

THE CURRENT ACTIVITIES OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

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ABSTRACT

ICRP was established in 1928 as the International X-ray and Radium Protection Committee. In 1950 the name was changed to reflect the wider scope of radiological protection. The present memberships of the Main Commission and its four Committees serve until July 2001. The four Committees are concerned with: (a) Biological Effects, Chaired by Roger Cox (UK); (b) Dosimetric Conversion Coefficients, Chaired by Alexander Kaul (Germany); (c) Protection in Medicine, with Fred Mettler (USA) Chairing; and (d) Application of the Commission's Recommendations, Chaired by Bert Winkler (South Africa).

An outline of the progress of the four Committees is given here which represents the present priorities that ICRP has set during its four-year term. This will cover the recent publications approved by the Commission, but not yet published, together with reports on the progress of the Task Groups of each Committee. The way by which the Commission works is that, when any Committee has identified a subject on which it wishes to develop guidance, it proposes that the Main Commission appoints a Task Group. This will be Chaired by a Member of the Committee that proposed it, and composed of Members most of whom are likely not to be members of the Committee. The work of the Task Groups thus gives an indication of the topics which the Main Commission and the Committees consider to be the most important over their term of office. In addition, the Committees have Working Parties composed solely of members of that Committee and which review topics that may eventually be proposed as Task Groups. The programmes of the Working Parties will also be described.

The Main Commission itself is beginning to think about developing a position on the protection of the environment from radiation as well as consolidating its recommendations to incorporate policy points that have been promulgated since Publication 60.

INTRODUCTION

The primary body in radiological protection is ICRP. It was formed in 1928 as the International X-ray and Radium Protection Committee, but adopted its present name in 1950 to reflect its growing involvement in areas outside that of medicine, where it originated. The main Commission consists of a chairman and 12 other members, elected for their contributions to the field of radiation protection, rather than by country, and they serve for 4 years. The Commission has four standing Committees on, Radiation Effects, Doses from Radiation Exposure, Protection in Medicine, and Application of the Commission's Recommendations. The present Commission and Committees serve from 1997 to 2001. This paper presents an overview of that work and summarises recent publications adopted by the Commission.

According to its constitution,

ICRP is established to advance for the public benefit the science of Radiological Protection, in particular by providing Recommendations and guidance on all aspects of radiation protection. In preparing its recommendations, ICRP considers the fundamental principles and quantitative bases upon which appropriate radiation protection measures can be established, while leaving to the various national protection bodies the responsibility of formulating the specific advice, codes of practice, or regulations that are best suited to the needs of their individual countries.

The activities of ICRP are financed mainly by voluntary contributions from national and international bodies with an interest in radiological protection. Some additional funds accrue from royalties on *ICRP Publications*. Members' institutions also provide financial support to ICRP by making the members time available without charge and, in many cases, contributing to their costs of attending meetings.

ICRP works closely with its sister Commission, ICRU, and has relationship with many other bodies, e.g. within the United Nations structure, with IAEA, ILO, PAHO, UNEP, UNSCEAR, and WHO; other bodies include IEC, ISO, OECD/NEA, and IRPA. The relationships imply exchange of information; it must be stressed that ICRP and the various bodies mentioned are completely independent of each other.

ICRP has always been an advisory body, offering its recommendations to regulatory and advisory agencies at international, regional, and national levels. In addition, ICRP hopes that its advice is of help to management bodies and professional staff with responsibilities for radiological protection in their own operations. No international organisation and no country is obliged to follow the recommendations of ICRP; that most organisations and countries do follow them shows that upon critical scrutiny, many regulatory bodies find the ICRP recommendations suitable.

The method of working within ICRP and its Committees is also perhaps worth noting. When a Committee decides that it would wish to develop guidance on a particular issue, it proposes a Task Group on the subject to the Main Commission who approve its terms of reference and membership including the chairman, who will be a member of the sponsoring Committee. The other Task Group members will probably not be members of any Committee of ICRP. This procedure is necessary because the Commission supports the travel and subsistence costs of the Task Group meetings. In addition, the chairman of any Committee may appoint a Working Party within the Committee, which is composed of one or more members of the Committee. The Commission takes no financial responsibility for Working Parties and they are usually formed to prepare papers for the Committee and their work often leads to the formation of a Task Group. Thus, ICRP is an independent international network of specialists in various fields of radiological protection. At any one time, about one hundred eminent scientists from all over the world are actively involved in the work of ICRP. The four-tier structure of ICRP provides a rigorous and time-proven Quality Management system of scrupulous peer review for the production of *ICRP Publications*. It is through those *Publications* that ICRP performs its primary task of providing recommendations and guidance on radiological protection.

NEW PUBLICATIONS

The Commission has adopted four reports for publication in the *Annals of the ICRP following the most recent Publication 79 on Genetic Susceptibility to Cancer* and *Publication 80 on Radiation Doses to Patients from Radiopharmaceuticals (Addendum 2 to ICRP Publication 53 and Addendum 1 to Publication 72)*.

Publication 81 is Radiation Protection Recommendations as Applied to the Disposal of Long-lived Solid Radioactive Waste. This report deals with the radiological protection of members of the public following the disposal of long-lived solid radioactive waste using the 'concentrate and retain' strategy. It covers options including shallow land burial and deep geological disposal. The recommendations made in this report apply to new disposal facilities where there is the opportunity for their implementation during the site selection, design, construction and operational phases; they should also be taken into account in justification decisions involving practices generating waste. A major issue in evaluating the acceptability of a disposal system for long-lived solid radioactive waste is that doses or risks may arise from exposures in the distant future. There is uncertainty surrounding any estimate of these doses or risks due to lack of knowledge about future conditions. Such exposures are treated as potential exposures as their magnitude depends on future processes and conditions that have probabilities associated with them.

Nevertheless, the Commission recognises a basic principle that individuals and populations in the future should be afforded at least the same level of protection from the action of disposing of radioactive waste today as is the current generation. This implies use of the current quantitative dose and risk criteria derived from considering associated health detriment. Therefore, protection of future generations should be achieved by applying these dose or risk criteria to the estimated future doses or risks in appropriately defined critical groups. These estimates should not be regarded as measures of health detriment beyond times of around several hundreds of years into the future. In the case of these longer time periods, they represent indicators of the protection afforded by the disposal system.

Two broad categories of exposure situations should be considered: natural processes and human intrusion. The latter only refers to intrusion that is inadvertent. The radiological implications of deliberate intrusion into a repository are the responsibility of the intruder. Assessed doses or risks arising from natural processes should be compared with a constraint of 0.3 mSv per year or its risk equivalent of around 10^{-5} per year. With regard to human intrusion, the consequences from one or more plausible stylised scenarios should be considered in order to evaluate the resilience of the repository to such events. The Commission considers that in

circumstances where human intrusion could lead to doses sufficiently high that intervention on current criteria would almost always be justified, reasonable efforts should be made at the repository development stage to reduce the likelihood of human intrusion or to limit its consequences. In this respect, the Commission has previously advised that an extant annual dose¹ of around 10 mSv may be used as a generic reference level below which intervention is not always likely to be justifiable. Conversely, an extant annual dose of around 100 mSv per year may be used as a generic reference level above which intervention should be considered almost always justifiable. Similar considerations apply in situations where the thresholds for deterministic effects in relevant organs are exceeded.

In *Publication 82* the Commission has addressed **Principles for Protection of the Public in Situations of Prolonged Exposure**. This report provides guidance on the application of the Commission's System of Radiological Protection to *prolonged exposure* to radiation. Prolonged exposures are adventitiously and persistently incurred by the public over long periods of time. They are incidental to situations in which members of the public may find themselves. The average annual dose associated with prolonged exposures is more or less constant or decreases slowly over the years. Public exposures of a temporary nature are not covered by the report; nor are occupational and medical exposures, which are not considered prolonged exposures. The application of the justification and optimization principles to practices may introduce individual inequities which may be important when prolonged exposures are involved. In order to limit these inequities and to allow for prolonged and transitory exposures to multiple sources, stringent individual dose restrictions should be applied to the prolonged exposure expected to be delivered by individual sources and to the prolonged exposures predicted to be aggregated by all regulated practices. The exposure restrictions to sources are termed *dose constraints*; the exposure restrictions to practices are termed *dose limits*.

The Commission continues to recommend that the maximum value of the dose constraint to be used in the optimization of radiological protection for a single source should be less than about 0.3 mSv in a year. Consideration should be given to exposure situations where combinations of transitory and prolonged exposures or a buildup over time of prolonged exposures from a source could occur. In these situations it should be verified that appropriate dose assessment methods are used for ensuring compliance with the established dose constraint. The assessment should take account of any reasonably conceivable combination and buildup of exposures. If, in a particular situation, such verification of compliance is not feasible, it will be prudent to restrict the prolonged component of the individual dose from the source with a dose constraint of the order of 0.1 mSv in any given year during the operational lifetime of the source.

The principles of the System of Radiological Protection for interventions are the *justification of intervention* and the *optimization of the protective actions*. These principles should be applied to any *de facto* exposure situations involving controllable prolonged exposure. The optimization of protective actions can be performed following the general approach to optimization of protection recommended by the Commission in the context of practices. The optimum form, scale and duration of the protective actions should be selected from the justified options of intervention. For some prolonged exposure situations the restricted use of human habitats can be the outcome of the optimization process.

The use of *generic reference levels* for interventions is recommended. These levels can conveniently be expressed in terms of the existing annual dose. They are particularly useful when intervention is being considered in some situations, such as exposures to high natural background radiation and to those radioactive residues that are a legacy from the distant past. Generic reference levels, however, should be used with extreme caution. If some controllable components of the existing annual dose are clearly dominant, the use of the generic reference levels should not prevent that protective actions are taken to reduce these dominant components. These actions can be triggered by either specific reference levels or case-by-case decisions following the requirements of the System of Radiological Protection for interventions. Nor should the use of the generic reference levels encourage a 'trade-off' of protective actions among the various component of the existing annual dose. A low level of existing annual dose does not necessarily imply that protective actions should not be applied to any of its components; conversely, a high level of existing annual dose does not necessarily require intervention. With these provisos, it is considered that an existing annual dose approaching about 10 mSv may be used as a generic reference level below which intervention is not likely to be justifiable for some prolonged exposure situations. Below this level, protective actions to reduce a dominant component of the existing annual dose are still optional and might be justifiable. In such cases, action levels specific to particular components can be established on the basis of appropriate fractions of the recommended generic reference level. Above the level below which intervention is not likely to be justifiable, intervention may possibly be necessary and should be justified on a case-by-case basis. Situations in which the annual (equivalent) dose thresholds for deterministic effects in relevant organs could be exceeded should require intervention. An existing annual dose rising towards 100 mSv

1 The term extant annual dose is used by the Commission to mean the existing and persisting annual dose incurred by individuals in a given location. The exposure that may occur from a repository is a component of the extant annual dose.

will almost always justify intervention and may be used as a generic reference level for establishing protective actions under nearly any conceivable circumstance.

The third report concerns **Risk Estimation for Multifactorial Diseases.** The main conclusion is that the risk of hereditary radiation-induced disease is less than had been previously estimated. The report will give details of computer simulation studies to estimate the risk of those Multifactorial diseases that commonly occur and where both mutation and environmental factors are known to be involved. It will indicate the limitations of the model and the impact of mutational changes on gene interactions in non-equilibrium populations. The preliminary conclusion is that radiation-induced mutations at low doses are not likely to significantly influence the incidence of the commonly occurring multifactorial diseases.

The fourth report is **Age-dependent Doses to Members of the Public from Intakes of Radionuclides, Part 6. Embryo and Fetus and** covers intakes by the mother before and during pregnancy for selected radioisotopes of the 31 elements for which age-dependent biokinetic models have been given in recent publications. This report should be available next year when the full quality assurance of the dose coefficients has been completed.

COMMITTEE 1

Committee 1 of the International Commission on Radiological Protection has the responsibility for maintaining the biological effects of ionising radiation under review and developing documents that relate such effects to the needs of radiological protection. The programme of work for Committee 1 that has been agreed by the Commission will include the preparation of reports by three Task Groups:

- A review of epidemiological evidence of radiation-induced cancer at low doses and characterisation of the dose-response relationship,
- Radiation effects on developing embryo/fetus to include judgements on the risks of cancer, neurological dysfunction and other deterministic effects, and
- An evaluation of RBEs in respect of deterministic and stochastic effects

Working Parties will continue:

- to review published epidemiological studies,
- to survey developments in cell and molecular biology relevant to the effects of ionising radiation,
- to identify cells at risk,
- to provide evidence of dose and dose-rate effects from animal studies,
- to advise on genetics risks in relation to both mendelian and multifactorial disorders, and
- to survey the evidence of synergism or additivity between the effects of ionising radiations and chemical carcinogens on cells and tissues.

COMMITTEE 2

Committee 2 has the responsibility for establishing dose coefficients for internal and external exposures. This necessarily involves developing the dosimetric models to be used in the calculations. The Committee and its Task Groups have been developing a series of documents related to both external radiation and internally incorporated radionuclides. The programme of work of Committee 2 has been quite extensive following publication of the 1990 Recommendations. A number of Task Groups do exist and the major activities are: -

- Reference Man (*ICRP Publication 23*) is being revised. The Skeleton is in *Publication 70*, and Basic Anatomical and Physiological Data for Use in Radiological Protection are due next.
- Dosimetric Model for the Alimentary Tract to replace the current 1966 GI Tract model.
- Dose calculations for the new reference phantoms.

The completion of these various Committee 2 Task Group reports should coincide with the revision of *ICRP Publication 30 (Limits for Intakes of Radionuclides by Workers)*. The future programme of work of Committee 2 will include:-

- Application of the human respiratory tract model to specific materials to provide site-specific dose coefficients
- A continuing review of biokinetic and dosimetric models required for the revision of *ICRP Publication 30*
- A critical appraisal of the dosimetry of radon between the model of the respiratory tract and the epidemiological data, in conjunction with Committee 1
- Development of realistic human phantoms for dose calculation based on medical imaging
- Provision of dose coefficients on CD-ROM
- Establishment of dose conversion factors for submersion in a cloud of, or from ground contaminated at varying depths with, radioactive material

COMMITTEE 3

The responsibility of Committee 3 is radiological protection and safety in medicine. The major task following *Publication 73 on Radiological Protection and Safety in Medicine* has been the establishment of three Task Groups to produce reports on:-

- Protection in interventional radiology for both patients and staff
- Prevention of accidents in radiotherapy, and
- Advice on dealing with pregnancy in patients undergoing diagnosis or therapy, and for staff. This report is currently undergoing the process of adoption by the Main Commission.
- There already exists a Task Group on *Doses to Patients from Radiopharmaceuticals*, which produced *Publication 80* and which will continue to produce data for the future

Working Parties of Committee 3 will consider:

- radiation protection in paediatrics,
- aspects of medical radioactive waste disposal,
- the principles of radiological protection for general practitioners and medical students,
- radiation safety in nuclear medicine,
- radiation protection in computed tomography: recommendations for dose reduction,
- implications of genetic susceptibility for radiation exposure in medical practice

COMMITTEE 4

- Committee 4 of the International Commission on Radiological Protection has the responsibility to consider the practical application of the Commission's recommendations. There have been two Task Groups in existence with Committee 4, both of which have produced reports that have been adopted as *Publications 81 and 82* (see New Publications).

Working Parties of Committee 4 will be considering

- advice on the use of collective dose;
- coherence between dose levels used for the public in practices and intervention;
- survey the literature on protection of the environment,
- accident management; and
- maintenance of contact with Committee 1 on their studies on genetic susceptibility to cancer.

PROGRAMME OF THE MAIN COMMISSION

The Commission is considering whether to restate or to revise its recommendations. This would involve taking account of any new biological information, of the issues in the present text that have been extended or clarified in later reports, and of the policy issues already identified as needing reconsideration. Firstly there is a need to incorporate the philosophy from the Waste Policy document (*Publication 77*), together with key items from the medical paper (*Publication 73*), and deal with Radon (*Publication 65*), and occupational exposures (*Publication 75*).

Then there are some policies that could change. Should the 5-year averaging of dose be dropped for workers? It has already been said in *Publication 78* that for intakes of radionuclides 20 mSv committed in a year is the limit. The dose restrictions to the fetus could be clarified. Effective dose is based on an estimate of detriment – should the Commission revert to mortality? The definition of organs and tissues, especially in the remainder, needs attention, particularly when a tissue is defined as a type of cell and when the remainder is split to avoid deterministic effects.

There is also a major question as to whether to develop an individual-based protection philosophy, as outlined in the discussion paper on Controllable Dose, distributed through the constituent societies of IRPA.

Such a fundamental review involves an examination of the Commission's objectives and of the aims of its recommendations. The present recommendations emphasise the collective good and harm and apply constraints in optimisation to limit the inequity between individuals and dose limits to prevent unacceptable risks to each individual. This traditional approach could be complemented by one that emphasised the protection of individuals against the dangers from individual sources.

One effect of this change would be to ensure that individuals were adequately protected, with adequacy defined for ranges of pre-selected situations. In practice it would result in as good a level of protection as now for those individuals with any significant level of exposure. In effect, the system would provide adequate protection for individuals and society without the present theoretical emphasis on low doses to large numbers of individuals. There may not be a need to distinguish between 'Practices' and 'Interventions', nor to distinguish between different categories of exposure.

These issues are discussed more fully in the paper **Progress Towards New Recommendations from the International Commission on Radiological Protection** at this conference.