

STATEMENT FROM THE 1987 COMO MEETING OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

The Commission met from September 7 to 17, 1987 with its four standing committees, the meeting having a total membership of 75 scientists from 20 countries working in a range of different fields. Observers from CEC, COMECON, IAEA, ICPEMC, ICRU, IEC, IRPA, OECD/NEA, UNEP, UNSCEAR and WHO also participated.

The ICRP Basic Recommendations

The Commission is presently revising its basic recommendations which were presented in *ICRP Publication 26* in 1977¹ and in a number of subsequent statements and amendments^{2,3,4,5,6,7} as well as in other ICRP reports (e.g. Publications 33,⁸ 37,⁹ 39,¹⁰ 40,¹¹ 41¹² and 46¹³).

The objective of the revision is to review and update these policy statements for consistency and to produce a single set of basic recommendations, presented as clearly and unambiguously as possible, supported by explanations and references to current scientific information. The revised recommendations are expected to be completed by 1990 after preparatory work by the Commission's four expert committees and a number of ad hoc task groups. This work includes a review and re-assessment of the complete system of dose limitation, including the values of the dose limits.

Cancer Risk Assessments

In this connection, current work on assessing the cancer risk per unit effective dose equivalent is of great importance. Comprehensive reviews of risk are being carried out for example by UNSCEAR and by the US BEIR-5 committee, as well as by the Commission's own Committee 1 on Biological Effects. The results of several studies are expected to be available in less than two years.

The Commission regularly examines papers relating to risk and in this regard a very recently published technical report of the Radiation Effects Research Foundation, "The effect of changes in dosimetry on cancer mortality risk estimates in the Atomic Bomb survivors", by D. L. Preston and D. A. Pierce,¹⁴ was examined by the Commission and by its Committee 1.

This report was recognized as giving a definitive account of the average changes in organ dose estimates from exposure to the atomic bombs in Hiroshima and Nagasaki, and of the resultant increase in estimated risks of cancer induction. Under the new "DS86" dosimetry, this increase in risk is reported as being by a factor of about 1.4 compared with the risk that would have been estimated by the former "T65D" dosimetry, assuming a reasonable relative biological effectiveness of such neutron exposure as is likely to have occurred in the two cities.

In addition, although not strictly an effect of the new dosimetry, the longer follow-up (to 1985) of the population sample for whom "DS86" doses are available so far, makes possible a more reliable estimate than previously, of a group who were young (less than 10 years) at the time of exposure. This inclusion and other factors cited in the paper raise the risk estimate for the exposed population by a total factor of the order of 2. This change is for a population of all ages, whereas for a worker population of ages 18-65 the change will be smaller. This information alone is therefore not considered sufficient to warrant a change in the dose limits for occupational exposure.

For the general population, the increase in risk indicated by the new data is also not considered to require change in recommended dose limits, following the reduction (in 1985) in the principal limit from 5 to 1 mSv in a year (from sources other than medical and natural background radiation).⁶

Substantially larger changes in the Commission's present risk estimates for cancer induction would, however, result from two further factors. Firstly, if it was established that the effects of any dose would be to cause a constant proportional general increase in the subsequent normal rate of cancer at all ages (after an initial "latency" of 5 to 10 years). Such a "relative risk" model of predicted cancer induction appears to describe the data available so far for breast cancer and probably for two other forms of cancer (of lung and of the intestines). It can be rejected for two other forms (leukaemia and bone cancer) for which the appearance of new cases has completely (for bone) or largely (for leukaemia) ceased within 25 years of the exposure. It remains uncertain for which other cancers such a "relative risk" model applies, and whether it applies with a constant relative factor of increase for the full remainder of life after exposure. This potentially important subject remains under investigation. Secondly, the shape of the dose-response curve is also an important factor in the assessment of the risk at low doses from observations at high doses. A reduction factor was used in the report by Preston and Pierce. This relationship requires further study.

Since the risk data are yet far from conclusive, the Commission will await the result of the comprehensive evaluations of its sources of epidemiological information that are currently being made, before judging the consequences for the revision of its system of dose limitation.

In the meantime it will be prudent to follow the present recommendations on dose limitation as they were intended to be interpreted. When this is done, the value of the dose limits, in most cases, will not be the controlling factor in the restriction of doses; therefore the final judgement on the choice of dose limits can await full scientific review without any serious consequences.

This is so because the requirement to keep all doses "as low as reasonably achievable" (optimization) should in most situations keep the doses far below the dose limits. The Commission wishes to re-emphasize its view, expressed in *Publication 26*,¹ that exposure near the dose limits would only be acceptable if a dose reduction is not reasonably achievable and the practice has been found justified. The limits are not intended for planning purposes but rather indicate the borderline to risk levels that must be considered unacceptable. Exposures below the dose limits are only acceptable if they are "as low as reasonably achievable".

Risk of Mental Retardation

A review is also in preparation on the effect of the new dosimetry on the estimate of risks of severe mental retardation being caused by exposure of children to radiation during their development *in utero*. It was shown about three years ago¹⁵ that this effect might be caused during the period of 8 to 15 weeks after fertilization, and, with less sensitivity, from 16 to 25 weeks after fertilization, but without detectable sensitivity for induction of these effects at other periods of pregnancy. ICRP published an important document¹⁶ estimating a zero threshold dose of causation of these effects in the earlier, 8 to 15 weeks, period, although indicating rather wide confidence intervals for this estimate.

The new dosimetry does not, of course, change the gestational ages of importance. Preliminary information, however, indicates that the estimated risk may be increased somewhat with the new dosimetry, from an average of about 40% to 45% per Gy in the more sensitive period.

It is potentially important for radiation protection, that preliminary analyses presented to the Commission's Committee I on Biological Effects indicate that significant thresholds may exist.

Radon in Spas

In recent years, the ICRP has been made aware of the widespread practice of deliberately exposing people to radon in spas or sanatoria. In its recent *Publication 50*¹⁷ "Lung Cancer Risk from Indoor Exposures to Radon Daughters", the Commission provided estimates of the risk of lung cancer associated with exposure to radon. Since this radiation exposure is clearly controllable, the ICRP recommends that its system of dose limitation should apply. For those practices that are identified as being part of medical treatment, those elements of the system of dose limitation which apply to medical application of radiation are relevant. These are that the practice should be justified and protection optimized. That is, such exposures should take place if, and only if, national authorities and the individual practitioners are satisfied that the procedure has a positive net benefit for the patient and that the exposure is reduced to levels judged to be efficacious. Those benefit balances should be established using the techniques of efficacy analysis outlined in *ICRP Publication 44*¹⁸ "Protection of the Patient in Radiation Therapy".

With respect to persons exposed while at work in such facilities, the entire system of dose limitation would apply. This would require, in addition to justification and optimization, the application of the dose limit, and all other relevant recommendations given for workers in *ICRP Publications 26*¹ and *32*.¹⁹

There are also reports of purely recreational use of radon exposure. The Commission reminds those concerned that such practices carry an enhanced risk of lung cancer.

Reference Terms for Estimates of Radiation Dose for X-ray Mammography

X-ray mammography is being used increasingly and, in many countries, efforts have been made to undertake risk-benefit and cost-benefit studies for x-ray mammography applied to various age groups. At present there is considerable variation in the way the radiation dose is expressed and there is a need for standardization so that an adequate assessment of radiation dose may be made, and for such estimates to be comparable from country to country.

The female breast is a composite of adipose and glandular tissues. The glandular tissue, including the acinar and ductal epithelium and associated stroma, is more vulnerable to radiation carcinogenesis than the skin, adipose tissue, or areola. Therefore, the average absorbed dose in the glandular tissue, excluding the skin layer, is the preferred quantity for assessing radiation risk from x-ray mammography. Other quantities, such as average absorbed dose in the whole breast, in the skin, or in a small volume of tissue at the midplane of the breast, have been used in the past as a convenience, in the absence of specific data on average absorbed doses in the glandular tissue. There are now extensive data available that permit calculation of average absorbed dose in the glandular tissue,^{20,21} and therefore the use of the preferred quantity can be implemented readily.

Most women undergoing routine x-ray mammography without symptoms are 40 years of age or older. Therefore, the reference breast should have a tissue composition with substantial adipose content to take account of this. A composition of 50% adipose and 50% glandular tissue distributed uniformly in the breast has been adopted by investigators in the field.^{20,22,23,24}

The critical dimension affecting absorbed dose to the breast in x-ray mammography is

thickness of the breast. In x-ray mammography, the breast is compressed to achieve better images, either by firm compression to a nearly uniform thickness, or by less compression which results in a conical geometry. A uniform breast thickness after firm compression has been adopted as a reference dimension.^{20,22,23,24}

The Commission therefore recommends that the usual reference terms for radiation dose estimation from x-ray mammography be the average absorbed dose in the glandular tissue (excluding skin) in a uniformly compressed breast of 50% adipose, 50% glandular tissue composition. The reference breast thickness should be specified.

Addendum to ICRP Publication 30

The Commission approved an Addendum to ICRP Publication 30 in which revised ALI's and DAC's are given for Neptunium, Plutonium, Americium, Curium, Berkelium, Californium, Einsteinium, Fermium and Mendelevium. In addition ALI's and DAC's are given for the first time for several radionuclides for which transformation data was given in *ICRP Publication 38*.²⁵ These are ⁸²Sr, ^{95m}Tc, ⁹⁵Tc, ¹¹⁶Sb and ¹³⁴La. This addendum will be published in the *Annals of the ICRP*.

Publications of the ICRP

*ICRP Publication 50*¹⁷ has recently been published. This report relates specifically to the risk associated with indoor exposure to inhaled radon daughters. The results indicate that, although it is considered that cigarette smoking remains the major cause of lung cancer in many countries, a significant fraction of the observed lung cancer frequency in populations may be attributed to indoor exposure to ²²²Rn daughters.

Forthcoming reports are:

ICRP Publication 51—Data for use in protection against external radiation

ICRP Publication 52—Protection of the patient in nuclear medicine

ICRP Publication 53—Radiation dose to patients from radiopharmaceuticals

ICRP Publication 54—Individual monitoring for intakes of radionuclides by workers: Design and interception

These reports should be available within the next 6 months from Pergamon Journals Ltd., Oxford, England.

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