

ELF Gateway Members ----

Teri Vierima's first report from Berlin covers 4 presentations on ELF dosimetry and opening remarks by Paolo Vecchia, chair of ICNIRP. Vecchia explained that ICNIRP will be re-examining its 1998 exposure guidelines.

One important message emphasized in yesterday's talks was that, according to one speaker, "there is more and more support for a biological rationale based on induced electric fields," the approach taken by IEEE in its current ELF standard.

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BERLIN, GERMANY - Meeting Report
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Problems in ELF EMF Dosimetry Highlighted in First Day of ICNIRP Workshop

3/21/06---Berlin, Germany---The International Commission on Non-Ionizing Radiation (ICNIRP) is holding a 3-day workshop in Berlin, Germany, on EMF Dosimetry and Biophysical Aspects Relevant to Setting Exposure Guidelines. It is somewhat of a "kick-off" meeting for ICNIRP's total reconsideration of its 1998 exposure guidelines for both ELF and RF EMF. As ICNIRP Chair Paolo Vecchia explained in his introductory remarks on Monday, ICNIRP will be starting from the beginning with a "completely new analysis" that will take into account dosimetry, mechanisms, and new sources and frequencies. The effort is expected to take several years and this workshop was intended to initiate the discussion of key issues and problems.

The Monday morning session focused on ELF dosimetry, with the first 4 speakers---Luc Martens of Ghent University, Belgium; Achim Bahr of IMST GmbH in Kamp-Lintfort, Germany; Kari Jokela of the Radiation and Nuclear Safety Authority (STUK) in Finland; and Hannah Heinrich of 2h-engineering in Germany---all covering different problems inherent in measuring ELF EMF. This Gateway summary will cover the key points of these 4 presentations. Of greatest importance was the strong message coming from many of the speakers that, as Martens put it, "there is more and more support for biological rationale based on induced electric fields" rather than current density. In other words, there seemed to be general agreement that the approach taken by the Institute of Electrical and Electronics Engineers (IEEE) is now thought to be more scientifically sound than the approach used by ICNIRP in 1998.

The last speaker of the morning was Jolanta Karpowicz of the research arm of the Central Institute for Labor Protection in Poland, who spoke on "problems and gaps for the assessment of occupational exposure; the EMF-NET MT2 experience." This issue is of particular interest to power companies in the European Union as they struggle with implementation of the European Directive (2004/40/EC) on limiting EMF exposure in the workplace. A summary of her presentation will follow in the next meeting report.

ELF DOSIMETRY

The presentations of Martens, Bahr, Jokela, and Heinrich highlighted in detail the many problems that ICNIRP will face in deliberating on the basic restrictions (BRs) and reference levels (RLs) for ELF EMF. No solutions were offered at this time.

Heinrich gave a clear picture of the challenges ahead as he noted that in 1998, there were limited applications of pulsed fields and no or limited turn-off capabilities in power semiconductors, and that sinusoidal fields (with some harmonics) were dominant. In 2005, he said, 80% of occupational exposures involve non-sinusoidal, pulsed, and intermittent fields, higher complexity of wave forms, greater proximity of exposures, more localized exposures, and more inhomogeneous field distributions.

The following list includes some of the specific issues pointed out by the speakers.

--Diversity of sources. As Heinrich touched on, new applications now force ICNIRP to deal with ELF EMF exposures that are pulsed, non-uniform, non-sinusoidal, partial-body, and composed of multiple frequencies of varying polarities and with varying phase relationships. These issues were addressed in only 2 footnotes in the initial 1998 guidelines. Potential biological mechanisms for these new field characteristics are unclear.

--Dosimetric evaluation criteria. Again, Martens, Bahr, and Jokela all endorsed the use of local electric field to determine limits, but the usual questions remain. Should rms or peak values be used, how should multiple frequencies be addressed, how should special and temporal differences be handled, and should average or maximum exposures carry greater weight?

--Uncertainties in modeling. Bahr's presentation dealt solely with this issue and a whole host of questions were raised but not answered. The topics included differing human models (e.g., the US Air Force Visual Human model, the National Radiological Protection Board male and female models, and models generated by the universities of Utah [US] and Victoria [Canada]); different computational methods and algorithms (e.g., Finite-Difference-Time-Domain [FDTD], Scalar-Potential-Finite-Difference [SPFD], and impedance methods [IM]); uncertainties in dielectric properties of tissues; differences between children and adults; frequency dependencies; tissue boundary conditions; discretization (grid scaling and rotation); anisotropy of tissues; microdosimetry for tissues such as the retina, cell membrane, and blood-brain barrier; and lastly, validation of the models by measurements.

In response to questions regarding exposure of the fetus, Howard Bassen of the US Food and Drug Administration (FDA) announced that models of 9 stages of pregnancy would be ready in 6 months and will be presented at the BEMS meeting. (Preliminary results were presented at the last BEMS meeting.) In addition, within a year the FDA will make available MRI-based models of a family (male, female, and 2 children).

One controversial conclusion offered by Bahr was that in situ electric field value was a more "stable" dosimetric quantity than current density. Two members of the audience noted that because the 2 parameters are linearly related, this was inconsistent, but Bahr continued to assert his conclusion.

In question and answer sessions during the meeting and in private conversations, the issue of whether significant differences exist between children and adults continued to surface. Some say that policy makers are ignoring the numerous scientific studies that show negligible differences, and instead are creating confusion and distress among the public by promoting special protection for children.

Lastly, Ken Foster of the University of Pennsylvania raised an issue that was likely on everyone's mind after these presentations: "What is the justification for more and more detailed models with smaller and smaller resolution" in light of what we know about health effects, that is, that no mechanism is established and few if any effects have been supported with data? The engineers' and modelers' answer was, of course, more accuracy.

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