

ICRP

**2003 Annual Report
of the
International Commission
on Radiological Protection**



ICRP

ICRP Annual Report on 2003
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*Cover photo: Mallard duck.
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ICRP Publication 91, published in 2003, outlines a framework for assessing the impact of ionising radiation on non-human species. A first step towards the implementation of such a framework is the development of a limited set of reference fauna and flora. Publication 91 emphasises that in addition to various scientific and practical criteria, species to be considered must also have

‘some form of public or political resonance, so that both decision makers and the general public at large are likely to know what these organisms actually are, in common language – such as a duck’.

Our Mission Statement

**The International Commission on Radiological Protection, ICRP,
is an independent Registered Charity,
established to advance for the public benefit
the science of radiological protection,
in particular by providing recommendations and guidance
on all aspects of protection against ionising radiation.**

Chairman's Foreword

The Main Commission met on three different occasions during 2003, the middle year of its term 2001-2005. The first meeting was held in Vienna, Austria, in January, at the premises of the International Atomic Energy Agency (IAEA). The second meeting took place at Chilton, in the UK, in June hosted by the UK National Radiological Protection Board (NRPB), while the Commission met jointly with its four Committees in Buenos Aires and then itself in Bariloche, Argentina, in November courtesy of the Ministry of Foreign Affairs and the Nuclear Energy Agency. There was significant progress in the development of the next Recommendations, scheduled for publication in 2005.

I attended and presented papers at two IAEA Conferences during the year. The first on Safety and Security of Radiation sources was held in Vienna in March, and the second on Protection of the Environment took place in Stockholm in October.

There was the second OECD Nuclear Energy Agency (NEA) forum which took place during April in Lanzarote, on the future policy for radiological protection, which concentrated on stakeholder dialogue on the implications of the ICRP proposals for new recommendations. This evolved

into a definitive meeting on the scope and style of the proposed recommendations.

The Vice-Chairman and I also presented progress to US colleagues at the National Council on Radiation Protection and Measurements' (NCRP) annual meeting in Washington DC, also in April, after which I attended the NEA Steering Committee meeting in Paris.

During May there was the meeting of the Conference of Radiation Control Program Directors for the USA in Anaheim where several presentations were made on ICRP issues. In June, I presented the developing proposals for next recommendations to the Northern European Radiological Protection Societies meeting in Utrecht, to the Values in Decisions on Risk (VALDOR) Conference in Stockholm, Sweden, and the French Radiological Protection meeting in Montpellier.

There were a number of publications approved by the Commission during the year and the procedure now followed of placing documents on the website for consultation appears to be working well. There is a good flow of documents which give confidence in filling the Issues of the Annals for this year but also for 2004 and 2005.

A major decision by the Commission, during its November meeting, was to establish a fifth standing committee, Committee 5, on Protection of non-human species. This decision was taken after much international consultation and discussion, and followed a consensus that was found at the Stockholm Environment Conference in October, that it was properly the role of ICRP to take the lead in policy development in this area.

Committee 5 will commence its work in the 2005-2009 period and will be funded by reducing the number of members in each

of the present four Committees from around 17 or 18, to 14 or 15, thereby creating up to 12 members of Committee 5. The work of this Committee will be reviewed and the need for its continuation examined after two terms.

In the meantime, over the next Commission's term, 2005-2009, Committees 1 to 4 will have their roles and remits reviewed in order to revise or replace them so as to position ICRP to address the issues that face radiological protection over the coming decade.

Roger H Clarke



Professor Roger H Clarke is the Chairman of the International Commission on Radiological Protection.

The International Commission on Radiological Protection

The primary body in radiological protection is ICRP. It was formed in 1928 as the 'International X-ray and Radium Committee', but adopted its present name in 1950 to reflect its growing involvement in areas outside that of occupational exposure in medicine, where it originated.

Broad structure

ICRP consists of the Main Commission, Committee 1 (Radiation Effects), Committee 2 (Doses from Radiation Exposure), Committee 3 (Protection in Medicine), Committee 4 (Application of ICRP Recommendations), *ad hoc* Task Groups and Working Parties, and the Scientific Secretariat.

Membership

The Main Commission consists of twelve members and a Chairman, while the Committees contain between 15 and 20 members each. The Commission and its Committees run for four-year periods, from 1 July. On each occasion of a new period, at least three, and not more than five, members of the Commission must be changed. A similar rate of renewal is sought for the Committees. Such a new period began 1 July 2001, and the autumn 2004 meetings of the Commission and its Committees will be the last time that the full set of members of the 2001 – 2005 term meet.

Meetings

The Commission meets once or twice a year. Each Committee meets once a year. Twice in each four-year period, the annual meeting of the Committees is

conducted jointly and together with the Commission. These meetings are funded as necessary from monies available to ICRP.

Financing

The activities of ICRP are financed mainly by voluntary contributions from national and international bodies with an interest in radiological protection. (A list of the bodies providing such contributions in 2000 is appended at the end of this report). Some additional funds accrue from royalties on ICRP *Publications*. Members' institutions also provide support to ICRP by making the members' time available without charge and, in many cases, contributing to their costs of attending meetings.

Mode of operation

The Commission uses Task Groups and Working Parties to deal with specific areas. Task Groups are formally appointed by the Commission to perform a defined task, usually the preparation of a draft report. A Task Group usually contains a majority of specialists from outside the Commission's structure. It is funded as necessary from monies available to ICRP.

Working Parties are set up by Committees to develop ideas, sometimes leading to the establishment of a Task Group. The membership of a Working Party is usually limited to Committee members. Working Parties receive no funding of their own, *i.e.* they operate primarily by correspondence and by meetings in direct conjunction with meetings of the Committee concerned.

These activities are co-ordinated with a minimum of bureaucracy by a Scientific Secretary, ensuring that ICRP recommendations are promulgated.

Thus, ICRP is an independent international network of specialists in various fields of radiological protection. At any one time, about one hundred eminent scientists are actively involved in the work of ICRP. The four-tier structure described provides a rigorous Quality Management system of peer review for the production of ICRP Publications.

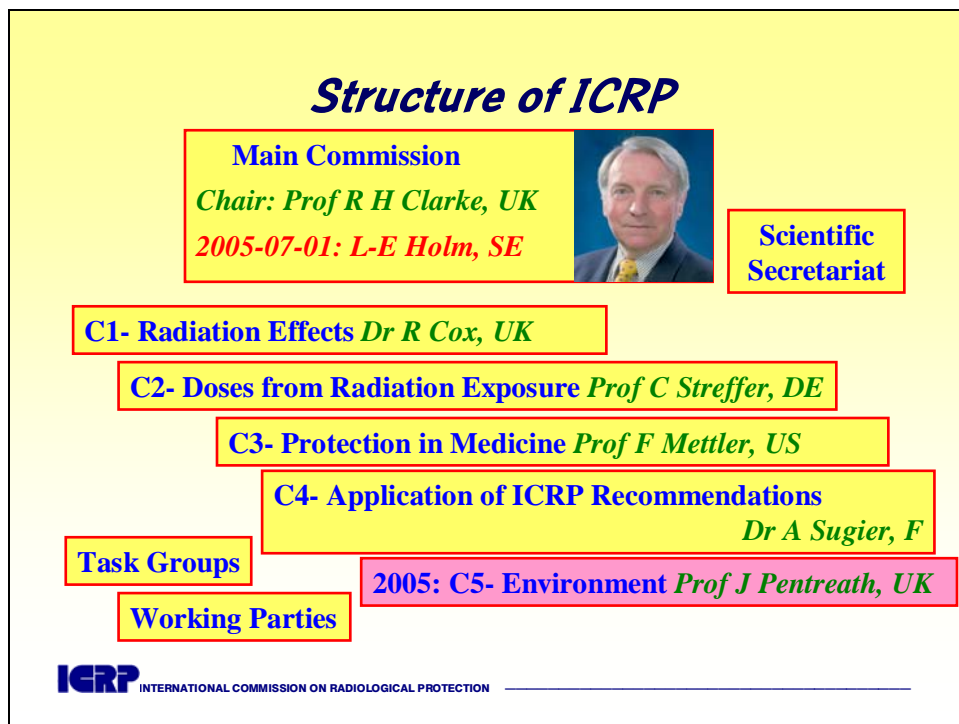
Furthermore, before draft ICRP reports are approved for publication, they are regularly circulated to a number of bodies and individual experts, and posted for public consultation on the Internet.

Objective

In preparing its recommendations, the Commission considers the fundamental principles and quantitative bases on 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 aim of the recommendations of ICRP is to

- *provide an appropriate standard of protection for mankind from sources of ionising radiation, without unduly limiting beneficial practices that give rise to exposure to radiation.*



The structure of ICRP comprises a Main Commission and four Committees, with a fifth Committee to be added 1 July 2005.

The Work Programme of the Commission and its Committees:

The Commission is an independent Registered Charity, established to advance for the public benefit the science of radiological protection, in particular by providing recommendations and guidance on all aspects of protection against ionising radiation.

Committee 1 considers the risk of induction of cancer and heritable disease (stochastic effects) together with the underlying mechanisms of radiation action; also, the risks, severity, and mechanism of induction of tissue/organ damage and developmental defects (deterministic effects).

Committee 2 is concerned with the development of dose coefficients for the assessment of internal and external radiation exposure, development of reference biokinetic and dosimetric models, and reference data for workers and members of the public.

Committee 3 is concerned with protection of persons and unborn children when ionising radiation is used for medical diagnosis, therapy, or for biomedical research; also, assessment of the medical consequences of accidental exposures.

Committee 4 is concerned with providing advice on the application of the recommended system of protection in all its facets for occupational and public exposure. It also acts as the major point of contact with other international organisations and professional societies concerned with protection against ionising radiation.

The Main Commission of ICRP met three times in 2003: In Vienna, Austria, in January, then in Chilton, UK, in June, and in November in Argentina: first in Buenos Aires together with the four standing, and immediately thereafter in San Carlos de Bariloche. The main issue at these meetings was the preparation of a set of draft fundamental ICRP Recommendations, intended to replace the current (1990) Recommendations sometime in 2005.

New publications

Two reports that had been approved in 2002 were published as 2002 issues of the *Annals of the ICRP*, although printing was not completed until early in 2003. These are:

- *Supporting Guidance 3: Guide for the practical application of the ICRP Human Respiratory Tract Model; and*
- *Publication 89: Basic anatomical and physiological data for use in radiological protection: Reference values.*

Furthermore, three additional reports were approved and published in 2003, viz.:

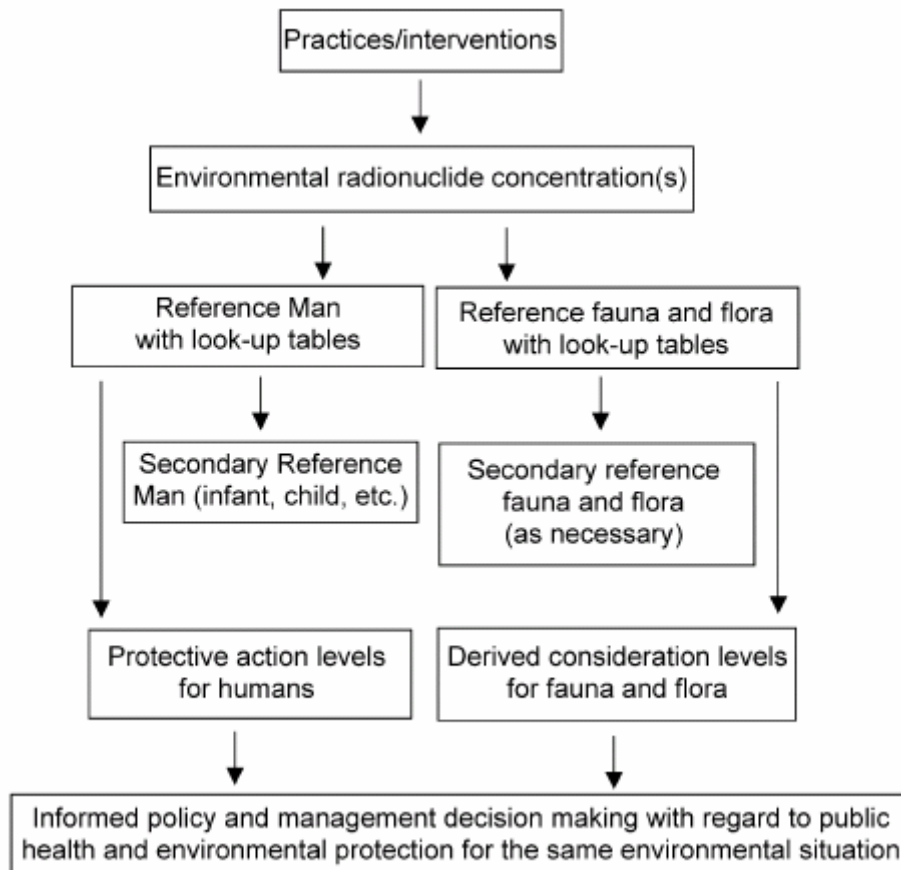
- *Publication 90: Biological effects after prenatal irradiation (embryo and fetus);*
- *Publication 91: A framework for assessing the impact of ionising radiation on non-human species; and*
- *Publication 92: Relative Biological Effectiveness (RBE), Quality Factor*

(Q), and Radiation Weighting Factor (w_R).

In addition to the printed version sent to all subscribers and a considerable number of buyers of single reports as book issues, these various reports are also available electronically through our

publisher's 'ScienceDirect' service (www.sciencedirect.com).

This increases penetration of our reports through the scientific and regulatory community very significantly, and also allows for a pricing structure that takes regional differences into account.



This Figure from ICRP Publication 91 outlines the development of a common approach for the radiological protection of humans and non-human organisms.

Committee 1 (Radiation Effects):

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.

Input from Committee 1 on the biological effects of radiation constitutes a platform for the current ICRP project of devising a set of next, 2005, fundamental Recommendations on radiological protection. The most important issues for Committee 1 in this context are as follows:

- Whether to use cancer incidence in place of the current system that weights non-fatal cancer on the basis of fatality rate;
- Implications of including weighting factors for a wider range of organs than at present;
- How to deal with the 'remainder' category of organs, in view of problems with non-additivity and very small weightings in the current system;
- Whether the tissue weighting factors for the gonads need revision in the light of recent assessments of risks of hereditary effects;
- Whether non-cancer endpoints should be included in the numerical measure of detriment, or whether the emerging data on this topic are as yet insufficient for this purpose; and
- Whether additional protection over and above tissue weighting might be required to avoid tissue injury.

The current programme of work for Committee 1 that has been agreed by the Commission includes the preparation of reports by two Task Groups.

The first one of these comprises a review of epidemiological evidence of radiation-induced cancer at low doses and characterisation of the dose-response relationship. Important aspects of this work include epidemiological considerations, carcinogenic effects of ionising radiation, the role of radiation-induced damage and its repair in carcinogenesis, cellular consequences of radiation-induced damage, and quantitative uncertainty analysis.

The second Task Group is charged with the preparation of supporting material (a 'foundation document') for the next basic ICRP Recommendations. The forthcoming report will address, i.a., risk modelling methodologies, nominal risk coefficients, judgements on tissue weighting, 'transport' of cancer risk from one population to another, and judgements of DDREF (the dose and dose-rate effectiveness reduction factor).

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.

A number of potential topics for future work were considered during the

2003 meetings of Committee 1 and its Task Groups. Those that were regarded as most important for further consideration included tissue injury and non-cancer effects; stem cell biology and target cells for cancer and their implications for radiological protection; and cancer risk from radon and

other internal emitters. The option of additional smaller projects addressing topical issues, such as radiation epidemiology, basic biology and cancer and hereditary risks, and biomarkers and biological dosimetry, was also discussed.



Professor Roger Cox, who was recently appointed Director of the UK National Radiological Protection Board, is the Chairman of Committee 1.

Committee 2 (Doses from Radiation Exposures):

Committee 2 has the responsibility for establishing dose coefficients for internal and external exposures. This involves developing the dosimetric models to be used in the calculations.

Two documents published in 2003 but approved in 2002 had been produced through Committee 2. Publication 89 on Basic Anatomical and Physiological Data updates Reference Man and provides comprehensive data that will be applied in future dose calculations. Supporting Guidance 3 on the Practical Application of the Human Respiratory Tract Model (HRTM) complements the earlier Publication 66 on that model.

Publication 92 (2003), on Relative Biological Effectiveness (RBE), Quality factor (Q) and Radiation Weighting factor (w_R), prepared by a joint Task Group of Committees 1 and 2, recommends staying with a w_R of 20 for alpha particles, as at present. However, instead of providing two functions for neutrons (step and continuous) it recommends only a continuous function. For protons, the report proposes a w_R value of 2 as more appropriate for protection purposes for cosmic-ray protons than the current value of 5. The Main Commission will decide on whether to implement these proposals in its new recommendations.

Committee 2 is preparing a Foundation Document to underpin the dosimetry needs of the forthcoming recommendations, effectively updating Annex A in Publication 60. The document will consider the use of dosimetric quantities for assessing exposures that may give rise to either stochastic or deterministic effects. It will summarise the key advice on w_R values given in Publication 92 and will also include

information on w_T values presently being developed by Committee 1.

A document on doses to infants from radionuclides ingested in mothers' milk will complete the set of reports of Committee 2 on dose coefficients for members of the public. It will comprise a main text and a series of element specific sections giving reviews of biokinetic data and models for 35 elements. It will also include a brief discussion of the doses calculated for selected radioisotopes. This will include a comparison of doses to the embryo, fetus and new-born child given in Publication 88 with those from the transfer of radionuclides in milk.

A new dosimetric model for the human alimentary tract has been developed to replace the gut model in Publication 30 and used for the calculation of all subsequent dose coefficients. The new model: takes account of newer data; defines anatomical regions needed for dosimetry; reviews and evaluates information on the movement of materials through the whole of the alimentary tract; includes the possible retention of radionuclides in the gut wall and absorption from different regions; reviews information on the location of cells at risk and calculates dose explicitly to target regions in the intestinal epithelium; provides age-dependent reference parameter values for the relevant biokinetic and anatomical parameters; and considers uncertainties in dose calculations.

The assessment of doses from radiopharmaceuticals is carried out by a Task Group of Committee 3, with membership from Committee 2. This ensures that the models used are consistent with the work in Committee 2. The Task Group has been involved in preparing a

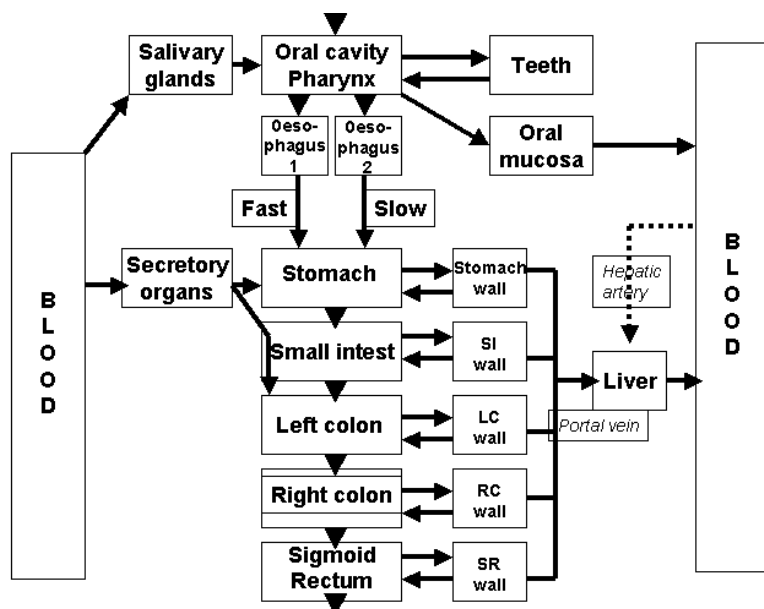
series of addenda to Publication 53 giving dose coefficients for a range of radiopharmaceuticals. Recent work has included the development of a generic model for amino acids labelled with ^{11}C and ^{18}F , fatty acids labelled with ^{123}I and a new substance for the detection of acute venous thrombosis, $^{99\text{m}}\text{Tc}$ -apicide.

A comprehensive revision of advice on dose assessment and monitoring for occupational intakes of radionuclides is being prepared. It is intended to replace Publications 30, 54, 68 and 78 by a single series of reports that will cover both dosimetry and bioassay interpretation.

Recent inter-comparison exercises on the assessment of internal dose from bioassay data have demonstrated a wide variety of results obtained by different laboratories. The report on Occupational Intakes of Radionuclides will therefore be accompanied by a Supporting Guidance report that will give more comprehensive advice on the interpretation of bioassay data. Substantial progress has been made on the development of this document.

An intractable issue in internal radiation dosimetry has been the discrepancy between the dose from exposure to radon inferred from epidemiology and the higher dose calculated using the human respiratory tract model (HRTM). The difference is a factor of 2-3. A draft paper provides an overview of the two approaches and suggests that if the risk of lung cancer had been developed from the extensive miner data, rather than the value derived for external radiation exposure of the Japanese A bomb survivors, then there would be improved agreement between the estimate of dose and risk calculated on the basis of epidemiology and that calculated on the basis of the HRTM.

A major priority has been the development of reference voxel phantoms based on medical CT and MRI imaging data. The MIRDOSE phantoms currently used to calculate doses to tissues from both internal and external radiation sources have a design based on simple geometric shapes of organs and tissues. They will be replaced by new phantoms that will have more realistic representations of organs and tissues.



Proposed structure for the new Human Alimentary Tract model (HAT)

Committee 3 (Protection in Medicine):

The responsibility of Committee 3 is radiological protection and safety in medicine.

During 2003, particular attention was paid to the following current issues for Committee 3:

Committee 3 provided a number of suggestions and comments on the draft next fundamental Recommendations of ICRP. These included, i.a., clarification of the concept of justification in medical radiation usage, explanation of the use of Diagnostic Reference Levels of dose, and stressing the importance of training and education.

A draft on 'Managing patient dose in digital radiology' was presented and some small corrections proposed. It was quite surprising that only two institutional comments were received after the public consultation period in the ICRP web. Other personal comments were received directly by the Task Group drafting the report. In general the comments were positive about the content of the document and the corrections proposed were taken into account. It was agreed to investigate whether the distribution of ICRP drafts for consultation could be approved. ICRU proposed some corrections to the annex on quantities and units that were taken into account. It was agreed to highlight some of the key points of the different chapters at the beginning of the document. The draft was approved by Committee 3 after implementing the agreed changes and it was forwarded to the Main Commission for consideration.

A draft on 'Prevention of high-dose-rate brachytherapy accidents' was presented for discussion. This document could also be useful for health administrators. It was

observed that the full introduction section could be an annex. It was also proposed (and accepted) that a recommendation on reporting accidents to the Health or Regulatory Authority be included.

In the presentation of a draft on 'Release of patients after therapy with permanently implanted sealed sources', mainly referring to prostate cancer, cremation proved to be one of the key discussion points. This document was felt to have a broader objective including other sources used in permanently implanted brachytherapy. It was also suggested to include a chapter on risks in connection with getting children.

An update of the report on 'Radiation dose to patients from radiopharmaceuticals' was also presented. This was intended for posting at the ICRP web site, but the various addenda available on the web site are now sufficient in number to warrant a printed summary which is being prepared.

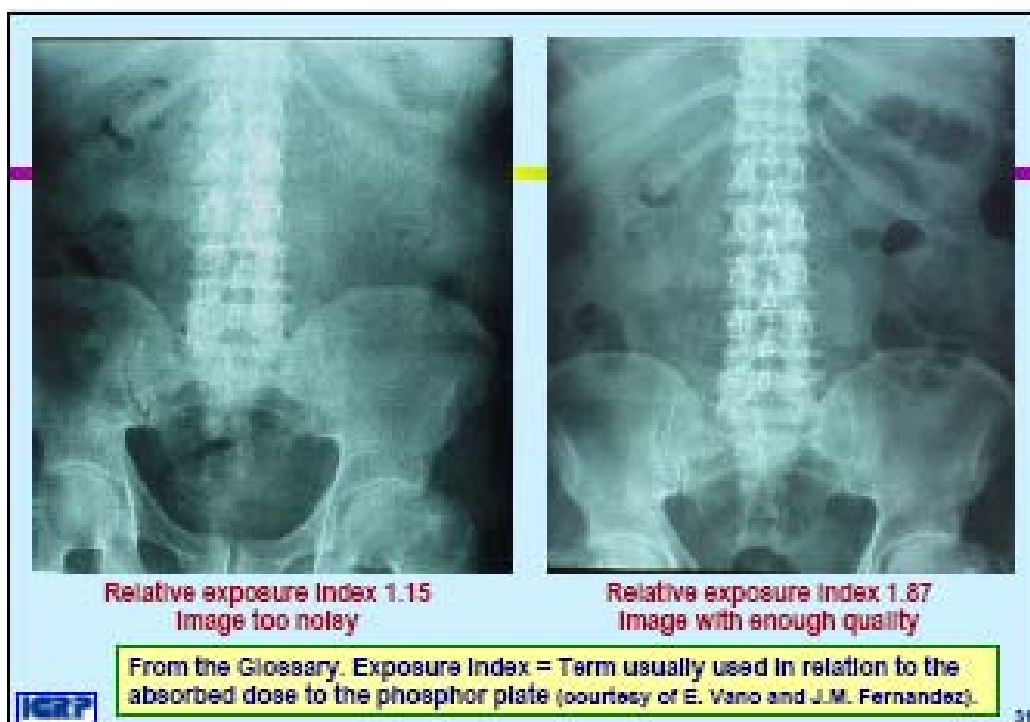
Data on some radiotherapy accidents in Japan were discussed in Committee 3. It was observed that mistakes in dosimetry with overdoses in the order of 7% can be clinically detectable. For the Japanese cases described, overdoses ranged from 10% to 28%. Japanese Committee members highlighted the lack of medical physicists in Japan (only about 100 in all the country).

The Committee noted with satisfaction that Publication 84, its earlier report on pregnancy and medical radiation, had now been translated into several further languages including Chinese and Spanish.

Committee 3 also discussed a possible update of Publication 87, the ICRP

report on Dose Management in Computed Tomography, including the new multi-slice systems, interventional procedures with CT, self referring and CT screening. An overview of the key points to be reviewed was discussed and the Committee felt that it was probably better to plan for a new ICRP publication, rather than an amendment to the already existing Publication 87. The importance of including a section dealing with optimisation of CT procedures in paediatrics was stressed.

Other topics considered for further work included occupational protection in brachytherapy, radiation surgery, positron emission tomography, occupational protection during preparation of radiopharmaceuticals, training and accreditation in diagnostic radiology, radiological protection in paediatrics and in cardiology, screening and self referral in computed tomography, and medico-legal exposures.



Like several other ICRP Publications, the forthcoming report on digital radiology will be supported by an 'educational slides file'; the figure above is taken from that file.. The 'educational files' are downloadable at no cost from the ICRP web site (www.icrp.org).

Committee 4 (Application of the Commission's Recommendations):

Committee 4 of the International Commission on Radiological Protection has the responsibility to consider the practical application of the Commission's recommendations.

The Committee comprises 17 members drawn from 13 countries (although, of course, people are elected to the Committees of ICRP in a personal capacity, not as national representatives). Membership covers expertise in dose assessment, regulation and radiological protection generally, reflecting experience in a wide range of countries. Observers from the European Commission (EC), the International Labour Organisation (ILO), the International Radiation Protection Association (IRPA), the International Atomic Energy Agency (IAEA), and the Nuclear Energy Agency of the OECD (NEA) also attend.

Aside from its other functions the Committee acts as a major point of contact between the ICRP structure and other international organisations and professional bodies concerned with protection against ionising radiation. At each meeting those representatives and officers of international organisations present, provide a description of their current activities. This two-way exchange of information helps to promote the harmonious development of radiological protection philosophy within the international organisations.

The most important issues for Committee 4 are as follows:

- Definition of an individual member of the public for purposes of assessing doses for protective action and demonstration of compliance;
- Optimisation, particularly when involving stakeholder participation;

- Radiological protection in space flight;
- Treatment of natural radiation exposures in regulatory contexts;
- Regulatory guidance on radiological protection recommendations; and
- Assessment of the role and methods of justification in future protection issues.

At the 2003 meeting of Committee 4, the Chairwoman, Dr. Annie Sugier, observed that the Committee would have a very important job regarding the review of the 2005 Recommendations. She also noted the passing of past Committee 4 Chairmen Mr. Bert Winkler and Dr. Dan Beninson and added that their invaluable contributions would be missed.

The Chairwoman then reviewed the main issues in the draft 2005 Recommendations and specific points of relevance to the Committee. After a discussion of these points, the Committee reviewed the draft 2005 Recommendations in detail over the next two days.

Progress reports were given by the Task Groups on 'Optimisation of Protection' and 'Defining the Individual Member of the Public for Assessing Doses.' The reports of these Task Groups will be 'foundation documents', i.e. building blocks published as separate reports supporting the 2005 Recommendations.

Progress reports were also provided for the Task Group on radiological risks due to space flight, and the Working Party on the application of the Commission's recommendations for protection of populations living in sites and environments affected by radioactive residues.

Reflections from the Working Party on the scope of recommendations were also provided, and a summary of its proposal was given. In addition, Dr. Lars-Eric Holm, Vice Chairman of ICRP, gave a presentation on the work plan for the new Main Commission Task Group on reference animals and plants.

Other work of the Committee included the discussion and ranking of

proposals for a work plan of work to be carried out over the next five years. The Committee also identified ICRP documents that will need to be revised or replaced as a result of the 2005 Recommendations.

Finally, reports were presented to the Committee by observers representing international organisations, on the activities of EU, IAEA, IRPA, ILO, and NEA in the area of radiological protection.



Committee 4 during its November 2003 meeting in Buenos Aires. The facilities provided by the Argentinean government and authorities were both very well equipped and organised and, as can be seen here, extremely elegant.

Participants, from left: Wolfgang Weiss, Augustin Janssens (CEC), Shengli Niu (ILO), Mikhail Savkin, Don A Cool, Anthony D Wrixon (IAEA), Mary Clark (secretary), Jean-François Lecomte, Annie Sugier (Chairperson), David Cancio, G Ches Mason (Vice-Chairman), John Cooper, Ciska Zuur, David Owen (ILO), Andrew C McEwan, Geoffrey A M Webb (IRPA), Yihua Xia, Jacques Lochar, John E Till, and Edward Lazo (OECD/NEA). Members E d'Amato and K Ulbak are not present in this photo.

The Main Commission:

The main focus of the Commission's work over the past year has been the further development and elaboration of the proposed draft basic recommendations, which are intended to be published in 2005.

A first internal draft was extensively reviewed during the meeting of the Main Commission with its four committees in Buenos Aires, Argentina in November 2003, immediately followed by a meeting of the Main Commission in San Carlos de Bariloche, Argentina.

The draft took account of the many important comments received during the first consultation through the International Radiation Protection Association (IRPA) on conceptual ideas and built on valuable input from many experts and organisations.

The draft will be reviewed again by the Main Commission at its next meeting, in April 2004. The updated draft will then be released for public consultation, with a first presentation to the radiological protection community will be at the IRPA-11 Congress in Madrid in May 2004.

The revised recommendations will not change the fundamental basis for radiological protection. Probably, they will not necessitate any significant changes other than updating in the Interagency and European Basic Safety Standards.

They will however consolidate in a single document and within a unified scheme a number of recommendations that have been made in individual publications over the period since the 1990 Recommendations of ICRP, Publication 60, was issued.

As indicated in the Chairman's Foreword, the Main Commission decided to establish a new Committee for the protection of non-human organisms against deleterious effects of radiation, thereby showing its commitment to this rapidly developing area. This new Committee 5 will begin to operate in 2005, in phase with the next four-year term of the other Committees.

The Commission invited Professor R. Jan Pentreath (Environmental Systems Science Centre, Univ. of Reading, UK) to fill the current vacancy in the Main Commission and to become Chairman-elect of this new Committee 5.

Another current issue that is being tackled by a Task Group of the Main Commission is protection against radiation exposure in the aftermath of a terrorist attack.

The proposed report will first deal with the matter of identifying potential terrorist scenarios and quantifying the radiological impact so far as possible. Measures for protecting first responders will be proposed.

The protection of members of the public will be a major topic with especial attention to pregnant women and children, and to the psychological aspects involving information and communication.

Control of low-level radiation exposure: time for a change?

Roger Clarke

Chairman, International Commission on Radiological Protection, and Director
National Radiological Protection Board, Chilton, Didcot, Oxon OX11 0RQ, UK

Received 1 February 1999, in final form 26 February 1999, accepted for publication 1 March 1999

Abstract. The carcinogenic risks of exposure to low-level ionising radiation used by the ICRP have been challenged as being, at the same time, both too high and too low. This paper explains that the epidemiological evidence will always be limited at low doses, so that understanding the cellular mechanisms of carcinogenesis is increasingly important to assess the biological risks. An analysis is then given of the reasons why the challenges to the ICRP, especially about the linear non-threshold response model, have arisen. As a result of considering the issues, the Main Commission of the ICRP is now proposing a revised, simpler, approach based on the concept of what is being called 'controllable dose'. This is an individual-based philosophy and represents a shift in emphasis by the Commission from societal-oriented criteria using Collective Dose. Finally the paper speculates on the consequences for radiological protection of such a change in policy. The Commission wishes its ideas to be discussed as part of its reconsideration of its recommendations.

1. Introduction

It is now ten years since the ICRP promulgated a draft version of what was to become the 1990 recommendations. That consultation process helped the Commission to clarify its aims and the expression of its philosophy. Since the issue of Publication 60 [1], the Commission has further elaborated its policy on a number of issues such as, control of exposure to radon-222, criteria for intervention after an accident, the management of occupational exposure, and its policy for the disposal of radioactive wastes.

However, in recent years questions have been raised about the Commission's application of its risk factors at low doses. This article discusses the current ICRP position and attempts to analyse why the questions have arisen. Some proposals are then made for a different, less complex, approach to protection. The Commission is considering a consolidation or recapitulation of its 1990 recommendations and wishes the ideas in this

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paper to be widely discussed leading to a restatement

2. Carcinogenic risks radiation exposure

2.1. Epidemiological evidence

Some of the most critical logical protection have limiting the risk of excess dose irradiation of human most difficult problem is that epidemiological those used with the Jap, have only the power to identify low-LET radiation doses [5]. However, some animal vivo data are claimed to 200-300 mGy, and certain appear to demonstrate risk than the data from the Ja

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MEMORANDUM

A report on progress towards new recommendations: A communication from the International Commission on Radiological Protection

International Commission on Radiological Protection¹

ICRP, SE-171 16, Stockholm, Sweden

Received 2 March 2001

Abstract

Throughout the hundred-year history of the uses of ionising radiation in medicine and industry there has been advice on the need to protect against the hazards associated with exposure. Protection standards throughout this period to reflect both the scientific understanding of biological effects of exposure and the social and ethical standards. The Main Commission of ICRP is now considering a revised, simpler, approach based on the concept of what is being called 'controllable dose'. This is an individual-based philosophy and represents a shift in emphasis by the Commission from societal-oriented criteria using Collective Dose. Finally the paper speculates on the consequences for radiological protection of such a change in policy. The Commission wishes its ideas to be discussed as part of its reconsideration of its recommendations.

1. Historical background

Roentgen discovered x-rays in 1895, and in 1896 Grubbé described x-ray damage to the skin in the first paper to appear reporting radiation damage to the skin of the hand by the early experimental investigators. On the 12 December 1896, the *American Electrician* contained a paper by Wolfram Fuchs giving the first protection advice:

- make the exposure as short as possible;
- do not stand within 12 inches (30 cm) of the x-ray tube; and
- coat the skin with Vaseline and leave an extra layer on the area most exposed.

Bequerel's identification of the phenomenon of radioactivity, also in 1896, separation of radium in 1898 soon led to the use of radioactive substances, topically for therapy. In the next ten years, many papers were published on the tissues by radiation.

¹ Presented by the ICRP Chairman, Roger H Clarke. E-mail: roger.clarke@iarp.org.uk

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MEMORANDUM

The evolution of the system of radiological protection: the justification for new ICRP recommendations

The International Commission on Radiological Protection¹

ICRP, SE-171 16, Stockholm, Sweden

Received 18 February 2003

Published 19 April 2003

Online at stacks.iop.org/JRP/23/1/29

Abstract

ICRP has been encouraging discussion during the past few years on the best way of expressing radiological protection philosophy in its next recommendations, which it plans to publish in 2005. The present recommendations were initiated by Publication 60 in 1990 and have been complemented by additional publications over the last 12 years. It is now clear that there is a need for the Commission to summarise the totality of the number of numerical values that it has recommended in some ten reports. This has been done in this paper, and from these a way forward is indicated to produce a simplified and more coherent statement of protection philosophy for the start of the 21st century. A radical revision is not envisaged, rather a coherent statement of current policy and a simplification in its application.

1. Introduction

The 1990 system of protection, set out in Publication 60 (ICRP 1991), was developed over some 30 years. During this period, the system became increasingly complex as the Commission sought to reflect the many situations to which the system applied. This complexity involved the justification of a practice, the optimisation of protection, including the use of dose constraints, and the use of individual dose limits. It has also been necessary to deal separately with endogenous prospectively involving radiation exposure, 'practices', for which unrestricted planning was feasible for reducing the expected increase in doses, and existing situations for which the only feasible protection action was some kind of 'intervention' to reduce the doses. The Commission also considered it necessary to apply the recommendations in different ways to occupational, medical and public exposures. This complexity is logical, but it has not always been easy to explain the variations between different applications.

The Commission now strives to make its system more coherent and comprehensible, while recognising the need for stability in international and national regulations, many of which have relatively recently implemented the 1990 recommendations. However, new scientific data have been produced since 1990 and there are developments in societal expectations, both of which will inevitably lead to some changes in the formulation of the recommendations.

¹ Presented by Professor Roger Clarke, ICRP Chairman. E-mail: roger.clarke@iarp.org

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Through a series of papers on conceptual ideas for the next ICRP Recommendations in the Journal of Radiological Protection, 1999 – 2003, the radiological protection community has been kept abreast of developments and formal consultation on concepts was possible through collaboration with IRPA. The Commission elected to publish its ideas in the open literature first, rather than in its own Journal, the Annals of the ICRP, in order to maximise distribution and penetration. The papers were also made available for downloading from the Internet at no cost. Furthermore, several OECD/NEA workshops were organised to discuss various aspects of these concepts. In addition, discussions were organised at numerous regional and national conferences. Based on this very thorough consultation on conceptual matters, the Commission moved forward in 2003 to begin produce a first draft text for the proposed Recommendations. After some internal editorial iterations, that draft text will be made public and formal consultation will take place in 2004.

The Scientific Secretariat

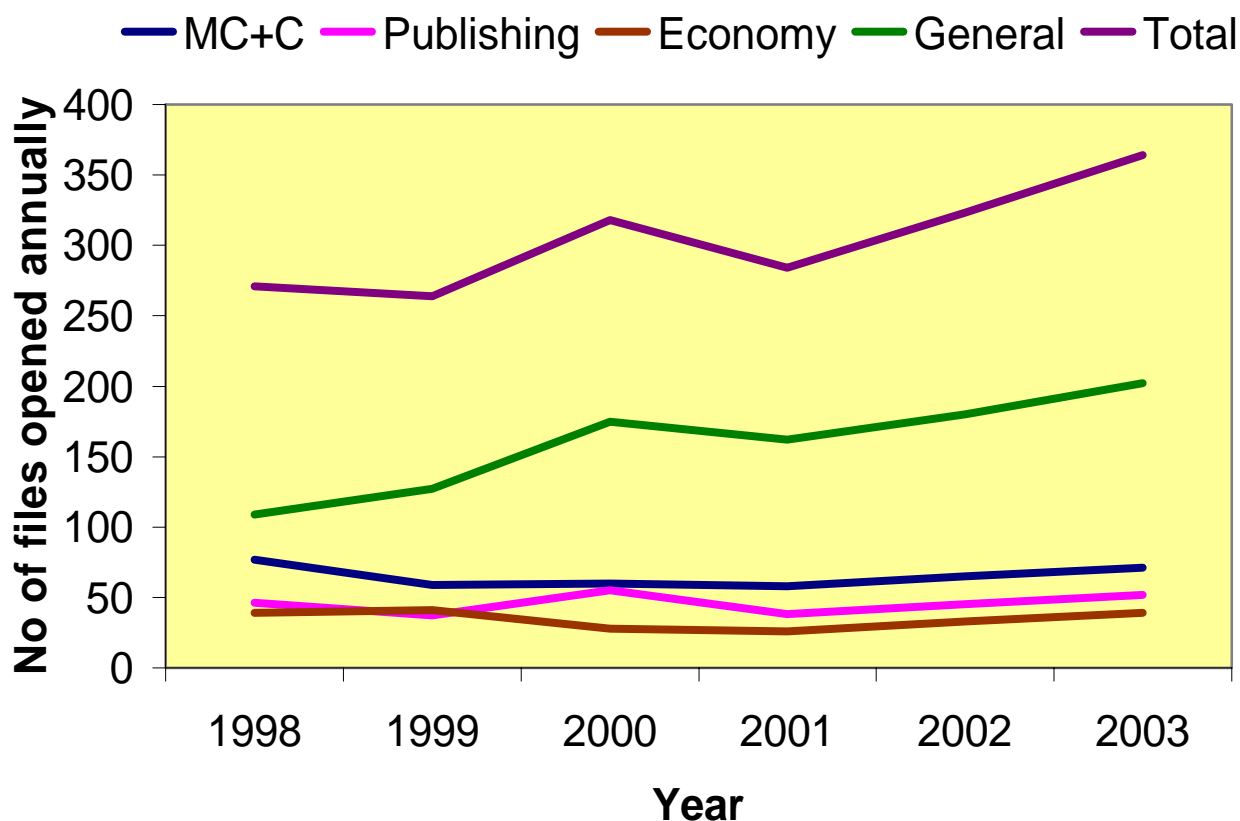
The Scientific Secretariat is currently situated in Stockholm, Sweden. The seat of ICRP remains in the United Kingdom where ICRP is a Registered Independent Charity.

Tasks of the Secretariat include preparations for and organisation of meetings, final editing of reports for publication in the *Annals of the ICRP*, maintenance of contacts with all collaborating organisations, and administrative issues.

The Secretariat also devoted an increasing part of its efforts to running the ICRP Internet web site. Apart from providing

general information about ICRP, the web site has proved particularly useful when ICRP wants to consult on its own draft documents. A drawback was that the resources of the Secretariat were not always quite commensurate with the demand for information and assistance generated through the web site, so that at times, considerable delays in attending to queries from the public were inevitable.

The diagram below shows that the number of files opened increases each year, and that this is primarily because there are more and more 'general' enquiries (from members of the public).





One of the tasks of the Scientific Secretary is to represent the Commission and make various presentations at scientific meetings. Here, Dr Jack Valentin (left) replies to questions at a seminar in Taipei, chaired by Dr Peter Chang (right).

Contacts, Meetings, etc.

As usual, numerous different contacts were maintained, formally and informally, during the year.

In addition to the many instances where the Chairman, Professor Clarke, represented the Commission as described in the Foreword, the Vice-Chairman, Dr Holm, the Scientific Secretary, Dr Valentin, and members of the Commission represented ICRP in meetings of various kinds.

Thus, contacts were held and continued with IAEA, the International Commission on Radiation Units and Measurements (ICRU), the International Radiation Protection Association (IRPA), the International Society for Radiology, the OECD Nuclear Energy Agency, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the World Congress on Medical Physics and Biomedical Engineering and the European Congress on Medical Physics, and the World Health Organization (WHO).

The persons mentioned also took part in many meetings with national regulatory

organisations, research establishments, and professional societies.

During the meetings of the Main Commission in Buenos Aires and in San Carlos de Bariloche, Argentina, in November, informal meetings were arranged with the considerable local community of experts interested in various aspects of ionising radiation and radiological protection.

ICRP also continued its relationship with the International Electrotechnical Commission (IEC) and the International Standards Organization (ISO), primarily through exchange of draft reports and information. On a number of occasions when ICRP was unable to send a formal representative, we arranged to obtain observers' reports so as to keep abreast with developments.

There was also a brisk demand for informal enlightenment and information via telephone, e-mail, and regular mail to the Secretariat.



The final November meeting of the Main Commission took place in San Carlos de Bariloche, Argentina, a well-known centre for various nuclear activities. In connection with the meeting, the Commission members visited INVAP, producers of research reactors as well as medical radiation equipment.

ICRP Publications, etc., printed in 2003

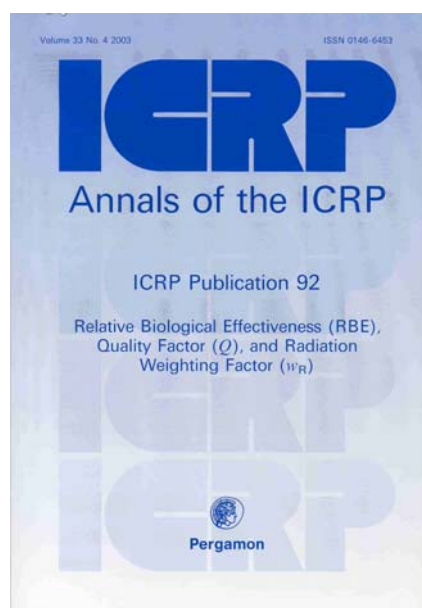
ICRP. Guide for the practical application of the ICRP Human Respiratory Tract Model. ICRP Supporting Guidance 3. *Annals of the ICRP* 32 (1-2), Elsevier Science Ltd, Oxford, UK. (Approved in 2002 but printing was delayed until 2003).

ICRP. Basic anatomical and physiological data for use in radiological protection: reference values. ICRP Publication 89. *Annals of the ICRP* 32 (3-4), Elsevier Science Ltd, Oxford, UK (Approved in 2002 but printing was delayed until 2003)..

ICRP. Biological effects after prenatal irradiation (embryo and fetus). ICRP Publication 90. *Annals of the ICRP* 33 (1-2), Elsevier Science Ltd, Oxford, UK.

ICRP. A framework for assessing the impact of ionising radiation on non-human species. ICRP Publication 91. *Annals of the ICRP* 33 (3), Elsevier Science Ltd, Oxford, UK.

ICRP. Relative Biological Effectiveness (RBE), Quality Factor (Q), and radiation weighting factor (w_R). ICRP Publication 92. *Annals of the ICRP* 33 (4), Elsevier Science Ltd, Oxford, UK.



ICRP Publication 92 is the most recent printed publication from ICRP. In addition to the printed version, like all new ICRP reports this is also available electronically at www.sciencedirect.com. An ongoing project aims at adding electronic backfiles to the site, so that in future all ICRP reports ever produced will be available to the scientific community

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The Annals of the ICRP are available electronically, for subscription and as pay-per-view downloads, at www.sciencedirect.com. Through the HINARI initiative, free access is being arranged for the 69 poorest countries in the world.

Organisations providing grants to ICRP in 2003

Unrestricted funds totalling about 296 000 US dollars were received from:

CEC;
IAEA;
IRPA;
ISR;
OECD/NEA;
Australia: ARPANSA;
Canada: CNSC and Health Canada;
Finland: STUK;
Germany: Bundesmin UNR;
Iceland: GR;
Japan: JAERI and PNC;
Norway: NRPA;
Spain: CSN;
Sweden: Min. Env.;
Switzerland: Fed. Off. Energy;
UK: HSE;
USA: NIH and NRC.

Denmark: NBH and France: IPSN, both regular contributors to ICRP, have indicated that unrestricted grants totalling about 18 000 US dollars which related wholly or partly to calendar year 2003 will be paid out in 2004.

No restricted funds were received in 2003.



The actual drafting of ICRP reports takes place in the Commission's Task Groups – here, Task Group No. 48 on Optimisation, a Committee 4 project, at its meeting in Paris in 2003. Participants, standing (from left): Yihua Xia, Ted Lazo, Jean-François Lecomte, Wolfgang Weiss; sitting: Mary E Clark, Jacques Lochard.

. The unpaid volunteer work that goes into the drafting and editing of ICRP reports represents many man-years annually. The value of this benefit-in-kind cannot easily be expressed in exact monetary terms. However, it is certainly orders of magnitude bigger than the Commission's budget, which represents direct meeting and secretariat costs only.

Table 2. Composition of the International Commission on Radiological Protection and Committees, 2001 - 2005

MAIN COMMISSION

R H Clarke (*Chairman*)
 R Alexakhin
 J D Boice
 R Cox (*Chairman C1*)
 G J Dicus
 A J González
 L-E Holm (*Vice-Chairman*)
 F A Mettler (*Chairman C3*)
 Y Sasaki
 C Streffer (*Chairman C2*)
 A Sugier
 B C Winkler (*Chairman C4*)
 Z Q Pan

Emeritus Members:

D Beninson (*elected in 2001*)
 H J Dunster
 B Lindell
 W K Sinclair
 L S Taylor

Scientific Secretary:

J Valentin

COMMITTEE 1 (Radiation Effects)

R Cox (*Chairman*)
 A Akleyev
 M Blettner
 J Hendry
 A Kellerer
 C Land
 J Little
 C Muirhead (*Secretary*)
 O Niwa
 D Preston
 J Preston
 E Ron
 K Sankaranarayanan
 R Shore
 F Stewart
 M Tirmarche
 R Ullrich (*Vice-Chairman*)
 P-K Zhou

COMMITTEE 2 (Doses from Radiation Exposure)

C Streffer (*Chairman*)
 M Balonov
 B Boecker
 A Bouville
 G Dietze
 K F Eckerman
 F A Fry
 J Inaba
 I Likhtarov
 J Lipsztein
 H Menzel
 H Métivier
 H Paretzke
 A S Pradhan
 J Stather (*Vice-Chairman*)
 D M Taylor (*Secretary*)
 Y Zhou

Cont'd next page

Table 2 cont'd: 2001-2005 members

COMMITTEE 3 (Protection in Medicine)

F A Mettler (*Chairman*)
J-M Cosset
C Cousins
M Guiberteau
I Gusev
K Harding (*Secretary*)
M Hiraoka
J Liniecki (*Vice-Chairman*)
S Mattsson
P Ortiz-Lopez
L Pinillos-Ashton
M Rehani
H Ringertz
M Rosenstein
C Sharp
E Vañó
W Yin

COMMITTEE 4 (Application of ICRP Recommendations)

B C Winkler (*Chairman*)
E d'Amato
D Cancio
M Clark (*Secretary*)
D Cool
J Cooper
T Kosako
J-F Lecomte
J Lochard
G C Mason (*Vice-Chairman*)
A McEwan
M Measures
M Savkin
J E Till
K Ulbak
W Weiss
Y Xia
C Zuur