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**REPORT FROM THE COMMISSION ON THE APPLICATION OF COUNCIL
RECOMMENDATION OF 12 JULY 1999 (1999/519/EC) ON THE LIMITATION OF
THE EXPOSURE OF THE GENERAL PUBLIC TO ELECTROMAGNETIC FIELDS
(0 Hz to 300 GHz)**

Second Implementation Report 2002-2007

1. INTRODUCTION

The public is exposed to electromagnetic fields (EMF) generated by an increasing variety of electrical and electronic devices and installations. EMF may have biological effects under certain conditions. On 12 July 1999, the Council adopted a Recommendation (1999/519/EC) to limit the exposure of the population to EMF.

It is the Member States' responsibility to protect the populations from potential health risks. However, the Council Recommendation has established a set of basic restrictions and reference levels to provide guidance to the Member States and to create a basis for EU product safety legislation. They are as laid down by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The Recommendation invites the Commission to keep the possible health effects of EMF under review. In 2002, the Commission presented its first report. This is the second one, relating to the situation in EU-27, based on the information received from the Member States, and presenting an update on initiatives taken by the Commission to review the available scientific knowledge.

2. THE ELECTROMAGNETIC FIELDS ISSUE

The rapid increase in mobile telecommunications and the growing range of personal, domestic, commercial and medical equipment have considerably increased the number of sources of EMF exposure¹ and are significantly changing the level, type and pattern of everyday exposure of the public.

A recent Eurobarometer survey² indicates that, while they are more concerned about chemicals, the quality of food, ambient air and the quality of drinking water, half of the people in the EU are also concerned about the potential health risks of EMF. A majority of citizens feel that public authorities do not adequately inform them of the measures taken to protect them, in particular from overhead high-voltage power lines and base stations placed close to dwellings.

3. COUNCIL RECOMMENDATION OF 12 JULY 1999 ON THE LIMITATION OF EXPOSURE OF THE GENERAL PUBLIC TO ELECTROMAGNETIC FIELDS (0HZ TO 300 GHZ) — (1999/519/EC)

This Recommendation is based on Article 152(1) of the Treaty to complement national policies for improving public health and preventing human illness and diseases, and obviating sources of danger to health. Moreover, Article 152(1) states that “*a high level of human health protection shall be ensured in the definition and implementation of all Community activities and policies*”.

¹ Static fields used in medicine (MRI), welding and transport systems fed by DC power; Extremely low frequencies (ELF) (0 to 300 Hz) used in household appliances; Intermediate Frequencies (IF) (300 Hz — 100 kHz) used in video displays, anti-theft devices, card readers, metal detectors, electro surgery; Radiofrequencies (RF) (100 kHz to 300 GHz) used in wireless communications such as GSM, UMTS, Wireless LAN and RFID for both mobile devices and base stations, hospital applications, radio and TV broadcasting.

² http://ec.europa.eu/health/ph_determinants/environment/EMF/ebs272a_en.pdf

The overall aim of the Council Recommendation (1999/519/EC) is to establish a Community framework for limiting the exposure of the general public to EMF based on the best available scientific evidence and to provide a basis for monitoring the situation. It also provides a reference framework for EU legislation on products and devices emitting EMF³.

The Member States are responsible for protecting their populations against potential risks from EMF exposure and may apply more stringent limits than those set in the Recommendation.

The current “basic restrictions” and “reference values” derive from the 1998 International Commission for Non-Ionizing Radiation Protection (ICNIRP) guidelines, designed on the basis of short-term effects of EMF. The ICNIRP guidelines use a safety factor of 50 resulting from the product between a factor 5, corresponding to the reduction of public exposure values compared to those applicable to occupational exposure, and a factor of 10 to cover variations of sensitivity and in exposure conditions in the whole frequency range. The “reference levels” are based on measurements and/or computational techniques.

The Recommendation calls on Member States to consider both the risks and benefits in deciding whether to take action, inform the public, promote research on the potential health effects of EMF and report on their action to the Council. The Recommendation asks the Commission to facilitate the establishment of European standards, to evaluate compliance with basic restrictions, to encourage research, to continue its involvement with relevant international organisations and to review regularly the action taken.

4. SCIENTIFIC BASES

The scientific bases for the ICNIRP guidelines were endorsed by the Scientific Steering Committee in June 1998, by the Scientific Committee on Toxicity, Ecotoxicity and the Environment⁴ in October 2001 and again by the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)⁵ in March 2007, each based on the latest scientific evidence available. The latest SCENIHR opinion stated:

- For Radio Frequency Fields (RF fields – 100 kHz-300 GHz)

No health effect has been consistently demonstrated at exposure levels below the limits of ICNIRP established in 1998. However, the data base for evaluation remains limited, especially for long-term low-level exposure.

- For Intermediate Frequency Fields (IF fields – 300 Hz–100 kHz)

Experimental and epidemiological data from the IF range are very sparse. Therefore, assessment of acute health risks in the IF range is currently based on known hazards at lower and higher frequencies. Proper evaluation and assessment of possible health effects from long-term exposure to IF fields are important because human exposure to such fields is increasing due to new and emerging technologies.

- For Extremely low frequency fields (ELF fields – 0-300 Hz)

³ Council Directives 2006/95/EC (low voltage) and 1999/5/EC (radio equipment).

⁴ http://ec.europa.eu/health/ph_risk/committees/sct/documents/out128_en.pdf

⁵ http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_007.pdf

The previous conclusion that ELF magnetic fields are possibly carcinogenic, chiefly based on the results of epidemiological studies on childhood leukaemia, is still valid. For breast cancer and cardiovascular disease, recent research has indicated that an association is unlikely. For neurodegenerative diseases and brain tumours, the link to ELF fields remains uncertain. No consistent relationship between ELF fields and self-reported symptoms (sometimes referred to as electrical hypersensitivity) has been demonstrated.

- For Static Fields

Adequate data for proper risk assessment of static magnetic fields are very sparse. Developments of technologies involving static magnetic fields, e.g. with MRI (Magnetic Resonance Imaging) equipment, require risk assessments in relation to occupational exposure.

Given the uncertainties and lack of scientific data on long-term and low-level EMF exposure, the SCENIHR made recommendations for further research, in particular:

- For RF fields

- A long-term prospective cohort study,
- Health effects of RF exposure in children,
- Exposure distribution in the population,

- For IF fields

- Epidemiologic and experimental studies on health effects from IF fields.

- For ELF fields

- Animal studies to elucidate the mechanisms responsible for the childhood leukaemia indicated by the epidemiological evidence.

- For Static fields

- A cohort study on personnel handling equipment that generates strong magnetic fields.
- Experimental studies, e.g. on carcinogenicity, genotoxicity and developmental and neurobehavioural effects.

In the 5th Framework Programme for Research (FP5 – 1998-2002), the *Environment & Health* “Key Action” provided a total EC contribution of €12 million to projects on the potential health impacts of EMF⁶. In FP6 (2002-2006), the Commission funded the EMF-NET⁷ project that produced fact sheets on various issues related to the potential health effects of exposure to EMF. This project concluded that research is still needed in most areas.

In response to the SCENIHR recommendations, the Commission introduced in the 2nd call for proposals of the Environment theme of the FP7 (2006-2013) Cooperation programme

⁶ http://ec.europa.eu/research/quality-of-life/pdf/emf_brochure_and_sheets_en.pdf;
http://ec.europa.eu/research/environment/themes/projects_en.htm#2

⁷ Effects of the exposure to EMF: From science to public health and safer workplace
<http://web.jrc.ec.europa.eu/emf-net>

(*Environment & Health* sub-activity), a topic that will lead to funding of a project focused on mobile telephone use and potential risks to develop brain cancer in children and adolescents. The 3rd call plans a project on improved exposure assessment to wireless communication devices.

5. IMPLEMENTATION OF THE RECOMMENDATION

5.1. General overview

Most Member States have adopted the Recommendation and some have legally binding measures to control EMF exposure of the general public. Although most consider the Recommendation sufficient to provide a high level of health protection, some have adopted more stringent exposure limits and others have suggested some modifications to the Recommendation: more stringent restrictions and reference levels for ELF (Finland, Sweden and the Netherlands), stricter restrictions and reference levels at fields of 10 kHz-300 GHz (Lithuania), long-term and non-thermal effects of EMF (Bulgaria), and information on product safety (Poland). While not asking for specific changes to the Recommendation, Slovenia insisted on the importance of the information to consumers on non-ionising radiation and on ways of minimising exposure, and Sweden has developed a simple and low-cost precautionary approach to minimise exposure to ELF and RF. Along similar lines, the Netherlands are suggesting the possibility of taking precautionary measures in view of the increased childhood leukaemia risks from 50 Hz magnetic fields from overhead power lines.

5.2. Specific implementation measures

5.2.1. Basic restrictions for exposure to EMF

In general, the restriction levels in place in the Member States for EMF exposure are in line with the Recommendation (See Table 1). However, in Cyprus, Denmark, Germany, Ireland, Lithuania, Slovenia and Slovakia, no implementation measures have been taken on basic restrictions.

More stringent approaches are applied in some countries on the basis of the precautionary principle. In Belgium, a Royal decree sets out basic restriction values which are four times stricter for RF fields between 10 MHz and 10 GHz. Greece applies reduction factors of 60 or 70% to the basic restrictions for all land-based antennas (60% when antennas are located less than 300m from schools, kindergartens, hospitals or eldercare facilities).

In Italy, the basic restriction level for power density applicable to power plants and fixed telecommunication equipment is ten times lower than in the Recommendation.

The United Kingdom's Health Protection Agency (HPA) has recommended a three-stage approach for some frequencies by modelling exposures numerically to clarify compliance with the ICNIRP basic restrictions. For power frequencies, the equivalent figures for field strengths are 9 kV/m and 360 μ T, i.e. less stringent than the reference levels in the Recommendation. The UK HPA notes that there is also the possibility of adverse indirect effects (microshocks) which can be controlled in occupational environments. For the general public, the reference level of 5 kV m⁻¹ will prevent microshocks in most people.

Table 1: Summary overview of the way implemented measures in Member States relate to the *Basic Restrictions* of Council Recommendation 1999/519/EC

Country	Implemented basic restrictions stricter than in the Recommendation	Implemented basic restrictions the same as in the Recommendation	Implemented basic restrictions less strict than in the Recommendation
AT		X	
BE	X ^a		
BG		X	
CH		X	
CZ		X	
CY			X
DE			X
DK			X
EE			?
ES		X	
FI		X	
FR		X	
GR	X ^a		
HU		X	
IE			X
IT		X	
LT			X ^b
LU		X	
LV		X	
MT		X	
NL			X
PL			X
PT		X	
RO		X	
SE		X	
SI			X
SK			X
UK		X	

a) Not for the whole frequency range — b) Only for workers

5.2.2. Reference level for electromagnetic radiation

The reference limits used for monitoring EMF radiation in the Member States generally follow those outlined in the Council Recommendation (See Table 2).

Belgium applies a twice-lower electric field reference level for RF-fields, but the same level as in the Recommendation for the ELF electric field in urban areas. However, the Flemish Government has recommended a far lower indoor quality standard (0.2 μT and 10 μT) for the ELF magnetic field. The Netherlands' precautionary measure for 50 Hz magnetic fields from overhead power lines applies a reference level of 0.4 μT for the magnetic field in dwellings, schools and child day-care centres when new overhead power lines or new dwellings are built or existing ones are renovated. In Luxembourg, a limit of 3V/m is applied to the electric field in areas where the public can be exposed for a long time (e.g. residential housing). Minimum

distances are also applied between high voltage power lines and residential areas. In Italy, a limit of 6V/m is applied to power plants and fixed telecommunication equipment.

Table 2: Summary overview of the way implemented measures in Member States relate to the *Reference Levels* of Council Recommendation 1999/519/EC

Country	Implemented reference levels stricter than in the Recommendation	Implemented reference levels the same as in the Recommendation	Implemented reference levels less strict than in the Recommendation
AT		X	
BE	X ^a		
BG	X		
CH	X		
CZ		X	
CY		X	
DE		X	
DK			X
EE		X	
ES		X	
FI		X	
FR		X	
GR	X ^a		
HU		X	
IE		X	
IT	X		
LT	X		
LU	X		
LV		X	
MT		X	
NL	X ^a		
PL	X		
PT		X	
RO		X	
SE		X	
SI	X		
SK		X	
UK		X	

a) Not for the whole frequency range —

As the permissible exposure of the population in Poland is several times lower than in the Recommendation, the same reduction is also reflected in the reference levels (e.g. 7 V/m for RF radiation) and for the magnetic component of fields with a 50 Hz frequency. Moreover, for the electric component, values for housing areas are ten times lower than for the general environment. In Bulgaria, the exposure limit values are categorised by four zones defined according to the possibility of exposure and the duration of the exposure. Accordingly, higher limit values are set for zones where human exposure is rare or practically impossible and much lower limits for zones with continuous exposure and areas for sensitive groups (including children, pregnant women, elderly and ill people). Slovenia applies ten times more stringent reference levels for new and reconstructed radiation sources in sensitive areas (e.g. schools, day-care centres, hospitals, residential housing, etc).

In Greece, the reference levels of the Recommendation were set as the safety limits for ELF fields, while new reference levels have been derived for all land-based antennas in the frequency range of 1kHz to 300 GHz. Similarly, in Lithuania the national levels in the frequency range of 10 kHz-300 MHz are 2-3 times stricter than the reference levels for EMF radiation; from 300 MHz to 300 GHz, even 100 times ($10\mu\text{W}/\text{cm}^2$)!

For ELF radiation from power lines, the Finnish recommendations call for magnetic fields to be kept as low as reasonably possible in the areas where the general public, particularly children, may stay for a significant length of time.

For ELF, the UK Health Protection Agency advises a three-stage approach, adopting realistic numerical modelling for exposure to clarify the application of the ICNIRP levels. For power frequencies, the ambient field levels that more realistically equate to the basic restrictions are less stringent than the reference levels in the Recommendation.

In Germany, the measures address exposure levels from specific frequency ranges: 9 kHz-300 GHz, 16 2/3 Hz, 50 Hz, and 10 MHz-300 GHz. Power lines operating at a voltage over 1 kV and fixed transmitters with a transmission power over 10 W EIRP are considered. For ELF and RF, the reference values for individual sources take into account similar sources in the same area.

The Czech Republic, Hungary, Latvia and Slovakia have no specific implementation measures.

In Switzerland the general exposure limits comply with the reference values in the Recommendation, but additional precautionary factors of 10 to 100 are applied for single installations in “sensitive areas”. Additional safety measures are applied for mobile telecommunication stations, radio and TV broadcasting stations and for high-voltage power lines. Some countries also apply specific restrictions on some appliances and in situations of high overall exposure.

5.3. Monitoring exposure to electromagnetic fields

The Council Recommendation asks the national authorities to monitor the levels of EMF exposure and check whether they exceed the limits set in the Recommendation. In general, exposure is evaluated by using models during the permit delivery procedure and/or after the installation of new systems or after any optimisation or changes in the installation.

In Slovakia and Slovenia, the measurements are done every three years by the authorities (every five years for low-frequency radiation in Slovenia). In Lithuania, measurements are done every year in the neighbourhood of EMF sources and more frequently where readings have exceeded the reference values. Luxembourg performs spot measurements. In Italy, surveys are done on request by the public or local authorities.

In the United Kingdom ad hoc measurements of electric and magnetic fields near power lines are carried out by the utility companies upon request from the public. The same applies in Denmark for power lines and telecommunication stations. In Cyprus, wireless communications operators conduct their own regular measurements in addition to ad hoc measurements upon requests from the general public and public authorities; in Ireland the main power company proceeds in a similar way. Greece makes provision for yearly measurements by the Atomic Energy Commission (EEAE) or other authorised laboratories of the 20% of all antenna stations installed in urban areas and upon request from the public. In Latvia the telecommunication operators periodically conduct monitoring activities. In the Netherlands a government agency (Agentschap Telecom) does yearly monitoring by

measuring RF fields at a few hundred random locations. Measurements of ELF fields are also done regularly (by several bureaus mainly on behalf of local authorities).

In Belgium, the operator must make model estimations of the specific and total exposure of his antennas on a given site, or by measurement if exposure exceeds the norm by more than 5%. Citizens may also request authorities to evaluate the residential RF and ELF exposure. Finland carries out regular studies on the exposure levels from mobile phones. In Sweden, the Radiation Protection Authority measures exposure from ELF and RF sources and has extended the measurements to exposure generated by electronic surveillance systems (TETRA, EAS).

Bulgarian legislation sets out two stages for EMF control. The first is about checking the way safety zones are calculated, and the second is dedicated to measuring EMF values applying standard methods. In Germany, the levels have been measured several times since 1992.

In France, specific monitoring studies are focused on areas of concern, and the results are publicly available. In Ireland, the authorities commission monitoring studies to check that operators are complying with their licences. The reports are publicly available.

5.4. Communication with the public

This refers to actions for informing the citizens of the potential risks of electromagnetic fields and of the protection measures taken. The Member States' experience of communication varies considerably. The most common channels of information are the Internet, special publications, meetings with citizens' committees and local authorities, newspapers and magazines. Some countries have established citizen blogs and/or juries for dialogue and may use TV and/or radio programmes (Cyprus, Bulgaria, and Lithuania). These raise the general level of public awareness and enable the authorities to determine areas of concern. Special environmental impact assessment meetings are also organised in connection with a new installation which may have a significant impact on the environment.

5.5. Public funding by the EU Member States of research on exposure to EMF

The main objective of the research on EMF is to determine levels of exposure of the public, and more specifically children, and potential health effects. In public funded research, strong emphasis is put on the effects of mobile communication base stations, mobile phones, radio and TV broadcasting and high-voltage power lines. However, new areas of development such as Wi-Fi or WLAN have also been addressed.

Most Member States finance research on the potential health effects of EMF (see Table 3). Six countries (Belgium, Switzerland, France, the Netherlands, Romania, United Kingdom) finance studies on the health effects of EMF exposure from combined sources. No or very limited public funds have been allocated to research on potential health risks of EMF in Hungary, Ireland, Latvia, Malta, and Poland.

Some countries have also promoted studies of EMF risk perception, examining growing public concerns about the possible damaging effects of electromagnetic radiation.

6. CONCLUSION

The purpose of the Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300 GHz) — (1999/519/EC) — is to provide a EU framework for national policies and measures to ensure a high level of protection of the population and for EU legislation and standards on EMF exposure from electric/electronic products and devices. This Recommendation is based on the guidelines of the International Commission for Non-Ionizing Radiation Protection (ICNIRP) which are

derived from the acute effects of EMF exposure on humans. To ensure that the Recommendation remains based on the most up-to-date scientific evidence, it is reviewed periodically. In 2007, the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) reviewed the scientific knowledge on potential health effects of EMF and found no consistent scientific evidence showing a need for revising the basic restrictions and reference levels set out in the Council Recommendation. Nevertheless, the SCENIHR identified gaps in the relevant scientific knowledge and areas where further research is needed, both at the national and European levels. The SCENIHR recommendations have already started to be reflected in the calls under the 7th Framework Programme for Research.

The European Commission has monitored the implementation of the Council Recommendation in the Member States. Most of them have implemented it either via legislative acts or decrees or via voluntary recommendations. In general, measures in countries where the Council Recommendation is not yet fully implemented are being improved. However, specific implementation measures vary significantly between countries.

A Eurobarometer survey on citizens' perception of the EMF issue shows considerable dissatisfaction in terms of information and communication. Most people would like to receive more information on the potential health effects of EMF through the TV, press and radio, while today most of this information is provided through Internet sites and specialist publications.

Table 3. National studies on EMF exposure and potential health effects

Country	Domains or studies funded
Belgium	EMF exposure assessment studies in the 0 – 3 GHz range in public places and transport. RF exposure assessment related to WIFI in i-city areas. Indoor dosimetry for exposure of children to ELF, VLF, RF-fields produced by all VTUs, wired and wireless in- and outdoor sources Modelling and GIS applications for estimating the 0.4 µT risk contours and the additional risk of childhood leukaemia by underground and overhead power lines. Magnetic field 0.4 µT exposure assessment of children and biological effect of the ELF magnetic field.
Bulgaria	High-voltage power lines, radio and TV broadcasting stations; mobile communication base stations
Cyprus	High-voltage power lines; radio and TV broadcasting stations; mobile communication; home/domestic wiring
Czech Republic	Childhood leukaemia in the proximity of power lines
Denmark	Mobile communication
Estonia	Mechanisms of biological Interaction of EMF; microwave effects on cognitive functions; EM sensitivity of biological systems
Germany	Radio and TV broadcasting stations; mobile communication; domestic equipment: www.emf-forschungsprogramm.de
France	Radio/TV broadcasting stations; mobile phones and base stations; combined exposure: http://www.sante-radiofrequences.org
Greece	High-voltage power lines/ epidemiological studies, exposure assessment of general public and workers, laboratory studies; radio and TV broadcasting/animal studies, exposure assessment of general public and workers; base stations/ exposure assessment of general public and workers; mobile phones/ theoretical studies modelling, laboratory studies, clinical studies
Italy	Project on protecting Man and the environment from EMF
Lithuania	Health effects for mobile phones users 2002-2003
Netherlands	High-voltage power lines; radio and TV broadcasting; transportation systems using static fields; mobile communication base stations; mobile phones; commercial equipment; Medical equipment; home/domestic wiring; domestic equipment; combined exposure; http://www.zonmw.nl/en/programmes/all-programmes/electromagnetic-fields-and-health-research
Portugal	Radio and TV broadcasting stations; transportation systems using static fields; mobile communication base stations; mobile phones
Romania	High-voltage power lines; radio and TV broadcasting stations; transportation systems using static fields; mobile communication base stations; home/domestic wiring; combined exposure; studies on bioelectromagnetic interactions and biological impact of human exposure to RF and microwave EMF; electromagnetic ecology — sources characterisation, effects, prevention and control
Slovenia	Exposure to electromagnetic field of high-voltage power lines in the living environment; measurement of EMF exposure in the living environment with database of all base stations, TV and radio transmitters nationwide; biological effects of TETRA system
Spain	Radio and TV broadcasting; mobile communication
Sweden	International prospective cohort study; case-control study on childhood brain tumours and RF fields
Switzerland	NFP57: high-voltage power lines; mobile communication; combined exposure
United Kingdom	High-voltage power lines/ ELF health research; the Mobile Telecommunications and Health Research (MTHR) programme funded jointly by government and industry under independent management. The 1st phase (6 years, €3 million) reported on 23 completed studies in September 2007. The 2nd phase is just beginning. (www.mthr.org.uk); a special study of the residential sources of magnetic fields related to data in a previous childhood cancer study (www.hpa.org.uk/radiation/publications/hpa_rpd_reports/2005/hpa_rpd_005.htm); Wi-Fi study

The Commission is very aware of public concerns in this area, remains active and takes initiatives to address them. In particular, through its Scientific Committee for Emerging and

Newly Identified Health Risks (SCENIHR), the Commission is reviewing periodically the available scientific evidence to ensure that the Recommendation is based on the most up-to-date knowledge. A new consultation of SCENIHR has recently been launched in that respect. In addition, the Commission continues to allocate significant funding to research on the health effects of EMF through the Framework Programmes for Research and Technological Development, which takes into account the research priorities identified by the SCENIHR.

On another level, the Commission has also established a working group of government experts to improve the exchange of information and identify ways of improving coordination and cooperation between Member States. This group will support the initiatives of the Commission to strengthen the research on exposure of the general public and on potential health effects and to identify which aspects of the Recommendation require more effort.

In conclusion, the Commission intends to continue monitoring closely the application of this Recommendation, promoting the development of scientific knowledge on key aspects of the potential health impact of EMF, re-assess the validity of the Recommendation in the light of any relevant new scientific development and take appropriate action should the need arise.