Bluetooth p87 others App E

Volume 15 No.5 2004

Documents of the NRPB

Mobile Phones and Health 2004

Report by the Board of NRPB

National Radiological Protection Board

Headquarters
Chilton, Didcot,
Oxfordshire OX11 0RQ

www.nrpb.org

Working in partnership with the Health Protection Agency

51 **The Board welcomes the research programme that the Home Office has established. This includes an epidemiological study on police officers who are occupationally exposed to TETRA signals.**

52 **The Board also considers that information on the location and specification of installed TETRA base stations be included in the Ofcom Sitefinder website.**

53 **The Board recommends that TETRA base stations are audited in the same way as GSM base stations.**

54 **Until much more information becomes available the Board considers that it would be premature to rule out the possibility of health effects on users of TETRA based equipment and believes that a precautionary approach should be adopted.**

Developing technologies

55 A variety of additional technologies are now being progressively developed and implemented in the field of telecommunications. New technologies include third-generation (3G) mobile telephony, wireless local area networks (WLANs), Bluetooth and ultra-wideband (UWB) technology, and radiofrequency identification (RFID) devices.

56 **The Board considers that it is important to understand the signal characteristics and field strengths arising from new telecommunications systems and related technologies, to assess the RF exposure of people, and to understand the potential biological effects on the human body.**

57 **The Board also believes it important to ensure that the exposure of people from all new and existing systems complies with ICNIRP guidelines.**

Sensitive groups

58 Populations as a whole are not genetically homogeneous and people can vary in their susceptibility to environmental hazards. There could also be a dependency on age. The issue of individual sensitivity remains an outstanding one in relation to RF exposure and one on which more information is needed.

59 IEGMP considered that children might be more vulnerable to any effects arising from the use of mobile phones. The potential for undertaking studies to examine any possible effects on children are, however, limited for ethical reasons. It was recommended in the Stewart Report that the use of mobile phones by children should be minimised and this was supported by the Departments of Health. Text messaging has considerable advantages as the phone is in use for only a short time, when the phone transmits the message, compared with voice communication.

60 **The Board concludes that, in the absence of new scientific evidence, the recommendation in the Stewart Report on limiting the use of mobile phones by children remains appropriate as a precautionary measure.**

61 **The Board also welcomes an initiative by the World Health Organization in its EMF programme to focus attention on research relevant to the potential sensitivity of children.**

62 Additionally, there is concern by an increasing number of individuals, although relatively small in relation to the total UK population, that they are adversely affected by

ICNIRP Statement

whether the basic restrictions are likely to be exceeded. ICNIRP recommends the use of reference levels as a general guidance for limiting exposures of workers and of the general public.

The basic restriction-reference level strategy depends on an understanding of the interaction mechanism and the appropriate development of dosimetric relationships. In some circumstances, an adverse effect may be identified, but the exposure limitation can only be described in terms of the external exposure. In such cases, reference levels may be used to control the exposure directly.

Depending on the specific biophysical mechanism involved in the interaction process, the exposure condition relevant for the biological effect of the non-ionizing radiation can be quantified either in terms of the instantaneous level (or time-dependent function thereof) of the biologically effective parameter or as its time integrated value. Examples of the use of the former include interaction processes involving the heating of tissue (for example infrared absorption rate) and of the latter photochemical processes (for example blue-light effects and ultraviolet radiation induced erythema).

Tables 1 and 2 summarize currently established mechanisms of interaction, adverse effects, biologically effective quantities, and corresponding external exposure parameters across different parts of the NIR spectrum.

People being protected

Different groups in a population may have differences in their ability to tolerate a particular NIR exposure. For example, children, the elderly, and some chronically ill people might have a lower tolerance for one or more forms of NIR exposure than the rest of the population. Under such circumstances, it may be useful or necessary to develop separate guideline levels for different groups within the general population, but it may be more effective to adjust the guidelines for the general population to include such groups.

Some guidelines may still not provide adequate protection for certain sensitive individuals nor for normal individuals exposed concomitantly to other agents, which may exacerbate the effect of the NIR exposure, an example being individuals with photosensitivity. Where such situations have been identified, appropriate specific advice should be developed within the context of scientific knowledge.

In some circumstances, it may be advisable to distinguish between members of the general public and individuals exposed because of or while performing their work tasks (occupational exposure). In its exposure guidelines, ICNIRP distinguishes occupational and public exposures in general terms. When applying the guidelines to specific situations, it is ICNIRP's opinion that the relevant authorities in each country should decide on whether occupational or general public guideline levels are to be applied, according to existing (national) rules or policies. Environmental conditions may also influence the effect of whole-body exposure to optical or RF radiation.

Many forms of NIR find application in medical practice, often at exposure levels that are much greater than those to which the general population might be exposed. In the case of patients receiving NIR exposures as a part of their medical treatment, ICNIRP considers that the provision of advice on such exposures lies outside the scope of its exposure guidelines. Seriously ill patients might be considered as more vulnerable when exposed to NIR, but ICNIRP guidelines do not consider these potential vulnerabilities because such patients are under active medical management.

The distribution of levels of exposure and the fraction of the population that may be exposed at each level are important factors in relation to exposure guidelines for NIR. Often there are few data on such distributions, but where they exist, they can provide an important insight as to the social and economic impact of implementation of recommended guidelines for NIR exposure.

The use of reduction factors

The identification and quantification of various adverse effects of NIR exposure on health and wellbeing are difficult at best, and such judgements require extensive experience and expertise. Uncertainties in the knowledge are compensated for by reduction factors, and the guidelines will accordingly be set below the thresholds of critical effects. Some of the immediate effects can be quantified with reasonable precision, and derivation of guidelines will not require a substantial reduction below the observed threshold levels. When the precision and certainty of the relationship between exposure and adverse outcome is lower, a larger reduction may be warranted. There is no definite basis for determining the precise magnitude of the reduction factors, and the choice of the reduction is a matter of scientific judgement. As with all the procedures, setting reduction factors should be free of vested commercial interest.

Some examples of sources of uncertainty about exposure-effect threshold levels include the extrapolation of animal data to effects on humans, differences in the physiological reserves of different people with corresponding differences in tolerance, and statistical uncertainties (confidence limits) in the dose-response function. In ICNIRP's view, uncertainty in measurements used to implement the guidelines is a problem more appropriate to the functions of organizations responsible for the development of compliance methods. It is not considered in the setting of reduction factors by ICNIRP.

It should be noted that the use of reference levels may, in many cases, result in additional reductions as they correspond to basic restrictions only under maximum absorption or coupling.

Approaches to risk management

The ICNIRP approach to providing advice on limiting exposure to NIR necessarily requires well-based scientific data related to established health effects. When, in the absence of sufficient scientific evidence for the existence of a suspected adverse health effect, there are

ICNIRP Statement

calls for protective measures, a number of approaches to risk management have been applied. These approaches generally center on reducing needless exposure to the suspected agent. However, ICNIRP emphasizes the need to ensure that the practical manner in which such approaches are applied should not undermine or be to the detriment of science based exposure guidelines.

ICNIRP notes the clarification afforded by the European Commission (CEC 2000; Foster et al. 2000) on the practical application of one such approach, the Precautionary Principle. For example, this includes the degree to which the Principle is based on the science (requiring an evaluation of risk research), and the provisional nature of measures pending further acquisition of scientific data.

CONCLUDING REMARKS

This document describes the philosophy and general methodology by which ICNIRP evaluates the scientific literature on possible health risks of non-ionizing radiation, and the procedures by which ICNIRP uses such data in formulating its advice on non-ionizing radiation exposure. In practice, the critical steps in applying these general procedures may differ across the non-ionizing radiation spectrum. Several steps in these procedures require scientific judgement, e.g., on reviewing the scientific literature and determining appropriate reduction factors.

This document provides a transparent general framework for these procedures. Descriptions of procedures and deliberations specific to various frequency or wavelength regions and sources of information are disseminated by ICNIRP in its scientific reviews, guidelines, statements, and practical guides. Through its independence and structure as described in this document, ICNIRP is also well placed to consult widely on these issues.

Acknowledgments-The support received by ICNIRP from the International Radiation Protection Association, the World Health Organization, and the French, German, Korean, and Swiss Governments is gratefully acknowledged.

REFERENCES

Commission of the European Community. Communication on the Precautionary Principle. Brussels, February 2, 2000. Available at http://europa.eu.int/comm/dgs/health_consumer/library/pub/pub07_en.pdf.

Food and Drug Administration. Good laboratory practice for non-clinical laboratory studies. Washington, DC: Food and Drug Administration, US Department of Health and Human Services; Fed Reg 21 CFR Ch: 1 (4-1-93 Edition), Part 58:245–258: 1993.

Foster KR, Vecchia P, Repacholi MH. Risk management: Science and the Precautionary Principle. Science 288:979–981; 2000.

Hill AB. The environment and disease: Association or causation? Proc R Soc Med 58:295–300: 1965.

International Agency for Research on Cancer. Monographs on the evaluation of carcinogenic risks of humans: Preamble Lyon, France: International Agency for Research on Cancer; 1995.

National Toxicology Program. Specification for the conduct of studies to evaluate the toxic and carcinogenic potential of chemical, biological and physical agents in laboratory animals for the National Toxicology Program (NTP). Attachment 2. August 1992 (including modifications through 9/95). Available from: National Institute of Environmental Health Sciences, Environmental Toxicology Program, PO Box 12233, Research Triangle Park, NC 27709; 1992.

Rothman KJ, Greenland S. Modern epidemiology. Philadelphia: Lippincott-Raven; 1998.

APPENDIX

Criteria for the design and evaluation of single studies

The following criteria are primarily intended for use when designing, conducting, and reporting a single study. By their nature, these criteria can also be used as a guide in evaluating studies. It should be kept in mind, however, that useful complementary data might be obtained also from studies that do not fulfil these criteria.

Epidemiological studies

Investigations of associations in people between exposure levels and adverse health effects can utilize both human laboratory and epidemiological studies (for laboratory studies, see below). Epidemiological studies require the fulfillment of a number of criteria that effectively take into account and reduce the possible impact of bias, confounding, and chance variation in the interpretation of results. Guidelines on the conduct of high-quality epidemiology have been given, e.g., by Rothman and Greenland (1998). A summary is given below.

- The study design should attempt to gain maximum efficiency, both in reaching study objectives and in utilizing resources. Depending on the nature of suspected relationships between exposure and adverse health effects, as well as the specific study aim, various designs, such as case-control or cohort, may be appropriate.
- Ascertainment of an adequate population sample size and statistical power should be based on prior statistical evaluation.
- In cohort studies, the study populations should be well defined from the outset. Hypotheses to be investigated must be explicitly and clearly stated. The manner by which cases of adverse health are ascertained must also be clearly stated, and case identification must be independent of exposure.
- In case-control studies, controls should be appropriately chosen, taking into account the specific study aim. This enables the study to minimize the impact of factors other than those under study.
- Regardless of study design, the minimization of non-response, non-participation, and incomplete follow-up