Environmental Health Criteria 137

ELECTROMAGNETIC FIELDS (300 Hz to 300 GHz)

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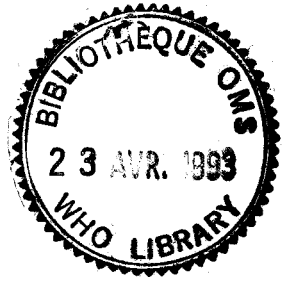

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NOTE TO READERS OF THE CRITERIA MONOGRAPHS

Every effort has been made to present information in the criteria monographs as accurately as possible without unduly delaying their publication. In the interest of all users of the environmental health criteria monographs, readers are kindly requested to communicate any errors that may have occurred to the Director of the International Programme on Chemical Safety, World Health Organization, Geneva, Switzerland, in order that they may be included in corrigenda, which will appear in subsequent volumes.

DEDICATION

This monograph is dedicated to:

Professor Przemyslaw A. Czerski, a charter member of International Non-ionizing Radiation Committee, who died on 15 April 1990 in Silver Spring, MD (USA). He was a pioneer investigator into the effects of non-ionizing radiation on biosystems and the assessment of the potential hazards associated with such exposure. As a fervent promoter of international cooperation, Professor Czerski played an active part in the establishment of the International Non-Ionizing Radiation Committee and in the development of its activities. His broad scientific knowledge and his tireless energy made him a major contributor to the present publication.

PREFACE

The International Radiation Protection Association (IRPA) initiated activities concerned with non-ionizing radiation by forming a Working Group on Non-Ionizing Radiation in 1974. This Working Group later became the International Non-Ionizing Radiation Committee (IRPA/INIRC), at the IRPA meeting held in Paris in 1977. The IRPA/INIRC reviews the scientific literature on non-ionizing radiation and makes assessments of the health risks of human exposure to such radiation. On the basis of Environmental Health Criteria monographs, developed in conjunction with the World Health Organization, Division of Environmental Health, the IRPA/INIRC recommends guidelines on exposure limits, drafts codes of safe practice, and works in conjunction with other international organizations to promote safety and standardization in the non-ionizing radiation field.

A WHO/IRPA Task Group to review the final draft of the Environmental Health Criteria on Electromagnetic Fields (300 Hz-300 GHz) met at the WHO Collaborating Centre for NIR in Ottawa, Canada, from 22 to 26 October 1990. Dr A.J. Liston, Assistant Deputy Minister, Health Protection Branch, opened the meeting on behalf of the Minister for Health and Welfare Canada. Mr J.R. Hickman, Director General, Environmental Health Directorate, welcomed the participants. The support of Health and Welfare Canada and the local organization by the Environmental Health Directorate are gratefully acknowledged.

The first draft of this publication was compiled by Professor J. Bernhardt, Professor P. Czerski, Professor M. Grandolfo, Dr A. McKinlay, Dr M. Repacholi, Dr R. Saunders, Professor J. Stolwijk, and Dr M. Stuchly. An editorial group comprising Professor J. Bernhardt, Professor P. Czerski, Professor M. Grandolfo, Mr C. Hicks, Dr A. McKinlay, Dr R. Saunders, Mr D. Sliney, Professor J. Stolwijk, and Dr M. Swicord met at the US Army Environmental Hygiene Agency, Edgewood, MD, in February 1990 to revise the draft. A second editorial group comprising Professor J. Bernhardt, Mme A. Duchêne, Dr A. McKinlay (Chairman), Professor B. Knave, Dr R. Saunders, and Dr M. Stuchly met at the National Radiological Protection Board, Didcot, United Kingdom, in May 1990 to collate and incorporate the comments received by IPCS Focal

Points, IRPA Associate Societies, and individual experts. Dr M. Repacholi was responsible for the scientific editing of the text and Mrs M.O. Head of Oxford for the language editing.

This publication comprises a review of the data on the effects of electromagnetic field exposure on biological systems pertinent to the evaluation of human health risks. The purpose of the document is to provide an overview of the known biological effects of electromagnetic fields in the frequency range 300 Hz to 300 GHz, to identify gaps in this knowledge so that direction for further research can be given, and to provide information for health authorities, regulatory, and similar agencies on the possible effects of electromagnetic field exposure on human health, so that guidance can be given on the assessment of risks from occupational and general population exposure.

Most radiofrequency (RF) field standards are based on the premise that there exists a threshold specific absorption rate (SAR) of RF energy (for frequencies above about 1 MHz) of 1-4 W/kg, above which there is increasing likelihood of adverse health effects. Below about 1 MHz, standards are based on induced currents in the body, causing shocks and burns. The purpose of updating the original Environmental Health Criteria monograph on radio frequency (WHO, 1981) is not only to provide a description of more completely developed RF dosimetry in humans, but to critically review more recent scientific literature, to determine if the threshold SAR on which standards are based is still valid. With the frequency range covered by the document extended down to 300 Hz, more emphasis is placed on induced currents and other possible mechanisms of interaction.

In conducting the literature review, earlier reports are not necessarily included, since these were reviewed in UNEP/WHO/IRPA (1981). Every effort has been made to distinguish clearly between biological effects that have been established and those that have been reported as preliminary or isolated results, or as hypotheses proposed to explain observed results. The conclusions of this document are based on peer reviewed and established knowledge of interactions of electromagnetic fields with biological systems.

Subjects reviewed include: the physical characteristics of electromagnetic fields; measurement techniques; applications of electromagnetic fields and sources of exposure; mechanisms of interaction; biological effects; and guidance on the development of protective measures, such as regulations or safe-use guidelines.

Health agencies and regulatory authorities are encouraged to set up and develop programmes that ensure that the maximum benefit occurs with the lowest exposure. It is hoped that this criteria document will provide useful information for the development of national protection measures against electromagnetic fields, as well as serving as a reliable basis for such reports as environmental impact statements necessary for proposed electromagnetic field emission facilities.

The WHO Regional Office for Europe has published a second edition of the book entitled *Nonionizing radiation protection*, which includes a chapter on radiofrequency radiation (Suess & Benwell-Morison, 1989).