Electromagnetic Fields a Fundamenta

Report on the 3rd International Conference on: "Electromagnetic fields and human health, fundamental and applied research" in Moscow and St. Petersburg

Eduard David

In September of last year an international conference took place on the subject of "Electromagnetic fields and human health, fundamental and applied research". It was of particular interest for scientists from all over the world since research that has been done in the former USSR on EMCE has not been completely revealed to the rest of the world and stipulation criteria for value limits in Russia are still not fully understood. The following article is an overview of the six-day conference, e.g. the programme of the conference, the schedule and the results.

Professor David with Andreas Wojtysiak and his wife in Peterhof (St. Petersburg)

The conference was organized by

- The Russian Academy of Sciences (Department of Physicochemical Biology)
- The Russian Ministry of Health
- The World Health Organization (WHO)
- The North-West Russian Scientific Centre for Hygiene and Public Health
- The Russian Centre for Electromagnetic Safety
- The Russian Centre for Bio-electromagnetic Compatibility
- The Russian National Committee for Non-ionising Radiation Protection (RNCNIRP)

The conference is a part of the WHO's programme for the international harmonization of guide lines concerning health relevant effects and for fully comprehending limit values.

The conference was supported by the World Health Organization (WHO), the European Office for Astronautic Research and Development, the Air force Centre for Scientific Research and the U.S. Air Force Research Laboratory.

In cooperation with the following organizations:

- MS Air Force Research Laboratory (AFRL)
- The International Commission for Non-ionising Radiation Protection (ICNIRP)
- The European Bioelectromagnetic Association (EBEA)

nd Human Health,
l and Applied Research

For some time the Americans have been especially interested in the results from research programmes compiled in the east, since the results have not been made available to foreigners. This could explain their willingness to help finance such conferences. According to Murphy of the US Air Force Research Laboratory, it is less expensive to gain knowledge in this way than to analyse the results in our own laboratories. On the other hand, we in the west would like to know why the Russians are demanding such low value limits.

Members of the International Programme Committee:

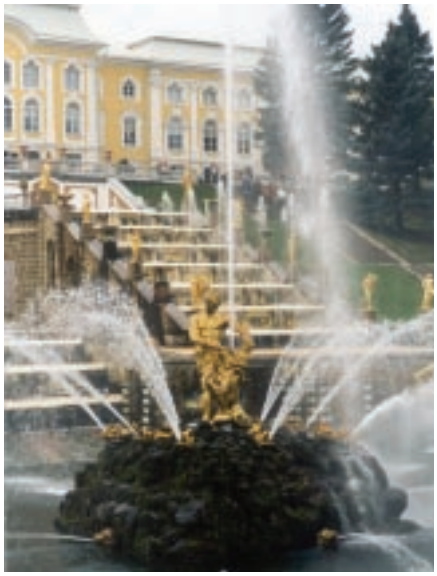
- Onischenko, G.G.; Ministry of Health in Moscow
- Repacholi, M.; WHO, Geneva
- Burlakowa,E.B.; Director of the Scientific Radiation Protection Commission for Biological Problems
- Ilyin, L. A.; Director of the Public Research Centre for Biophysics in Moscow
- Kheifets, L.; Representative for the international WHO EMF project and director of the Radiation Protection Programme
- Fesenko, E. E.; Director of the Bio-physical Research Institute in Puschino, near Moscow
- Murphy, M.P.; Director of the Radio-Frequency-Radiation Department of the US Air Force research laboratory in Texas, USA
- Klauenberg, B.J.; Vice-chairman of the NATO, TG-002
- Chaslim, V.P.; Director of the North-West Centre for Hygiene and Public Health in St. Petersburg, Russia
- Grigoriev, Y.G.; Vice-chairman of the RNCNIRP

The committee made every effort to stimulate a marked discussion between the Russians and western scientists and used the results to substantiate the determination of value limits. Therefore, several western scientists were invited to take part in the conference who originally came from the former Soviet Union.

The Organization Committee consisted of:

Six Russians and two Americans members under the auspices of the Russian Academy of Sciences and the Russian Ministry of Health.

The conference interestingly enough took place at two different venues, in Moscow on 18-20 of September 2002 and in St. Petersburg on 23-24 of September 2002, each venue was separately organized. In Moscow five scientific sessions were held followed by a discussion. In St. Petersburg there was a round-table discussion which was carried out by participants, who actively took part in the conference, the round-table discussion was followed by a discussion on the harmonization of EMF standards. A resolution was agreed on at the end concerning the results of the conference.



A fountain in St. Petersburg at the summer residence of the Czar

"The tower of silence", in this tower Pawlow (see bust) carried out his experiments with dogs.

Dr. Repacholi (WHO) and Professor Grigoriev opening the conference

Main Topic of the talks

These talks took place in Moscow and covered the following points:

- Basic problems with regard to research on electromagnetic effects and public health
- Biological effect mechanisms from exposure to electromagnetic fields
- Somatic effects of exposure to radio frequencies and pulsed electromagnetic fields
- Problems of field irradiation from a hygienic standpoint, in particular the pathology of occupational medicine
- Electromagnetic fields in mobile telecommunications
- Dosimetry and Therapeutics (medical) using electromagnetic fields

Further sessions took place in St. Petersburg in the form of a round-table discussion, participants of the conference took part in the discussion.

The following topics are subdivided into individual subject related categories:

- Harmonization of EMF-standards in conjunction with scientific findings of east European countries;
- A discussion concerning the results of chronic field exposure experiments (conducted for months or for years) which were carried out in the former USSR;
- EMF-standards in the USSR and Russia and how they were derived from the chronic experiments;
- The opinion of the foreign (not Russian) scientists regarding the EMF-standards in the USSR and Russia;
- Discussion concerning any questions on the harmonization of the different EMF-standards.

The main points listed above were dealt with in 55 short talks (15 minutes), main seminar papers and with 71 posters. The majority of the authors are from Russia (the number of contributions: 84), followed by the US with (14) and White Russia (11). The other authors came from the following countries: Armenia (4), Azerbaijan (1), Bulgaria (2), China (1), Germany (1), England (1), France (2), Georgia (1), Italy (3), Croatia (1), Latvia (1), Poland (2), the Republic of Kazakhstan (1), Riga (1), Sweden (2), Republic of Serbia (1), the Ukraine (3). Two authors represented the WHO (Geneva).

Individual lectures

Dr. Michael Repacholi (WHO Switzerland)

In his opening lecture Mr. Repacholi referred to the necessity of having a universal international harmonization of standards and in particular, in conjunction with the effects of electromagnetic fields on technology, the environment and especially on human health.

This harmonization should not only minimize international trade barriers but to serve the purpose of integrating our eastern colleagues into our information system. In connection with this he presented an international EMF-project dealing with the frequency ranges of 0-2000 GHz, which was started in 1996, the project will be conducted over a 10-year period and requires 150 million dollars. It covers scientific reporting, technical innovations and risk perception. Its goals are to collect results, to establish heath effects and to set up guide lines incorporating effects, safety factors and limit values. The project aims to lower the value limit by 10 fold for those working and by 50 fold for the general public.

Dr. Leeka Kheifets (WHO Switzerland)

spoke about risk perception, safe value limits, and "ALARA"- promotion ("as long as reasonable is achievable") while considering the correlation between the extent of the individual influences and the assured effects. Therefore, in 2002 a European commission was founded in order to deal with sensible protective measures. This commission is trying to proceed according to the benefit/risk ratio. What is required here is: weighing the evidence, the knowledge of the costs (effectiveness), and

if necessary to reduce any probable effects or to prevent them altogether.

The commission is investigating the following questions:

- How much weight can be placed on the data gathered from animal experiments with regard to humans?
- How should false positives and negatives be evaluated?
- What measures make sense from a financial point of view "prudent avoidance"?
- Finally it must be explained, which client will be granted the task of checking and monitoring?

Professor Grigoriev (Russian Academy of Sciences and the Russian Commission for Non-ionising radiation)

In his anxiously awaited introduction talks, he first introduced the Russian institutions involved in this type of research. These institutions are those which do research in the following areas: radiology, radio-biology, hygiene, standardization, dosimetry, therapeutics, and many others, with a total of 32 specifications. In addition, there are centres for biophysics, medicinal biology, physical and technical measuring technology, boards of health (hygiene), astronautics, the military etc.

Chronic and acute effects are sought and questions are posed about dosages and cumulative effects. Russia is especially suited for doing this kind of research. The scientific structures still exist that were set up by the previous political system. Russia has many people at its disposal due to the great size of its population. Since in Russia many regions have different technical standards this allows for the use of comparison groups which have not been exposed to any mobile telephone emissions. Moreover, there is a great capacity for astronautic research and the heterogeneity of the landscape makes it possible to find many confounders. In contrast to many western countries (Germany) the limit values in Russia are recommendations and not decreed by law. They are generally at least by factor 10 lower than in the west, so the export industry in the west has to adjust its exports. In Russia results from hygienic epidemiological studies are available, these studies concern children, the ill (unfortunately most of them were done without negative controls), the elderly and pregnant women (the so-called genetic effects) and investigations were done with rats and HF-irradiation at 5-10 mW/cm^2 with modulated frequencies, however these studies must be done again in compliance with international research quality standards. The question was raised in the discussion as to who will do the experiments again (east or west). The question was also raised as to who will finance it and who will be authorized to evaluate the results.

The next speakers gave 15 minute talks on biological effect mechanisms caused by EMF-irradiation. (Chairmen: C. Chou and E. Fesenko)

This set of talks was principally held by scientists from Russia and the U.S.A., at first they dealt with the fundamental principles of the physical interaction of fields with material, and questioned if entropy, thermal noise and the law of energy conservation play an important role in this interaction. While the Russian scientists mainly described phenomenological reactions concerning lowly organized forms of life, such as insects, the Americans concentrated more on causal analyses. The Russians reported in their data that an increase in the production of pheromone occurs when the feelers of insects are irradiated. In this case action potential sequence of neurons in the feelers of insects showed a higher open state probability, i.e. a higher rate of excitation – when the Ca-ion canals in the nerve cell membrane are frequently in an opened state. The experiments were done with the Patch clamp technique. Magnetic, constant and alternating fields in combination with ELF-fields exhibited clear effects with regard to amplitude and frequency windows, especially with regard to the photo receptors.

Participants from China, Russia, Poland and the U.S.A. presented the next set of talks on additional results obtained from single cell experiments.

The effects concerned cell-cell communication changes or their suppression brought gap junction interference caused by ELF magnetic fields (low frequencies). Hereto, Russian scientists demonstrated a single cell physiological mechanism specific to the phosphate cycle. This mechanism while under the influence of weak ELF-magnetic fields produces changes in the life of organisms, which only live for a short time. In the discussion it was pointed out that no negative controls were done. Effects with low probability could occur on a purely statistical basis. In the same way, positive controls are required here, which could reveal the natural occurrence of the investigated effects without any field influence taking place.

This is also valid for the gene technology studies, such as those done by the Italian working group. Their investigations were concerned with ETS-genes (genes which play a role in the occurrence of cancer and in embryonic development) and EMF-exposure. The Polish group, under the direction of Szmigielski presented their findings on the immunotrope potency of isolated, immune competent human cells (lymphocytes) in in vitro experiments by means of pulse modulated 1300 MHz microwaves.

The Russian as well as the Americans keep on looking for primary physical and or biochemical mechanisms during HF-field exposure; mechanisms which are triggered by changes in protein-water structures. They are also attempting to solve the "KT-problem". An attempt is also made to explain the effects demonstrated by the

Dr. Murphy (US-Air-Res.Lab.)

Prof. Grigoriev

Italians (but only for 0.8 mT ELF) on the phosphorization of the connective protein found in gap-junctions with a laser scanning microscope. Even in the field of molecular oncology, studies have been conducted, for example, in Italy which show at 50 MHz amplitude modulation and at 60 V/m that different "domains" are affected (protein structures, respectively their fractions). These effects influence gene expression in mRNA (messenger-RNA) in the cell-cell bonding process. It is assumed that the metastasising of carcinoma cells is based on this mechanism. With special methods, e.g. with the gyroscope a structural analysis of fluids can be done, which is based on a kind of polarization microscope. V.N. Binhi, who is an internationally known biophysicist, used this to explain the "window-effects" in the microwave range. Nevertheless, the problem lies in transferring this micro effect to humans.

The following session on the somatic effects of radio frequency EMF-exposure was moderated by S. Szmigielski (Poland) and A. Pakhomov (Texas, U.S.A.)

The talks were given by scientists from many different countries but the majority were from Russia, they reported on function changes in live organs. Merritt reported on experiments that were reproduced on the calcium out-flow of nerve cells in the brains of chicks while being exposed to microwave irradiation. This observation was of interest because normally the extra cellular space has a higher concentration of Ca-ions than the intra cellular space. This means that when the Ca ion canals open, Ca ions should actually flow into the cell. There were other reports on the subject of morpho-functional changes in specific areas of the brain (in chickens, rats, cats, etc.). Another large subject area is the field of immune modulation, for the most part it deals with isolated lymphocytes, which were exposed to microwaves, some of the lymphocytes investigated were intra vital - before they are taken out of the blood - and some in vitro. The working group of Hansson Mild (Sweden) together with Lyskov (Russia, St. Petersburg) showed in a 24-hour monitoring that sensitive people exposed to field effects had a restricted variability in heart rate. This observation has been reported on from different sides in Russia and has even been used by employing the long-term Fourier-Analysis all the way to astronautics research. The results from the above-mentioned authors are regarded as preliminary because there is no exact definition as to electromagnetic over-sensitivity, whereas exact information on normal heart rates exists.

Further investigations on the plasticity of cerebral synaptic connections lead to changes in behaviour and how people cope with stress while exposed to continuous pulsed microwaves.

The following session moderated by M. Murphy (Texas), L. Kheifets (WHO, Geneva) and Khudnitsky (Russia) dealt with the hygiene problems and occupational medicine.

In his introduction Murphy described the mode of operation employed and the subject areas investigated in the research laboratories of the Air Force. Most of the studies dealt primarily with animals' reactions to being exposed to highly energized, radio frequencies. If exposure intensity is substantially higher than exposure in everyday life than it is all the more suited for making a statement on the validity of limit values. His opinion on HF-effects and hearing was also interesting.

The following Russian authors, N.B. Rubstova, to mention one, interpret hygiene problems as the occupational medical conditions of certain occupations and a correlation to the health status of each occupation.

Several presentations were on studies done with airport personnel and their ex-

posure to radar, however, a causal correlation between EMF-exposure and illness was difficult to detect. For example, those reports dealing with highly stressed personnel working in out-patient wards exposed to radar, this exposure has not been quantified.

In the following sections talks are presented which deal with the problem of EMF-communication:

French scientists, for example (F. Batellier and others) observed the direct effects of mobile radio radiation on a large number of chicken embryos and described their results in a kind of epidemiological evaluation. The fact that only very slight effects were observed, lead to the reproach that the results lacked significance thus rendering them very difficult to assess.

A very large group of Russian scientists working in the field of industrial medicine investigated the possible effects posed by telecommunications to those working in the industry. These talks especially focused on the setting up of standards which would make it possible to institute precautionary measures. In this case some information has been borrowed, as Grigoriev described in his talk, from information concerning radio technology in the region of Moscow. In Bokitko's talk he held up the plans of the Russian Ministry of Health's and the Ministry of Health's working group "Mobile Communication" as examples of researchers striving to create and set up guide lines for measurements, planning, information and for safety measures.

In the next section the talks on dosimetry and the evaluation of absorption rates are summarized together. These talks were moderated by Yu Spodobaev (Russia) and D.Simunic (Croatia):

Real measurement data and calculated absorption rates were individually presented and compared to dosimetric data from computerized models of humans and animals. Moreover, data from models was compared to experimental data on HF-skin absorption and analysed . C. Andenna (Italy) presented the ISPESI (National Institute for Industrial Safety and Prevention). Requirements for organ resonance and whole body models were presented by A.L. Lyssy (USA).

The last session held in Moscow on the use of EMF for medical diagnostics was lead by M.Markov and R. Gimranov.

M.Markov (U.S.A.) opened the session and presented his talk on the use of magnetic impulses in medicine and in biology. The session continued with a talk on the use of magnetic field applications, used to activate organic functions after irradiation damage. The report dealt with a retrospective clinical study. Moreover, from the U.S.A. there was a report on the treatment of osteoarthritis and epilepsy with magnetic fields. These types of treatments use, in part, extremely weak magnetic fields, whose interference with the substantially stronger magnetic field of the earth is not taken into consideration. Otherwise, the organizational question arises as to the use of medical applications and the general validity of limit values.

The journey to St. Petersburg

The conference in St. Petersburg served the purpose of a plenum discussion, with individual speakers who presented their opinions in a short talk. It ended with a presentation of the standards in each individual country and this was followed by a common resolution being made of the conference.

Conclusions

- Children and EMF: for the WHO this is still a current topic. In 2003 a conference has been planned by the WHO on the subject.
- Electro sensibility: lectures by Lyskov and Belyaev: as in the past, there is no strong evidence indicating a correlation between field effects and health symptoms. Both find that various biological and medicinal parameters have experimental effects, but no differences were found among control persons and those with apparent electro sensibility.
- Pulsing: Review by Lu (US Air Force), there were various studies which exhibited pulsing effects but no effects were exhibited with CW. According to the author, altogether there was no strong or conclusive evidence with regard to any particular effects from pulsing fields.
- Combination effects: according to D'Andrea (US Air Force) there were no unexpected effects from irradiation at 2000 MHz and 3 GHz (2-6 W/kg) in behaviour tests done on monkeys. The reactions were as if they had resulted from a combination form of individual exposure according to their respective fields. The reactions were of a thermal nature.
- Russian Research: the work presented was often relatively old, done in the 70s and 80s in the area of high frequency/ microwaves. It partly dealt with the correlations between field exposure and symptoms that arose (illnesses) partly with experimental studies, mainly with rodents and partly with studies on the mechanisms of field effects. Many studies were only published in Russian and were therefore in the English speaking world largely unknown and this was also the case for English publications in Russia. The language barrier still poses problems in communication.
- Mechanisms: no detectable significant progress:

– Epidemiological studies: Illnesses in the states and in the former USSR are systematically documented (especially on the job). The connection to electromagnetic fields, from a scientific standpoint, often seems to be of no harm.

– Point of criticism: Possible co-factors may not been determined and taken into consideration.

– Experiments with animals: The parameters that have been investigated are often relevant to health (for example, teratology, haematology, see Grigoriev's summary in conference publication). The methodology often seems quite sound, in part the methods used in the west were not customary, but on the other hand very often usual methods were applied. One can see that the research is of a rather good internal consistency (within laboratories and/or research groups). External consistency or no independent reproductions remained a point of criticism in the discussions. Moreover, in most cases the small number of animals (8-10) used per experimental group has to be questioned. In the Russian studies a lot of single parameters were determined for the animals, where many statistically significant changes were discovered. However, no conclusive statement can be made concerning the changes, many of them seem to be unsystematic and bear no relationship to each other.

– Value limits: The representatives of the Russian committee adhere to their opinion that the research presented and further research justifies the low value limits. The WHO's specifications on established health effects was discussed by the Russians and questioned. No agreement could be reached on the term "established".

Principal Problems with the harmonization of standards in Russia.

In the USSR studies were mostly published in Russian and in their own publications, these studies were done under very different conditions than those adhered to by western institutions. Firstly, a lack of communication with foreign countries in the west was fertile ground for creating their own independent ideas, however with the handicap that their investigations were not subjected to international controls. So the existing research results did not come about from the point of view of determining limit values but rather in a sense from a value free scientific approach. It is of course conceivable that their applicability, at least for political and military purposes cannot be excluded.

The establishment of value limits arose out of a necessity in the west to protect the population from so-called collateral damage, as it is called in the military, this was also the case in the USSR but under different prerequisites. The statement, "below the value limits there are no reactions whatsoever", was interpreted in such as way that even from a molecular point of view no changes could occur. It is generally known that in this sub-molecular region, e.g. at very low temperatures, weak effects which are normally swamped by thermal noise, become visible, these effects on a cellular level or even with regard to the entire organism play absolutely no role. Finally, at that time psychological reactions were not properly classified and not given somatic parity . As early as the 1970s the Russians informed western scientists about such psychological effects –however the effects took place in low frequency ranges used for energy supplies- and started with their announcement an intense well-known debate that is stilling going on today.

Of decisive significance for the Russians was our definition "below the value limits nothing happens". Since in Russia, interestingly enough, low-energy therapy is very popular, we can ascribe this as an effect too. This type of therapy is used in an extremely low energy range, so that it must be below the value limits.

On the other hand, experiments are often not done according to the rule, "good scientific practice" and so often a negative control is lacking or an exact definition of the exposure parameters. So the Russians have extensive statistics on cases of illness from employees in different branches, but one cannot refer to the corresponding exposure parameters.

Therefore, it is clear to everyone that the experiments done earlier will have to be repeated, and this time under international control. The question is however, where will the experiments take place, in Russia financed internationally or in another country. In the end it is only possible of course when the exact parameters are made known.

Understandably, there is the desire in Russia, if possible even in a sense of a better utilization of scientific facilities, to carry out the experiments on their own. An agreement on this matter is reserved for a later meeting. The above-mentioned problem together with the necessity of harmonizing the value limits between us and east European countries was expressed in the final communiqué.