

AN INTERNATIONAL PROGRAM FOR MICROWAVE EXPOSURE PROTECTION*

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Abstract

In the developed countries there has been a remarkable increase in the number of processes and devices that utilize or emit microwaves during the last 25 years. Such devices are used in all sectors of our society for military, industrial, telecommunications, and consumer applications. Because of the world-wide implications of the rapidly developing technology and associated health safety considerations, development and implementation of a program for international cooperation in the use and protective measures related to microwave/radiofrequency exposure is required. Activity in this respect has been initiated by the Regional Office for Europe of the World Health Organization (WHO/EURO) which has developed a long term program concerned with the health effects of nonionizing radiations. To implement this program, several steps have been taken with participation by scientists and administrators from several countries. These activities have engendered plans and proposals for facilitating exchange and evaluation of information on the biologic and health effects of microwave radiation and in focusing attention on those areas in which additional information and new approaches are needed.

Interest and concern about the biologic effects and potential hazards of microwave/radiofrequency (MW/RF) exposure is not insular in nature and requires international understanding and cooperation. In this context the Regional Office for Europe of the World Health Organization (WHO/EURO) has developed a long term program concerned with the health effects of nonionizing radiations. Although other nonionizing radiant energies (NIR) come under the purview of this program, only that pertaining to MW/RF is reviewed and discussed.

To implement this program, a working group met in The Hague in November, 1971 to review and assess the situation prevailing in Europe and elsewhere, consider trends and developments, recommend approaches, and suggest priorities for a long term program.¹ The deliberations of the Working Group stemmed from consideration of four basic questions, namely: how serious are the problems in regard to MW/RF exposure, what are their dimensions, and what acute and/or chronic effects on the body are involved; how adequate is our present knowledge about occupational risks and public health hazards from these types of radiation; how can exposure be reduced; are protection standards adequate, and if not, how can better regulations be drafted and enforced to reduce the exposure to these energies?

The approaches used in implementing this program are: 1) collect and evaluate informative data in a systematic manner, 2) support further investigations into the health hazards of MW/RF, 3) discuss possible biologic criteria for damage, 4) develop criteria for health protection, 5) assist in the establishment of rules and regulations and the proper means of enforcing them. The conclusions and recommendations of this Working Group will be presented.

At the conclusion of the United Nations Conference on the Human Environment in Stockholm, 1972, WHO was entrusted with the task of developing international health criteria and standards. In a meeting in Geneva, the scope of such a program and its priorities were discussed.² To enable the preparation of the criteria document on NIR, among others, it was considered essential to first prepare critical reviews of the existing knowledge of health effects of microwaves as part of the category of first priority.

As the next step, WHO, together with the United States Department of Health, Education, and Welfare and the Scientific Council to the Minister of Health and Social Welfare of the Polish Peoples' Republic sponsored an International Symposium on Biologic Effects and Health Hazards of Microwave Radiation which was held near Warsaw, 15-18 October, 1973. This Symposium served as the first international forum for personal exchange of research information and professional experience and provided a milieu for the exchange and evaluation of current information and concepts about the biologic effects and health implications from microwave exposure. In this way attention was focused on those areas of general agreement to determine where additional information is needed and development of new approaches where appropriate. Over fifty participants from 12 countries and representatives from five international organizations attended the Symposium. Thirty-nine papers from nine countries were presented. Of these papers, nine were related to physiopathology of the central nervous and neuro-endocrine systems, seven each to epidemiological surveys and energy absorption/measurement techniques. Other subjects included cellular and molecular biophysics - 5, ocular effects - 3, thermal regulation - 3, mammalian development - 1, combined effects - 1, and applications - 2.

*This paper reviews and analyzes a portion of the Long-Term Programme in Environmental Pollution Control in Europe under development of the Regional Office for Europe, World Health Organization with specific reference to the International Symposium on Biologic Effects and Health Hazards of Microwave Radiation, Warsaw, Poland 15-18 October 1973, co-sponsored by the World Health Organization, Department of Health, Education, and Welfare of the United States and the Scientific Council to the Minister of Health and Social Welfare of the Polish Peoples' Republic, and the deliberations of an Evaluation Group which was convened by the WHO Regional Office for Europe in Copenhagen, 22-23 October 1973.

The proceedings of the Symposium, including papers, discussions and recommendations, will be published by the three sponsors during 1974. The report of the Evaluation Group has already been published by the WHO Regional Office for Europe as document EURO 3170, Copenhagen 1974.

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The major accomplishment of this Symposium no doubt is that this may be the first step in removal of barriers between countries to permit international cooperation.

An important outcome of the Symposium was the consensus of the participants that for convenience and uniformity of approach microwave intensities could be classified in three broad categories such as:

- a) Above 10 mW/cm^2 , at which thermal effects occur which in some instances (at high average power densities) may prove hazardous.
- b) Below 1 mW/cm^2 , in which gross thermal effects are improbable.
- c) An intermediate range in which weak but noticeable thermal effects occur as well as direct field effects and perhaps other effects of a microscopic or macroscopic nature, the details of which have not yet been clarified.

This categorization was qualified with the notation that the limits of these ranges have not yet been determined. They may differ for various species of animals and may also depend on a variety of parameters such as frequency and modulation.

The material submitted to this Symposium and the conclusions drawn from discussions were subjected to a special evaluation by a small group of experts convened by WHO/EURO which provided the feedback for the NIR Program.³ During this evaluation meeting, the research gaps and the need for complementary information on the study of microwave radiation were identified.

The work of the Evaluation Group culminated in a series of recommendations. It was suggested that there should be international cooperation in microwave bioeffects research by means of continuing exchange of information, improved and timely translation services, exchange visits, and collaborative projects and publications. Every effort should be made to establish internationally accepted definitions and nomenclature for quantities and units and to standardize measurement techniques.

The development of a program in NIR should be encouraged and supported under the auspices of an international agency, such as WHO/EURO, which could exert leadership and coordination in the field, and facilitate international communication among scientists active in this field of research. Such a program has been started by WHO/EURO.

More biomedical and biophysical investigations are needed before clarification and understanding of subtle effects will be possible. Special attention should be paid to investigations to determine the absorbed energy and its spatial distribution. Carefully controlled epidemiologic studies are required.

Investigations of the effects of low intensity microwaves should continue to be conducted with the aim of determining threshold values at which biologic effects are induced. An evaluation should be made as to when or where such effects are significant. Combined effects of microwaves and of other environmental factors should be investigated. Attention should be paid to investigations of bioeffects induced at various MW/RF bands.

There is a need for further research to clarify and improve our understanding of interaction of microwave and radiofrequency radiation with biological systems at all levels of organization to provide

information and improve our understanding of the implications (if effects are established) for: a) cumulative effects, b) delayed effects, c) differential sensitivity (i.e., sensitivity as a function of a selected system or stage of development).

It was recommended that the WHO/EURO continue to foster and wherever possible, provide the encouragement and the environment for exchange and interaction between the physical and biological scientists from different laboratories and institutions. A fellowship program to implement this interaction was highly recommended.

The Evaluation Group recommended that WHO/EURO evaluate the requirements on pacemaker susceptibility which will permit freedom from interference in any fields likely to be encountered by a patient and to review the practices regulating the siting of transmitters near hospitals.

It was also suggested that WHO/EURO evaluate the use of microwave diathermy and make suggestions as to whether an epidemiologic survey of groups of patients exposed to high levels of microwaves or other electromagnetic radiations could contribute to knowledge as far as the tolerance level of the human eye and brain are concerned. Although protection guides and personnel exposure standards have been recommended or introduced into the legislation in various parts of the world, there is, nevertheless, lack of uniformity, and, in many cases, either misinterpretation or lack of understanding of some of these standards. Whereas in the field of ionizing radiations such groups as the International Commission on Radiation Protection (ICRP), the International Commission on Radiological Units and Measurements (ICRU), and International Labor Organization (ILO) have effectively brought order and agreement into the field on an international scale, this is not true in regard to RF/MW exposure. At its last meeting (Wash., D.C., September, 1973) the International Radiation Protection Association (IRPA) included nonionizing radiation as part of its program. It was recommended that coordination of RF/MW protection guides and personnel exposure standards be fostered, an activity in which WHO/EURO can play an important role. It was further recommended that WHO/EURO undertake a survey of product performance standards for microwave emitting devices, with a view towards consistency with personnel exposure standards and standardization whether official or non-governmental.

The evaluation Group finally recommended that WHO/EURO set up a course for health physicists and public health officials responsible for the evaluation of MW and RF radiation. Such a course should make the participants conversant with the field from the physical, the biological, as well as regulatory aspects.

These activities and recommendations should permit us to realistically assess the potential hazards related to the use of nonionizing radiation emitting devices, especially when large amounts of energy are transmitted. There is little doubt that international rules for the use of some of these radiant energies are needed. Before workable international rules for maximum exposure and regulations for manufacture can be set up, a number of conditions have to be fulfilled. Most important of these conditions is agreement based on reliable scientific evidence, credibility, and experience on the level of exposure that represents the least potential hazard to man. With such knowledge, it should be possible to formulate standards with a sufficiently large margin of safety which

would then be the protection guideline to be used anywhere in the world. In this way can the full potential for use of these energies be developed without hazard to mankind.

References

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