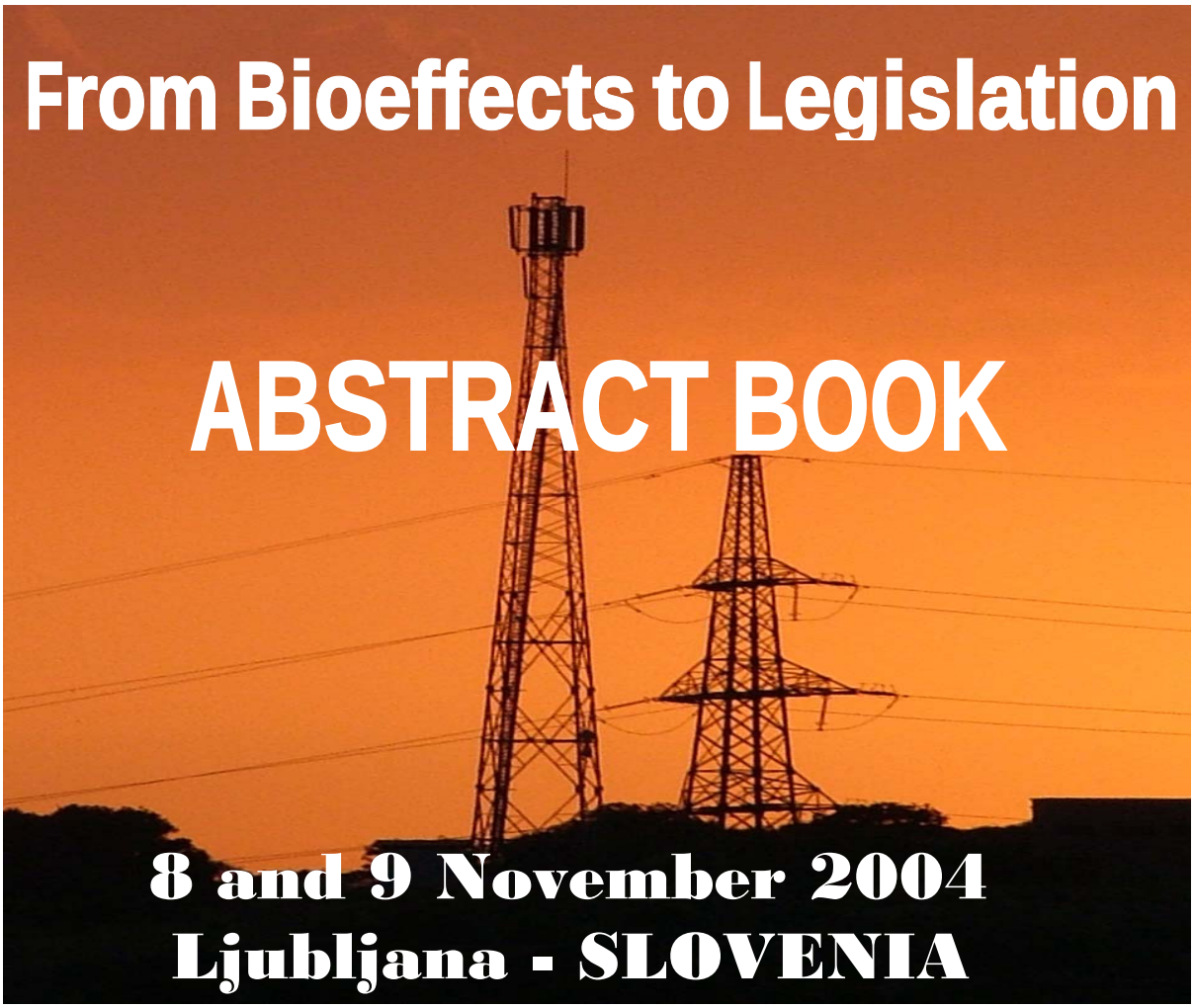
International Conference on Electromagnetic Fields

From Bioeffects to Legislation



ABSTRACT BOOK

8 and 9 November 2004
Ljubljana - SLOVENIA

Organized by:

- Institute of Non-Ionizing Radiation (INIS),
- World Health Organization (WHO),
- International Commission on Non-Ionizing Radiation Protection (ICNIRP),
- European Commission,
- Project EMF NET,
- Project Forum EMS,
- Project COST 281,

INTERNATIONAL CONFERENCE ON ELECTROMAGNETIC FIELDS:
FROM BIOEFFECTS – TO LEGISLATION

November 8-9, 2004, Ljubljana, Slovenia

AGENDA - day 1

MONDAY, 8.11.2004		
SCIENCE AND HEALTH POLICY Chairs: D.Miklavcic & E. van Rongen	**09.00**	**Welcome and opening remarks**
	09.30	**THE ROLE OF SCIENCE IN HEALTH POLICY** Dr. Emilie van Deventer, WHO
	09.50	**SCIENTIFIC BACKGROUND OF THE ICNIRP GUIDELINES** Dr. Paolo Vecchia, ICNIRP
	10.10	***COFFEE BREAK***
	10.30	**EMF AND HEALTH – STATE OF THE SCIENCE** Dr. Eric van Rongen - Heatlh Council of Netherlands
	10.50	**EMF PUBLIC AND WORKERS PROTECTION IN EU** Dr. George Herbillon - European Commission
	11.10	**THE ROLE OF THE INDIVIDUAL ELECTROSENSITIVE FOR LIMITING THE EXPOSURE** – Dr. Norbert Leitgeb, Graz University of Technology
	11.30	**EMF NET ACTION** Dr. Paolo Ravazzani - CNR
	12.00	**LUNCH**
EMF NET PANEL: EMF STANDARDS AND LEGISLATION WITHIN THE NEW EU MEMBER AND CANDIDATE STATES - Chairs: P.Ravazzani & G.Thuroczy	**13.00**	**EMF regulations and research in Hungary** Dr. Gyorgy Thuroczy - National Public Health Centre
	13.20	**Currrent situation in Slovenia related with EMF Legislation** Dr. Peter Gajšek – Institute of Non-Ionizing Radiation (INIS)
	13.40	**EMF regulations system implemented in Poland** Dr. Jolanta Karpowicz - Central Institute for Labour Protection
	14.00	**Regulations of EMF exposure in Czech Republic** Dr. Ludvik Pekarek - National Reference Laboratory
	14.20	**EMF regulations and research in Latvia** Dr. Anton Kolodynski - University of Latvia
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	15.50	**A 'painless' way for the candidates countries for EU to accept the international EMF recommendations** - Dr. Michel Israel – NC of Hygene
	16.10	**Currrent situation in Turkey related with EMF Standarts and Legislation -** Dr. Nesrin Seyhan – GAZI University
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	17.00	**CONCLUSION – END OF THE DAY 1**

INTERNATIONAL CONFERENCE ON ELECTROMAGNETIC FIELDS:
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AGENDA - day 2

TUESDAY, 9.11.2004		
CONCERNS, PRECAUTION AND RESPONSE – Chairs: P.Vecchia & E.van Deventer	**09.00**	**Establishing a dialogue on EMF RISKS** Dr. Emilie van Deventer - WHO
	09.20	**European Information System on Electromagnetic Fields** Dr. Carlos del Pozo - JRC Ispra, European Commission
	09.40	**Community Consultation and Stakeholder Engagement in Mobile Telecoms Network Development –** Mike Dolan - MOA
	10.00	**The impact of EMF concerns on network rollout** Alan Freeman - GSM Europe
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	10.50	**WHAT THE INDUSTRY IS DOING IN RESPONSE TO EMF CONCERNS?** Michael Milligan - Mobile Manufacturer Forum
	11.10	**THE ACCIDENT PREVENTION REGULATION ON EMF IN GERMANY** Peter Steimel - BGFE
	11.30	**PANEL: How governments could manage the EMF Issue**
	12.00	**END OF THE CONFERENCE - closing remarks**

FOREWORD

Dear colleagues,

Welcome to the International EMF Conference - From Bioeffects to Legislation.

The possibility of adverse effects of exposure to electromagnetic fields (EMF) has become one of the important issues of health policies, both at the level of individual countries and internationally. Thus, international scientific organizations around the world are trying to respond to those concerns with establishment of the health and safety standards, whereas national governments are implementing corresponding legislation.

Globalization and the rapid growth of mobile telecommunications world-wide have focused attention on the large differences existing in standards limiting exposure to EMF. These differences have raised concerns about the lack of uniformity and have led to public concern and distrust about EMF exposures from the increased use of various EMF sources in the living and working environment. The approach in some new EU member states is now interpreted by many as application of the precautionary principle, but has nothing to do with it. The reason for divergence is that some Eastern standards are based on a different scientific database for biological and health short-term effects.

The main goal of the EMF conference is to discuss the strategies for development of exposure limit values in EMF standards currently in force in EU, new EU member states and some candidate Members of the EU. Some differences as well as similarities of the national health and safety standards and the main obstacles to harmonization of these standards with those being established by national and international organizations and agencies will be discussed. A special session sponsored by *EMF NET ACTION* on the different models for EMF standards in new EU member states and candidate Members of the EU and their possible harmonization including review of the current research activities in those countries is organized. It is hoped that the harmonization process will not benefit only from ongoing research, better health risk assessment but also from continuous discussion and exchange of different opinion at the meetings like present conference.

The aim of the conference is also to provide the answer to the most commonly asked question from the public: Do current internationally recognized limit values provide sufficient protection against EMF exposure? This question is particularly important since some new EU member states use quite lover limit values in their standards and legislation in the field of EMF.

Waiting for conclusive evidence of a health threat has sometimes had unfortunate consequences. More and more often, precautionary measures are called on to prevent or limit exposures whose effects are not known or are poorly understood, but that may be harmful. Thus, combination of current legislation and the implementation of the best practice code for sitting EMF sources in environment seems to be the best way to address community concerns about EMF sources in the environment. A special session will address those important topics.

I sincerely believe that the conference will provide a useful forum for exchange of ideas and the latest results in this field of science.

In the name of all organizers I wish you a pleasant stay in our beautiful capital of Ljubljana.

doc.dr. Peter Gajšek

Ljubljana, November 2004

INTERNATIONAL CONFERENCE ON ELECTROMAGNETIC FIELDS:

FROM BIOEFFECTS – TO LEGISLATION

Ljubljana, Slovenia, 8th – 9th November 2004

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THE ROLE OF SCIENCE IN HEALTH POLICY: *WHO* RECOMMENDATIONS ON EMF

Dr Michael H Repacholi and Dr T Emilie van Deventer

World Health Organization,
Switzerland

Public health policy refers to laws, regulations, and other mechanisms by which government seeks to influence individual health-related behavior. The role of science in public health policy development ranges from decisive to limited, and science has the potential to serve at least three functions in relation to public health policy: 1) to reveal the existence or magnitude of a problem, 2) to facilitate the evaluation of policy options, and 3) to evaluate the effectiveness of existing policies.

In the context of electromagnetic fields (EMF), there is clear scientific evidence of hazardous health effects when exposure levels are sufficiently high. In such cases, when risk is quantifiable, evidence-based health policy is practicable. At lower levels of exposure, such as typically found in the environment, it is the absence of data demonstrating a health risk that makes health policy difficult to establish, particularly when public concern is high.

Through the International EMF Project, WHO is assessing health effects of exposure to static and time varying electric and magnetic fields in the frequency range 0 - 300 GHz. This work is carried out in collaboration with WHO's specialized agency on cancer research, the International Agency for Research on Cancer (IARC), and other international organizations, including the International Commission on Non-Ionizing Radiation Protection (ICNIRP), governmental agencies and independent research institutions. The main objectives of the Project are to carry out reviews of the scientific literature on possible health risks from EMF exposure, identify gaps in knowledge, and establish a research agenda.

This presentation will provide an update on the International EMF Project activities related to its scientific evaluation of health hazards from EMF exposure, and its recommendations on EMF health policies.

SCIENTIFIC BACKGROUND OF THE ICNIRP GUIDELINES

Dr.Paolo Vecchia

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Italy

Abstract
ICNIRP is an independent organisation responsible for providing advice to international and national authorities, and to the public, on exposure to non ionising radiation and related biological and health effects. In particular, ICNIRP develops guidelines for the safe exposure of workers and the general public to different kinds of non ionising radiation, including electromagnetic fields. These guidelines are based on established scientific literature, and are developed following well defined steps and criteria. The basic approach and the fundamental concepts adopted in such process are presented in this paper.

Introduction
The International Commission on Non Ionizing Radiation Protection (ICNIRP) was established in 1992 as an independent scientific organisation whose aim is to provide guidance and advice on the health hazards of non-ionizing radiation exposure. Guidance and recommendations provided by ICNIRP are based on scientific data and on established principles and criteria.

Depending on the nature of the biological effects, and the weight of evidence, different systems of protection may be implemented, to which ICNIRP and other similar organisations may contribute to various extent (Berqvist 1996).

Health threshold based systems are adequate when biological effects that might lead to health detriment have been established and corresponding thresholds have been identified. Guidelines on limits of exposure are adequate to prevent such effects.
Optimisation systems may be appropriate in face of a known and accepted hazard, where a threshold cannot be established. Finally, precautionary measures may be adopted in case of uncertainty, to protect against hazards that have been suggested, but not established by the scientific research.

While the last two systems require economical, social and political considerations to be taken into account, guidelines developed by ICNIRP to protect against established, acute effects of electromagnetic fields are based solely on scientific data and criteria. The basic concepts of these guidelines are shortly discussed in the following. For a more comprehensive discussion, the reader is referred to the text of the guidelines (ICNIRP 1998), and to a specific document on the general approach of ICNIRP towards the protection against non-ionising radiation (ICNIRP 2002).

Review of the literature
ICNIRP continuously carries out critical reviews of the scientific literature concerned with the physical characteristics of sources of electromagnetic fields (EMF) and their possible biological and health effects. In doing so, ICNIRP monitors the accumulation of new evidence, updating health risk assessments as appropriate. Such assessments are based on the totality of the science, and not just on the added information. The process is therefore dynamic: all assessments are based on current knowledge, and are subject to revision in the light of new substantiated evidence.

While any single scientific study may indicate the possibility of a health effect related to a specific exposure, ICNIRP bases its evaluations on the weight of evidence coming from several studies. The scientific quality of the studies is critical; therefore, only peer-reviewed literature is selected in principle, although technical reports of adequate quality may provide further, useful information.

The established effects
In the evaluation of health effects carried out by ICNIRP, three steps can schematically be identified.

Initially, each study is evaluated in terms of its relevance for the health effect being considered and quality of methods used. Different weights may be assigned to the studies, depending on the extent to which they meet quality criteria regarding e.g. the experimental techniques used, the assessment of exposure, the control of environmental conditions, possible biases and confounders, the replicability of the experiments and the reproducibility of results.

As a second step, all information relevant for each health effect is evaluated. This review is normally done separately for epidemiological investigation, human laboratory tests, animal studies and in vitro research.

Finally, the outcomes of the above steps are combined in an overall evaluation, taking the consistency of data in proper consideration. ICNIRP recognises that this process involves some judgements; to minimise bias due to personal attitudes, the steps described above are performed collectively by the whole Commission, with the support of its standing Committees.

When the overall evaluation allows the identification of an effect that is causally related to the exposure, the effect becomes *established*. Leading criteria in the identification of effects are the reproducibility of findings, and the consistency across studies of different nature (e.g. data from research in vitro that may give biological plausibility to a causal interpretation of statistical correlations indicated by epidemiology.

Dosimetric quantities
The entity of a given biological effect of EMF exposure is related not only to the level of the external fields, but also to the coupling of the fields with the exposed body. The quantitative relationship by which the external exposure effects a biologically effective parameter of the target tissues is unique to a single exposure condition. Therefore, effects are better described by quantities that reflect the efficacy by which the external exposure causes a certain biological effect. These quantities are termed *biologically effective quantities*, or *dosimetric quantities*.

Although several dosimetric quantities have been introduced for different regions of the EMF spectrum, the most relevant are the induced current density, that is appropriate for low frequency electric and magnetic fields (up to 10 MHz), and the Specific Absorption Rate (SAR) that is related to thermal effects resulting from exposures to electromagnetic fields of frequency above 10 MHz.

The critical effect
Once the adverse effects have been catablished, and related to the exposure through the appropriate biologically effective (dosimetric) quantity, it is generally possible to rank them according to the exposure level at which each becomes relevant. The *critical effect* is the established adverse effect that is relevant at the lowest level of exposure.
The adoption of limits below the threshold for the critical effect provides in fact protection against any other adverse effect hat has been identified.

Basic restrictions and reference levels
The biological and health effects depend on several parameters characterising the exposure. These include, but are not limited to, the strength of the electromagnetic fields. The strategy of ICNIRP is therefore to define *basic restrictions* in terms of the appropriate dosimetric quantities rather than the intensity of the fields themselves. For each frequency range, the basic restriction is set below the threshold for the appropriate critical effects. For some regions of the EMF spectrum, where available data are insufficient to establish a critical effect with adequate confidence, the basic restriction is obtained by extrapolation from lower and higher frequencies.

Due to practical difficulties in measuring or calculating some dosimetric quantities, these are - in a further step of development of the guidelines - related to *reference levels* that are expressed in terms of a directly measurable parameter of the external exposure (power density, electric field strength or magnetic field strength).
This strategy is conservative. The use of reference levels ensures in fact compliance with the basic restrictions, since the relationships between them have been developed for maximum coupling conditions

between the external fields and the exposed person. On the other hand, exceeding the reference levels does not necessarily imply that the basic restriction is exceeded; whether this occurs or not should be ascertained through a more detailed investigation.

Reduction factors

The identification and quantification of the adverse effects of EMF is difficult, due to uncertainties in the scientific data. Sources of uncertainty include e.g. the intrinsic variability of biological data, experimental errors, extrapolation of animal data to humans, biases and confounders. The derivation of reference levels from basic restrictions is also affected by uncertainties in dosimetry, and in the characterization of the exposure.

To compensate for these uncertainties, *reduction factors* are introduced. Their magnitude varies depending on the degree of uncertainty. Some effects can in fact be quantified with reasonable precision and little reduction, if any, is required below threshold levels; when the precision is lower, a larger reduction may be warranted.

While the use of reduction factors in basic restrictions is a cautionary measure, it should be noted that further precaution is provided by the conservative approach adopted in the derivation of reference levels. These are in fact set in such a way as to assure compliance with basic restrictions in the most unfavourable combination of the many parameters characterising exposure. This means that additional reduction factors are implicitly introduced under realistic conditions. Such factors may be substantially higher than those explicit in basic restrictions.

Conclusions

Over the years, ICNIRP has developed a comprehensive system of protection against the established effects of exposure to electromagnetic fields.

The exposure guidelines are developed through a clear and transparent process, following steps and criteria defined *a priori.* These criteria include rigorous selection and careful evaluation of the scientific data.

The two-level structure, with basic restrictions and reference levels, makes the guidelines flexible and virtually of use for any exposure condition and any category of exposed population. At the same time, margins of precaution are included with the use of explicit and implicit reduction factors, assuring that in realistic conditions exposures are kept well below the threshold for established effects.

Effects that have been established so far are almost completely of acute nature. ICNIRP is aware that long-term effects have been suggested by some epidemiological studies, but not adequately supported by experimental research, or studies on possible interaction mechanisms. In the view of ICNIRP, the overall results of research on EMF exposure and cancer – or other degenerative pathologies – are not strong enough to form a scientific basis for setting exposure guidelines.

More in general, it should be noted that for long-term effects, that are stochastic in nature, protection strategies different from exposure guidelines should be employed. Such strategies should be based on the acceptability of a given risk - taking into account its nature and dimension - but also on social and economic considerations that fall outside the responsibility of ICNIRP.

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EMF AND HEALTH – STATE OF THE SCIENCE

Dr. Eric van Rongen

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The Netherlands

Abstract
This paper gives a very short overview of a very broad field: studies into possible health effects of exposure to electromagnetic fields in the frequency range of 0 – 300 GHz. Different frequency ranges are discussed: static fields, extremely low frequency (powerline) fields and high frequency (radiofrequency) fields. An overview is given of which effects are considered scientifically established and which are not.

Introduction
In the past decades, there has been an increase in the number of people that worry about possible health effects associated with exposure to electromagnetic fields. Alarming reports in the media and the growing number of visible sources of radiation, such as antennas for mobile telecommunication, contribute to this. Questions arise such as: Can I live safely near overhead power lines or will my child get cancer from that? Is my headache caused by the base station antenna on the rooftop of my apartment building? Can I get brain cancer if I use a cellular telephone?

Since the mid-1900's many studies have been done on possible health effects of exposure to electromagnetic fields. In the early 1990's, the focus was on exposure to powerline frequency fields (extremely low frequencies of 50 and 60 Hz). Towards the end of the century the focus shifted to radiofrequencies, particularly those used by mobile telecommunication systems(e.g. 900 and 1800 MHz for GSM).
Regularly the available scientific material is reviewed by international and national organizations, such as the International Commission on Nonionizing Radiation (ICNIRP) (www.icnirp.de), the International Committee on Electromagnetic Safety (ICES) of the USA-based IEEE (http://grouper.ieee.org/groups/scc28/index.html), the National Radiological Protection Board (NRPB) of the UK (www.nrpb.org) and the Health Council of the Netherlands (www.gr.nl). The World Health Organization (WHO) runs the International EMF Project that will result in major reviews of health effects of static, low-frequency and high frequency electromagnetic fields (www.who.int/peh-emf). The state of science that is, necessarily brief and sketchy, presented in this contribution is drawn from the reviews of the abovementioned organizations. No references are provided to individual studies. Instead, a (non-exhaustive) reference list is given with the main recent reviews and reports.

Electromagnetic spectrum
Electromagnetic fields come in many different forms. The basis characteristic is the frequency (expressed in hertz, Hz), that is coupled to the wavelength. The higher the frequency, the higher the intrinsic energy content of the fields. Fields with wavelengths shorter than 100 nm possess sufficient energy to break chemical bonds and to cause ionizations. Such fields are therefore named ionizing radiation. All other fields, including ultraviolet radiation, visible light, infrared (heat) radiation and radiofrequency and low-frequency fields form the non-ionizing part of the electromagnetic spectrum (fig. 1).

Direct and indirect effects
Direct effects are the result of an interaction between the electromagnetic field and biological tissue. They may lead to biological or health effects (see below). Indirect health effect may occur when there is an interaction between electromagnetic fields and medical devices that contain electronics. Under certain circumstances external electromagnetic fields may interfere with electronic circuits of exposed equipment. This may lead to situations where these devices malfunction and the health of people using them may be afflicted. Such devices include small and sometimes implanted devices such as cardiac pacemakers, insulin pumps and blood glucose meters, but also larger ones like electric wheelchairs. Indirect effects are the result of problems of a technical nature and are not further dealt with here. This contribution only discusses direct effects.

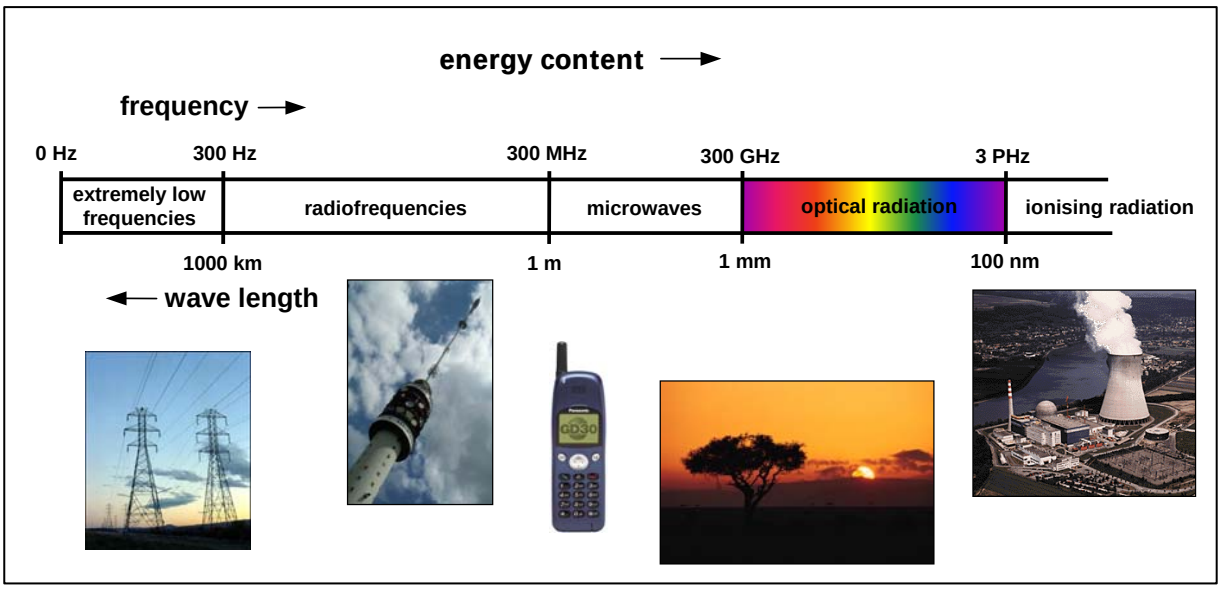

Figure 1. The electromagnetic spectrum.

Thermal and non-thermal effects

A distinction that is often made with regard to exposure to higher frequency electromagnetic fields is that between thermal and non-thermal effects. Thermal effects result from the fact that electromagnetic fields with frequencies above approximately 100 kHz may be partly absorbed by materials containing water (such as biological tissues) and be converted into heat. Excessive heating may lead to biological or health effects, as will be discussed below. Exposures in everyday life generally do not involve tissue heating, however, and therefore will not lead to thermal effects. Nevertheless, people fear that such exposures might still result in health effects, e.g. non-specific symptoms such as headache and sleeplessness or even life threatening effects like the induction of cancer. Because heating is not likely to occur, such effects are called non-thermal.

Sometimes accusations are made that non-thermal effects are not being considered in the analysis of the scientific information, because they are not used as a basis for exposure guidelines. This is not the case, however. The organizations mentioned above review all relevant studies, including those looking at non-thermal effects. In several studies non-thermal biological effects have been demonstrated, but adverse health effects on the basis of such effects have not been established. Therefore they cannot serve as a basis for exposure guidelines. It should be noted, however, that this only pertains to high frequency fields. Effects of low-frequency fields are by nature always non-thermal.

Short-term and long-term effects

Depending on when effects can be measured or observed, they are considered short or long-term effects. Short-term effects occur during or shortly after exposure. Long-term effects may not become manifest until months or years later. Of course every long-term effect is always the result of a short-term effect. At some point in time there should have been an interaction between the electromagnetic fields and biological tissue.

Biological and health effects

In the interpretation of the data on the effects of non-ionizing radiation it is important that a distinction is made between biological effects and (adverse) health effects. A biological effect is any influence of a chemical, physical or biological factor on the resting state of a biological system. That can be a cell, a tissue, an organ or an entire organism. Only when the natural compensatory mechanisms can no longer adequately deal with the external influence and the system is affected outside of its natural bandwidth, an

adverse health effect may result. So when in, for instance, *in vitro* studies an effect on certain cell types is demonstrated, this does not necessarily mean that this same effect will result in an adverse health effect in an organism. Even when a certain factor is demonstrated to affect experimental animals, the same effect does not necessarily also occurs in humans. It should be noted, however, that effects demonstrated in experimental animals are much stronger indications for possible effects in humans than effects found *in vitro*. In summary: a biological effect is not the same as, or does not necessarily result in, an adverse health effect.

Static fields

Short-term effects

Static electric fields induce a surface charge on the body. This can lead to the movement of hairs and perception of the field. The threshold for this effect is a field strength of approximately 20 kV/m. If a charged person that is insulated touches a grounded object, a small spark discharge may occur. This happens, for example, when walking over a synthetic carpet in a dry environment. Depending on the conditions, the field strength generated in this situation can range from around 10 kV/m to more than 1200 kV/m. These discharges do not result in adverse health effects. They may, however, cause discomfort and startle responses. Annoyance may occur above 25 kV/m.

Static magnetic fields can interact with organisms by different mechanisms. By a process of magnetic induction, charged particles moving in a static field can give rise to electric fields and currents. This can result in the generation of small electric currents in the blood. Induction of this kind also occurs when an organism moves
through a static field. According to Faraday's Law, small electric currents will then be generated in the body.

Magnetomechanical effects are a second mechanism. These can result in molecules and larger structures being oriented in a static field (similar to the working of a compass). The biological effects of this type of interaction are (at least in human beings) negligible, since the number of natural magnetic substances present in the body is extremely low.

The third type of effect relates to interactions between molecules. A static magnetic field can exert an influence on certain intermediate products of chemical reactions whereby the rate of those reactions can change. For reactions involving the formation of radicals as intermediate products, it has been suggested that an influence would be detectable even at field strengths of 10 mT. However, biological effects have never been discovered at such low field strengths.

Biological effects have not been unequivocally demonstrated at field strengths below about 2 T. In humans, movement of the head in a strong magnetic field sometimes invokes effects such as vertigo, nausea, headache, metallic taste and phosphenes. At field strengths below 2 T, such effects have not been observed.

Long-term effects

There is no information on possible effects of chronic exposure, but long-term exposure to high field strengths in practice does not occur. The strength of the natural magnetic field varies between approximately 35 μT at the equator and 70 μT on the geomagnetic poles.

Low-frequency fields

Short-term effects

The physical effects of exposure to alternating fields with frequencies up to several MHz is the induction of electric fields and currents in tissues. These can result in biological and adverse health effects and provide the basis for exposure limits. The principal biological effect is stimulation of electrically excitable tissues such as the nervous systems.

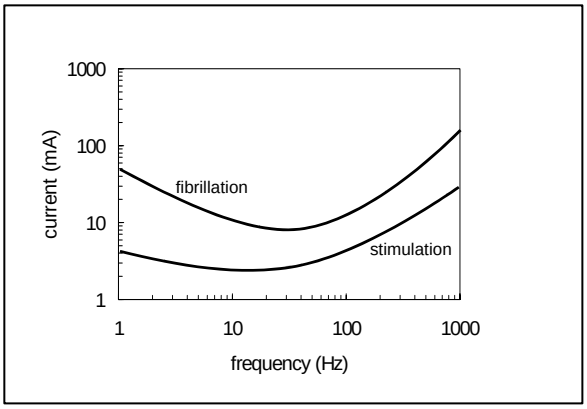

Figure 2. Frequency-dependence of cardiac effects (adapted from Reilly, 1998).

The most serious effects, which can be life-threatening, are cardiac arrhythmias. Fig. 2 shows the frequency-dependence of this effect. At 60 Hz - i.e. within the range in which sensitivity is greatest - the minimum current density that is required for ventricular fibrillation (the uncontrolled contraction of the muscle fibres of the ventricle, resulting in drastic reduction of the heart's pumping action) is around 2.5 A/m^2 in experimental animals. It can be regarded as a conservative limit value for stimulation of the heart in human beings. The current density values which result in excitation of the heart lie at around 40% of the levels that cause fibrillation, consequently at approximately 1 A/m^2. This value, which can be regarded as the estimated value of a 'lowest observed adverse effect level', corresponds closely to that of the minimum current density required for stimulation of nerve fibres: 1.2 A/m^2.

The most significant effect at lower current densities is the occurrence of phosphenes. These are spots or flashes of light which are perceived in response to direct stimulation of the retina by electrical current. They can, for example, result from an external electric or magnetic field. They generally disappear within an hour after exposure stops. A value of 10 mA/m^2 can be regarded as a reasonable lower limit for the occurrence of phosphenes, observed at about 20 Hz. With both increasing and decreasing frequency, the current density required for the perception of phosphenes increases rapidly (fig. 3), and therefore the frequency range within which this phenomenon actually plays a role is limited from a few Hz to around 200 Hz.

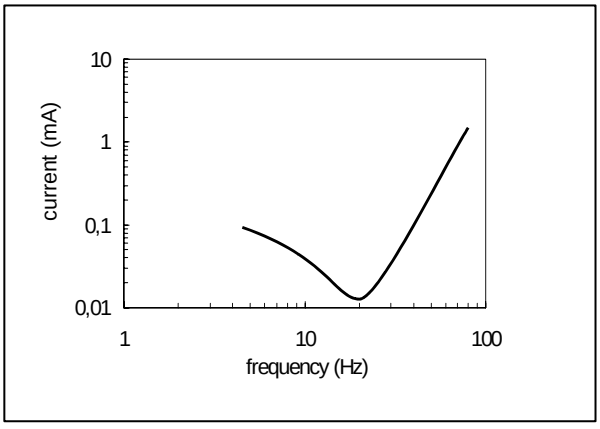

Figure 3. Frequency dependence of phosphenes (adapted from Reilly, 1998).

Long-term effects

The discussion on potential harmful effects of powerline frequency (50/60 Hz) fields has resulted from several epidemiological studies performed in the 1980's in the USA. These studies seemed to indicate an association between living near overhead powerlines (which was presumed to be associated with

increased exposure to extremely low-frequency fields) and an increase in childhood leukaemia. This triggered a series of similar epidemiological studies in a number of countries throughout the world, as well as many laboratory studies into a possible mechanism that might explain the observed association. Also a number of diseases other than childhood leukaemia was studied.

The design and results of the epidemiological studies have been mixed. In general, assessment of exposure is a main problem, especially since it is not know what aspect of exposure (if any) is important. Most studies have been case-control studies, in which exposure is assessed sometimes many years after the critical period in the development of the disease. Nevertheless, several researchers have performed a pooled analysis of the raw data of what they considered to be the best available studies. These analyses came to the similar conclusion that there is a consistent statistical relationship between exposure to extremely low-frequency powerline magnetic fields higher than approximately 0.4 μT and a doubling of the risk of childhood leukaemia. The question is, whether this conclusion can be generalized to all countries. Also, although a doubling of the childhood leukaemia risk seems serious, the impact of the presumed association is limited. For instance, it has been calculated that in the Netherlands one extra case of childhood leukaemia in two or three years could result from magnetic field exposure, with an annual incidence of approximately 110 cases.

In 2002 the IARC, the International Agency for Research on Cancer of the WHO, performed a formal assessment of the carcinogenicity of static and extremely low-frequency electromagnetic fields. The IARC classified extremely low-frequency magnetic fields as “possibly carcinogenic to humans”. Static electric and magnetic fields as well as extremely low-frequency electric fields were considered “not classifiable as to their carcinogenicity in humans”. The classification “possibly carcinogenic” is based on limited evidence in humans, the childhood leukaemia data. For all other cancers in both children and human the evidence was considered inadequate. This was also the case for carcinogenicity in experimental animals.

What are the ramifications of these conclusions? It should be emphasised that this does not mean that extremely low-frequency magnetic fields *are* actually carcinogenic, simply that they *might* be. There is no evidence to support the existence of a causal relationship, nor has research yet uncovered any evidence that a causal relationship might exist. The IARC has classified more than two hundred agents as “possibly carcinogenic”. However, not for all of these agents has their possible carcinogenicity lead to measures by the authorities to limit exposure. In many cases these are agents with which there is regular contact in daily life[1].

Radiofrequency fields

Short-term effects

The only scientifically established effect associated with exposure to radiofrequency (RF) electromagnetic fields is heating of tissues. An excessive rise in body temperature may result in adverse health effects, such as dehydration, heat shock and cardiovascular problems. The absorption of RF energy is expressed in the SAR, the Specific Absorption Rate. The SAR is a measure of the rate of uptake of electromagnetic energy in the body. With that it is a measure of the conversion of this energy into heat and therefore of heating. It is expressed in watts per kg bodyweight (W/kg). In animal experiments, (behavioural) effects were observed with exposures resulting in an SAR of approximately 4 W/kg and higher. Experimental studies on humans indicated that healthy adult human beings can tolerate much higher exposures, but since the population also contains groups, e.g. young children, elderly people and diseased people, that might have less efficient thermoregulatory capabilities, it is generally accepted that exposure should not exceed 4 W/kg. In fact, many exposure limits and guidelines apply a large margin of safety resulting in a maximum permissible SAR of 0.08 W/kg for the general population.

[11] Examples of such agents include coffee, acetaldehyde (a substance naturally occurring in grapes and wine, and in higher concentrations in oxidised wines such as sherry and Madeira), pickled vegetables but also crude diesel oil, bitumen and carbon black (produced by burning scented candles and released into the air from toner during photocopying).

With the increasing number of applications that result in low-level, often continuous exposure, increasingly questions are asked about possible non-thermal effects. For instance, the use of a cellular telephone results in exposure of part of the head, including brain tissue, that is not associated with any significant increase in temperature (maximally approximately 0.2 ºC). Exposure of people living in the vicinity of base station antennas is much lower, albeit continuous, and is highly unlikely to be associated with any temperature increase. Still some people complain about non-specific symptoms such as headache, concentration problems, etc.

A increasing number of studies is being performed on a variety of endpoints. Several studies have measures cognitive functions during exposure to mostly handset-strength GSM-like signals. No consistent and reproducible effects have been found. In other studies, the influence of exposure to electromagnetic fields similar to those generated by a cellular phone on the natural electric activity in the brain during sleep has been studied. Characteristic brain wave patterns can be measured by making electroencephalograms. GSM-field exposure was shown to slightly modify some of these brain waves. Again, however, the effects were found to be not very consistent over the different studies. Moreover, any influence found did not seem to affect the way the test subject felt rested after the experiment – they even fell asleep somewhat earlier in some experiments – and it also had no influence on their health in general.

Several studies attempted in an experimental setting to invoke non-specific symptoms in people who complained about such symptoms and attributed them to electromagnetic field exposure. In none of these studies a relationship between exposure and symptom occurrence could be established.

In some biological systems effects have been found in laboratory experiments. Some years ago a study in which animals were exposed to cellular phone-like fields found DNA damage in brain tissue. Replication studies could not reproduce this effect, however. Recently, low level GSM-like fields were shown to result in DNA damage in cultured human cells. These data have not been confirmed thus far. Also membrane effects have been found in vitro, resulting in altered transmembrane transport of calcium, which might affect cellular functioning. It is not possible, however, to conclude that these effects will lead to adverse health effects. Such relationship has not been found and indeed it is very likely that there are many homeostatic mechanisms in an organism that compensate or annihilate effects of external factors.

In conclusion, thermal effects have been firmly established, but there is no or no clear and consistent evidence for health effects of a non-thermal nature. On the other hand, there is also no evidence for the absence of health effects. There are still a lot of questions, therefore further research should be performed.

Long-term effects

The questions concerning possible long-term effects of RF electromagnetic field exposure mainly focus on cancer. A number of epidemiological and animal experimental studies has been published.

One of the main problems in the epidemiological studies is exposure assessment. In most studies exposure has not been measured, but a proxy has been used, e.g. the distance of living to the source. In several countries, studies have been performed on people living near radio and television transmitters. Altogether, the results do not indicate that this is a risk factor for the development of cancer. In several other studies, occupational exposure has been estimated on the basis of job descriptions, also a very crude measure. No consistent association with the incidence of cancer emerges from that data.

In recent years, many studies have been done, or are still ongoing, on the effect of mobile phone use on the incidence of brain cancer. In several large cohort studies no associations were found with tumour incidence or mortality. The authors of some case-control studies, on the other hand, claimed to have found an association, but these studies had methodological shortcomings. The general conclusion is, that clear, consistent evidence for an association between mobile phone use and cancer incidence is lacking. In the near future, the results from a large coordinated study in thirteen countries, the Interphone study, will provide valuable additional information.

In cancer bioassays - long-term exposure experiments in animals - no effect of such exposure at thermal

or non-thermal levels has been observed. Also, no effect was found on growth and development of chemically-induced tumours. In one study, a stimulating effect was observed on the development of lymphomas in transgenic mice. A replication study found no effects, however, and also in non-transgenic mice no effect was observed on lymphoma growth or development.

Again, also for long-term effects no clear and consistent evidence for effects has been found. Although the animal studies do not provide indications for effects of long-term exposure, further epidemiological studies appear to be necessary. The presently available epidemiological data only pertains to relatively short exposure periods (measured on the human lifetime). The Interphone study will provide information on a longer exposure period, but further follow-up remains indicated.

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EMF PUBLIC AND WORKERS PROTECTION IN THE EUROPEAN UNION

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On 12 July 1999, the Council adopted a Recommendation (1999/519/EEC) limiting the exposure of the **general public** to non-ionising radiation in a view of protecting human health against well-known acute health effects. This was decided following a European Parliament resolution of 1994, which called the commission to propose legislative measures to reduce the exposure of workers and public to electromagnetic fields (EMF). A legal base for a binding act was not possible for the general public but only for workers due to the limitation in the article 152 of the Treaty. It has however to be noted that the Amsterdam Treaty in 1999 expanded the scope of EU activities in public health. Due to the fact that "*A high level of human health protection shall be ensured in all Commission policies and activities*", the idea is to use this statement to achieve a certain harmonisation using the binding product legislation. For instance EU legislation governing radio products, including mobile telephone masts, obliges manufacturers to ensure that they are safe. In particular, article 3.1.a of Directive 1999/5/EC on Radio Equipment and Telecommunications Terminal Equipment, also obliges manufacturers to ensure that their products do not have an adverse effect on health when used for their intended purpose.

The Recommendation of 1999 was adopted after endorsement of the scientific steering committee. The Recommendation covers all the range of frequencies till 300 GHz; this means that it's technology neutral and applies for all devises emitting electromagnet fields (actually the frequencies higher the 300 GHz are not yet covered (in particular the optical radiation) however there are projects in the Commission (DG SANCO) to address this issue in the next future in particular subbed and laser light. The annexes of the Recommendation specify maximum exposure levels. Limits come from the ICNIRP guidelines and are based on established health effect taking also into account a precautionary approach to long-term possible carcinogenic effects by the introduction of safety margins in the exposure.

For **workers**, the situation developed differently: article 137 of the EU Treaty provides for a much stronger legal framework and enables the Commission to develop proposals for directives i.e. binding legislation related to health and safety at work.

In 1992 already, the Commission tabled a first proposal covering different physical agents: vibrations, noise, electromagnetic fields and optical radiation. A slightly amended proposal was made in 1994 after the first opinion of the European Parliament. The discussions of the proposal only started in 1999, after the decision had been taken to split the proposal into four parts and to discuss each component separately. This boosted the process and a first directive was adopted by the Council and the Parliament in 2002 on "vibrations" and a second one in 2003 on "noise" at work. The discussions on the third component "EMF" started in 2002 and a related binding directive was adopted on 29 of April this year.

This directive covers the same range as the recommendation (up to 300 GHz) and introduces binding Exposure Limit Values (ELVs) but also Action Values, i.e. values under the ELVs but above which the employers are obliged to implement measures specified in the directive. However the static magnetic fields have been excluded from its scope because it was considered that there was not sufficient consistent scientific evidence.
The EMF directive also clarifies the obligations of the employers which were already made compulsory in the so-called framework directive 89/391/EC: determination and assessment of risk, provisions aiming at avoiding or reducing of risks, information and training of workers, consultation and participation, health surveillance. Article 12 also imposes on the Member States that the provisions of the directive, considered as minimal prescriptions against occupational risks due to exposure to electromagnetic fields, be transposed in national legislation within 4 years. The provisions of the EMF directive shall thus be "operational" by April 2008.

THE ROLE OF INDIVIDUAL ELECTROSENSITIVITIES FOR LIMITING EMF EXPOSURE

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Abstract
ICNIRP's guidelines for limiting exposure to electric and magnetic fields in the ELF range basically limit intracorporal electric current densities caused by external electric or magnetic fields [1]. The basic limit for intracorporal electric current densities is derived from laboratory studies on cellular and animal systems which were summarized to show no established adverse health effects if induced current densities were at or below 10mA/m² [1,2]. It was acknowledged that other established effects such as magnetophosphenes or electrophosphenes may occur below this limit. However, since such effects were not considered to be health relevant, ICNIRP saw no need to base exposure limits on them. The adverse effect level was defined to be the threshold for acute changes in the excitability of the central nervous system which was assumed to be 100mA/m². However, little information was available on the interpersonal variability of sensitivities to electric currents among the general population and on the location of the chosen threshold within the expected probability distribution.

To limit touch currents at 50Hz, ICNIRP choose 500µA which already then was above the limits as used in electrical safety standards [16,17] and almost equal the value chosen for (relaxed) single fault conditions [17]. The "safety factor" was not explicitly mentioned. Not to adverse but even to dangerous effects (let-go threshold) it amounts to 20.

At the time of elaboration of ICNIRP's exposure limits only data from cellular studies and experimental touch current data from only very small numbers of individuals (men) were available. Therefore, it remained uncertain as to which extend they could be extrapolated to the general population. Since new studies are available now, it needs to be discussed whether the arbitrarily chosen "safety factors" are sufficient to account for interpersonal variations of sensitivities in particular if other groups like women, children and elderly are taken into account. Even more sparse data were available for electric current-induced changes of the CNS. However, today results from electric current stimulation of peripheral nerve cells are available to determine the interpersonal variability of the general population. These results can also be used to estimate the interpersonal variability in respect to CNS tissue.

It could already be shown that former assumptions on the nervous excitation levels of the general population need revision. The estimated electric current perception level as used by ICNIRP (and in electric safety standards) to limit touch currents turned out to be considerably too high. Besides this, the interpersonal variability estimated so far turned out to be considerably too small. As 50Hz- 0,5%-probability threshold 500µA had been chosen, however, at that time based on men's results only and neglecting the increased sensitivity of women and the possibly further increased sensitivity of children.

Based on measurements at 708 randomly selected adult occupied persons (349 men and 359 women) the 0,5%- perception threshold was found to be as low as 53µA for men, which is considerably lower as assumed so far. It could be confirmed that there is a gender-specific difference and that women exhibit an increased electrosensitivity. The perception threshold for women at the same statistical level turned out to be as low as 24µA [5]. More surprising, the span of measurements turned out to comprise more than 2 magnitudes (from 15µA until 1800µA) instead of the span of about one magnitude as assumed so far.

The inclusion of further investigations on 123 elderly (older than 60 years, among them 60 women and 57 men) and, most interesting, on 240 children (among them 117 girls and 123 boys, aged between 9 to 16 years) showed that also in respect to children former assumptions need revision. The results for elderly show that their perception thresholds are fairly similar with those of other adult people.

Since ICNIRP's recommendations are not restricted to white European people, there is a need to consider as to which extend body dimensions of other societies need to be taken into account. It is obvious that other societies may be characterized by other demographic data in respect to body size, body weight and age distribution. Therefore, it needs to be investigated to which extent the sensitivity to electric currents is dependent on the height and the weight of persons.

It could be shown that the sensitivity to electricity decreases proportionally with increasing body mass index, but only up to overweighted persons. At adipose or very adipose people no further increase of the electric current perception threshold could be found. The difference of electric current perception thresholds between underweighted and overweighted relative to the overall mean value amounts to 34% (women) and 37% (men), respectively.

Simulations show that different prevalence in regard to body mass index groups primarily affects probability- related measures such as the mean value rather than the span of electric current perception thresholds. This is supported by the accumulation of published data of perception thresholds of different countries which, although based on different societies, lie within the span of our results (Fig.1).

Different age distributions among societies will not change the span of perception thresholds, but may lead to different cumulative probability curves and hence to different limits for the same statistical level.

However, so far the data refer to healthy people only. There are no results available yet to conclude on the quantitative impact of illnesses or of medical drugs on electrosensitivity. Therefore, the potential sensitivity- enhancing effect of illnesses and drugs still merit a further reduction factor to derive limits for the general population. Overall, this leads to the conclusion that the reduction factor 50 is not oversized.

There are still two other aspects to be considered. On the one hand, so far there is no provision made to account for contributions of mobile sources such as electrical appliances. On the other hand, experience shows that limits are frequently applied for conditions of intended use only. However, in case of unintended use or overload such as for power lines or transformers within a power supply network a significant increase of emissions can occur which may last even for days or longer. Further considerable overexposures can occur in single fault conditions. To account for such overexposures a real "safety" factor would be needed.

For the time being, the ICNIRP concept of limits does not include such real "safety" factors. The presented data show that the existing reduction factors leave no space for a "safety margin" and therefore should not be called "safety factor" at all (as done by ICNIRP) nor be misinterpreted as safety factor as done by some institutions like CENELEC.

Conclusion

The investigation of interpersonal variations of sensitivities to electric currents among the general population leads to three conclusions. On the one hand, they show that there is a gender- related difference with women being considerably more sensitive compared with men. It is a pity that this aspect has not been explicitly considered yet. On the other hand, children do not exhibit increased sensitivities exceeding those of women. Finally, the extend of interpersonal variations of sensitivity to electricity among the general population turned out to be considerably larger than assumed so far. The reduction factors as chosen by ICNIRP to account for biological uncertainties are hardly sufficient to account for this one aspect only. Therefore, they do not leave space for an additional "safety margin" to prevent from adverse effects in case of additional contributions of electromagnetic fields from mobile sources or due to unintended overload conditions. The argument of standards bodies to tolerate the excess of limits (e.g. due to measurement uncertainties, dosimetric limitations or to restrict assessment to conditions of regular intended use only) therefore needs critical revision.

Whether or not the derivation of reference levels by ICNIRP has been conservative enough to cover the uncertainties of dosimetry would merit an additional discussion.

EFFECTS OF THE EXPOSURE TO ELECTROMAGNETIC FIELDS: FROM SCIENCE TO PUBLIC HEALTH AND SAFER WORKPLACE: THE EUROPEAN COMMISSION COORDINATION ACTION EMF-NET

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Abstract
EMF-NET is a Coordination Action established by the European Commission in the 6th FP, that aims to provide a framework for the coordination and the interpretation of the results of the research activities related to the biological effects of electromagnetic fields (EMF). The main objectives of EMF-NET can be summarized as follows:

- Provide a framework for the co-ordination, the interpretation and the dissemination of the results of the ongoing research activities
- Provide policy relevant interpretation/advice for the facilitation of policy development options by the EU (and other bodies)
- Support informed decision-making by health and environmental authorities, industry and consumer associations as well as individuals.
- Support informed decision-making for regulation and risk communication and risk perception
- Provide an inventory of all the ongoing research in the field. Identify research priorities and needs. Provide European Commission and other bodies appropriate information for policy making.

The EMF-NET Consortium involves 41 participants, including all the coordinators of the EC (FP5) on-going projects, representatives of research projects at European national level (Finland, France, Germany, Greece, Hungary, Italy, UK), and representatives of other EC and international activities, such as EC COST ACTION 281 and the WHO EMF project, associations of industries and manufactures, trade union associations, regulatory bodies and scientific associations.

Introduction

The European Coordination Action EMF-NET "Effects of the Exposure to Electromagnetic Fields: from Science to Public Health and Safer Workplace" is financed by the 6th Framework Programme of the European Commission. The aim is not to produce new studies, but to ensure the best use of existing data on exposure to electromagnetic fields by identifying all relevant studies and analysing their findings: the EMF-NET efforts will be to scientifically inform political and health authorities, providing them with the tools and building blocks to take appropriate actions and decisions. The focus of the work is not only exposure associated with cell phones, but also exposure to many other sources such as power lines, broadcasting antennas, and electric household appliances such as induction ovens, mixers, washing machines and televisions, as well as various electromagnetic sources used in the work environment especially in the industry and health care.

The project, which will last four years (2004-2008) involves 41 partner organisations. It includes all the coordinators of previous projects supported by the EC on these topics, representatives of the main National research activities in the field, the coordinators of other European and International research projects, industrial partners from mobile phone operators and the electrical and electronic industries, and representatives from trade unions, regulatory bodies and other stakeholders.

Several separate tasks will be undertaken in the EMF-NET coordination action. The results of current research will be brought together and analysed, with consideration of both general public and occupational exposure. The issues of risk perception and risk communication will be investigated, with an emphasis on how to communicate information about potential risks, so that that health hazards are properly addressed without introducing groundless fears. A particular emphasis will be on the monitoring

of emerging technologies, including third and fourth generation mobile communications, to identify future research priorities. The EMF-NET coordination and interpretation activities will include research (both completed and planned) from outside EU, particularly in Eastern Europe, but also activities in North America, Japan, Korea and Australia.

The EMF-NET approach will be to produce a series of EMF-NET Interpretation Reports, each based on the consolidation of all available evidence in a topic area by a board of EMF-NET experts. These reports will be disseminated first to policy and health authorities, and then adapted for release to the general public in Europe.

EMF-NET will also provide the European Commission with the *European Fast Response Team on EMF and Health*, comprising eight European experts whose expertise covers all aspects of the relationship between electromagnetic fields and health. The Fast Response Team, who will give prompt and concise answers, will assist the European Commission Services with questions on these topics. EMF-NET will also organize public meetings, round-tables, workshops and conferences, targeted to the different needs of those concerned (scientists, political and health authorities, stakeholder associations, European citizens), and will contribute to education and information activities in the field.

Aims

EMF-NET is a Coordination Action established by the European Commission in the 6th Framework Programme, that aims to provide a framework for the coordination and the interpretation of the results of the research activities related to the biological effects of electromagnetic fields (EMF).

The main objectives of EMF-NET can be summarized as follows:

- Provide a framework for the coordination, the interpretation and the dissemination of the results of the ongoing research activities
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- Support informed decision-making by health and environmental authorities, industry and consumer associations as well as individuals.
- Support informed decision-making for regulation and risk communication and risk perception
- Provide an inventory of all the ongoing research in the field. Identify research priorities and needs. Provide European Commission and other bodies appropriate information for policy making.

EMF-NET started on March 1, 2004 and will last four years, till February 2008

The EMF-NET Consortium

The EMF-NET Consortium involves 41 participants, including all the coordinators of the EC (FP5) ongoing projects, representatives of research projects at European national level (Finland, France, Germany, Greece, Hungary, Italy, UK), and representatives of other EC and international activities, such as EC COST ACTION 281 and the WHO EMF project, associations of industries and manufactures, trade union associations, regulatory bodies and scientific association.

The EMF-NET approach

EMF-NET activities are based on Main Tasks, focused on:

MT1: Scientific evaluation of the results of the studies on EMF health effects
- Laboratory studies
- Epidemiological studies

MT2: EMF exposure related risk in the working environment

MT3: Improvement of specific common aspects of the research on EMF and health

MT4: Risk communication and perception

MT5: Observatory functions
- Monitoring emerging technologies
- Monitoring EMF research plans

Monitoring with new Member States, candidate countries and 3rd Countries

In each Main Task the approach will be mainly based on the activity of Technical Working Group of experts (TWG). The main outcomes of TWGs will be:

- Identification and definition of "key issues"
- Production, systematic update, and validation of "key issue" reports and Interpretation reports, providing the interpretation of the research results as building blocks for policy making. First reports should be ready by Summer 2005.

The European Fast Response Team on EMF and Health has been established to give rapid reactions to the questions and/or needs of the European Commission Services

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EMF STANDARDS AND LEGISLATION IN HUNGARY

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Legislation & Regulations: Public exposure
In Hungary the 1999/519/EC Recommendation was fully adopted by the government. The new ordinance "*63/2004 (VII.26) ESzCsM Ordinance"* issued by the *Ministry of Health, Social and Family Affairs* who is responsible for the regulation on the exposure limits of electromagnetic fields. The new ordinance has been in force since 4th of August 2004.

The *Hungarian Ministry of Informatics and Communications* released last year a modification in one of the ordinance relevant to the radio permission of the implementation new radio stations (i.e. base stations, broadcast systems etc.) According to the new modification any new radio station need an expert report of radiohygiene when the radiated RF power emitted by the stations higher than 400 W ERP toward any direction and the stations will be planned in the residential living and/or resting area. The ordinance was published and put into power in 2003 April.1. *The Ministry of Informatics and Communications:* is responsible for the implementation of EMF sources of the telecommunication industry and broadcast systems. Including base stations, radio and TV broadcast systems, radio navigation and wireless telecommunication.

Legislation & Regulations: Occupational exposure of workers
The *Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields* has been accepted by Hungary and until the publication into a national ordinance, the Directive will be used in the EMF exposure of workers. The new ordinance for workers will be published within 2 year.

Other governmental bodies who are involved in the EMF regulation and issue:
The *National Public Health and Medical Officers Service* is responsible for the application of the limits and the implementation of the EMF sources in the workplaces and the environment. The *National Public Health Centre- National Research Institute for Radiobiology and Radiohygiene* is a governmental advisory research institution, responsible for the scientific background of the EMF issues from science to risk communication. The *Ministry of Environment and Water* is responsible for the environmental issues of the EMF exposure. The *Ministry of Economic Affairs and Transport* is responsible for the implementation of electric power systems, including power lines, distribution systems, power plants

Implemenmplementation and adaptation of EU-CENELEC standards
The European CENELEC Standards are fully adopted by the *Hungarian Standards Institution*. Some CENELEC standards have been translated to Hungarian language, others have got a Hungarian Cover Sheet and published in English.

Rationales
Scientific rationale to support the limits and safety factors: The rationales issued by ICNIRP is adopted by the EU recommendations and in the Hungarian legislation as well.

EMF LEGISLATION IN SLOVENIA – NEED FOR HARMONIZATION

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Introduction

In the last 10 years, new political and economic situations in Central and East European countries have dramatically changed international relations and the geopolitical map in this part of the world. In most countries, new democratically-elected authorities decided to join the European Union (EU) and adapt their regulations and standards. Therefore, both standards and existing legislation in the field of EMF in those countries are a subject for harmonization with EU legislation. This is, no doubt, the first step in a long-lasting process of the global harmonization of the EMF standards. The next step calls for a coordinated program of work, based on an international consensus of what needs to be done. Thus, the scientific criteria for evaluation of the literature reporting on biological effects of the EMF and requirements for a scientific rationale to support limits have been established (Bernhardt 1998). Another important step is to carry out an analysis of the available research data which were used as a basis for Eastern European standards and try to address questions as follows (Gajšek et al. 2001):

- are biological effects induced by low intensity EMF exposure scientifically valid ?
- are biological effects of chronic exposure based on sound scientific criteria ?
- what is the rationale for Eastern European standards?

It is hoped that the harmonization process will benefit from ongoing research and health risk assessment such as those expected from WHO and International Agency for Research on Cancer. Thus, the next generation of standards would be able to incorporate the latest information on health risks within the same harmonized standards framework.

Slovenian approach

In Slovenia, the Eastern European concepts for EMF exposure limits that originated from former Soviet Union were never applied. Since Slovenia is a member of EU, its legislation has to be harmonized with the directives and recommendations of the European Union.

In 1996, Slovenia implemented a Decree on EMF in the environment based on ICNIRP guidelines that clearly defines the highest level of EMF exposure allowed. As a result of the concern about the potential health effects of EMF and political pressure, the government judged that the state of the science in the field of bioelectromagnetics justified the application of protective measures in the form of environmental protection. Thus, the principle of precaution has been enforced in addition to ICNIRP guidelines not only in Slovenia but also in some other West European countries (Italy, Switzerland).

For new systems and installations of EMF sources in the environment in Slovenia, an additional factor of 10 across the whole frequency spectrum (0-300 GHz) was introduced to the current ICNIRP limit values. Clearly, this represents a political decision, which does not rely on specific scientific knowledge (Gajšek 1995). For new devices the stricter criterion in the sense of providing a narrower secure area - e.i. minimum secure distance between the source of EMF and the buildings/institutions of special categories(2), ensuring the lessening of radiation to the level, which can be ensured with the technical and organizational means and measures.

In addition to the decree, a special regulation on initial measurements and operational monitoring has been introduced. This document regulates measurement procedures; EMF sources that need a license from Ministry of Environment; special conditions on installation of EMF equipment and special conditions for licensing experts in the EMF monitoring. The referent standards are:, IEEE Std 644-1987, IEEE Std 664-1997 and SIST IEC 61786-2001 or SIST EN 61566-2001.

Having such a strict legislation for new EMF sources ("new" means that the EMF source has been put

[2] *According to the Proposal of the Environment Pollution Regulation due to EMF the following buildings-institutions are classified into special categories: schools, playgrounds, recreation areas, day care centres, hospitals, residential housing*

into service after the implementation of the decree in 1996) in force for eight years no change in general risk perception and public acceptability for EMF based technology (i.e. base stations) have been detected. There is still a common opinion that current limit values are not protective enough against possible health hazards related to low level EMF exposure in the environment.

Thus, best practice code signed by telecommunication industry was launched by the Forum EMS in 2004 to supplement Government regulations with the goal to strengthen links with the community through open dialogue. It is hoped that this combination of current legislation and the implementation of the best practice code is the best way to address community concerns about EMF sources in the environment.

The Ministry of Environment is preparing the revision of the Decree on EMF in living and natural environment from 1996. The new revision will be harmonized with the Council Recommendation (1999/519/EC of 12 July 1999) on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) and will implement also some precautionary measures. At the same time, the Ministry of Environment is preparing the open database on all EMF sources that are operating in the environment in Slovenia and exceed the certain threshold in terms of radiated power. Such a database will offer a good background for completing the mapping of the field strengths around EMF sources in real 3-D environments.

The Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 on the minimum health and safety requirements regarding the EMF exposure of workers has been accepted by Slovenia and until the publication into a national ordinance, the Directive will be used in the EMF exposure of workers. The new ordinance for workers will be published within 2 years.

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EMF REGULATIONS' SYSTEM IMPLEMENTED IN POLAND

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In Poland regulations are defining the principles of EMF exposure assessment of workers and general population. Regulations concerning occupational exposure to EMF have been in force since 1972. Current regulation concerning the exposure limits for EMF of 0 Hz - 300 GHz frequency range was worked out in 1999 [7,8] – (current ed. - Journal of Laws 217/2002, item 1833) [5,6]. Other occupational safety regulations established also the obligation to carry out periodical testing of EMF occurring in the working environment and employers' obligations. Polish Standards determine the requirements referring to the measuring devices used for the examination of the working environment and protocols how to do EMF measurements and workers exposure assessment (PN-T-06580:2002, revised in 2002 [6]). [info - *www.ciop.pl* or *www.wypadek.pl*]

Regulations concerning general public exposure have been in force since 1980 - (the recent, revised issue - Journal of Laws 192/2003, item 1883). This regulation introduced general public exposure limits and protocols how to do EMF measurements in the public accessible environment. Exposure duration is not taken for general public exposure assessment.

The main base for all EMF regulations in Poland was taken from the thresholds of thermal and nerve excitation effects. Basic restrictions (*j*, *SAR*) were not introduced into regulations since there is no possibility to measure them in real conditions. However, the ICNIRP's and IEEE's basic restrictions were used during theoretical modelling and discussion concerning the values of restricted exposure. Workers should not access to the area where EMF exceeding thresholds from table 1.

Assessment of occupational exposure to EMF concerns the strength of electric and magnetic fields (*E*, *H*), the frequency of these fields (*f*) and workers' exposure duration (*t* and exposure factor *W*). Exposure to EMF, which exceeding the level 4-15-fold lower than the level of restricted exposure, was called "safety zones". The permissible exposure to the fields of safety zones is defined by exposure factor *W*. It means that during working day an exposure factor (*W*) defined as a ratio of a real dose to a permissible dose should be less than 1 (the exposure duration should be shorter than 8 hours). Exposure to *E* and *H* fields 10-times lower than presented in the tab. 1 (2-times lower for *E* field f<300 Hz) are permissible for 8-hours exposure per shift (tab. 2).

According to this regulation and Polish Standard [3, 4] occupational exposure is evaluated by the summing of the particular worker's dose calculated at "moving work stand", or calculated for particular frequencies existing in EMF in work place, in order to determine exposure factor. In the case that both electric and magnetic fields reach the levels of EMF safety zones, exposure factor is the sum of both components of the frequency up to 3 GHz. For higher frequencies or exposure to the fields of so-called low or high impedance the exposure factor is calculated on the basis of only one field, dominant component. For electric field exposure, it is expressed by equation (1), for magnetic field exposure by analogy.

$$W_{\mathrm{E}} = \frac{\sum E_{\mathrm{n,f}}^{2} \cdot t_{\mathrm{n,f}}}{PD_{\mathrm{E,f}}} \qquad (1)$$

where: W_E – electric field exposure factor, $E_{n,f}$ – electric field strength in the place where particular working activity can be assumed as stationary (at the fixed place and to the fields of fixed level), $t_{n,f}$ – duration of this activity, $PD_{E,f}$ – permissible dose established for frequency *f*.

Permissible exposure of the limbs to magnetic fields of the frequency up to 800 kHz is 5-fold higher than that of the whole body. Permissible occupational exposure concerning peak value of EMF is defined in Polish regulations only for EMF of frequency higher than 100 MHz.

The values of restricted occupational exposure for pregnant woman and young workers (below 18 years) are 2-3-times lower (tab. 3).

The similar values, harmonised with occupational regulations were established as maximum levels of general public exposure (tab. 4).

Conclusion

The regulations established in Poland contain more restrictive limitations of permissible exposure than EC directive/ICNIRP guidelines, because results of some biological investigations still provoke questions if limitations based on ICNIRP are not too liberal in the case of chronic occupational exposure of workers, who could be exposed many times a day and should be protected against adverse health consequences during long working years (up to 40 years). The regulations established in Poland contain more restrictive limitations of permissible 8-hours' exposure than other recommendations and guidelines, because additional less restrictive limits concern exposure of shorter duration.

Polish experience in practical use of occupational environment assessment, based on EMF exposure level, as well as exposure duration, proves that this approach provides a very suitable tool for occupational safe and healthy (OSH) engineering and for reduction of the workers' exposure. Moreover, the Polish system enables harmonisation with the EC Directive's/ICNIRP's basic restrictions and, at the same time, practical application of precautionary practice in occupational environment. Exposure factor use enables practical implementation of the exposure duration into EMF exposure occupational risk assessment (harmonised with obligations of article 4 and 5 of Directive 2004/40/EC).

The consequences of implementation of the presented EMF regulations system observed in practice are: protective measures concern "high level of EMF", as well as "medium level of EMF"; work places are under OSH periodical inspections; sources of exposure have been identified and labelled; high and medium exposed workers are informed and trained (on exposure level, sources and methods of avoiding), which results in positive psychological effects; if necessary: reorganisation of a workplace in order to minimise the level and duration of the workers' exposure (often without involving funds); suitable shielding.

An open question is the formula for comparing "personal exposure factors" of workers under different exposure conditions (various exposure levels and duration). Currently, it is presumed that for practical OSH engineering the presented uniform formula is the most convenient one.

Almost 25 years of the use of regulations for general public EMF exposure limits resulted in the consequent controlling of EMF emitted from such sources, as broadcasting centres, high voltage power lines, and all mobile phone base stations. The general public overexposure (higher than thresholds from table 4) is very rarely. Any change in the thresholds values is very difficult from the administrative point of view.

Regulations are periodically revised and if necessary updated under the umbrella of Interdepartmental Commission for Maximum Admissible Concentrations and Intensities for Agents Harmful to Health in the Working Environment (info - www.ciop.pl).

Paper was prepared in connection with the realisation of the EC FP6 project EMF-NET.

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Table1. *Electric and magnetic field strength - values of restricted occupational exposure*.

Frequency range	E [V/m]	H [A/m]	Frequency range	E [V/m]	H [A/m]
0 Hz ≤ f ≤ 0.5 Hz	40000	80000	0.8 MHz < f ≤ 3 MHz	1000	80/f
0.5 Hz < f ≤ 50 Hz	20000	2000	3 MHz < f ≤ 15 MHz	3000/f	80/f
0.05 kHz < f ≤ 0.3 kHz	20000	100/f	15 MHz < f ≤ 150 MHz	200	80/f
0.3 kHz < f ≤ 1 kHz	1000/f	100/f	0.15 GHz < f ≤ 3 GHz	200 [100*)]	0.53
1 kHz < f ≤ 800 kHz	1000	100	3 GHz < f ≤ 300 GHz	1.6 f + 195	------

*) *while far-field exposure conditions*

Table 2. *Electric and magnetic field strength - thresholds of 8-hour occupational exposure*.

Frequency range	E [V/m]	H [A/m]	Frequency range	E [V/m]	H [A/m]
0 Hz ≤ f ≤ 0.5 Hz	20000	8000	0.8 MHz < f ≤ 3 MHz	100	8/f
0.5 Hz < f ≤ 50 Hz	10000	200	3 MHz < f ≤ 15 MHz	300/f	8/f
0.05 kHz < f ≤ 0.3 kHz	10000	10/f	15 MHz < f ≤ 150 MHz	20	8/f
0.3 kHz < f ≤ 1 kHz	100/f	10/f	0.15 GHz < f ≤ 3 GHz	20	0.053
1 kHz < f ≤ 800 kHz	100	10	3 GHz < f ≤ 300 GHz	0.16 f + 19.5	------

Table3. *Electric and magnetic field strength - thresholds of negligible occupational exposure (values of restricted occupational exposure for pregnant woman and young workers).*

Frequency range	E [V/m]	H [A/m]	Frequency range	E [V/m]	H [A/m]
0 Hz ≤ f ≤ 0.5 Hz	10000	2670	0.8 MHz < f ≤ 3 MHz	33	8/3f
0.5 Hz < f ≤ 50 Hz	5000	67	3 MHz < f ≤ 15 MHz	30/f	8/3f
0.05 kHz < f ≤ 0.3 kHz	5000	10/3f	15 MHz < f ≤ 150 MHz	6.7	8/3f
0.3 kHz < f ≤ 1 kHz	100/3f	10/3f	0.15 GHz < f ≤ 3 GHz	6.7	0.018
1 kHz < f ≤ 800 kHz	33	3.3	3 GHz < f ≤ 300 GHz	0.053 f + 6.5	------

Table 5. *Electric and magnetic field strength - thresholds of permissible environmental exposure*

Frequency range	E [V/m]	H [A/m]	Frequency range	E [V/m]	H [A/m]
0 Hz	1000	2500	0.001 MHz < f ≤ 3 MHz	20	3
0 Hz < f ≤ 0.5 Hz	------	2500	3 MHz < f ≤ 300 MHz	7	------
0.5 kHz < f ≤ 50 kHz	10000	60	300 MHz < f ≤ 300 MHz	7 (0.1 W/m^2)	------
0.05 kHz < f ≤ 1 kHz	------	3/f			

"sensitive area" 50 Hz - 1 kV/m; 60 A/m

REGULATIONS OF EMF EXPOSURE IN CZECH REPUBLIC

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In Czech Republic, new regulations for limiting exposure to electromagnetic radiation and fields have been introduced in 2000. They adopted without any change the limits published in ICNIRP Guidelines (1998, 1995). As the previous Czech regulations (in use practically from 1970´s) did not introduce any restrictions for exposure to fields with frequency lower than 60 kHz, main effort of the Czech Health Service has since 2001 been directed to measurements and calculations of low-frequency fields in different places.

In flats and offices, the levels of the low-frequency fields were found to be safely below the ICNIRP limits. In some workplaces, however, strong low-frequency magnetic fields able to cause exposures substantially exceeding the ICNIRP limits have been found. Special measures must have been introduced there to comply with the requirements of the new regulations. The work on low frequency fields continues still and the obtained results show, that previous neglecting the magnetic fields in workplaces using induction ovens, melting metals by alternating magnetic field, producing chemicals via electrolysis and similar manufactures was not justified. The measures which had to be taken to avoid the overexposure were, however, not very expensive.
Measurements and evaluation of exposure carried out on request of people living near the masts of mobile phone base stations never found the power flow density (S, W/m^2) in flats higher than 1 % of the relevant reference value. In most cases, it was lower than 0.1 % of the ICNIRP reference level.

For those countries, which are still only preparing the obligatory limits, may be interesting, that switching from lower values (typically used by the former COMECOM countries) to ICNIRP values was not so difficult, as it might be expected. Objections were coming rather from the authors of the previous (more stringent) regulations than from the general public, though the new limit values were in some cases more than hundred times softer than the previous ones. Statement, that WHO regarded the ICNIRP guidelines sufficient for protection of health against the non-ionizing radiation helped much in convincing people about the safety of the new regulations. Also announcement of the European Commission, which stated, that the precaution principle as well the ALARA rule need not be applied in case of electromagnetic fields and radiation, played important role in relatively smooth acceptance of the new EMF regulations in Czech Republic. It is regrettable, that some recent claims heard from high-ranking European officials are not always in accordance with the mentioned statements, in spite of the fact, that no new scientific discovery appeared which would indicate effects not accounted in the ICNIRP 1998 guidelines.
Checking the levels of the electromagnetic fields or radiation, we often find calculations more reliable than measurements. Calculations proved to be especially useful near the antennas of the base stations, where the technical parameters of each individual antenna were known and the declared maximum high frequency power feeding the antenna could easily be verified looking at the technical parameters of the used high frequency generators.

During measurements fulfilled on request of people afraid of irradiation (usually by the field radiated by a nearby base-station) we often encountered people living in flats in the highest floor with antennae of the base station on the roof or on the building in close neighborhood. They were surprised by the low level of the field intensity (we use a spectral analyser and show its screen with many peaks which include the TV and radio transceivers) and usually accepted the scientific arguments. Assessing our experience, we observe that only few people do not accept the arguments about safety of ICNIRP limits, if they are presented in a friendly and persuasive way and with good knowledge of the physical laws of propagation of the electromagnetic waves.

EMF REGULATION AND RESEARCH IN LATVIA

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In Latvia the studies on biological effect of electromagnetic field (EMF) at the moment are carried out by three research groups.

The Group of Prof. Dr. Med. I. Detlav is studying the therapeutic effect of super- low frequency modulated EMF. The range of EMF frequencies applied in these investigations is 0.3 – 1,000 Hz, intensity – 0.15 – 24 μT. Positive therapeutic effect are reported for the patients with increased arterial pressure.
Two laboratories of the Institute of Biology University of Latvia are also carrying out the studies of possible biological EMF effects.

Laboratory of Bioindication (Head – Dr. Biol. V. Melecis) studies a possible EMF effect on the plants in the area of action of the military radars (1.5 – 2.7 GHz).

Laboratory of Psychophysiology (Head – Dr. Biol. A. Kolodynski) evaluates the probable effect of the modern communication means on the development of motor and psychological functions of children and teenagers. This is a long-time Project and the investigations will be in progress in the nearest 4 years. The number of children using the mobile phones is rapidly increasing. According to our data (2004) every tenth pupil of the first form has a mobile phone. Moreover, at the age of the secondary school nearly every pupil has a mobile phone. At the same time, the children sick rate also increases, which is testified by the School Board of Administration of the Riga City. Within the period of 1996/97 school year to 2000/2001 school year already before going to school the children heart and blood-vessel diseases increased approximately by 4 times, other somatic diseases by 6 times. By the present medical doctors fail to find the reason thereof. The EMF constant action could be also one of the factors affecting children health.

The EC EMF Standards are used in Latvia. The Report will concern the peculiarities of the control as to the following of these Standards in Latvia.

EMF REGULATIONS AND RESEARCH IN ESTONIA

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1. Regulations and protection guidelines

Up to 2002 the Soviet Union EMF safety limites were formally aplied in Estonia. Situation changed in 2002, when new regulations and EMF safety guidlines were approved by government.
The Regulation of Ministry of Social Affairs on EMF safety limits for General Public came into force from 15.05.2002 and Regulation for Occupationally Exposed Persons from 01.07.2002.

Table 1. :EMF safety limits for general public

Frequency	Electric field E (V/m)	Magnetic field H (A/m)	Magnetic flux B (μT)	Power density S (W/m^2)
0–1 Hz	–	$3,2*10^4$	$4*10^4$	–
1–8 Hz	10 000	$3,2*10^4/f^2$	$4*10^4/f^2$	–
8–25 Hz	10 000	4000/f	5000/f	–
0,025–0,8 kHz	250/f	4/f	5/f	–
0,8–3 kHz	250/f	5	6,25	–
3–150 kHz	87	5	6,25	–
0,15–1 MHz	87	0,73/f	0,92/f	–
1–10 MHz	$87/f^{0,5}$	0,73/f	0,92/f	–
10–400 MHz	28	0,073	0,092	2
400–2000 MHz	$1,375\ f^{0,5}$	$0,0037\ f^{0,5}$	$0,0046\ f^{0,5}$	f/200
2–300 GHz	61	0,16	0,20	10

The Health Protection Inspectorate (HPI) organises and executes health protection state supervision and applies enforcement powers pursuant to procedures and to the extent prescribed by law [1]. HPI is a government agency in the area of the Ministry of Social Affairs. Central Physical Laboratory, incorporated in HPI, is responsible for non-ionising radiation level regulation and measurements [2]. The Laboratory provides measurements of the level of EMF in frequencies from 100 kHz to 2,5 GHz, static electric field and 50 Hz magnetic field.

2. Research on EMF effects

There are no state programs in Estonia aimed to research. Financial support to research is project based. Investigations in EMF effects are supported by Estonian Science Foundation Grants.

Main attention in EMF research is focused on low-level modulated microwave effects on human brain: its bioelectrical activity estimated by changes in EEG and mental behaviour.

2.1. During the experiment twenty healthy volunteers were exposed to microwave (450 MHz) with 7 Hz frequency on-off modulation [3]. The measured field power density at the cortex was 0,160 mW/cm^2. The signals from the following EEG channels were utilised: FP1, FP2, P3, P4, T3, T4, O1 and O2. The experimental protocol consisted of one cycle of the short-term photic and ten cycles of the repetitive microwave stimulation. The experimental results demonstrated that the microwave stimulation effects became apparent starting from the third-forth stimulation cycle. The changes were more regular on alpha waves. The photic stimulation causes changes in the EEG energy level in majority of cases in occipital and the microwave stimulation in frontal region. The changes varied strongly from subject to subject. Therefore, in majority of cases, low-level microwave exposure did not cause statistically significant changes in EEG activity level.

2.2. The aim of the other study was to examine low-level 7Hz modulated 450MHz radiation effects on human performance in visually presented neurophsychological tasks associated with attention and short-term memory [4]. A homogeneous group of 100 subjects, 37 female and 63 male, were randomly assigned to exposed (10-20 minute, 0.158 mW/cm^2) and sham exposed groups. A battery of three different tests was used to measure attention and short-term memory. Task 1 involved alternately selecting black digits from 1 to 25 in ascending and white digits from 24 to 1 in descending order. The time spent on the task and the number of errors were recorded and analysed. Task 2 involved viewing a picture of 12 objects during 3 seconds, followed by a list of 24 words. The subjects were required to select words representing previously presented objects. In task 3, an array of letters in 10 rows (60 in each row) was presented, and the subject was required to identify all examples of a particular two-letter combination. *Results:* The results of tasks 1 and 3 showed a significant increase in variances of errors ($p<0.05$) in the exposed group versus the sham exposed group. The results of task 2 indicated to a significant decrease in errors ($p<0.05$) in the exposed group. This experiment provides additional evidence that acute low-level exposure to microwaves modulated at 7Hz can affect cognitive processes, such as attention and short-term memory.

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EMF REGULATIONS AND RESEARCH IN CROATIA

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EMF human protection regulation in Croatia is based on two legislative acts: «Non-ionizing radiation law» (NN115/1999) and «Telecommunications Law» (NN122/2003). The both laws have specific ordinances related to human exposure to electromagnetic fields.

The EMF topic in «Non-ionizing radiation law» is specified in «Ordinance for EMF protection» (NN204/2003). The ordinance regulates public and occupational exposure limit values of EMF and measurement procedures; EMF sources that need a license from Ministry of Health; special conditions on installation of EMF equipment and special conditions for licensing experts in the non-ionizing radiation protection. The referent standards are: HRN IEC 61786:2001, HRN EN 61566:2001, EN 50383: 2003 and HRN EN ISO/IEC 17025:2000.

The «Telecommunications Law» in the related «Ordinance on the maximum permissible radiated power of the radio stations in the cities»(NN111/2001) defines maximum permissible radiated power of fixed radio stations, siting them and calculation of safety distance. The reference for limit values is 1999/519/EC and it is oriented to public exposure. The referent standards are: HRN IEC 61566:2001 and DIN VDE 0848:2000.

Currently, Ministry of Health works on adoption of EC 2004/40 and its implementation in the Croatian legislative acts.

The Croatian Government adopted ICNIRP 1998 and 1999/519/EC scientific rationale with SAR. However, due to the very high social impact related to possible non-thermal effects, the both Ordinances apply a safety factor of 2.5 for the electric and magnetic fields.

A 'PAINLESS' WAY FOR THE CANDIDATES COUNTRIES FOR THE EUROPEAN UNION TO ACCEPT THE INTERNATIONAL RECOMMENDATIONS FOR EMF HUMAN EXPOSURE

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Abstract
The gulf between the recommendations of the World Health Organization (WHO), the International Commission for Non-Ionizing Radiation Protection (ICNIRP) and the European Commission (EC) for limit values for human exposure to electromagnetic fields (EMF), on the one hand, and the national standards of some former socialist countries, on the other hand, is widening. An increased number of countries, others than those mentioned above, like China, Switzerland, Austria, Italy and others are strongly influenced by the 'low' limit values in those countries and adopt new regulations, being not theoretically and biologically well-grounded. The low limits, we are talking about here, should be put in quotes, because it is not quite right. For example, the low limits for magnetic field in the range of 60 kHz to 10 MHz in Russia, Bulgaria, Poland etc. are many times greater than those recommended by the international organizations. Therefore, not only the different results of scientific research, carried out in East European countries and the differences in traditions raise problems, but also the philosophy of standardization, the risk communication policy among population, the terminology and the methodology for setting up limit values.

Unfortunately, there is some 'obstinacy' among scientists from both sides, which does not allow difference to be settled cleverly. The policy of the WHO through the international project EMF is the only one showing sufficient patience 'to hear' each party opinion and making efforts to solve the problems.

After all, countries, which are candidates for accession to the European Union, have to accept its recommendations as minimum requirements in spite of the right to have stronger limit values as national standard.

We propose here a policy for harmonization of the standards for EMF human exposure with the purpose of accepting adequately and reasonably the minimum requirements, recommended by the WHO and the EC. It covers the following several major points:

- We propose to organize Balkan Electromagnetic Fields Association (BemFA), which could be a basis for an East Countries Association – ECEmfA). Other West European Countries with similar standardization ideas can join it further.
- We recommend organizing a workshop in Bulgaria in April-May 2005, which will develop a conception for adopting ICNIRP Guidelines as minimum requirements for the human protection from EMF radiation, without neglecting the results from scientific studies carried out in East European Countries.
- We propose to form a working group of interested scientists and specialists from countries with stronger limit values, which will discuss the here proposed conception for ICNIRP Guidelines. In the beginning only representatives of Balkan or former socialists countries can be involved in it, while specialists from China and other West European Countries can join it further.
-

A framework for standard harmonization should be developed only for the special case, i.e. the adoption of the ICNIRP Guidelines as minimum requirements for EMF human exposure by countries with stronger hygienic standards.

The method to be used for developing the new standards has already been applied in Bulgaria and is largely approved by various institutions, organizations, administrative bodies, ecological organizations

and population groups. We suggest discussing it in details at the workshop in 2005 to be held in Bulgaria. The method is based on the zoning of controlled and/or uncontrolled regions of EMF human exposure, recommending different limit values according to the real duration of exposure in them, and the application of the precautionary principle in standardization.

Before starting a real collaboration the precautionary approach could be used for providing a good protection and safety. It could be applied for areas where people are living or staying for long time or temporarily. A good protection is possible, for instance, by applying zones for different exposures, labeling, caution, and preventive measures. Also special approaches for children, elderly people, sensitive groups, pregnant women, etc. are very positive methods as a part of the precautionary principle, proposed by WHO.

CURRENT SITUATION IN TURKEY RELATED WITH EMF STANDARDS AND LEGISLATION

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Turkey has EMF standards since 2001. Telecommunication Authority published the Turkish EMF Standards for 10 kHz – 60 GHz frequency range in 12 July 2001 and this guideline entitled **"Regulation of EMF reference values, measuring methods and auditing of fixed telecommunication instruments working at the frequency band 10 kHz - 60 GHz"** is based on the ICNIRP standards for total environment. According to the TK standards one instrument standard should be ¼ of ICNIRP standard. This philosophy comes from 4 operators available in Turkey (Aycell, Turkcell, Telsim and Aria).

TK regulations are accepted as mandatory for 10 kHz – 60 GHz frequency range since July 2001. These standards are announced in the WHO EMF Project web site.
Telecommunication Authority (Telekomünikasyon Kurumu – TK- **http://www.tk.gov.tr**) was founded as a public judicial entity with a private budget having administrative and financial autonomy on January 27, 2000 in accordance with Article 5 of Law No. 4502 amended by Wireless Law No. 2813 in order to execute the actions envisaged in Wireless Law No. 2813, Law No. 406 on Telegraph and Telephone and other laws, and became effective as from August 15, 2000.

The Authority works under the auspices of Ministry of Transportation. Telecommunication Authority executes among others its tasks under law to establish a dynamic telecommunication sector based on fair and free competition and to protect consumer rights.

Base stations and high power lines are still an issue of public concern. People don't want base stations near their houses. Cases are being increased on the subject. Municipalities and mayors are helding meetings related with public concern on the topic. In most of the cases expert reports includes PP approaches since occasionally lawyers of environment are involved in the cases related with EMF. Most of the cases are on RF. But especially school administrators are being applied to us for high power lines passing near the school buildings, some of them have HPL in their gardens, distance being just 2-3 meters.

Since the beginning of 2000 I've been informing local authorities about IARC classification of ELF magnetic fields as 2 B carcinogenic.
There are many ongoing studies of effects of RF, IF and ELF on biological systems at the universities and institutes.
My staff are heavily working in answering questions, telephones, e-mails and being expert and preparing expert reports related with EMF cases at Gazi Biophysics Dept. and in NRPB Center.

Department of Biophysics at Gazi University, Faculty of Medicine is the leader about the studies of biological and health effects of EMF and standards about ELF & RF Electromagnetic Radiation in Turkey. The studies of Gazi Biophysics can be summarized under those headlines ;

- *National Non-Ionizing Radiation Protection Center*
- *Experimental Radio Frequency and ELF System*
- *On-Going Studies*
- ***National Non-Ionizing Radiation Protection Center (NRPC)***

I have been founded National Non-Ionizing Radiation Protection Center (UNRK – Ulusal Non-İyonizan Radyasyondan Korunma Merkezi) in 2004.

The main aims of the center are;

- to make researches on the health effects of electromagnetic radiation

- to measure the levels of electromagnetic radiation (5 Hz – 60 GHz)
- assessment of the measurements with respect to the International & National Standards and interpretation of the levels wrt health effects
- to give concultancy on electromagnetic radiation

- ***Experimental Radio Frequency System***

Experimental Radio Frequency System is constructed in the Gazi Biophysics Dept. We have been making our reseraches about ELF electric and magnetic fields since 1980. Now, it will be possible to make also RF studies in our Department. Construction of a special anechoic room is on the way.

- ***On-Going Studies***
  - Turkey has still no standards for 0 – 10 kHz and 60 GHz – 300 GHz frequency ranges.
  - **No occupational exposure standard for 10 kHz – 60 GHz frequency range is available yet.**
  - Gazi Biophysics & NRPC are planning to publish a book related with electromagnetic fields, biological and health effects and National & International standards about the electromagnetic radiation protection. I hope I could present this book at the next years' IAC meeting.
  - National Non-Ionizing Radiation Protection Center is going to prepare brochures / information sheets about ELF and RF exposure of children / general public / workers and precautionary principle on EMF exposure.
  - We are going to create a National Non-Ionizing Radiation Protection Center web site including all of the required information about RF and ELF EMF radiation sources and related protection ways of EMF and also present these fact sheets in our Center web site.

IEEE EMC Symposium was held between 11-16 May 2003 in Istanbul. I organized "Biological Effects of EMF" sessions in the Symposium. 28 papers were discussed in two oral sessions entitled **"Limitations to EMF Worldwide and Situation in Turkey"** and **"Biological Effects of ELF, IF and RF"** and one open forum.

I have arranged the **"9th International Advisory Committee (IAC) Meeting"** of the WHO International Electromagnetic Fields Project in Istanbul, Turkey from 7-8 June 2004. After this meeting I have organized **"WHO Workshop : Sensitivity of Children to EMF Exposure"**. This WHO Workshop was arranged in collaboration with WHO and took place from 9-10 June 2004 in Istanbul, TURKEY. There were 152 participants from 43 different countries and 24 participants from Turkey in the workshop.

EMF REGULATIONS AND RESEARCH IN ROMANIA

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Abstract
In Romania, during the communist regime the legislation in the field of electromagnetic fields (EMFs) and sources was focused on electromagnetic compatibility and on indirect effects - electric shocks - but not on health protection against direct effects of exposure to such fields. In that period, research has been carried out concerning biological consequences of electromagnetic exposure, but the results were rarely published before 1990 because of political authority interdiction on this subject.

Current regulations in the field of health protection against exposure to EMFs (0 Hz - 300 GHz) were modified in 2002 in order to overcome some deficiencies mainly regarding some frequency gaps and value discontinuities in reference levels. Another reason for modifying the previous regulations was the necessity of harmonization of Romanian regulations with the European Community ones, in this field.

The occupational exposure standard in force takes into account the well-known short-term effects of EMFs and it is based on ICNIRP guidelines. For power frequency fields, additional reference levels were added in the case of exposures that last shorter than whole working day. Romanian regulations on public exposure to EMFs provide reference levels that are the same as those set by ICNIRP and there is no additional reference level. Given that both public and occupational exposure standards are based on ICNIRP guidelines, there is a good agreement of Romanian regulations with EU ones in the domain of human exposure to EMFs.

We also present some future trends of standardisation in Romania in the field of health protection against exposure to EMFs, as well as some difficulties in implementing these regulations. At the low end of the frequency spectrum, additional reference levels were calculated for magnetic field exposures shorter than 8 hours. These additional limits have been calculated in a manner that provided compatibility with ICNIRP guidelines and continuity of reference level values at the low end of the frequency spectrum.

In the next future, the work on harmonising Romanian regulations with EU ones will continue. However, the influence of restrictions on social and economic areas might press authority to maintain a few different reference levels: additional levels for occupational exposures that last shorter than whole working day (at frequencies of 50 Hz or below 1 Hz).

Another factor that might influence the future changes in Romanian regulations is the public pressure. During the last years, there is a growth of the public concern regarding the sources of EMFs and their impact on human health.

Key-words: electromagnetic fields, health protection, Romanian legislation

ESTABLISHING A DIALOGUE ON EMF RISKS - DOES PRECAUTION HAVE A ROLE TO PLAY?

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In the public health arena, priority is usually given to controlling those risks that are clear cut: that is, substantial, involving common diseases or widespread exposure, and well-established. However, changing societies and rapid technological developments produce an ever-increasing variety of agents and circumstances whose health consequences are difficult to predict and manage. Waiting for conclusive evidence of a health threat has sometimes had unfortunate consequences. More and more often, precautionary measures are called on to prevent or limit exposures whose effects are not known or are poorly understood, but that may be harmful, and indeed precaution is included in the legislative reference framework of the European Union (EU).

With regard to electromagnetic field (EMF) protection, the relationship between exposure to EMF and health is controversial. A variety of epidemiological studies have suggested that EMF, over virtually all the frequency spectrum, might be a risk factor for several health endpoints, including cancer and neurodegenerative disease. For exposure to extremely low frequencies (ELF), epidemiological studies have shown a reproducible association with childhood leukemia. This finding prompted the International Agency for Research on Cancer (IARC) in 2002 to classify ELF magnetic fields as "possibly carcinogenic" to humans. These associations are not explained by any confirmed biological mechanism, and there are doubts as to their causal nature, as the available evidence is inadequate to make sound scientific conclusions. In addition even if the association was causal, the overall impact on public health (i.e., the number of cases attributable to ELF exposure) is likely to be very small. Against this background, it is proving difficult to identify and develop policies for protection of human health.

Given the uncertainties surrounding the available evidence, the development of precautionary measures are reasonable, but the adoption of specific protective actions is controversial. Largely due to intense pressure from the public, the debate has widened, and certain interest groups have expressed anxiety, possibly magnified by media attention, and have called for immediate and specific actions. One of the most potent drivers of public perception is the way in which information and policy are communicated, or, frequently, miscommunicated. A better understanding of the factors which affect the perception of risk will be important to creating a successful dialogue and, ultimately to defining precautionary policies. The ingredients for effective dialogue include consultation with stakeholders, acknowledgement of scientific uncertainty, consideration of alternatives, and a fair and transparent decision-making process. Failure to do these things can result in loss of trust and flawed decision-making as well as project delays and increased costs.

As major breakthroughs in EMF research might not be imminent, decisions will necessarily be made on uncertain grounds for some time to come. This situation has prompted the WHO International EMF Project to develop a framework on the use of precautionary measures to protect human health from environmental hazards such as EMF in the face of scientific uncertainty. This precautionary framework, and the need for dialogue to ensure its effective implementation, will be discussed in this presentation.

EUROPEAN INFORMATION SYSTEM ON ELECTROMAGNETIC FIELDS - Project Outline & Main Actions

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Rationale

There is a growing public concern on the potential adverse health effects of human exposure to electromagnetic fields. These fields are from the large number of relatively weak intensity sources, which are a very common and necessary presence in the landscape of modern life. Particularly from GSM base stations whose number will raise even more to implement the latest 3-G developments (UMTS), and from other new wireless technologies entering all our domains of activity. Moreover,

Scientific research has not been able to establish in a consistent and consensual manner the existence of causal links between low levels of exposure to weak EMF, and its possible adverse health effects.
Misrepresentation of scientific uncertainties in idenfying and quantifying health risks – particularly in the long term – may be contributing to public fears and inducing public debate on validity of limit values.

In answer to these concerns, the EC has recommended the implementation of exposure limits (EC99/519; ICNIRP, 1998) providing minimum requirements for health protection of the general population across EU. EC continues working towards reduction of public exposure to EMF, towards common standards and for the harmonisation of norms covering all devices emitting EMF. In addition, EC supports further research to keep exposure limits under review according to the best available scientific evidence. In this light, it has been a targeted R&D planning and funding by FP5 at EU level, and by Member States at national level. As a result, various ongoing R&D activities are expected to provide data to clarify this state of things. In order to integrate the emerging scientific results into policy-making priorities, two major projects, the JRC/EIS-EMF and the EMF-NET FP6 Coordination Action, funded by the European Commission, are currently at their starting phases.

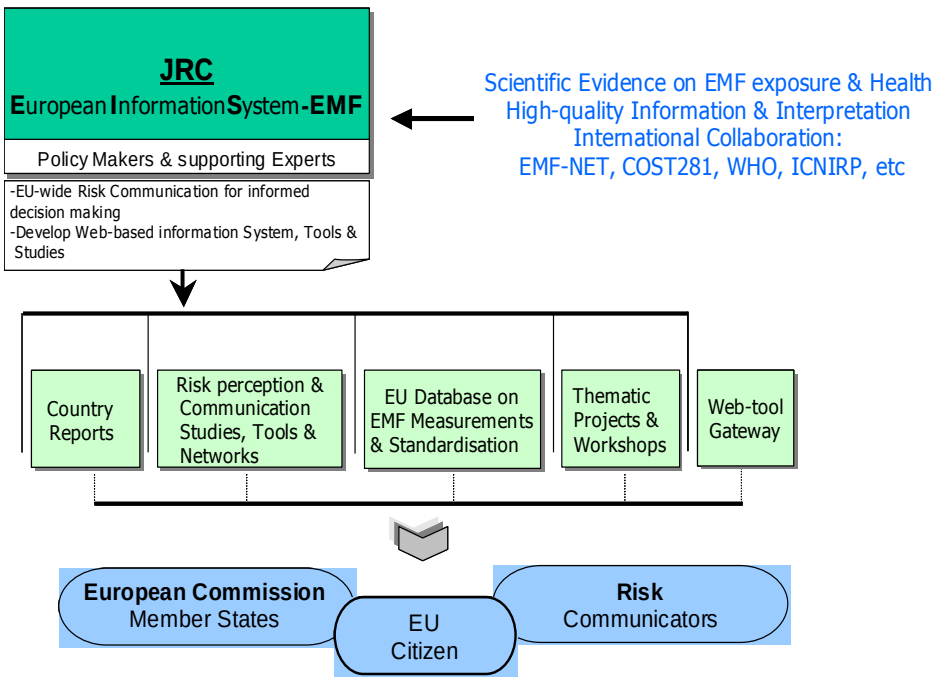
Project Objective, Structure and Management

The European Information System on Electromagnetic Fields Exposure and Health Impacts, is a policy-driven/support project, providing information and risk communication contents. It is an activity of the Institute of Health and Consumer Protection (IHCP) at the DG Joint Research Centre of the European Commission in Ispra, Italy, and carried out on behalf of DG SANCO. The main objective of EIS-EMF is to develop and implement a EU-wide programme on EMF risk communication, and contribute to the development of a EU-wide risk communication channel on EMF and Health. For this purpose we are:

Establishing an EU-wide network of policy-makers and experts to exchange and assess strategies on how information on EMF exposure is to be used in a harmonised way in risk communication.
Developing and will operate a Web based platform on public health protection, risk perception and risk communication issues.
Promoting common practices and harmonised tools (surveys, media monitoring, newsletters, FAQs, fact-sheets, audio-visual material, etc) for the dissemination of information to stakeholders and EU citizens.

The Physical and Chemical Exposure Unit of the JRC/IHCP is responsible for the day-to-day management of the project. EIS-EMF includes a steering committee chaired by SANCO, an advisory board and several committees of thematic experts. The steering committee and the advisory board ensure that the project planning and execution respond to the needs of the European Commission and of Member States. The project "kick-off" meeting, together with the first workshop (on “EMF Risk Perception and Communication”) and the preparatory meeting for the Stakeholder dialogue on EMF and Health took place at the JRC in Ispra, Italy, on the 12th to the 14th July 2004 (further information and meeting presentations at http://www.jrc.cec.eu.int/eis-emf).

Fig.1 Project Structure



EIS-EMF Work Programme

Specific activities that constitute the work programme of EIS-EMF:
Advisory Board acting as a network of decision makers on EMF & Health from EU Member States.
Comprehensive Country-specific reports on EMF & Health and Web-gateway to national EMF activities.
Web-based information system on EMF and Health. Setting-up thematic expert networks, and risk communication networks.
EU-wide programme on EMF risk perception and risk communication. To develop common knowledge base and appropriate common tools and contents. To identify best practices, to propose and carry out studies.
EU database on EMF exposure measurements. Standardisation issues for exposure measurement and assessment.
Interface with EMF-NET and international collaboration (with WHO, ICNIRP, COST, etc).
Other topics of interest: Thematic studies and Workshops.

The advisory board supervises the planning and progress of the above work-programme. After validation and endorsement by the EC Scientific Committee on Health and Environmental Risks (SCHER) final results are disseminated to the public.

COMMUNITY CONSULTATION AND STAKEHOLDER ENGAGEMENT IN MOBILE TELECOMS NETWORK DEVELOPMENT – UK BEST PRACTICE

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Abstract
There are now 50 million mobile phone subscribers in the UK and they need networks of radio base stations in the right places in order to use their phones. Because of the fast uptake of the technology in recent years the five UK mobile network operators (the Operators) have had to expand their networks to keep pace with customer demand. Network expansion has caused concern in some sections of the community with much of the concern being focused on radiofrequency health and safety issues.

This paper outlines the Operators' response to public concern since 1999 and their commitment to best siting practice for mobile phone radio base stations including initiatives for community and local authority consultation known as the Ten Commitments and a proactive programme of stakeholder engagement undertaken for the Operators by the Mobile Operators Association (MOA). The programme has been in place since 2000 and is ongoing

Background

The Mobile Operators Association (MOA) represents the collective interests of the Operators – 3, O2, Orange, T-Mobile, and Vodafone -- on radiofrequency health and associated radio base station siting and planning issues. MOA came into existence in January 2003 succeeding the Mobile Telecoms Advisory Committee (MTAC) within the Federation of the Electronics Industry (FEI).

At the end of 2003 there were 50 million mobile phone subscribers in the UK – four years earlier there had been 23 million. This represented a remarkable growth in the use of mobile telephony in the UK within a comparatively short period of time. Because of this fast uptake of new technology the Operators had been required to expand their networks rapidly to keep pace with customer demand. This network expansion caused concern within some sections of the community with much of that concern being focused on the radiofrequency health and safety issue.

In 1998 the Operators and Cable & Wireless plc (a part owner of one of the Operators) formed MTAC within the FEI and in 1999 created a small full-time secretariat to manage the radiofrequency health issue at an industry level. This culminated in the launching of MOA in its own right in January 2003 (for ease of understanding, references in this paper to MOA should be taken to include references to MTAC/FEI). In the meantime, there had been increasing community concern about the health issue reflected by a rise in media interest and parliamentary activity.

The Stewart Report

In response to this increasing community and political concern, in early 1999 the UK Government established the Independent Expert Group on Mobile Phones (IEGMP) "*to consider present concerns about the possible health effects from the use of mobile phones, base stations and transmitters, to conduct a rigorous assessment of existing research and to give advice based on the present state of knowledge. To make recommendations on further work that should be carried out to improve the basis for sound advice*" (Independent Expert Group on Mobile Phones, 1999). The IEGMP consisted of ten independent scientists and two laypersons and was chaired by Professor Sir William Stewart FRS, FRSE who had served as the Chief Scientific Adviser to the Prime Minister and the Government between 1990 and 1995. The IEGMP quickly became known to the media and the public as the "Stewart Group" and

its report as the "Stewart Report" and I shall refer to it as such in this paper.

The Stewart Report was published on 11 May 2000 following a wide ranging public consultation and literature review. As Sir William Stewart wrote in its Foreward, the report concluded that "*the balance of evidence does not suggest mobile phone technologies put the health of the general population of the UK at risk (but) there is some preliminary evidence that outputs from mobile phone technologies may cause, in some cases, subtle biological effects, although, importantly, these do not mean that health is affected"* and it proposed that a *"precautionary approach be adopted until more robust scientific information becomes available*" (Independent Expert Group on Mobile Phones, 2000). Importantly, the Stewart Report outlined what it meant by a precautionary approach and its recommendations in that regard were largely accepted by the mobile phone industry and government.

WHO and other UK RF Health Documents

In June 2000 the World Health Organisation (WHO) published Fact Sheet No. 193 on the RF health issue (World Health Organisation, 2000) and later in the year the UK Departments of Health (England, Scotland, Wales, and Northern Ireland) jointly published public information leaflets on "*Mobile phones and Health*" and "*Mobile phone base stations and Health*" (Department of Health, 2000). In May 2001 the British Medical Association (BMA) published an Interim Report on the RF health issue which came to the same conclusions as the Stewart Report (British Medical Association, 2001). This interim report was updated in June 2004 (British Medical Association, 2004).

In January 2004 the NRPB published a scientific review prepared by its independent Advisory Group on Non-ionising Radiation "*Health Effects from Radiofrequency Electromagnetic Fields*" (AGNIR Report). The AGNIR Report concluded that "*in aggregate the research published since the IEGMP report does not give cause for concern. The weight of evidence now available does not suggest that there are adverse health effects from exposures to RF fields below guideline levels, but the published research on RF exposures and health has limitations, and mobile phones have only been in widespread use for a relatively short time. The possibility therefore remains open that there could be health effects from exposure to RF fields below guideline levels: hence continued research is needed"* (National Radiological Protection Board, 2003). It was robust in its conclusions about radio base stations and health: "*Exposure levels from living near to mobile phone base stations are extremely low, and the overall evidence indicates that they are unlikely to pose a risk to health*."

The Planning Dilemma – how to deal with the RF health issue

Following publication of the Stewart Report the four countries of the United Kingdom (England, Wales, Scotland, and Northern Ireland) issued consultations for possible changes to their telecoms planning regimes. Each country changed its planning regime following the consultation. A central issue to be decided was how local authorities should deal with the radiofrequency health issue. In its planning guidance to local authorities published in August, 2001, the English Government stated:

"*It is the Government's firm view that the planning system is not the place for determining health safeguards. It remains central Government's responsibility to decide what measures are necessary to protect public health. In the Government's view, if a proposed mobile phone base station meets the ICNIRP guidelines for public exposure it should not be necessary for a LPA, in processing an application for planning permission or prior approval, to consider further the health aspects and concerns about them*." (Office of the Deputy Prime Minister, Planning Policy Guidance Note. 8, 2001)

A similar approach was taken by each the other countries of the United Kingdom. The language used in the English guidance has been described by an English High Court Judge as "*perfectly clear*" with there being "*nothing open-ended about Government policy.*" (T-Mobile and others –v- The First Secretary of State and Harrogate Borough Council, 2004)

Despite this clear planning guidance to local authorities, there have been repeated calls from local communities for health concerns of residents to be allowed to be taken into account within the planning system and for local precautionary policies to be put in place by local authorities.

A "Middle Ground" Approach

Against the background of the Stewart Report in 2000 MOA put in place a proactive programme of stakeholder dialogue in order to facilitate open discussion and to move forward on the recommendations of the Stewart Report. MOA did this by adopting a "middle ground" approach to the radiofrequency health and safety issue. This can be contrasted to a "denial" approach which restricts debate about uncertain health issues to proven scientific outcomes, relies on those outcomes being negative, ignores risk perception, polarises stakeholder positions, hinders government responses, and ultimately encourages litigation. On the other hand, a "middle ground" approach supports research, is neutral to scientific outcomes, advocates information sharing, encourages two way communication, supports stakeholder partnering, pursues solution driven policies rather than conflict based strategies, and does all of this to try and build social trust. This philosophy has underpinned MOA's approach to the radiofrequency health issue.

MOA Stakeholder Roundtable Meetings

On 7 November 2000 MOA convened its first stakeholder roundtable (SRT) meeting. The one day meeting was chaired by an independent facilitator, Professor Ray Kemp of Galson Sciences. The meeting was attended by various Government officials, the National Radiological Protection Board (NRPB), scientists, BMA, Powerwatch (NGO), mobile phone manufacturers, the Operators, and MOA. As a background to discussion, presentations were given by Government officials, Powerwatch, and MOA. Key issues of interest to stakeholders were identified by attendees as:

- *Voluntary initiatives by the Industry*
- *Precautionary approaches*
- *Exemplars in other sectors*
- *Difference between DTI and Which responses to handsfree research*
- *Public perception about the contradictory results of the above and research*
- *Effective Communication*
- *The audiences*
- *Scientific and technical assessments of potential health effects*
- *Biological effects versus the health risk*
- *Mechanisms to communicate the issues*
- *Journalistic responsibility*
- *Ownershire and Benefits*
- *Children and SAR + retail outlets*
- *Retail outlets – responsibility*
- *Dialogue and responsibility*
- *Rationale – do people realise they need masts to have mobiles?*
- *Communicating uncertainty and disputed advice*
- *Time – pressures and education*
- *Positive Planning – controls, ICNIRP, Numbers and Power*

The Chairman led a roundtable discussion around these issues and invited meeting attendees to summarise their learning and advice from the meeting. These were summarised and recorded as follows:

"Many comments were made on the success of today's meeting and the valuable opportunity to meet and discuss mobile phone health issues with a wide range of different people. There was a general recognition that there were many expectations and yet "no one person owns this issue". Therefore there were good grounds and sufficient good will to continue with the initiative.

It was agreed that a contact list would be drawn up and sent to all attendees, including copies of the slide presentations by E-mail.

The Chairman concluded by thanking all the participants for their positive approach to the day's discussions and made a general observation that where there is heightened concern about any

environmental public health issue, more scientific information and better facts often does little to alleviate concern at the local level. The manner in which you communicate with people is much more important, not just what you say but how you engage with stakeholders. Taking people seriously and making them feel that they have a role to play in the process is an important part of the way forward."

Overall, those present regarded the SRT meeting as positive and encouraging and there was universal support for future meetings.

As part of its response to the Stewart Report recommendations for changes to UK planning regimes, MOA and the Operators moved forward to develop a voluntary code of best siting practice for mobile phone radio base stations. As part of that initiative, on 23 March 2001 MOA convened a further SRT meeting to explore with stakeholders the relevant planning issues for radio base station siting.

Once again Professor Kemp chaired the meeting which was attended by Government officials, the Planning Inspectorate, local planning authorities, the Royal Town Planning Institute, mobile network operators, and MOA. There was a wide-ranging facilitated roundtable discussion on mobile telecoms planning issues. There was clear support for improved consultation procedures to be undertaken by the Operators, and the MOA decided to hold two days of "surgeries" for interested stakeholders to input to such procedures in more detail.

On 5 and 6 April 2001 MOA facilitated one-on-one stakeholder discussions regarding community consultation procedures. These were attended by individual stakeholders including local planning authorities and NGOs. Questions formulated by MOA to lead the discussions were:

- Are the different elements of the planning process recognisable – do you agree with this model?
- *Additional public consultation can take a number of forms e.g. via local authority officers and / or members, parish councils and community councils, direct mailings, drop-in sessions. Which of these do you think are the most useful forms of consultation?*
- *Can you suggest other forms of consultation that could be explored?*
- *At which stage can additional public consultation add most value?*
- *What are the criteria for deciding the level of consultation for each site?*
- *What is the best way to identify stakeholders? Who should or could be consulted?*
- *Are there any other issues you would like to raise?*

Input from stakeholders to this process was extremely valuable in assisting the Operators and MOA in the formulation of consultation strategies to include in the code of practice.

The Ten Commitments to Best Siting Practice

MOA and the network operators published their "*Ten Commitments to best siting practice*" in August 2001 (the Ten Commitments) (Mobile Operators Association, 2001). These are set out in the Appendix to this paper and can also be viewed at http://www.mobilemastinfo.com/planning/best_practice.htm

The Ten Commitments are based on improved consultation and communication, more information, and more transparency undertaken by the Operators to assist local planning authorities in the discharge of their statutory consultation responsibilities.

The first two commitments are improved consultation with communities and detailed consultation with planners. Underpinning these commitments is the Site Selection and Planning Model (SSPM) which is the process designed by the Operators in conjunction with stakeholders setting out the consultative stages that an Operator will adopt when developing its network. The SSPM is set out in full on the MOA website:
http://www.mobilemastinfo.com/planning/best_practice.htm

The SSPM consists of a four-stage process which can be briefly described as follows:

Stage 1 – Area-wide LPA Consultation:
This formalises the process by which an Operator provides information on its annual rollout plans to all local planning authorities throughout the United Kingdom enabling early engagement with planning officers and elected members of councils regarding base station siting proposals. It also provides the opportunity for an Operator to explore site sharing and joint developments with other Operators.

Stage 2 – Site Selection and Community Consultation
In this process process an Operator will identify "options" for a base station site that will satisfy a coverage requirement in a given area and will then discuss them with the local planner to identify the most appropriate community consultation strategy. To assist in this assessment, each option is assessed against a Traffic Light Rating Model (TLM) which enhances the objective analysis and impact of the proposal against planning, environmental and community related criteria. The rating from this assessment will help the Operator determine the level of site-specific consultation that should be proposed to the local planning authority.

Stage 3 – Community Consultation
This is the implementation of the consultation strategy as determined by the TLM Assessment and agreed in subsequent discussions with the local planning authority. The consultation options range from simple notifications to local planning authorities and through to meetings with community groups and the provision of extensive information on site design and site selection.

Stage 4 – Planning Submission
This part of the model details the improved level of information which is submitted to the local planning authority with a formal application for planning permission. This includes details of the alternative sites considered and the consultation strategy undertaken.

The Operators' Implementation of the Ten Commitments
Following publication of the Ten Commitments, on 14 September 2001 MOA convened a further SRT meeting to discuss their implementation by the Operators. Once again this one day meeting was chaired by Professor Kemp and attended by local planning authorities, Mast Action UK (NGO), the Operators, and MOA. Feedback from this meeting informed the Operators as they moved forward with implementation of the Ten Commitments.

Beginning on 4 December 2001 MOA and the Operators conducted two months of stakeholder briefings for local planning authorities in England, Wales, and Scotland. Overall, 17 briefings were held with audiences consisting of both professional planning officers and Elected Members. The purpose of the briefings was to communicate to local authorities throughout the UK the existence and purpose of the Ten Commitments and other relevant information on mobile network development.

At each stakeholder briefing two presentations were delivered – one by MOA and one by a representative of one of the Operators on behalf of MOA -- followed by a question and answer session which always provoked lively discussion, ie. two way dialogue. Written delegate packs were distributed to attendees at the briefings and, in many instances, these were made available to Elected Members who were not able to attend.

All the briefings took place in a positive manner and none had confrontational elements from delegates. There was criticism and searching comment, but it was given in a constructive manner. Many Elected Members were industry-supportive, but indicated that they were under strong community pressure to oppose radio base station sites, especially in sensitive urban areas and near schools and hospitals.

On 17 July 2002 MOA convened another SRT meeting to review progress on the Stewart Report recommendations. The one day meeting was again chaired by Professor Kemp and was attended by various Government officials, a local planning authority, NRPB, scientists, Powerwatch (NGO), Mast Action UK (NGO), mobile phone manufacturers, the Operators, and MOA. As a background to

discussion, presentations were given by Government , Mast Action UK, MMF, and MOA. Key areas of discussion were summarised by the Chairman:

> ***"Post Implementation Review of the 10 Commitments*** *- much is being done to deliver the recommendations of the IEGMP, but the question of how effective are the steps taken, remains the subject of debate. It is anticipated that a post implementation review of the Ten Commitments, to be carried out later this year by external auditors, will provide a clear picture of progress, and identify areas for operator improvement.*
>
> ***Communication*** *– trusted sources of information are needed to ensure that two way communication can develop effectively between industry and its stakeholders. A review of the content and exchange of existing communications was considered valuable. The public would value information on the health issue from trusted sources.*
>
> ***Health Research*** *– ongoing research is fully supported by all stakeholders. Health effects relating to living near base stations is a key priority for the public but it is a difficult issue to assess.*
>
> ***Local Planning Authorities*** *– lack of resources and expertise were identified as major factors influencing the LPAs' ability to deliver their contribution to the 10 Commitment process. It is hoped that a support programme can be developed enabling planning officers to access professional expertise and information. The lack of consistency among LPAs was identified as another problem and additional guidance is suggested to smooth the inconsistencies.*
>
> ***Stakeholder Engagement*** *– a review of current practices is suggested. Much of what is happening at both industry and government levels is not widely recognised. Improvement seems to have been made but for some people the level of stakeholder consultation needs to be increased – operators felt the roundtable forum was an important "reality check" and should be supported further."*

Deloitte & Touche Implementation Reviews

In order to maintain confidence in the Ten Commitments, in August 2002 MOA appointed independent auditing firm Deloitte & Touche to carry out a review of how well the Operators were implementing the Ten Commitments. The review aimed to provide guidance to the Operators, help establish best practice, involve multiple stakeholders, create a foundation for future assurance, and facilitate improvements in processes.

Deloitte & Touche were asked to form an independent opinion on whether the Operators had made demonstrable progress in implementing the Ten Commitments across the UK. In doing this they reviewed the processes, controls and procedures which the Operators use in siting radio base stations. The period reviewed was the first twelve months of operation of the Ten Commitments.

The main emphasis was on the local authority and community consultation commitments, but an overview of progress against all of the commitments was included. In-depth interviews were conducted with all of the Operators, site acquisition agents, local planning authorities, and local community representatives. Interviews were also conducted with national stakeholders and activist groups.

The Deloitte & Touche Implementation Review Report was published in July 2003 (Deloitte & Touche, 2003). Deloitte & Touche reported that they had found evidence that the Operators had made demonstrable progress in their implementation of the Ten Commitments, but they identified some areas for improvement and made 46 recommendations all of which were accepted by MOA and the Operators.

The report was sent by MOA to key stakeholders including Government, local government, interested politicians, and NGOs. It was also placed on the MOA website. The MOA and the Operators have commissioned a further review in 2004 which is expected to be undertaken and completed by the end of this year. This report will also be placed in the public domain.

As part of the implementation of the Operators' response to the Deloitte & Touche recommendations, on 24 September 2003 MOA convened another SRT meeting to seek stakeholder input to the process. The one day meeting was chaired by an independent facilitator, Professor John Durant, Chief Executive of At-Bristol, an independent science centre in the West of England, and Visiting Professor of Public Understanding of Science at Imperial College, London .

The SRT meeting was attended by Deloitte & Touche, various Government officials, local planning authority representatives, site acquisition agents, six NGOs, the Operators, and MOA. As a background to discussion, a presentation was given by Deloitte & Touche. The remainder of the day was dedicated to working through the detail of the Deloitte & Touche recommendations, the Operators' proposed responses to them, and gaining detailed input from stakeholders.

This meeting was an extremely valuable exercise and allowed the Operators and MOA to gain a deeper insight into the perspectives of community interest groups (six were represented at the meeting). This assisted the industry in formulating its detailed responses to the Deloitte & Touche recommendations. MOA made a commitment to report back to stakeholders and this was done subsequently by way of written report.

Other MOA Stakeholder Engagement Activities

For the past three years MOA has held regular meetings with Mast Action UK (MAUK) as a result of which a joint public information leaflet entitled "*Mobile Phone Networks*" was published in October 2003 (Mobile Operators Association/Mast Action UK, 2003). This was a significant achievement in MOA's stakeholder engagement process and MOA is very appreciative of MAUK's co-operation and willingness to work with industry on a common document for the benefit of the public.

This leaflet may be viewed at http://www.mobilemastinfo.com/information/intro.htm The leaflet is distributed by MAUK to members of the public who contact them on radio base station siting issues. These meetings have been a useful forum for the exchange of views on mobile telecoms siting policy issues and to facilitate discussion between the Operators and MAUK on site specific issues.

MOA has also published a Community Consultation Handbook written by Professor Ray Kemp and Ms. Tamsin Gruelich of Galson Sciences (Kemp and Greulich, 2003). The key readership audience is site acquisition agents and network operator staff to assist them in their interaction with local communities when seeking to site radio base stations. The handbook cross references directly to the Ten Commitments and provides practical help and guidance in their implementation on the ground. The handbook can be purchased in hard copy from MOA or viewed on-line and downloaded from http://www.mobilemastinfo.com/planning/intro.htm

MOA has also published Fact Sheets on radio base station siting issues both in hard copy and on its website (Mobile Operators Association, 2003). These leaflets have been widely distributed to local planning authorities throughout the UK.

MOA conducts a proactive public affairs programme including correspondence and meetings with Government Ministers and officials, Opposition Shadow Ministers, interested politicians, and local government. MOA attends and hosts fringe meetings at UK annual political party conferences. It also provides regular briefings to local planning authorities throughout the UK as part of the Ten Commitments. Audiences include planning officers and Elected Members. MOA has recently appeared before and given evidence to an all party parliamentary group on mobile phone radio base station siting issues (AP Mobile, 2004).

Conclusion

MOA believes that implementing the Ten Commitments and conducting a proactive stakeholder engagement programme encourages two way dialogue, improves public policy to the benefit of all stakeholders, and builds public trust. MOA's and the Operators' activities in this regard will continue.

Appendix

MOA Ten Commitments to best siting practice:

- develop, with other stakeholders, clear standards and procedures to deliver significantly improved consultation with local communities
- participate in obligatory pre-rollout and pre-application consultation with local planning authorities
- publish clear, transparent and accountable criteria and cross-industry agreement on site sharing, against which progress will be published regularly
- establish professional development workshops on technological developments within telecommunications for local authority officers and elected members
- deliver, with the UK Government, a database of information available to the public on radio base stations
- assess all radio base stations for international (ICNIRP) compliance for public exposure, and produce a programme for ICNIRP compliance for all radio base stations as recommended by the Independent Expert Group on Mobile Phones
- provide, as part of planning applications for radio base stations, a certification of compliance with ICNIRP public exposure guidelines
- provide specific staff resources to respond to complaints and enquiries about radio base stations, within ten working days
- begin financially supporting the UK Government's independent scientific research programme on mobile communications health issues
- develop standard supporting documentation for all planning submissions whether full planning or prior approval

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THE IMPACT OF EMF CONCERNS ON NETWORK ROLLOUT IN EUROPE

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Abstract
The growth of mobile communications has been one of Europe's great success stories. Since commercial services were launched in the 1980s, the uptake has been phenomenal. Mobile communications are now fundamental to business operations, individual lifestyles and the welfare of the European economy. Cumulative European investment in mobile networks has reached 170 Euro billion in 3rd Generation licence fees plus an estimated 132 Euro billion in infrastructure. The sector employs around two million people directly and indirectly.

GSM Europe (GSME) is the European interest group of the GSM Association, the global body representing mobile phone operators worldwide. The membership of GSME extends to around 143 operators in 50 countries/areas in Europe, serving more than 454 million subscribers. The GSME Health & Environment Working Group is responsible for ensuring the responsible management of health & safety and general environmental issues relating to mobile telecommunications technology.

The priority for the Working Group is to minimise the impact of EMF concerns on mobile telecommunications through effective risk communications with relevant stakeholders, including national governments and the European Commission, and to highlight the importance of maintaining a science based approach to health and environment issues.

In recent years, concerns have been raised about alleged adverse health effects from the operation of mobile telecommunications technology. This is despite independent expert reports across Europe [Stewart1 and AGNIR2 (UK), Zmirou3 (France), Health Council4 (Netherlands), the Radiation Protection Authority5 (Sweden), Independent Expert Committee6(Spain), other major scientific reviews and advisory bodies around the world continuing to conclude that, based on the current weight of scientific evidence, there are no known adverse health effects from exposures below international guidelines. The reports do however recommend that research continue.

In the public mind health concerns have focused primarily on the community impact of base station developments. Operators continue to experience considerable difficulties in deploying base stations to meet 2nd Generation needs and in the deployment of 3rd Generation services due to community resistance and political restrictions. Obtaining the required authorisations remains a real challenge in a number of Member States due to public concern over alleged health effects together with resistance to the deployment of further base stations for other environmental reasons.

The continual growth and reconfiguration of base stations are essential to extend service coverage, enhance call quality and increase network capacity. It is often not understood that base stations must be located near to where phones are used and, because of the limited number of radio channels available to each operator, additional base stations must be installed as the usage increases. In response to health concerns some local authorities and national governments have imposed more restrictive, arbitrary, rules on the siting of mobile phone base stations. This causes problems for operators in responding to the needs of their millions of customers, and undermines the competitive edge that Europe has and wants to retain through the swift uptake and development of this technology.

Policy on base station siting and related health concerns should be based on substantiated scientific evidence and should provide a framework to support both GSM and 3G services across Europe. Implementing arbitrary levels that are lower than the international public exposure guidelines [EU

Council Recommendation of 12 July 1999 (Reference 1999/519/EC)] undermines the basis of current standards, creates further public confusion and increases public concern.

Experts in risk communication advise that the best way to address community concerns about the alleged health risks of base stations lies in improved information and dialogue with stakeholders. Hence, GSM Europe member companies introduced, in November 2001, a policy of network deployment best practice:

GSME Health & Environment: Recommendation on Network Rollout Good Practice.
To this end, operators in co-operation with governments across Europe are:

- ensuring information on mobile phone health issues is widely available
- financially supporting quality, independent research programmes based on the World Health Organisation research agenda
- complying with national regulations and international public exposure guidelines as set out in the EU Council recommendation of 12 July 1999 (Reference 1999/519/EC)
- implementing communication processes to address community concerns
- engaging in dialogue with local and national administrative authorities
- sharing base station sites where possible and developing aesthetic base station solutions

The GSM industry believes this voluntary initiative constitutes a responsible and balanced approach to addressing public concerns and safeguarding the development of mobile technology in Europe.

WHAT THE INDUSTRY IS DOING IN RESPONSE TO EMF CONCERNS?

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Introduction

The Mobile Manufacturers Forum (MMF) is an international association of radio equipment manufacturers whose members include Alcatel, Ericsson, Mitsubishi Electric, Motorola, Nokia, Panasonic, Philips, Sagem, Samsung, Siemens and Sony Ericsson.
The MMF was established in 1998 to jointly fund key research projects, as well as to cooperate on standards, regulatory issues and communications activities concerning wireless communications and health.

Our starting point

The starting point for the industry's response is the consistency of the scientific conclusions that have been arrived at in the various national and international expert reviews – that is – *that there is no substantiated scientific evidence of adverse health effects from exposure to RF energy at or below international limits*.

Independent expert reviews	Website References
National Radiological Protection Board (NRPB): 1993, 1999, 2004	http://www.nrpb.org.uk
The International Commission on Non-Ionizing Radiation Protection (ICNIRP): 1996, 1998	http://www.icnirp.de
Royal Society of Canada: 1999, 2001	http://www.rsc.ca
UK Independent Expert Group on Mobile Phones (IEGMP – Stewart Report): 2000	http://www.iegmp.org.uk
Health Council of the Netherlands: 2000, 2002, 2004	http://www.gr.nl
French Expert Group ('Zmirou'): 2001,2003	http://www.sante.gouv.fr
Spain – Campos electromagnéticos y salud pública (Comité de Expertos Independientes): 2001	http://www.msc.es/
German Commission for Radiation Protection (SSK): 2001	http://www.ssk.de/
European Committee on Toxicology, Eco-toxicology and the Environment (CSTEE): 2001, 2002	http://europa.eu.int/
Swedish Radiation Protection Authority (SSI) 2002,2003	http://www.ssi.se
Norwegian Radiation Protection Authority 2003	http://www.nrpa.no

What are we doing in response to consumer questions and concerns?

Notwithstanding the weight of scientific evidence, the industry continues to support research that is aimed at addressing the recommendations of the World Health Organization's Research Agenda. The industry believes that a more complete scientific database will lead to more definitive assessments by public health authorities which, in turn, ensures that questions and concerns can be appropriately addressed.

The MMF has an extensive commitment to scientific research in this field with projects undertaken with national and international health agencies, and in a manner which ensures the scientific independence of the work. Details on the MMF research program and the projects supported can be found on the MMF website at: www.mmfai.org

The industry also supports regulatory and standards harmonisation. The MMF advocates for the widespread adoption of ICNIRP guidelines into national standards, consistent with WHO advice. The

ICNIRP guidelines provide a high level of protection against all known health effects and provide protection for all members of the community.
For our part, members of the MMF ensure that all of our products are designed, tested and manufactured to meet these standards. In our view, regulatory and standards harmonisation in this area provides the following benefits:

- Consumers gain the protection of an internationally recognized safety standard, while also having equal access to products and services that are available to consumers elsewhere in the world.
- Regulators have a consistent approach to regulation which is consistent with the recommendations of the WHO, the ITU and the WTO.
- Industry gains by developing and manufacturing products to a widely accepted international standard.

With respect to communications, the MMF seeks to provide high quality public information and analysis in order to address consumer or public concerns. Using both traditional and interactive media, the MMF also works in partnership with other stakeholders to ensure the wide availability of information. Our international SAR reporting program, for example, now results in SAR information being automatically provided to in excess of 300 million consumers each year.

Conclusion
While the consensus of scientific opinion is clear, the industry continues to strive to be open and responsive to consumers and the public alike through:

- Supporting quality research that strengthens public health policy and public confidence
- Supporting regulation and standards based on ICNIRP recommendations; and
- Improving our own communications in a way that seeks to adequately and appropriately address the issues raised.

As a result of this approach we believe that consumers can continue to have confidence in the safety of our products while at the same time enjoying the many benefits that wireless communications provides.

THE ACCIDENT PREVENTION REGULATION ON "ELECTROMAGNETIC FIELDS" (BGV B11) IN GERMANY

Experiences with the implementation and new solutions for the assessment of pulsed fields, especially for resistance welding equipment

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In Germany, the Accident Prevention Regulation on „Electromagnetic fields" (BGV B11) was issued in 2001. This regulation was prepared by the Subcommittee "Electromagnetic Compatibility" within the Electrotechnical Committee of BGZ.
It refers to employees exposed to electromagnetic fields in the frequency range from
0 Hz to 300 GHz. The employer is requested to investigate and assess the electromagnetic fields in the workplace.

Since the release of this accident prevention regulation and the related to it BG Regulation "Electromagnetic fields" (BGR BG11), it shows that for approx. 90 per cent of installations there are no measures required, but there are workplaces with specific installations, which have exceeded the permissible values and in this case, measures are required.

Pulsed electric, magnetic and electromagnetic fields are applied in many branches of industry and medicine today. The applicable statutory assessment requirements within the Accident Prevention Regulation on "Electromagnetic fields" (BGV B11), established for these specific fields, are unique on the international scale within occupational health and safety.

The implementation of this regulation in practice has shown, that although considerably simplified, there still exist problems. Many users of this very fast spreading technology of pulsed fields, especially the big circle of users of resistance welding equipment, still feel confused.

The Subcommittee on "Electromagnetic fields" within the Electrotechnical Committee has set up a Working Group on "Assessment of magnetic fields for resistance welding equipment". The task of this WG, which includes experts from fields as BG measurement services, welding technology and research, is to prepare an instruction manual (BGI).