

**RESPONSE TO QUESTIONS AND COMMENTS ON THE
GUIDELINES FOR LIMITING EXPOSURE
TO TIME-VARYING ELECTRIC, MAGNETIC, AND
ELECTROMAGNETIC FIELDS (up to 300 GHz)***

- 1) *Question:* What dosimetric models were used by ICNIRP to derive the reference levels from the basic restrictions?

Answer: To a limited extent, the ICNIRP guidelines provide a description of the dosimetric models that were used, and give references to the primary literature describing these models in detail. However, for purposes of brevity, ICNIRP decided not to include a detailed discussion of these dosimetric models in its published guidelines.

- 2) *Question:* On which specific data are the guidelines for magnetic fields at frequencies less than 4 Hz based?

Answer: The guidelines for magnetic fields below 4 Hz are ramped in a manner that joins the ELF reference levels with the values previously recommended by ICNIRP for static fields, i.e., at 0 Hz (ICNIRP. Guidelines on limits of exposure to static magnetic fields. Health Physics 66:100-106; 1994), and they are not based on specific biological studies.

- 3) *Question:* Why was 10 g chosen as the averaging mass without defining a regular tissue geometry?

Answer: The 10 g of tissue is intended to be a mass of contiguous tissue with nearly homogeneous electrical properties. In specifying a contiguous mass of tissue, ICNIRP recognizes that this concept can be used in computational dosimetry, but may present difficulties for direct physical measurements. A simple geometry such as a cubic tissue mass can be used provided that the calculated dosimetric quantities have conservative values relative to the exposure guidelines.

- 4) *Question:* Is the 10 g averaging mass appropriate for the limbs of the body?

Answer: ICNIRP recognizes that, under certain exposure conditions, the localized SAR basic restrictions for occupational and general public exposures may be exceeded in the wrist by a small amount. However, this condition is not

considered to present any significant health risk.

- 5) *Question:* Would exposure to RF fields at the reference levels recommended for workers or members of the general public lead to an increase in body temperature?

Answer: Adherence to the ICNIRP guidelines under either occupational or public exposure conditions would prevent an increase in temperature to levels that lie outside of the normal range of variation associated with body functions.

- 6) *Question:* Under certain circumstances, the fields emanating from appliances and machine tools can exceed the ICNIRP reference levels. Is there a problem with adhering to the ICNIRP guidelines under these circumstances?

Answer: ICNIRP recognizes that a number of common devices emit localized fields in excess of the reference levels. However, this generally occurs under conditions of exposure where the basic restrictions are not exceeded because of weak coupling between the field and the body.

- 7) *Question:* What is the rationale for recommending a public exposure guideline of 5 kV m⁻¹ at 50 Hz and 4.17 at 60 Hz?

Answer: The reference levels for electric fields at power frequencies were set to limit indirect effects of contact with electrical conductors in the field. Provided that adverse health impacts of indirect effects of exposure (such as microshocks) can be avoided, ICNIRP recognizes that the general public reference levels at power frequencies can be exceeded provided that the basic restriction of 2 mA m⁻² is not surpassed. In many practical exposure situations external power frequency electric fields at the reference levels will induce current densities in central nervous tissues that are well below the basic restrictions. Recent dosimetry calculations indicate that the reference levels for power-frequency magnetic fields are conservative guidelines relative to meeting the basic restrictions on current density for both public and occupational exposures (Dimbylow, P.J. Induced current densities from low-frequency magnetic fields in a 2 mm resolution, anatomically realistic model of the body. Phys. Med. Biol. 43:221-230; 1998).

- 8) *Question:* Why did ICNIRP not recommend guidelines for pulsed and/or transient fields at low frequencies?

Answer: ICNIRP has provided frequency-dependent basic restrictions and reference levels from which a hazard assessment and exposure guidelines on

* This response was published in Health Physics 75 (4), 438-439; 1998

pulsed and/or transient sources can be derived. A conservative approach involves representing a pulsed or transient EMF signal as a Fourier spectrum of its components in each frequency range, which can then be compared with the ICNIRP reference levels for those frequencies. The summation formulae for simultaneous exposure to multiple frequency fields given in the ICNIRP guidelines can also be applied for purposes of determining compliance with the ICNIRP basic restrictions.

- 9) *Question:* Why does ICNIRP not recommend higher basic restrictions or reference levels on exposure to ELF fields when exposures are of short duration?

Answer: The basic restrictions for ELF fields are based on established adverse effects on the central nervous system with a safety factor included. Such acute effects are essentially instantaneous, and it is ICNIRP's view that there is no scientific justification to modify the basic restrictions for exposures of short duration.

- 10) *Question:* Is the basic restriction of 10 mA m^{-2} based only on the threshold for acute effects in the central nervous system, or does it apply to other tissues in the trunk of the body?

Answer: The basic restriction of 10 mA m^{-2} is intended to protect against acute exposure effects on central nervous system tissues in the head and trunk of the body, with a safety factor of 10. ICNIRP recognizes that this basic restriction may permit higher current densities in body tissues other than the central nervous system under the same exposure conditions.

- 11) *Question:* Why are there no averaging times for induced and contact currents at low frequencies?

Answer: ICNIRP has not included time averaging or limitations on the time of exposure to fields at low frequencies because the known effects of induced and contact currents at those frequencies are acute phenomena involving a rapid response of the nervous system.

- 12) *Question:* Does ICNIRP intend to modify its guidelines at 300 GHz to remove the discontinuity that occurs at this frequency between the EMF guidelines and the recently published laser guidelines (ICNIRP. Guidelines on limits of exposure to laser radiation of wavelengths between 180 nm and $1,000 \mu\text{m}$, Health Physics 71:804-819; 1997)?

Answer: ICNIRP recognizes that a discontinuity exists in the EMF guidelines at

300 GHz relative to the exposure limits at this frequency in the recently published laser radiation guidelines. This difficulty will be addressed by ICNIRP as more experimental evidence becomes available upon which to base a revision of the guidelines at this frequency. It should be noted that, at the present time, there are no sources of radiation at this frequency to which workers or members of the general public are exposed.

- 13) *Question:* What is the basis for the added safety factors used for basic restrictions and reference levels for the general public relative to workers?

Answer: The safety factors used by ICNIRP are conservative, and were selected for reasons given in the published guidelines (p. 508).

- 14) *Question:* Are there scientific data indicating a variation in sensitivity to EMF among individual workers or members of the general public?

Answer: ICNIRP is aware of scientific data on variations among individuals in electrical and thermal sensitivity, and in accord with conventional health protection principles, has applied safety factors that encompass a possible range of individual sensitivities to EMF.

- 15) *Question:* It is not clear how the EMF guidelines should be applied to exposure of the fetus, especially when the mother is at work. Would the mother be subject to the general public exposure guidelines, and in certain cases, have to cease work during pregnancy as a result?

Answer: ICNIRP recognizes that exposure of the fetus and pregnant mother may require evaluation on a case-by-case basis. Exposure of the fetus and pregnant mother is an issue that should be dealt with on the basis of either national policy or administrative rules established by individual employers.

- 16) *Question:* For devices utilized in both occupational and public settings, how is the user of the ICNIRP guidelines to decide which set of basic restrictions apply?

Answer: This decision is to be made on the basis of administrative policies established by the specific organization using the ICNIRP guidelines.

- 17) *Question:* Are farm workers in fields under powerlines expected to adhere to occupational or general public exposure guidelines?

Answer: ICNIRP recognizes that differences exist in national policies on occupational versus public exposures under this (and similar) conditions. In its

guidelines ICNIRP has defined occupational and public exposures in general terms. However, for exposure situations such as the above, it is ICNIRP's opinion that authorities in each country should decide on whether occupational or general public guidelines are to be applied in accord with existing policies.