in County Meath, on underground and subsea cables to a converter station in North Wales (or in the reverse direction). More information about this project can be found at www.eirgridprojects.com

The transmission grid is constructed and operated to rigorous safety standards. Among the standards to which it adheres are those as set out by the International Commission on Non-Ionising Radiation Protection (ICNIRP) – the independent standard-setting body for EMF which is recognised by the World Health Organisation and the European Union. Established in 1992, it provides science-based guidance and recommendations, including recommended limits of exposure.

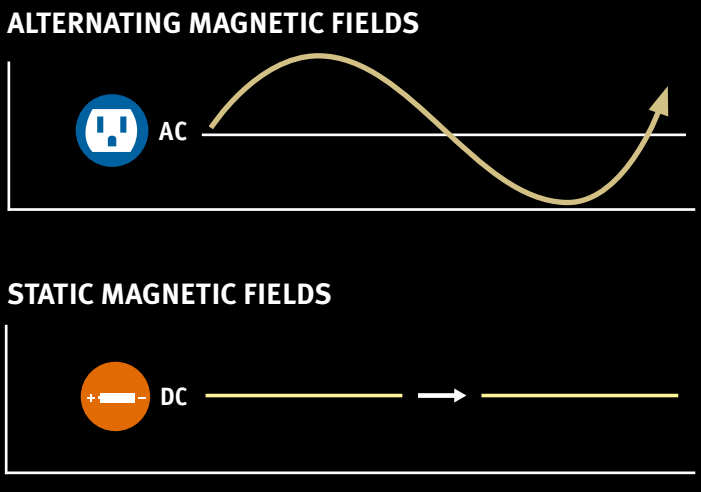


Figure B. Schematic comparison of AC and DC current flow and the resulting magnetic fields.

THE EFFECT OF DISTANCE ON MAGNETIC FIELDS

Both AC and DC technologies produce magnetic fields and both decrease with distance as you move away from the line or cable. See graphs below:

AC LINE AND CABLES

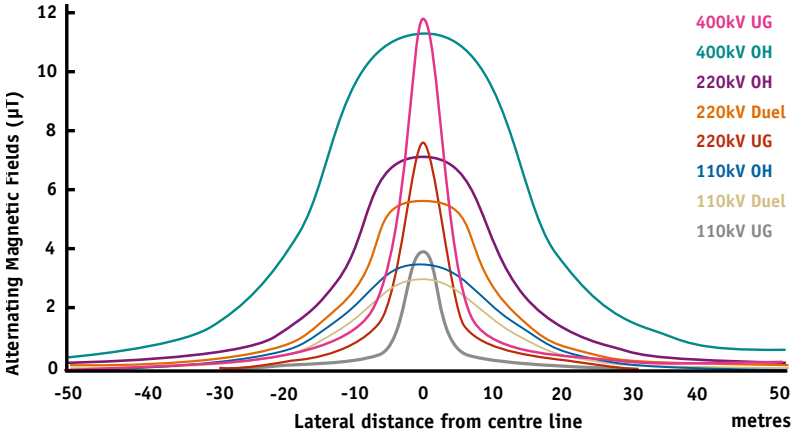


Figure C illustrates the magnetic field from overhead AC lines operating in Ireland. The fields strength decreases with distance. The fields from these AC lines are far below the 1998 ICNIRP Guidelines for exposure to AC magnetic fields (100µT).
In 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200µT reference level for exposure for the general public, but these have not yet been adopted by the European Union.

UNDERGROUND DC CABLE

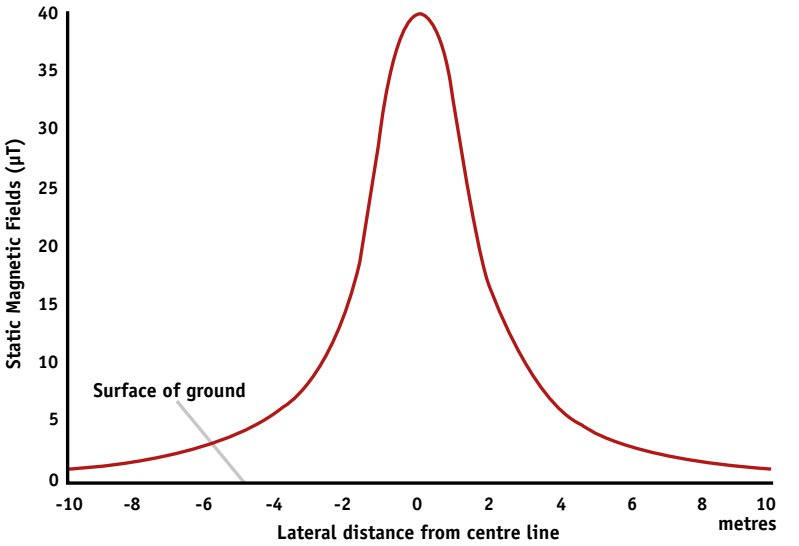


Figure D illustrates that the DC magnetic field decreases rapidly as you move away from the cable centre line. At a distance of 10 metres, the static magnetic field from the cable diminishes to 0.6µT. The DC magnetic field from this cable is far below the ICNIRP guideline (400,000µT).

DIRECT CURRENT CABLES

The fields associated with DC cables like those of the East-West Interconnector are predominately static fields and have no frequency i.e. the direction of the field does not change or oscillate (0Hz). This is different than AC lines or cables which have alternating fields which change or oscillate at 50 times a second (50Hz).

The magnetic fields associated with the East-West Interconnector have similar characteristics to the magnetic field that occurs naturally in the earth, e.g., earth's own magnetic field. Naturally occurring magnetic fields, such as that of the earth, are relatively weak. The earth's magnetic field varies between 30μT at the equator and 60μT at the north and south poles. In Ireland, the intensity of the earth's magnetic field is approximately 49μT.

Underground DC cables are normally buried to a depth of approximately 1 metre and the strongest static magnetic field produced along the route of the East-West Interconnector in Ireland is on the ground directly above the buried cable. For the East-West Interconnector this is approximately 43μT. This value is similar to or lower than the Earth's natural magnetic field.

Figure D, page 13 illustrates that the magnetic field from the East-West Interconnector decreases rapidly as you move away from the cable centre line. At a distance of 10 metres, the static magnetic field from the cable diminishes to 0.6μT.

Sources of static magnetic fields, besides the earth and the East-West Interconnector, include those generated by suburban transportation systems, permanent magnets, MRI scanners and some industrial processes.

Graph 3 on page 30 illustrates the range of static magnetic field levels measured near electric trains and magnets in common devices compared to calculated static magnetic field levels from the East-West Interconnector cables when the cables are carrying maximum current.

WHAT DO HEALTH AND SCIENTIFIC AGENCIES SAY ABOUT RESEARCH ON DC MAGNETIC FIELDS AND HEALTH?

Research has been conducted over many decades on the potential biological or health effects of exposure to DC magnetic fields.

Independent review panels of scientific experts assembled by authoritative national and international scientific agencies have reviewed this research. None has concluded that static magnetic fields found in normal living and working environments cause adverse health effects.

These agencies include the World Health Organisation (2006), the National Radiological Protection Board of Great Britain (2004), and the International Agency for Research on Cancer (IARC) (2002). In 2009 the International Commission on Non-Ionising Radiation Protection (ICNIRP) issued guidelines for exposure for members of the public to DC magnetic fields. Other more recent reviews have been performed for the UK's Health Protection Agency (2008) and the European Union's Scientific Committee on Emerging and Newly Identified Health Risks (2007, 2009).

These agencies concluded that exposure to only very strong DC magnetic fields can cause biological effects. The exposures required to produce such effects, however, are extraordinarily high relative to levels of DC magnetic fields produced by common sources.

The International Commission on Non-Ionising Radiation Protection (ICNIRP) developed its guidelines for exposure limits to the public and workers after reviewing evidence from cell and tissue studies, experimental studies of humans and laboratory animals, and epidemiologic studies.

The ICNIRP limits for occupational exposure to static magnetic fields is *2T for the head and trunk, and 8T for limbs.

The ICNIRP limits for general public exposure to static magnetic fields is ** 0.4T.

The ICNIRP published additional guidance on exposures to DC magnetic fields in 2014, but stated: “The guidelines are not expected to be relevant for the general public because all exposures to intense magnetic fields below 1Hz are currently found at workplaces.”

The ICNIRP noted that cardiac pacemakers may be affected by very strong magnetic fields, but the levels where this might occur are more than ten times higher than the highest magnetic field produced by DC cables such as those of the East-West Interconnector.

* 2T = 2,000,000μT
** 0.4T = 400,000μT

Installation of East-West interconnector in a public road in Ireland

WHAT IS THE VIEW OF THE IRISH GOVERNMENT ON DC FIELDS?

In Ireland, the Government published a report of the Expert Group on the Health Effects of Electromagnetic Fields on 22 March, 2007 (DCMNR, 2007).

A panel of eight scientists examined a wide range of issues in relation to the potential health effects of EMF, including those produced by the electricity system.

The panel's conclusions regarding static magnetic fields were similar to those of the World Health Organisation and other scientific agencies.

During the planning and construction of the East-West Interconnector, concerns were raised about the magnetic fields produced by currents flowing through its DC cables.

The Irish Government appointed an Independent Expert Panel to measure and assess the fields from the cables. The panel was satisfied from the measurements provided that the magnetic field at all frequencies was well below levels recommended by the ICNIRP guidelines.

The measurements and reports from this independent study can be found at www.dcenr.gov.ie/energy.

In response to public concerns about magnetic fields from the East-West Interconnector, in 2011, the Irish Government commissioned a Dutch health scientist to investigate the situation.

In 2012, the Government commissioned a report* from the Chief Medical Officer which concluded that the East-West Interconnector does not pose a risk to public health.

*www.dcenr.gov.ie/energy/

Where can I find more information on DC magnetic fields?

The following are sources EirGrid recommends you visit should you require more detailed information on DC magnetic fields.

- Expert Group on Health Effects of Electromagnetic Fields. Department of Communications, Energy and Natural Resources (DCENR) 2007. www.dcenr.gov.ie/energy/
- Department of Communications, Energy and Natural Resources (DCENR). Data and Report of the Expert Monitoring Panel on Electro Magnetic Fields (EMF) Emissions in relation to the East-West Interconnector (EWIC) www.dcenr.gov.ie/energy/
- International Commission on Non-ionising Radiation Protection (ICNIRP). Fact Sheet – On the guidelines on limits of exposure to static magnetic fields published in Health Phys 96(4);504-514; 2009. www.icnirp.de/PubEMF.htm
- World Health Organisation (WHO). Static electric and magnetic fields – Fact Sheet N°299 (March 2006). www.who.int/peh-emf/publications/facts/fs299/en/

ARE THERE ANY PRECAUTIONS THAT NEED TO BE TAKEN?

The assessments by the national and international health and scientific agencies of health and biological research on DC magnetic fields do not support the idea that fields generated by the underground cable system would have any health impacts on humans or animals.

All exposures are far, far below limits on public exposure recommended in health guidelines.

WHAT DO HEALTH AND SCIENTIFIC AGENCIES SAY ABOUT RESEARCH ON AC MAGNETIC FIELDS AND HEALTH?

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 ELF-EMF from power lines or other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health. Agencies have recognised a statistical association between estimated higher long-term exposures to magnetic fields and childhood leukaemia in some epidemiological studies. However they have not been able to rule out the contribution of chance, selection bias and other factors to explain this association 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.

SCENIHR is the European Union's Scientific Committee on Emerging and Newly Identified Health Risks. The committee provides opinions

on emerging or newly-identified health and environmental risks. On 4 February 2014, SCENIHR published its "Preliminary opinion on Potential health effects of exposure to electromagnetic fields (EMF)". This is an update to its 2009 opinion.

The committee reported that new epidemiology studies do not shed light on a previously reported association with childhood leukaemia. Shortcomings in these studies, and a lack of experimental support from animal studies or cellular evidence prevent a causal interpretation of this statistical association.

Several recent epidemiology studies examined residential proximity to power lines and childhood leukaemia risk, but overall provided no new evidence for an association. In the largest study to date, Bunch et al. (2014) provided an extension and update to the 2005 study in the United Kingdom by Draper et al. The authors extended the study period by 13 years (1962-2008), included lower voltage lines (132kV) in addition to 275/400kV lines, and included Scotland in addition to England and Wales in their analyses. Bunch et al. (2014) included over 53,000 childhood cancer cases and over 66,000 healthy control children and reported no overall association with residential proximity to 132kV, 275kV, and 400kV power lines for leukaemia or any other cancer among children. The statistical association with distance that was reported in the earlier Draper et al. (2005) study was not apparent in this extended analysis.

No health agency 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.

In 2007, the World Health Organisation updated the International Agency for Research on Cancer (IARC) report with the publication of its comprehensive review of ELF-EMF health research.[1]

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 leukaemia and long-term exposures to magnetic fields greater than 0.3-0.4μT, 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 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.
- The view of the World Health Organisation on ELF-EMF and health issues provided on its website is "based on a recent in-depth review of scientific literature, [we conclude] that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields".[2]

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

To date, the whole body of scientific research has not confirmed 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 document entitled "Health Effects of Electromagnetic Fields". The conclusions of this report were consistent with those of The International Agency for Research on Cancer (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.'

In January 2014, the Department of the Environment announced it was conducting a review of the latest research on EMF and EirGrid is committed to addressing any recommendations in this report.

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 EMF. This recommendation applies the exposure guidelines advocated in 1998 by the ICNIRP, to locations where people spend significant time.

The 1998 ICNIRP guidelines specify limits on exposure to 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 at 50Hz are 500kV/M and 100μT.[3] If the 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] In 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200μT reference level for exposure for the general public, but these have not yet been adopted by the European Union.

ARE THERE ANY PRECAUTIONS THAT NEED TO BE TAKEN?

A 2007 Government report stated that, while there is limited scientific evidence of an association between ELF-EMF and childhood leukemia, considerable research carried out in laboratories does not support this possibility.

Nevertheless, the report recommended that the evidence should not be discounted and suggested no-cost, or low-cost, precautionary measures to lower people's exposure to ELF fields.

As a precautionary measure, it recommended that future power lines and power installations should be sited away from heavily populated areas. The report also noted that lowering international guideline limits as a precautionary measure is not recommended by the World Health Organisation.

These precautionary goals are achieved by EirGrid by routing lines as far from existing residences as is reasonably possible, optimising the phasing of adjacent lines, and incorporating stakeholder input during the consultation process carried out in the development of new electricity infrastructure.

Source: Report from Expert Group on the Health Effects of Electromagnetic Fields for Department of Communications, Marine and Natural Resources, 2007.

DO POWER LINES AFFECT ANIMALS?

As with human health, some have expressed concern about the potential effects of EMF from high-voltage transmission lines on animal health, welfare, behaviour and productivity.

The potential effects from EMF on both economically important domesticated animal species and wildlife have been investigated since the 1970s. This has led to a good understanding of the potential means by which EMF could affect organisms in the vicinity of power lines.

Overall, the research does not show that EMF have adverse effects on the health, behaviour or productivity of animals, including livestock.

The substantial body of research on wild and domestic animals is informative for all large mammals and does not indicate any risk.

Thus, there is no scientific basis in the research literature to conclude that the presence of a transmission line would create conditions that would impair the health of animals or would precipitate abnormal behaviour.

Studies on dairy cows, for example, failed to find any consistent variation in fertility, hormone levels, milk fat content or dry matter intake beyond what would be expected due to normal variation even when exposed to ELF-EMF far stronger than would occur from the Irish transmission system.

Other research on sheep has examined the effect of ELF-EMF on weight gain, wool production, behaviour, onset of puberty and immune function. None of the studies showed consistent or replicated evidence of adverse effects.

CROPS, PLANTS AND TREES

As scientific literature has accumulated, both from laboratory and field studies, on the potential effect of EMF from transmission lines on plants, including agricultural crops and trees, and forest and woodland vegetation, no adverse effects on plants have been reported from electric and magnetic field exposures at levels comparable to those near high-voltage transmission lines.

Where can I find more information on ELF fields?

The following are sources EirGrid recommends you visit should you require more detailed information on AC fields.

- **THE WORLD HEALTH ORGANISATION – INTERNATIONAL EMF PROJECT (2007)**
  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**
  www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/ElectricAndMagneticFields/HealthEffectsOfElectricAndMagneticFields/
- **DEPARTMENT OF COMMUNICATIONS ENERGY AND NATURAL RESOURCES**
  www.dcenr.gov.ie
- **EUROPEAN COMMISSION**
  http://ec.europa.eu/enterprise/sectors/electrical/documents/lvd/electromagnetic-fields/
- **INTERNATIONAL AGENCY FOR RESEARCH ON CANCER**
  www.iarc.fr/en
- **INTERNATIONAL COMMISSION ON NON-IONISING RADIATION PROTECTION**
  www.icnirp.de
- **SCIENTIFIC COMMITTEE OF THE EUROPEAN COMMISSIONS**
  http://ec.europa.eu/health/scientific_committees/consultations/public_consultations/scenihr_consultation_19_en.htm
- **EIRGRID PROJECTS**
  www.eirgridprojects.com

WHAT IS EIRGRID'S POSITION AND COMMITMENT?

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

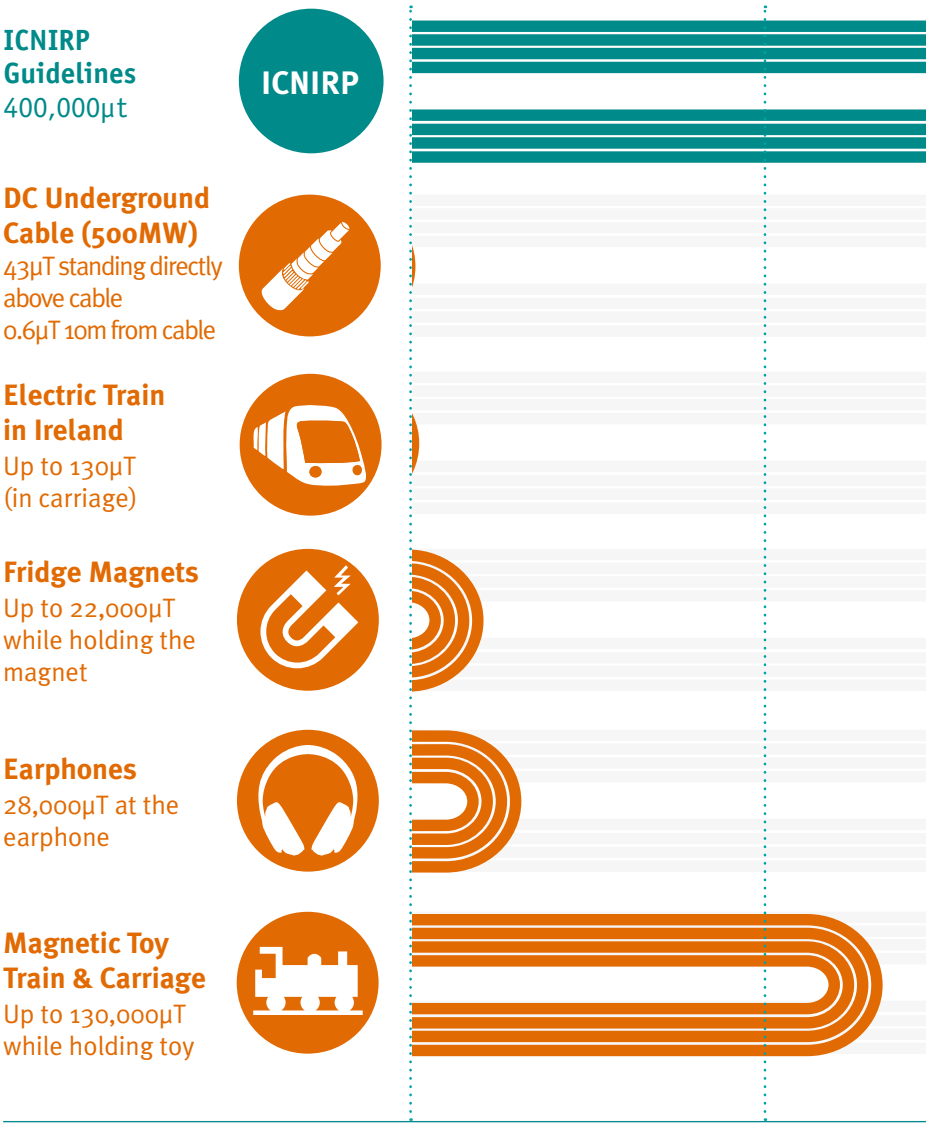
These agencies have consistently concluded that the research does not indicate that EMF cause any adverse health effects at the levels encountered in our everyday environment and that compliance with the existing ICNIRP standards provides sufficient public health protection.

EirGrid recognises that some individuals are 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.

COMPARISON OF DC MAGNETIC FIELDS FROM COMMON SOURCES

Graph 1. DC magnetic fields from common sources compared to calculated magnetic fields from a 500MW DC cable.



THE INTERNATIONAL COMMISSION ON NON-IONISING RADIATION PROTECTION (ICNIRP) WAS ESTABLISHED 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 formally recognised by the World Health Organisation and the European Union as the non-governmental standard setting body for EMF.

This graphic provides an indication of approximate fields from lines and appliances. For actual measurements from DC cables already built in Ireland see www.dcenr.gov.ie/energy/

Source of data: Compliance Engineering Ireland (CEI).

AC ELECTRIC FIELDS

Graph 2. The graphic opposite shows some examples of different sources of electric fields and how they compare to typical electric fields associated with overhead electricity lines that make up part of the electricity grid in Ireland.

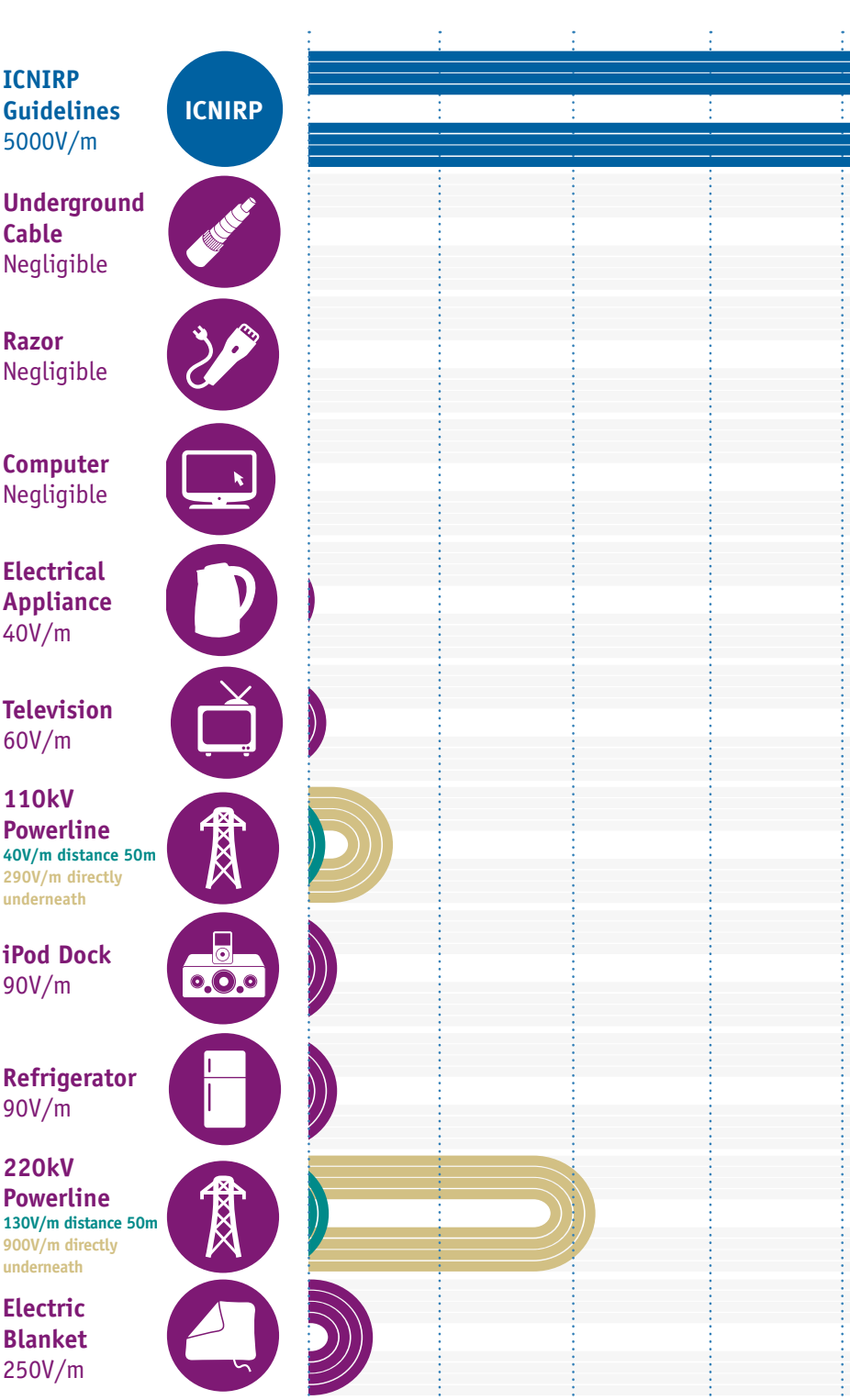
The graph also references the ICNIRP guidelines for exposure to electric fields set to ensure public health and safety.

THE INTERNATIONAL COMMISSION ON NON-IONISING RADIATION PROTECTION (ICNIRP) WAS ESTABLISHED 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 formally recognised by the World Health Organisation and the European Union as the non-governmental standard setting body for EMF.

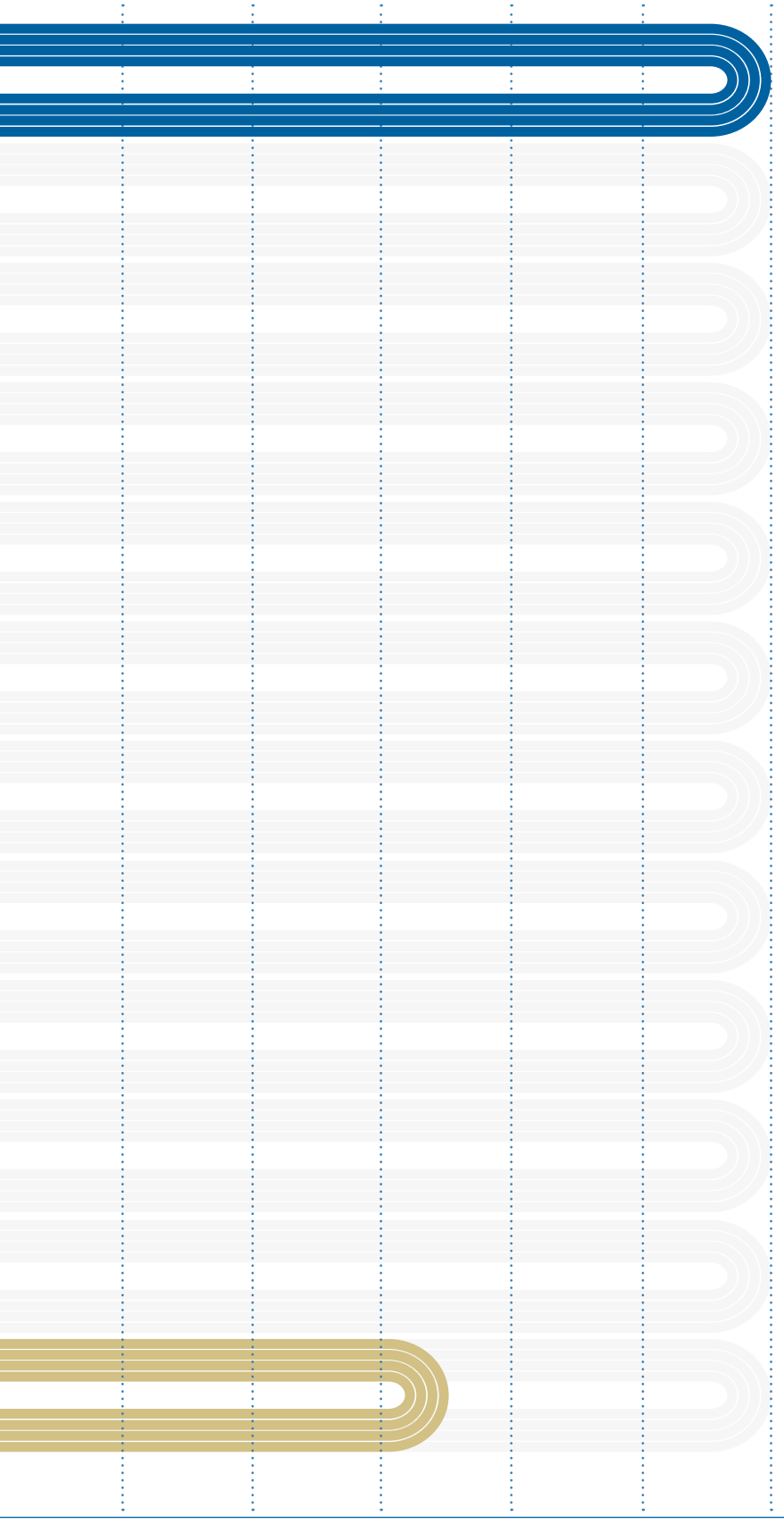
This provides an indication of approximate fields from lines and appliances. For actual measurements from transmission lines already built in Ireland see eirgridprojects.com

COMPARISON OF AC ELECTRIC FIELDS



5kV/m is a reference value, 9.2KV/m is maximum allowable electric field as per the ICNIRP recommendati

S FROM COMMON SOURCES



00 | 2,500 | 3,000 | 3,500 | 4,000 | 4,500 | 5,000

Source of data: Compliance Engineering Ireland (CEI).

ons (using the Dimbylow calculations).

AC MAGNETIC FIELDS

Graph 3. The graphic opposite shows some examples of different sources of magnetic fields and how magnetic field levels from these sources compare to typical magnetic field levels from electricity lines or cables that make up part of the electricity grid in Ireland.

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

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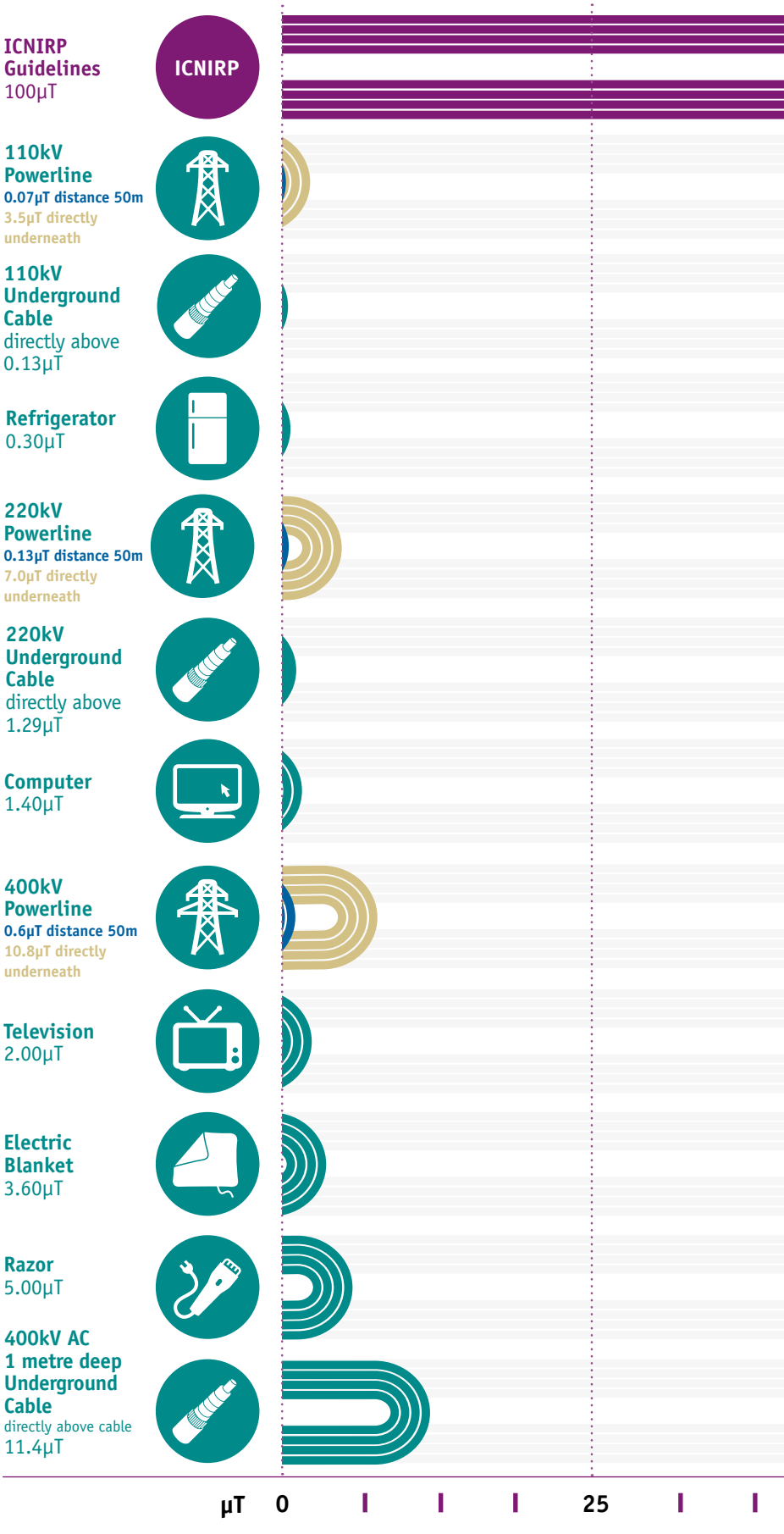
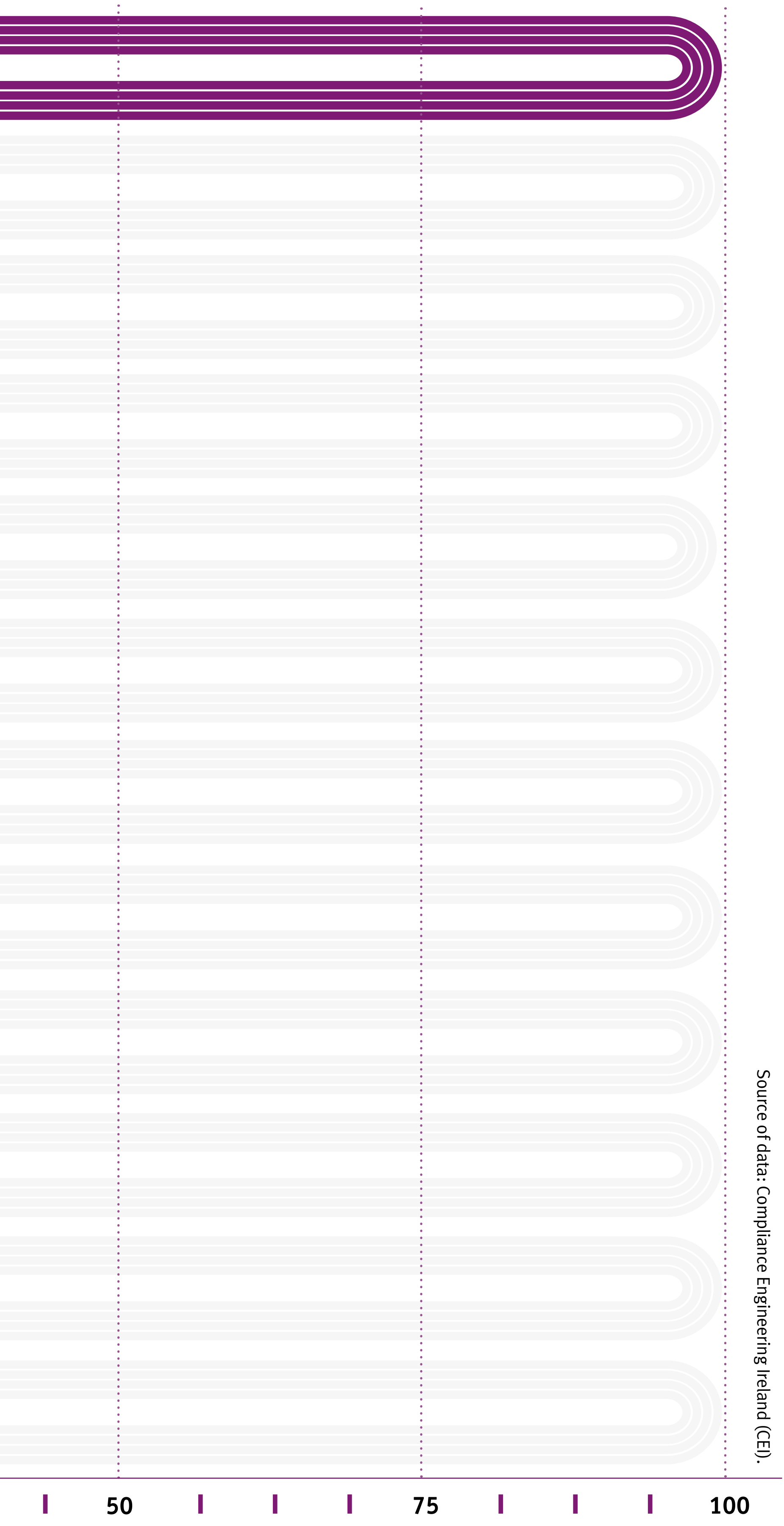
This independent scientific commission was established to advance non-ionising radiation protection for the benefit of people and the environment. It provides science-based guidance and recommendations including independent international guidelines and recommended limits of exposure. ICNIRP is formally recognised by the World Health Organisation and the European Union as the non-governmental standard setting body for EMF.

This graphic provides an indication of approximate fields from lines and appliances. For actual measurements from transmission lines already built in Ireland see eirgidprojects.com

COMPARISON OF DIFFERENT SOURCE



S OF AC MAGNETIC FIELDS (µT)



Source of data: Compliance Engineering Ireland (CEI).

GLOSSARY

AC (ALTERNATING CURRENT)
Electricity that changes direction at regular intervals is described as AC electricity. AC is the form in which electricity is delivered to our homes and businesses. This is the type of electricity used mainly on the Irish transmission system and in every other system in the world.

CARCINOGENIC
Any substance or agent, including ionising radiation, that causes cancer.

CONDUCTOR
An object or material that can carry electricity, like the power cables used in an overhead line.

CURRENT
The movement of an electrical charge similar to the rate of fluid flow in a pipeline.

DC (DIRECT CURRENT)
Electricity that flows in one direction only, like the battery in your car.

ELECTRIC FIELD
An electric field is created by the difference in electric potential (voltage) between the conductors in power cables. The strength of an electric field is expressed in units of volts per meter (V/m). Higher voltage sources produce higher electric fields.

ELECTROMAGNETIC FIELD
The term electromagnetic field is frequently used to refer to electromagnetic energy across a wide frequency spectrum ranging from the earth's natural fields to cosmic radiation. Sometimes it refers to frequencies above about 100 kHz where electric and magnetic fields are coupled and radiate away from sources.

ELF (EXTREMELY LOW FREQUENCY)
Frequencies found at the end of the electromagnetic spectrum that contain very little energy and cannot directly break molecules apart, ie., non-ionising. 50Hz electric power operates at ELF levels.

FREQUENCY
AC Electricity is transmitted in waves. The number of times the wave repeats itself in a second is the frequency and is measured in Hertz. On the Irish transmission system, AC electricity is transmitted at 50Hz.

INDUCED CURRENT
A flow of electric current in an object created by the proximity to an AC power source.

IONISING RADIATION
Radiation, such as X-rays, which has sufficient energy to break molecular chemical and electrical bonds.

MAGNETIC FIELD
Created by the movement of electric charges.

Magnetic fields surround magnetic materials and electric currents. In magnetic materials and permanent magnets, the field is created by the coordinated spins of electrons and nuclei within iron atoms. The magnitude of the magnetic field is expressed as magnetic flux density, also referred to as magnetic field strength. Measured in Tesla (for large fields) or μT (for small fields).

MOLECULE
The smallest particle of a substance that retains the properties of that substance.

NON-IONISING RADIATION
Electromagnetic fields at frequencies that do not have enough energy to disrupt atoms or molecules.

RADIATION
Any of a variety of forms of energy propagated through space.

VOLTAGE
Voltage is the difference in electric potential between any two conductors of a circuit. It is the electric 'pressure' that exists between two points and is capable of producing the flow of current through an electrical conductor. Voltage in a power line is comparable to pressure on a pipeline. Voltage is measured in units of kilovolts/m.

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