

Controlled exposure

Laurent Bontoux and Katja Bromen, from the Directorate General for Health and Consumers, look at the need to disseminate the scientific facts about electromagnetic fields...

Electromagnetic fields are a combination of electric and magnetic fields of force. An electric field is an invisible force field created by the presence of an electric charge or of a time-varying magnetic field that affects other electric charges, whereas a magnetic field is created by a magnet or as a consequence of the movement of electric charges. The magnitude (intensity) of an electric field is usually measured in volts per meter (V/m) and of a magnetic field is usually expressed in tesla (T) or millitesla (mT). Both electric and magnetic fields decrease with the distance from the source and because they are almost always present simultaneously, people often talk of electromagnetic fields (EMF).

EMFs are generated both by natural phenomena, such as the Earth's magnetic field and electromagnetic storms of solar origin, or by human activities, mainly through the many uses of electricity.

Because of the broad use of alternating currents that change direction many times per second, most man-made electromagnetic fields also alternate. The rate at which this change of direction takes place is called 'frequency' and is expressed in number of oscillations per second, or Hertz (Hz). The frequencies of the EMF of interest here range from extremely low frequencies (ELF, such as those generated by power lines (50-60 Hz)), through intermediate frequencies (IF, such as those generated by computer screens (a few thousand Hz)), to radio frequencies (RF, such as used by mobile phones (millions of Hz or MHz)). Static fields, such as the Earth's magnetic field or fields produced by permanent magnets, do not vary with time. Static magnetic fields are used, for example, in medical imaging (see Fig. 1).

A long-lasting concern

If the fields are strong enough, exposures to electromagnetic fields trigger biological effects ranging from stimulation of nerves and muscles to heating of biological tissues, depending on the frequency.

The situation that led to the 1999 Recommendation

Concerns about the long-term health effects of EMF since the 1970s led to the creation in 1992 of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This is a body of independent scientific experts covering epidemiology, biology, dosimetry and optical

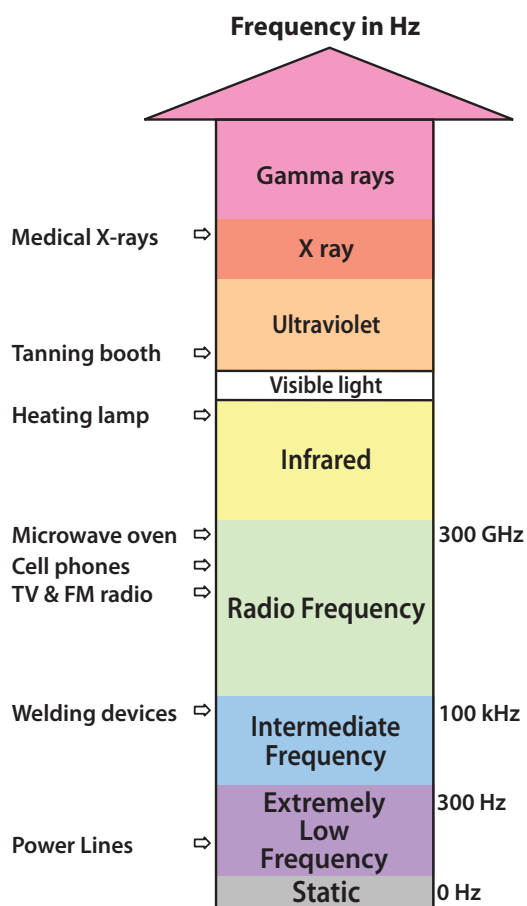


Fig. 1: The classic frequency bands for electromagnetic fields (Source: Greenfacts)

radiation addressing the important issues of possible adverse effects on human health of exposure to non-ionising radiation. ICNIRP's principal aim is to disseminate information and advice on the potential health hazards of exposure to non-ionising radiation. ICNIRP also publishes exposure guidelines.

Preparation of the recommendation and the development of related legislation

In parallel, EU regulators felt the need to provide a protective framework for the general EU population.

For this purpose, Council Recommendation 1999/519/EC¹ was developed that is based on the guidelines developed by



ICNIRP². This framework is supported by four periodic scientific reviews carried out by the independent EU Scientific Committees since 1998, the latest one by the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) in January 2009.

The framework proposed by the recommendation was used to develop EU legislation to protect workers (2004/40/EC) and to develop safety standards that are necessary under EU legislation for all products emitting EMF (the LVD Directive and the R&TTE Directive). As a result, there is now a comprehensive regulatory framework in place to limit EMF exposure³.

Research effort

Shortly after the adoption of the recommendation, the Commission decided to embark on a major research effort to elucidate the potential health effects of EMF. It spent €12m in the 5th Framework Programme for Research on a wave of projects that investigated whether mobile phone use could cause cancer, whether EMF could be genotoxic, whether other toxicological evidence could be obtained, and started to investigate extremely high frequencies (THz) used in imaging applications. The results from this research contributed to the scientific evidence used by the SCENIHR in its periodic updates.

The current state of affairs

An increasing level of concern

Despite the protective regulatory framework put in place at EU level and the measures it triggered at MS level, and despite sizeable research efforts that led various independent scientific assessments to draw broadly reassuring conclusions, public concern about the potential health risks from EMF has not abated.

It is difficult to ascertain the reason for this concern but the following may play a role. First of all, EMF are physically complex. They are comprised of several dimensions and components (E field, H field, B field), thereby making measurement and quantification of dose very difficult, unlike for chemicals, where a single unit (eg. mg/l) can be used to express the dose.

Second, most of the research performed to date investigated potential effects at realistic levels of exposure, for which only weak effects, if any, can be realistically expected. This means that the experiments are very sensitive to confounding factors. Indeed, the results that came out were not all negative. This triggered endless scientific debates and provided a platform for certain stakeholders to promote their call for a moratorium on wireless technologies as long as uncertainty remains.

The two main concerns: RF and ELF

There are two main sources of concern among the public: extremely low frequencies (ELF) from high-voltage power lines and radiofrequencies (RF) from wireless telecommunications.

For ELF, concern is expressed mostly through resistance to the installation of new power lines and through complaints from residents living near power lines. For RF, resistance is mostly against mobile phone base stations and, to a smaller extent, against WiFi hotspots in schools and libraries.

Regardless of the source of exposure, certain citizens consider themselves electrohypersensitive and claim that EMF severely affect their quality of life through many symptoms. Some of these persons use Faraday cages to try and protect themselves or even move to areas considered free from man-made EMF.

Strong action from groups of concerned citizens combined with the impossibility for the authorities to provide categorical answers has triggered a pressure to set lower exposure limits: a number of member states have set exposure limits that are stricter than those proposed by the Recommendation. For example, in Belgium, the region of Brussels capital has set the reference value for the electric field from mobile telephony base stations to as low as 3V/m, instead of 41V/m proposed by the Recommendation at 900MHz.

Market disturbances

Regarding mobile telecommunication, legal actions against base stations and the lowering of the limits have consequences for the market. Legal action against base stations coupled with increasingly stringent conditions for obtaining building permission means that it is becoming more and more difficult for operators to develop or upgrade their network. New operators claim that this is creating a barrier. This is, for example, the case in the city of Brussels at a moment when the authorities want to deliver a fourth licence to increase competition and put a downward pressure on mobile phone charges. Imposing lower reference levels also means that operators must increase the number of base stations to maintain coverage. This may end up increasing the cost base for mobile telecommunications and may create economic discrepancies between neighbouring countries at a time when there is a push to render the EU market more uniform and to lower roaming charges.

What to do?

The demands from the various stakeholders

We are now facing a situation where the various stakeholders are pursuing conflicting goals. On the one hand, the public wants easy and universal access to electricity and mobile telecommunications. Some parts of the public (electrohypersensitive citizens) want no EMF at all, other parts no high-voltage power lines near their homes and others no base stations. However, mobile telecommunications are impossible without base stations and lowering exposure limits leads to an increase in the number of base stations.

On the other hand, on the industry side, the general demand is for the same, predictable regulatory environment across the EU. For new entrants or second movers, the demand is for low barriers to entry (ie. the possibility to install networks, be it base stations or power lines, easily). In general, there is an industry demand to keep the costs of infrastructures as low as possible.

Trade-offs

Resolving these issues will require the policy-makers to draw the line on some trade-offs. In the case of radio frequencies, ideally we would like to have a cheap, reliable and safe service. However, in a simplified way, the main factors at play are the following:

- The more base stations of sufficient power, the better the wireless service coverage;
- The lower the power of base stations, the higher the power needed by the wireless terminals (eg. mobile phones) to establish connection;
- The lower the exposure limit to be respected, the more base stations are needed to ensure coverage;
- The lower the number of base stations necessary to ensure coverage and the easier the permitting procedures to install infrastructures, the lower the barrier to entry for new operators and the cheaper the service can be.

On this basis, it becomes obvious that arbitrage is needed in order to develop a consensus among all the stakeholders. The latest scientific assessments still consider that the use of RF at current levels is safe, but if there is a societal demand for revised exposure limits, it would be necessary to make these trade-offs transparent to all. In the case of ELF, the main trade-off is the following: in simple terms, the higher the voltage of power lines, the higher the fields around the lines, but the more electricity can be transported by the same infrastructure, thereby exposing fewer people.

Proposals for Commission action

In this context, the Commission has developed a range of actions. First of all, it is continuing to update the scientific basis on which the current recommended

exposure limits are based and will continue to rely on the SCENIHR to that end. It is also strengthening the scientific advice process by applying higher standards of transparency and independence.

In order to address the remaining gaps in knowledge concerning the potential health effects of EMF, the Commission is drawing a road map for additional research and it is mobilising funds from the 7th Framework Programme for Research.

The Commission will also continue to develop its interactions with all the relevant stakeholders to move towards generating consensus around the trade-offs mentioned above. To that end, there is a proposal to set up a standing 'Group of Moderates' to discuss policy options.

A proposal to organise a top-level international scientific conference on EMF and health is being discussed to address the remaining questions, hopefully leading to a strengthened scientific consensus on which to build for the future.

In order to better assess public opinion on this very sensitive issue, the Commission plans to launch a new Eurobarometer survey.

Finally, the input from all these actions will be used to prepare a Commission Communication describing a revised global and coherent policy approach at EU level and provide further guidance for member states.

Conclusion

In spite of decades of research efforts, and of repeated and broadly reassuring official and independent scientific advice from many authorities worldwide, public concern about the potential health effects of electromagnetic fields does not abate. This requires significant efforts towards reducing the remaining scientific uncertainty and rebuilding trust in independent scientific advice.

¹ http://eur-lex.europa.eu/pri/en/oj/dat/1999/l_199/l_19919990730en00590070.pdf

² See <http://www.icnirp.de/documents/emfgdl.pdf>

³ http://ec.europa.eu/health/ph_determinants/environment/EMF/emf_en.htm



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