

# ICRP

## 2001 Annual Report of the International Commission on Radiological Protection



# ICRP

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*Cover photo: The 2001 – 2005 Main Commission at its first meeting in The Hague,  
The Netherlands, September 2001*

*Front row from left: Dr A. J. González, The Hon. G. Joy Dicus; Dr J. D. Boice Jr, Prof. R. H. Clarke  
(Chairman); Dr A. Sugier; Prof. Z.-Q. Pan. Back row from left: Dr R. Cox; Prof. F. A. Mettler Jr; Mr. B.  
Winkler; Dr L.-E. Holm; Prof. Y. Sasaki; Prof. R. Alexakhin; Prof. C. Streffer*

## ***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 past year has seen a number of significant steps forward for the Commission and its Committees.

Firstly, there is the new Commission that came into being at the beginning of July 2001. There are five new members, Rudolf Alexakhin, Greta Dicus, Abel Gonzalez, Yasuhito Sasaki and Annie Sugier. These new members, together with Christian Streffer who recently inherited the Committee two chairmanship, will face the challenging task of guiding the preparation of the Commission's recommendations for the 21<sup>st</sup> century.

The new Commission met for the first time with its four standing Committees, which themselves were reconstituted in 2001, in The Hague, Netherlands in September 2001. There are many people in the Committees who are also new, or returned, to the ICRP family and the meeting proved to be a most profitable start to the four year term of the Commission.

Secondly, it must be noted that the majority of the recent ICRP Publications, which were approved by the outgoing Commission, have been directed to protection in the medical uses of ionising radiation. It is not by default that

Publications 84, 85, 86, and 87 deal with prevention of unnecessary or unwarranted exposures in medical practice. From Computed Tomography in diagnosis, to accidents in therapy, the Commission recognises and is addressing these pressing problems in the uses of radiation in medicine.

Thirdly, the new Commission has approved further publications on recommendations with regard to; (a) diagnostic reference levels in medicine, and (b) a new Reference Man and Woman, the latter detailing anatomy and physiology to replace Publication 23 from 1975. It is of note that reference man is now some 6 cm taller at 176 cm than in 1975, with an increase of 3 kg in weight to 73 kg. It would be indelicate to state how much weight the reference woman has gained in that time!

The reference anatomical data will be used to begin preparations for dose coefficients that will be produced following a restatement of protection principles. Those recommendations will be produced as a result of the continuing discussions following the issue of the progress report prepared by the outgoing Commission and published in the June 2001 issue of the Journal of Radiological Protection.

Finally, the Commission is delighted with the overwhelming positive response to its initiative in opening up a debate on the future direction of, and imperatives for, radiological protection. The Commission is committed to continuing this dialogue and is responding to the helpful input from all quarters. The year 2002 should see the

promulgation of the first, incomplete, draft of restated policy which it has been agreed within the Commission should be called Radiological Protection at the Start of the 21<sup>st</sup> Century. A report on its reception may be available for the 2002 Annual Report.

*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 1997, and the autumn 2000 meetings of the Commission and its Committees were the last time that the members of the 1997 – 2001 term met.

### ***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.

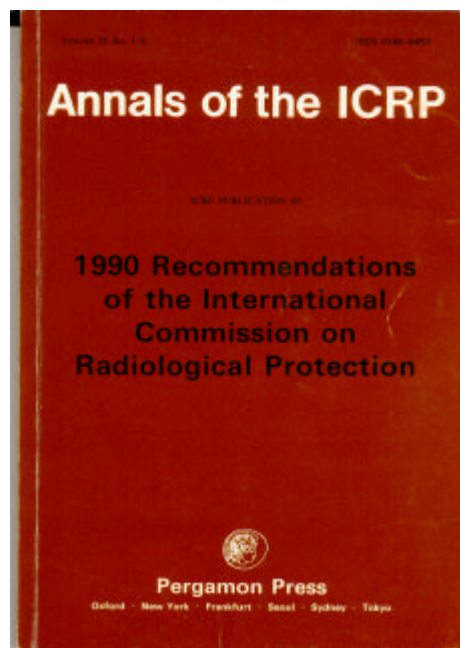
Furthermore, before draft ICRP reports are approved for publication, they are regularly circulated to a number of bodies and individual experts, and posted for public consultation on the Internet.

### *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 1990 Recommendations of ICRP were issued as ICRP Publication 60 in our own journal, the Annals of the ICRP.*

## **The Main Commission:**

*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.*

*The Main Commission of ICRP met, together with the members of its four standing Committees, in The Hague, Netherlands in September 2001. This was the first meeting of the members elected for the period July 2001 – June 2005 and the meeting was hosted by the Dutch Ministry for Housing, Spatial Planning and the Environment.*

*During the first five days the Committees met to conduct their business in which the Main Commission members participated. The Main Commission itself then met to approve programmes of work for the Committees and itself for the next year.*

### **Reports approved**

The report on 'Basic Anatomical and Physiological Data for Use in Radiological Protection: Reference Values' produced by a Task Group of Committee 2 chaired by Bruce Boecker was approved for publication by the Main Commission. This report is the culmination of a major project to update ICRP *Publication 23*, which dates from 1974. It will form the basis of new phantom development for use in internal and external dosimetry.

The draft was posted on the ICRP web site for information and it will appear in the *Annals of ICRP*.

Committee 3 provided two reports upon which the Commission was invited to comment. The first was 'Diagnostic Reference Levels in Medical Imaging' produced by Marvin Rosenstein. The Main Commission noted this short document which essentially recommends that national authorities adopt Dose Reference Levels in order to reduce unnecessary exposures in diagnosis. It was decided that this should be available on the ICRP web site and relevant medical and radiological journals as well as regulatory authorities should be

notified that this advice is to be found on the web.

The second report from Committee 3 was 'Radiation and your Patient: A Guide for Medical Practitioners' produced by Fred Mettler and Julian Liniecki. This text is produced in a question and answer format for easy reading and aims to provide basic information on radiation mechanisms, doses from different medical radiation sources, the magnitude and type of risk as well as answers to frequently asked questions such as risk of radiation in pregnancy.

It is not intended to provide sufficient information for interventional cardiologists, radiologists, orthopaedic and vascular surgeons and others who actually use radiation sources. Rather it is meant for general medical practitioners, medical students and even patients. It is deliberately designed so that interested individuals can download it from the ICRP website for use in medical training. The Commission decided it should be available on a dedicated education segment on the Commission's web site.

Committee 3 has proposed that teaching modules in the form of PowerPoint

presentations be prepared and made available on the ICRP website to be downloaded. The Commission agreed, in principle, and Committee 3 will develop these modules.

### ***Radiological Protection at the Start of the 21<sup>st</sup> Century***

The Main Commission has a Task Group to take forward its protection philosophy, which has agreed that its objective is to state the principles for the practice of radiological protection as the 21<sup>st</sup> century begins. Meanwhile the Committees discussed their contributions to the philosophy and proposed the formation of Task Groups or working parties to carry out the work.

The Commission reviewed these proposals and approved programmes of work for the Committees. The Main Commission intends to agree on an initial outline of restated protection philosophy, which will be available to all four Committees to assist them in their work before their meetings in the summer of 2002.

### ***Task Groups Approved by the Commission***

**Committee 1:** There already exist three Task Groups of Committee 1 and two of them are close to producing reports for approval. The first one, chaired by Albrecht Kellerer, is reviewing RBE data for radiological protection purposes, while the second one (chaired by Christian Streffer) is quantifying health effects of radiation on the developing embryo/fetus. These Task Groups will probably conclude their work in the coming year.

The third existing Task Group, chaired by Charles Land, is on risks at low levels of radiation exposure. This is

expected to continue for at least two years so as to interact with the Main Commission and answer questions that arise in the development of the protection principles. It will cover both reviews of epidemiological data as well as animal and mechanistic information to make judgements primarily on risks at the levels of exposure actually received, i.e. in the range of a few to a few 10s of mSv per year.

A new Task Group of Committee 1 was approved on 'Input to ICRP Recommendations for the 21<sup>st</sup> Century' to be chaired by Roger Cox. This will provide a co-ordinated foundation document summarising the concepts and judgements on health effects of ionising radiation. It will take the scientific evaluations of the 3 existing Task Groups and build on them to recommend risk parameter values for protection purposes.

**Committee 2:** The Task Group on Reference Values for Anatomical Physiological Data, chaired by Bruce Boecker, has essentially finished its work with the approval of its report. Committee 2 then has three Task Groups that were approved to continue work.

The first is the Task Group on the Human Alimentary Tract (chairman: Henri Métivier). It complements the anatomy/physiology and respiratory tract models already approved. It is expected that this Task Group will produce its report during the coming year when it will form part of the basis for revised dosimetric calculations.

The second Task Group is that on Dose Calculations (DOCAL), chaired by Keith Eckerman. The Commission determined that the major priority for this Task Group is the development of reference voxel phantoms, firstly with adult male and female characteristics. This will be required to calculate doses from internal and external sources once the Commission



has finalised any revision to weighting factors for radiations and tissues.

The third Task Group is on Internal Dosimetry (INDOS), which is chaired by John Stather. This Task Group has undertaken a major programme of work on dose coefficients for workers and the public since the publication of the 1990 Recommendations. The Commission decided that the Task Group should concentrate on the review of biokinetic data over the next few years so as to be ready to work with the DOCAL models for the production of the next generation of dose coefficients after the Commission has begun to finalise its recommendations.

**Committee 3:** Two existing Task Groups continue: the first is on the release of patients who have undergone radiotherapy or brachytherapy with unsealed sources. This is chaired by Keith Harding. The report conclusions are expected within the next year. The second Task Group, chaired by Sören Mattsson, is addressing the ongoing issue of doses from commonly used radiopharmaceuticals. The immediate issues here are for Tc-99m depreotide, fatty acids labelled with I-123 and various dopamine transporter and receptor substances, as well as PET substances.

A new Task Group was approved to address Dose Reduction in Digital Radiography and this will be chaired by Eliseo Vañó. This new technique can lead to higher doses in diagnosis and the report is intended for manufacturers and users with recommendations to reduce dose.

Committee 3 will also be providing foundation information on the principles of justification and optimisation in the medical field that can be incorporated into the revised statement of the Commission's recommendations.

**Committee 4:** Committee 4 is established to provide guidance on the application of the Commission's recommendations. The Committee discussed at length the issues involved in restating the Commission policy and proposed the formation of three new Task Groups, each of which was welcomed by the Commission.

A new Task Group is 'To Characterise Individual Members of the Public'. This will assist in defining the individual to be used for determining exposures of the public for avoidable and unavoidable sources. The Task Group is to be chaired by John Till. It will address demonstration of compliance and develop the critical group concept for the 21<sup>st</sup> Century.

The second new Task Group is on 'Optimisation in Radiological Protection' and is to be chaired by Wolfgang Weiss. It will develop the Commission's ideas on stakeholder involvement in the process of optimisation and addressing the inclusion of numbers of exposed persons and the operational and managerial aspects in optimisation.

The third new Task Group is on 'Radiological Protection in Space Flight' to be chaired by Toshiso Kosako. The major aspects are low earth orbit extended flights and are relevant for the construction, operation and maintenance of the International Space Station. The radiation spectrum differs from that in other occupational exposures and specific dose constraints will be derived to provide coherent international guidance.

#### *Emeritus election*

Dan Beninson was elected an Emeritus Member of the Main Commission for his outstanding contribution to radiological protection over a working

lifetime and, in particular, his guidance in the preparation of 1990 recommendations.

*Next meetings*

The Main Commission will meet in May 2002 in order to agree on an outline of

ideas on the philosophy of protection for use by the four Committees. It will then meet in Albuquerque, New Mexico, during October 2002 to review input from the Committees.



*Dan Beninson, a former Chairman of ICRP, was elected an emeritus member in 2001.*

## **Committee 1 (Radiation Effects):**

*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 1 of the ICRP has the responsibility for maintaining the biological effects of ionising radiation under review and developing documents and views that relate such effects to the needs of radiological protection. The Committee 1 that served in the period 1993-2000 had completed two comprehensive task group reports on Genetic susceptibility to cancer and Risks for multifactorial genetic diseases. Task groups had also initiated work on a) Cancer risks at low doses; b) Relative biological effectiveness in relation to radiation weighting and c) Radiation effects on the developing embryo/fetus.

### ***Continuing Work of Task Groups***

**Cancer Risk at Low Doses:** The principal brief of this Task Group (TG) led by Charles Land is to consider sources of information for the purposes of developing a view on cancer risks at low doses of radiation. Also, the uncertainties that are inherent in making these risk estimates.

Much of the work to date has centred on the extrapolation of epidemiological data to low doses and the extent to which these data can comment upon the linear non-threshold hypothesis. A current view from the task group is that judgements on the dose/dose rate effectiveness factor (DDREF) may be more critical for low dose cancer risk than uncertainties on whether there may or may not be a cancer risk threshold at very low doses.

The dose threshold issue is also being pursued via a review of fundamental

cellular/molecular data particularly in relation to DNA damage repair - as yet the TG have not identified convincing scientific evidence of such a threshold mechanism. The TG is currently reviewing the comparative aspects of cancer risk models and animal carcinogenesis data. A final report is expected in 2003.

**Relative Biological Effectiveness (RBE) in Relation to Radiation Weighting:** The main objective of this TG led by Albrecht Kellerer is to review data on the relationship between radiation quality and biological effectiveness and from this to explore the consistency between scientifically judged values for RBE and the radiation weighting factors used in radiological protection.

The TG has explored the uncertainties surrounding judgements on radiation weighting factors and clarified the biophysical relationship of these with largely experimental determination of RBE for cancer and cancer-related endpoints. Calculations on the true neutron component of absorbed neutron doses in organs have been made and reconciled with radiation weighting based upon incident energies. In addition a specific scientific case has been made to reduce radiation weighting for protons. The TG is expected to submit a final report in 2002.

**Radiation Effects on the Developing Embryo/Fetus:** This TG led by Christian Streffer (now Chairman of Committee 2) is considering both the tumorigenic and developmental effects of radiation on the embryo/fetus.

In respect of cancer risk the TG has been able to assemble data suggestive of different patterns of tumorigenesis *in utero* but there was no clear answer as to whether tissue weighting *in utero* should be different to that for post-natal exposures. The issue of dose thresholds for lethal and developmental effects proved more straightforward and has been significantly clarified by the TG. A final report is expected in 2002.

### ***The New Work Programme for Committee 1***

The previous Committee 1 had provided some initial thoughts on the biological input necessary for ICRP to move forward towards Radiological Protection Recommendations for the 21<sup>st</sup> Century. This issue has been pursued further by the new Committee 1, including specific discussions with the ICRP Chairman, Roger Clarke, and other members of the Main Commission.

In brief, in reviewing the topics and progress of the previous and current TG activities it was judged that the cumulative information available by 2003 from TG reports would be an important but not sufficient foundation for the MC to use in their deliberations. Accordingly Committee 1 considered all the issues of critical biological importance.

From these discussions it was agreed to set up a new set of Working Parties (WP) in order to 'fill the gaps' by developing or re-confirming Committee 1 views on the following issues (WP leaders in parenthesis):

- Cancer risk coefficients, organ specific risks and the transfer of risks between populations (Dale Preston);

- Genetic susceptibility to cancer (Roger Cox);
- Comparative aspects of cancer risk after exposure to radiation or chemical agents (Julian Preston);
- Risk of heritable diseases (K Sankaranarayanan);
- Deterministic effects, including those after chronic exposures (Jolyon Hendry).

Committee 1 has, for some time, followed the development of knowledge on the dose-response for non-cancer diseases - particularly the new information coming from epidemiological study of the Japanese A-bomb survivors. It is already clear that developing a view on risks at low doses will be difficult and to maximise efficiency the Committee will seek to work with UNSCEAR who are appointing a consultant for this area of study. This is a good example of the highly synergistic activity of the two international bodies.

The overall workplan for Committee 1 is that the WPs noted above will report on their topic areas over the next two years. As these reports develop, the agreed views will be amalgamated with those provided by TG reports.

This amalgamation process will be the responsibility of a new TG chaired by R Cox who will draft a summary document which will serve to advise the MC and act as one of the foundation documents in support of ICRP recommendations for the 21<sup>st</sup> century.

In conclusion, ICRP Committee 1 has gained agreement from the MC on its specific actions over the next four years. Whilst the formal development of documents to directly support ICRP MC will tend to dominate proceedings, Committee 1 will maintain general surveillance on the rapid technical and

academic developments that are major features of modern biology.



*Roger Cox is the Chairman of ICRP Committee 1. Here, he is lecturing at the 2<sup>nd</sup> International Conference in Dublin, Ireland, of WoNuc, the World Council of Nuclear Workers.*

## **Committee 2 (Doses from Radiation Exposures):**

*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 2 has the responsibility for developing dose coefficients (doses per unit intake or unit exposure) for the assessment of internal and external radiation exposure. It is also involved in the development of reference biokinetic and dosimetric models for intakes of radionuclides and reference data for workers and members of the public.

The Commission has determined that the main thrust of the programme of work of ICRP over the next four years will be to review the existing recommendations and supporting documentation with the aim of developing further advice for radiological protection at the start of the 21<sup>st</sup> Century.

Committee 2 already has an on-going programme of work but has been given further responsibilities related to the development of further recommendations by the Commission.

### ***Dose Coefficients for the Public and Workers***

In recent years, Committee 2 has developed a series of publications giving dose coefficients for intakes of radionuclides by members of the public of various ages from environmental exposures. It has also issued a compilation of dose coefficients for the public in ICRP *Publication 72*.

An updated set of dose coefficients for adults who are occupationally exposed has also been issued as *Publication 68*. The contents of these documents are

summarised in Table 1. These dose coefficients have been adopted in the International Basic Safety Standards and in the European Basic Safety Standards Directive.

A CD-ROM has also been issued that gives inhalation dose coefficients for a range of particle sizes (0.001, 0.003, 0.01, 0.03, 0.1, 0.3, 1, 3, 5 and 10  $\mu\text{m}$  AMAD) as well as ingestion coefficients for members of the public. It gives equivalent doses to all tissues with specific tissue weighting factors,  $w_T$  and effective doses for a range of integration times (1, 7, 30 days, 1, 5, 10, 20, 30 and 45 years) together with committed equivalent doses and committed effective doses.

It also includes similar data for the radionuclides for which committed effective doses are given for workers in *Publication 68*. The CD-ROM gives biokinetic models for the elements, as well as the relevant text from *Publications 68* and *72*. It has recently been updated to be compatible with Windows 95/98/Me/NT/2000/XP.

### ***Dose Coefficients for the Embryo and Fetus***

As a continuation of this programme of work a new report on dose coefficients for the embryo and fetus following intakes of radionuclides by the mother has been completed and was issued as *Publication 88* towards the end of the year.

This publication covers intakes by members of the public and workers of selected radionuclides of the 31 elements covered in the previous reports giving age-dependent dose coefficients. It gives dose coefficients for a range of intake scenarios by both inhalation and ingestion. For acute exposures, intakes are taken to occur at the time of conception and after 5, 10, 15, 25 and 35 weeks of the pregnancy and at six months and 2½ years before conception.

For continuous intakes, exposures are taken to occur during the year of pregnancy, starting from conception and for one or 5 years up to the time of conception. This range of intake patterns should allow doses to the offspring to be calculated for any pattern of intake by the mother. Summary information on equivalent doses to selected tissues together with effective doses to the offspring to birth and to age 70 years is given in the report.

The report will be accompanied by a CD-ROM giving more comprehensive information than is possible in the published report. It will give dose coefficients for a range of inhaled particle sizes and equivalent doses to a range of tissues at various times after the intake in addition to committed equivalent doses and committed effective doses.

### ***Technical Document on Application of HRTM***

Guidance on the practical application of the human respiratory tract model (HRTM) is to be given in a technical document. This covers situations for which information is available that enables more accurate dose assessments to be made than would be the case using the general default parameter values.

It will cover examples of both occupational and public exposure and will give practical guidance on the development

of material specific dose coefficients as well as the use of the HRTM in interpreting bioassay data. The report should be published early in 2002.

### ***Reference Man***

A Task Group on Reference Man (REM) has been preparing a report on reference values for anatomical and physiological data. This report will effectively supersede ICRP *Publication 23*<sup>1)</sup> on Reference Man and provide the basic information on organ masses needed for dose calculations. The report is essentially finished and has been approved for publication by the Commission.

The new report summarises information in recent ICRP publications (eg. the respiratory system given in *Publication 66*<sup>2)</sup> and the skeletal system in *Publication 70*) and provides additional information on other organ systems not previously covered (eg. the circulatory and urogenital systems and the thyroid). Some information will be given on differences between ethnic groups although the emphasis will be on Western man. The report was posted on the ICRP web site ([www.icrp.org](http://www.icrp.org)) at the end of 2001, and it will be published in the *Annals of the ICRP* towards the end of 2002.

### ***Committee 2 Task Groups and Working Parties***

**Human Alimentary Tract (HAT):** Committee 2 has three Task Groups that will continue their work. The first one, led by Henri Métivier, is concerned with the development of a new dosimetric model for the human alimentary tract (HAT) that will complement the HRTM.

The present model of the gastrointestinal tract, applied by ICRP in the calculation of dose coefficients, has

provided an essential basis for dose calculations for more than 30 years. There is now a need to develop a new model which takes account of more recently published information and is age-specific. The programme of work covers:

- definition of the anatomical regions needed for dosimetry;
- review and evaluation of information on the movement of materials through the whole of the alimentary tract, including the mouth;
- determination of age-dependent parameter values;
- the possible retention of radionuclides in the gut wall and absorption from different regions;
- review of the information on the location of cells at risk, methods for estimating radiation doses and provision of reference parameters for the relevant biokinetic and anatomical parameters; and
- consideration of uncertainties in dose calculations.

It is expected that the report will be completed during 2002 and will be used as the basis for future dosimetric calculations for both ingested radionuclides and radionuclides passed through the throat and swallowed after inhalation.

**Internal Dosimetry (INDOS):** A second Task Group on 'Internal Dosimetry' (INDOS), chaired by John Stather, is concerned with developing biokinetic models to describe the behaviour of radionuclides in the body following their entry by inhalation or ingestion. A report is presently being prepared covering the transfer of radionuclides to mother's milk. This will allow the calculation of doses to the offspring following intakes of radionuclides by the mother. The report will cover:

- the transfer of radionuclides to breast milk following inhalation or ingestion by the mother, considering intakes before or during pregnancy as well as during the period of breast feeding; and
- dose coefficients for the infant ingesting radionuclides in breast milk for each of the scenarios considered.

It will give information on radioisotopes of the 31 elements covered in previous reports giving age-dependent dose coefficients, together with radioisotopes of some additional elements. This modelling approach may also be extended to cover some radiopharmaceuticals in conjunction with Committee 3.

Over the next few years INDOS is to concentrate on a review of the biokinetic data needed to provide models that can be used both for dose calculations for persons who are occupationally exposed and for the interpretation of bioassay data.

**Dose Calculations (DOCAL):** A third Task Group is on 'Dose Calculations' (DOCAL). This Task Group, chaired by Keith Eckerman, implements in computer code the biokinetic models developed by INDOS and carries out the necessary dose calculations. A major task will therefore be preparation of the updated dose coefficients for workers. DOCAL also has the responsibility for calculating dose coefficients for external radiation exposure.

A major priority of DOCAL is the development of more realistic phantoms for the calculation of dose coefficients. Phantoms are used to calculate the regional deposition of energy in different organs and tissues following exposure to internally deposited radionuclides and external radiation.

The aim is to replace the current MIRD phantoms, which are based on



simple geometric shapes of organs and tissues, with more realistic representations of organs and tissues based upon medical imaging data. These new phantoms are expected to be developed from voxel (volume pixel) phantoms in which the body can be represented by many millions of voxels each identified as a particular tissue type.

Priority will be given in the first instance to the development of adult male and female phantoms. DOCAL will use the voxel phantoms to calculate doses from both internal and external radiation sources once the Commission has finalised any revisions to tissue and radiation weighting factors.

**Interpretation of Bioassay Data:** To complement the development of dose coefficients for workers, Committee 2 has set up a Working Party, chaired by Frances Fry, to give advice on the interpretation of bioassay data. The experience of some recent interlaboratory comparisons has been that the interpretation of monitoring data can be very variable with a wide range of results.

The Commission considers that this is unsatisfactory and that there is a clear need to give advice on appropriate procedures to follow. The Working Party's objective is to provide guidance to those with responsibility for interpreting bioassay data from routine or special investigative monitoring programmes. It is intended that a Technical Document will be complete by the time that the new dose coefficients for workers are published.

**Dose Coefficients for Radiopharmaceuticals:** Some areas of work of Committee 2 are carried out in conjunction with other Committees. A joint Task Group with Committee 3 (Protection in Medicine) is concerned with providing biokinetic models and dose coefficients for radiopharmaceuticals commonly used in

medicine. This is chaired by Sören Mattsson, and is an ongoing programme of work as increasingly new radiopharmaceuticals are becoming available and are used by physicians. The Task Group has to be selective in identifying the most important new radiopharmaceuticals and in providing advice on dose coefficients. The materials being examined at present are  $^{99m}\text{Tc}$  labelled depreotide, fatty acids labelled with  $^{123}\text{I}$  and various dopamine transporter and receptor substances as well as PET substances.

**Wounds:** To date, ICRP has not given advice on the interpretation of wound monitoring data following accidents involving radionuclides. The biokinetic models that have been developed for various radionuclides are, however, applicable to the soluble component of any deposit in wounds that enters the blood circulation.

Committee 2 has considered the need to give advice on doses from material deposited in wounds. The United States National Committee on Radiological Protection and Measurements (NCRP) has recently set up a Committee to review the problem of wound dosimetry. ICRP will, for the present, follow the work of this Committee and has established cross membership.



*Christian Streffer is the Chairman of ICRP Committee 2.*

**Table 1**

**Summary of Reports on Dose Coefficients for Workers and Members of the Public From Intakes of Radionuclides**

	Workers <sup>a</sup>	Public <sup>b</sup>				
		Part 1	Part 2	Part 3	Part 4	Part 5
ICRP Publication	68 <sup>a</sup>	56 <sup>c</sup>	67 <sup>d</sup>	69 <sup>e</sup>	71 <sup>f</sup>	72 <sup>g</sup>
Equivalent doses to specific tissues	-	(+) <sup>c</sup>	+	+	+	-
Ingestion dose coefficients	+ <sup>i</sup>	(+) <sup>c,i,j</sup>	+ <sup>i,j</sup>	+ <sup>i,j</sup>	-	+ <sup>i</sup>
Gastrointestinal tract model <sup>h</sup>	30	30	30	30	30	30
Inhalation dose coefficients	+ <sup>j</sup>	(+) <sup>c,i,j</sup>	-	-	+ <sup>i,j</sup>	+ <sup>i</sup>
Respiratory tract model <sup>h</sup>	66	30	na	na	66	66
Tissue weighting factors <sup>h</sup>	60	26	60	60	60	60

a ICRP Publication 68 (ICRP, 1994b) gives effective dose coefficients for workers, for about 800 radionuclides: selected radioisotopes of the 91 elements covered in ICRP Publication 30, Parts 1–4. The inhalation dose coefficients for workers exposed to <sup>226</sup>Ra given in ICRP Publication 68 were revised in Annexe B of ICRP Publication 72.

b ICRP Publications 56, 67, 69, 71 and 72 give age-dependent dose coefficients (3 months, 1-, 5-, 10-, and 15-years and adult).

c ICRP Publication 56 (ICRP, 1989) gives age-dependent biokinetic models, and dose coefficients for selected radioisotopes, for H, C, Sr, Zr, Nb, Ru, I, Cs, Ce, Pu, Am and Np. It was issued before ICRP Publication 60 (ICRP, 1991a), and hence gives dose equivalents using the tissue weighting factors from ICRP Publication 26 (ICRP, 1977), rather than equivalent doses using the tissue weighting factors from ICRP Publication 60. The dose coefficients given in ICRP Publication 56 were superseded by those in ICRP Publications 67 and 71.

d ICRP Publication 67 (ICRP 1993) gives age-dependent biokinetic models, and dose coefficients for selected radioisotopes, for S, Co, Ni, Zn, Mo, Tc, Ag, Te, Ba, Pb, Po and Ra. Updated biokinetic models are given for Sr, Pu, Am and Np.

e ICRP Publication 69 (ICRP, 1995a) gives age-dependent biokinetic models, and dose coefficients for selected radioisotopes, for Fe, Sb, Se, Th and U.

f ICRP Publication 71 (ICRP, 1995b) gives age-dependent dose coefficients for selected radioisotopes of elements in Parts 1, 2 and 3, plus Ca and Cm for which age-dependent biokinetic models are given.

g ICRP Publication 72 (ICRP, 1996) gives a compilation of effective dose coefficients for members of the public for radioisotopes of the 31 elements covered in ICRP Publications 56, 67, 69, and 71, plus radioisotopes of the further 60 elements covered in ICRP Publications 30 and 68.

h ICRP Publication number.

i Committed effective doses (Committed Effective Dose Equivalent in Part 1).

j Committed equivalent doses (Committed Effective Dose Equivalent in Part 1).

+/- Dose coefficients given/not given in report.

na not applicable.

## **Committee 3 (Protection in Medicine):**

*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.*

Radiation in medicine has brought enormous benefits to people and populations throughout the world, since the discovery of radioactivity and x rays in the late 19<sup>th</sup> century. However, approximately two thirds of the world's population has little or no access to these benefits. The burden of disease on the economic and social systems in countries without adequate access to diagnostic and treatment resources is substantial.

A number of modalities will need to be employed to address the problem, but for the foreseeable future, ionising radiation procedures will provide a significant proportion of the procedures. Consequently, a substantial increase in radiation exposure of populations will ensue, and urgently. For the maximal benefits to be realised, the risks need to be pragmatically controlled.

Procedures are becoming increasingly complex, often allowing faster, more accurate (and sometimes reduced cost) diagnosis and treatment. However, this complexity carries enhanced risks of error, with the very real possibility of severe detriment. Many physicians are unaware of the risks of ionising radiation exposures.

Globally, physicians have a good understanding of benefits of medical procedures, but little understanding of many of the risks – this is for **all** interventions not just those involving radiation. Thus far ICRP's advice has had little impact on physicians who actually prescribe radiation.

### *Strategy*

Committee 3 (C3) was reconstituted in 1997 to achieve a majority representation of practitioners from the relevant fields of medicine, reinforced by expertise from those medical professionals who support medical practice using ionising radiation in the field. The new C3 produced a Mission Statement and devised a strategy with the aim of reaching the practising physicians of the world. The main objectives are to:

- identify and prioritise the major protection problems in medicine;
- write single reports to address each specifically;
- direct reports to specific medical users;
- include colour pictures, main points, and bold important messages;
- make reports widely available through routes other than ICRP's traditional methods.

### ***Committee 3 Task Groups and Working Parties***

**Pregnancy:** Lack of knowledge among medical practitioners leads to anxiety and probably unnecessary termination of pregnancy, when pregnant patients and workers are exposed to ionising radiation. Some of the exposures are inappropriate resulting in unjustifiable increased risks to the child, but many pregnant patients are exposed according to good radiological practice.

This was the first issue addressed and the result is ICRP *Publication 84*, which

gives practical advice on addressing the commonly asked questions. The Task Group was chaired by Fred Mettler. Now published in English, translated into Chinese and French and shortly to be distributed, in abridged format, by WHO in developing countries.

**Interventional Radiology:** This is increasingly used by practitioners in many specialties to reduce morbidity and mortality. However, most physicians using these techniques have had **no** radiation effects or safety training.

There is a growing literature on serious skin injuries to patients and less serious injuries to staff. Although the techniques can often save life or substantially improve quality of life, patients are not routinely informed of the potential, serious adverse effects, which can significantly impair the quality of life the procedures seek to provide. The result of a Task Group chaired by Chris Sharp, ICRP *Publication 85* has recently been published in English to provide practical guidance. It is currently being translated into French and summaries will be published in specialty journals.

**Accidental Exposures in Radiation Therapy:** Devastating, fatal overdoses and significant underdoses continue to occur in radiotherapy. Radiotherapy usage is increasing worldwide and the potential for accidents is increasing concomitantly.

The complexity of equipment and procedures is amplifying this risk and there is therefore a need for robust systems to protect patients. ICRP *Publication 86* was drafted by a Task Group chaired by Pedro Ortiz Lopez. It provides practical radiological protection advice in radiotherapy.

**Managing Doses in CT:** Absorbed doses from CT can approach or exceed levels known to increase cancer risk. CT

frequency is increasing rapidly along with the doses for each procedure. In UK, for example, CT represents 4% of procedures, but around 40% of the total population dose.

The availability of rapid, comprehensive images have led to a problem with the justification and optimisation of these procedures – these issues are often ignored. However, there are many practical techniques available to reduce dose without compromising the clinical purpose. ICRP *Publication 87* provides such practical advice. It was drafted by a Task Group chaired by Madan Rehani.

**Radiation Doses from Radiopharmaceuticals:** A standing Task Group with Committee 2 provides dosimetry advice on some of the large number of radiopharmaceuticals used in medicine (see above under Committee 2; the Task Group chairman is Sören Mattsson). Reports are published as Addendums to *Publications 53*, and *Publications 62* and *80*. The emphasis recently has shifted to positron emission tomography (PET) with its ability to detail short-lived functional events.

**Release after Therapy with Unsealed Sources:** Legislation and practice varies considerably in many countries and there is a need to clarify the rationale and essential elements of discharge policies to protect carers, friends, and the public after therapy. Ethical issues are an integral part of such policies. The Task Group, chaired by Keith Harding, has a target of 2002 to provide a draft to the Main Commission.

**Dose Reduction in Digital Radiography:** Digital radiology has improved the quality and recall of images, but doses are often higher than in conventional procedures. There is a lack of awareness of this by many clinicians.

The Main Commission has approved a Task Group, chaired by Eliseo Vañó, to provide a report that will recommend dose optimisation techniques to both manufacturers and users. The objective is to provide a draft by 2004.

**Paediatric Exposures:** In non-paediatric radiology facilities children are often treated like adults, resulting in unnecessarily high doses in a putative higher risk group. A poster and information sticker have been designed to be located in examination rooms and on equipment to provide practical advice to radiographers and technicians (Working Party chairman: Hans Ringertz). The International Society of Radiology has jointly sponsored these publications, but practical distribution is awaiting a commercial sponsor.

**Guide on Radiation in Medicine for Medical Practitioners:** Medical practitioners are generally inadequately knowledgeable about radiation: its benefits and risks; doses quantities and effects; typical procedure doses and sources; justification and optimisation; and special circumstances, e.g. pregnancy. This is extant in a setting where patients wish to know more about their investigation and treatment. A document was drafted by a Working Party chaired by Julian Liniecki. It provides advice in a 'frequently asked questions' format, to make it an indispensable aid in the consultation room. The Main Commission has decided to make this available on a dedicated education segment of the ICRP website with a download facility.

**Training Requirements for Practitioners using Ionising Radiation:** There is growing concern in many countries about the ongoing demonstration of competency by medical practitioners. Knowledge, attitudes and behaviour are just as relevant in the use of radiation as in any other technique in medicine. The proposal is for a Working Party, chaired by Marvin

Rosenstein, to prepare a document to provide recommendations on training for radiation protection and safety for operators at all levels. Additionally, recommendations on potential authorisation networks are envisaged.

**High Dose Rate Brachytherapy:** This new technology has the potential for devastating effects from small errors. The proposal is for a Working Party chaired by Luis Pinillos to provide an outline of the aspects of this technology that are different from conventional radiation therapy, to reduce risks of detriment.

**Web-based PowerPoint Presentations:** This proposal seeks to provide the main points of C3 reports in a format for teaching, downloadable from the Internet (Working Party chairman: Fred Mettler). Telemedicine is making a considerable impact on the practice of medicine in developing and remote regions of the world. Internet connection is considerably cheaper than microwave and other higher quality communications links. Reproduction of presentations is also likely to be more cost-effective. Each presentation should be 10-15 slides with lecturer notes. The presentation would be cross-referenced with the ability to order publications on line.

### *Watching Briefs*

The effects of genetic susceptibility to radiation continue to be investigated and in medicine are only likely to be significant for therapy. However, the ability to identify susceptible patients before treatment could significantly enhance the treatment of non-susceptible patients – therapy is already moderated to guard against serious effects in the small number of susceptibles – and reduce morbidity in those that are.

Intravascular brachytherapy is being used in some countries with reportedly mixed results. Doses to staff are of particular concern with some techniques.

Gamma knife techniques are gaining 'market share' in neurosurgery as they reduce collateral brain damage and are extensively used in developing countries as cost-effective techniques.

### ***Continuing Problems***

- Communication to clinicians remains the most fundamental challenge for ICRP. In providing recommendations and writing guidance, ICRP must understand the issues that drive physicians in their everyday work. By meeting their needs, when concerns arise (whether ICRP raises these concerns or they are raised by others) with easily accessed information, the objectives of protecting patients and staff will be served.
- Is patient protection globally a significant issue at doses below 10-50 mSv? Answering this question is fundamental to where limited effort is applied. The special issue of the use of effective dose for in-utero and

paediatric exposures will continue to be a contentious issue.

- Quantification of the risk-benefit ratio eludes most of medicine – but has it a provenance in low dose procedures?
- Human error is the cause of most accidents and despite good training, practical procedures and tight regulation they continue to occur in even industrialised countries – how can this be reduced?
- What is the level of unjustified practice, is it controlled by criteria, is audit working?



*Fred Mettler is the Chairman of  
ICRP Committee 3*

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

*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.*

Committee 4 deals with application of the Commission's Recommendations. It interprets, expands and develops the Recommendations, providing a forum for identification of issues stemming from the Recommendations and, hopefully, a means for resolution.

The Committee comprises eighteen members drawn from fifteen 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 Nuclear Energy Agency of the OECD (NEA) and the International Atomic Energy Agency (IAEA) 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.

### **Current Work**

With the completion of the work on solid waste disposal and on prolonged

exposure situations, the bulk of the Committee's work on the interpretation of the 1990 Recommendations of the ICRP has been completed.

The focus for much of the Committee's future work is centred upon the development of the Commission's 'Recommendations for the 21<sup>st</sup> Century'. This had also provided a stimulus for its work programme developed at earlier meetings, notably the previous meeting in Leesburg, Washington in 2000.

The Committee received the following working reports developed by working parties of Committee members. These reports will not be published as they stand but rather form an input to the Committee's programme at work, agreed at this meeting, supporting the Commission's developmental work on recommendations.

**The scope of the new Recommendations:** This working party had been asked to cover the content and scope of the 'new' Recommendations. Particular issues included: rationalisation of the system of protection with that applied to other pollutants; exemption and exclusion, covering amenability to control; justification, making a decision between generic and specific justification; and categories of exposure and sources.

One conclusion that emerged from discussions was that in principle, ICRP Recommendations should apply to all exposures and sources no matter what their magnitude. The 'new' Recommendations

should, however, provide some guidance to regulatory bodies on their implementation. This guidance would necessarily cover the concepts of exclusion (not amenable to control) and exemption (not worth controlling). IAEA also has a developing work programme in this area and it was recognised that links between ICRP and IAEA on these topics would have to be maintained.

The general issue of the interface between ICRP Recommendations and IAEA Basic Safety Standards came up both during discussions on this report and, subsequently, in meetings with members of the Main Commission. The current view is that ICRP Recommendations would focus on principles for radiological protection with only the minimum necessary guidance on translation into regulations. This latter role could be fulfilled by IAEA.

**The protection of the individual:** This report provided background information for the new Task Group that is being established on this topic (see below). A number of issues for further discussion were identified.

These included categorisation of sources (controllable, non-controllable, *etc*), individual related versus source related control criteria, the definition of the group representative of the most exposed individuals, and accounting for uncertainties in the dose assessment process. In the discussions the importance of involving stakeholders (interested and affected parties) in radiological protection decisions was identified as an important issue.

**Principle of optimisation of protection:** Again, this report provided background material and issues for discussion for a new Task Group on this topic (see below). Important topics for future development are a definition of optimisation of protection, the implications

of moving from an ALARA (As Low As Reasonably Achievable) approach to one placing emphasis on ALARP (As Low As Reasonable Practicable), operational and managerial aspects including stakeholder involvement, and the integration of optimisation into regulation.

Subsequent discussions showed the benefit of having observers present from other organisations. The NEA observer, Dr Lazo, distributed a paper prepared by NEA as input to the Committee's discussions on the integration of the optimisation concept into regulation.

**Potential exposures, intervention and emergency issues:** A number of issues surrounding the definition and use of the concept of potential exposures were explored. These included how to use estimates of potential exposure, ways of categorising emergencies and how to assess potential exposures. The discussions on these topics will be an input into the Main Commission's deliberations on the new system of protection.

**Operational and regulatory matters:** This was another exploratory report taking a general look at the application of ICRP Recommendations pointing out that, as they are intended for world-wide application, their meaning should be crystal clear and they should contain some guidance on regulatory implementation.

**Rehabilitation of contaminated land:** The purpose of this area of work is to develop the radiological protection framework established in ICRP *Publication 82* specifically in the context of contaminated land. It draws on experience that has been gained in applying ICRP's Recommendations to the protection of populations living in the contaminated areas of the former Soviet Union. It is at the stage of identifying topics where further work is required. Such topics include the



distinction between practices and interventions, the issue of the circulation of potentially contaminated commodities, how to establish action levels, stakeholder involvement, use of the critical group concept, and the management of radioactive wastes resulting from daily life activities. Committee 4 will continue to work on this general topic.

Work on these topics will be done in two ways. The first way, the preparation of key 'building blocks' for the Recommendations, would be undertaken by task groups. The second way, to be conducted by working parties, would be the preparation of text for key terms that would be used in the Recommendations. The importance of clarity was emphasised. The distinction between task groups and working parties is that the former may have members drawn from outside the Commission's structure and are funded as necessary by the Commission whereas the membership of working parties is usually restricted to Committee and Commission members. Three new task groups are to be set up:

**To Characterise Individual Members of the Public:** This task group, chaired by John Till, will attempt to develop a definition of the individual to be used for determining exposures of the public in a variety of exposure situations. The critical group concept will be revisited and, if necessary, revised in the context of both past experience and the possible form and nature of the new Recommendations. Guidance is also being sought from this group on methods for assessing compliance with radiological criteria for members of the public. Associated issues such as environmental monitoring and the treatment of uncertainties will also be subjects for consideration. This task group is to be chaired by John Till.

**Optimisation in Radiological Protection:** This task group is to be chaired

by Wolfgang Weiss. It will develop guidance on optimisation of protection making any necessary distinctions with the justification of practices. Stakeholder involvement will be an issue for discussion, as will protective action levels (a possible new term encompassing constraints). The use or otherwise of the quantity collective dose may also have to be considered. Guidance on operational and managerial aspects of optimisation will also be developed.

**Radiological Protection in Space Flight:** This group, chaired by Toshiso Kosako, has a somewhat different emphasis from the others as it is not directly concerned with the development of the new Recommendations. The major issue concerns exposure during low earth orbit extended flights and is relevant to the construction, operation and maintenance of the proposed International Space Station. A member of Committee 2 is likely to serve on this task group in order to address the dosimetry.

Three new working parties were also established. One, led by Anthony Wrixon, will address issues of scope including the thorny questions of exclusion and exemption. Another one, chaired by Kaare Ulbak, will develop a glossary of ICRP terms, and a third one led by Ciska Zuur will develop ideas on potential exposure and regulatory issues.

An earlier Working Party of Committee 4, led by Rudolf Alexakhin, provided a final report concerning the Commission's statement (in ICRP *Publication 60*) on Protection of the Environment. This discussed possible aims for protection of the environment, possible criteria, and the interpretation of terms such as biodiversity. Since the Main Commission had now launched a Task Group on this topic, with the Working Party chairman as one of its members, the

Working Party was disbanded and its report was forwarded as input to the Task Group.



*Bert Winkler is the chairman of ICRP Committee 4.*

## The Scientific Secretariat

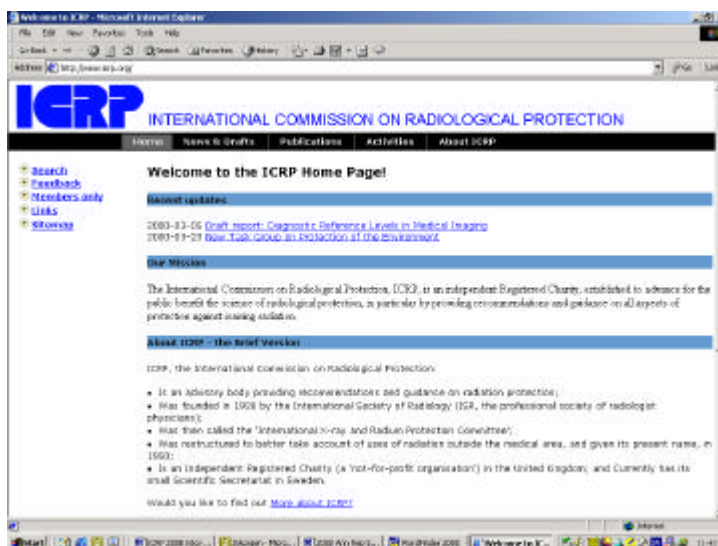
The Scientific Secretariat is currently situated in Stockholm, Sweden. The seat of ICRP remains in the United Kingdom where ICRP is a Registered Independent Charity.

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.

In 2001, 284 different new matters were filed for action in the Commission's computerised document filing system. 26 matters that had been filed but not completed in 2000 were also settled. Of the 284 new matters, 8 concerned the Main Commission, 15, 15, 9, and 11 matters concerned Committees 1, 2, 3, and 4 and their Task Groups, and the remaining 226 concerned the

Scientific Secretariat. Of the latter, 38 were to do with ICRP Publications (mostly, requests for permission to translate and/or publish ICRP material). 162 were general enquiries to ICRP including 9 draft documents sent to us for consultation, and 26 file items concerned economical matters. 272 of these 284 actions were completed in 2001.

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 ICRP web site at [www.icrp.org](http://www.icrp.org) provides an opportunity to disseminate information about ICRP activities and at the same time to receive comments and questions from interested organisations and persons.*

## ***Contacts, Meetings, etc.***

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

The Chairman, Professor Clarke, participated in the 2<sup>nd</sup> Villigen Workshop in January, sponsored by the NEA-CRPPH, on the ethics of radiological protection. In February he participated in a special CRPPH meeting to present evolving ideas for the future of protection recommendations, and visited WHO in Geneva for discussions with Dr Repacholi and the DG Mrs Brundtland.

He visited CSN in Madrid and presented a paper at a conference organised by CIEMAT. In March he presented papers to the State regulators, Savannah River Health Physics staff and Columbia University staff in South Carolina. A speaking tour of Australia involved Government in Canberra, ARPANSA staff in Sydney and Malbourne, and professional society meetings there and in Adelaide.

In April a paper was presented to the Conference of Radiation Program Control Directors in Anchorage, Alaska. During May he attended a conference at the Low Dose Effects Research Centre in Tokyo, while June saw visits to the USNRC and a meeting with the Chairman, Dick Meserve, followed by presentations to the American Academy of Health Physics meeting in Cleveland and a meeting with officials from USDOE. There was also a visit to Dublin for the 2<sup>nd</sup> WONUC Conference and a presentation.

August saw an attendance at the Swedish Risk Academy's meeting on test cases with proposed recommendations for protection, while September began with the Main Commission meeting in The Hague. November visits included a second visit to CRPPH in Paris, a visit to Munich for the Nuclear and protection communities and December saw a second Paris visit to the Gustav-Roussy Institute for papers at a

Conference largely on medical aspects of protection.

In addition, the Vice-Chairman, Dr Holm, the Scientific Secretary, Dr Valentin, and members of the Commission represented ICRP in meetings of various kinds 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).

They also took part in many meetings with national regulatory organisations, research establishments, and professional societies, particularly in the Netherlands where the annual meeting of ICRP was held in The Hague.

In line with standard ICRP procedure, ICRP also invited representatives of authorities, professional societies, and other bodies interested in radiological protection to a briefing session in connection with the annual ICRP meeting.

The great turnout, on a Friday afternoon, and the many questions, comments, and suggestions during the session again proved that such contact opportunities are highly appreciated and useful.

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.

telephone, e-mail, and regular mail to the Secretariat.

There was also a brisk demand for informal enlightenment and information via



*Simon Carroll (left), Greenpeace International, and the ICRP Chairman, Roger Clarke, in discussion at a meeting. Dr Carroll is a corresponding member of the ICRP Task Group on protection of the environment.*

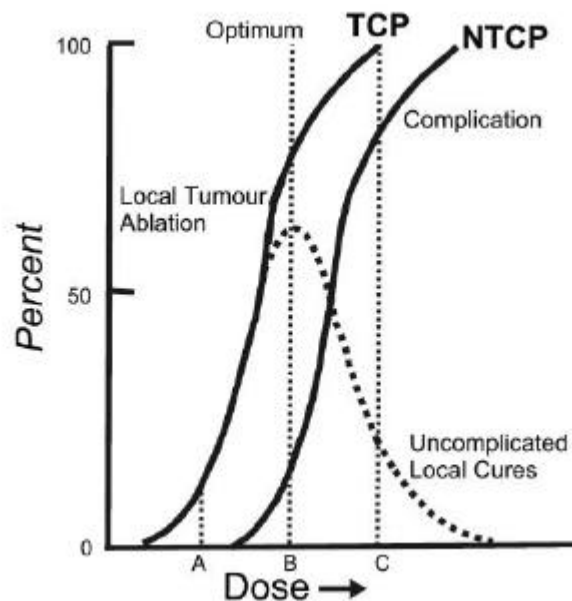
## **ICRP Publications, etc., printed in 2001**

ICRP. Avoidance of radiation injuries from medical interventional procedures. ICRP Publication 85. *Annals of the ICRP* 30 (2), Pergamon Press, Oxford, UK.

ICRP. Prevention of accidental exposures to patients undergoing radiation therapy. ICRP Publication 86. *Annals of the ICRP* 30 (3), Pergamon Press, Oxford, UK.

ICRP. Managing patient dose in computed tomography. ICRP Publication 87. *Annals of the ICRP* 30 (4), Pergamon Press, Oxford, UK.

ICRP. Doses to the embryo and fetus from intakes of radionuclides by the mother. ICRP Publication 88. *Annals of the ICRP* 31 (1-3), Pergamon Press, Oxford, UK.



*The solid curves represent the probability of tumour control (TCP) and of normal tissue complication (NTCP) versus delivered dose. The dashed curve indicates the probability of uncomplicated tumour control, with a maximum at dose B representing the optimal balance between tumour ablation and acceptable side effects.*

*From ICRP Publication 86, Figure 3.*

## Contact Information

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*Most ICRP reports are translated into Chinese (and many reports are also translated into various other languages). This is the Chinese version of ICRP Publications 81 and 82.*

## ***Organisations providing grants to ICRP in 2001***

Unrestricted funds totalling about 196 000 US dollars were received from:

CEC;  
IAEA;  
IRPA;  
ISR;  
OECD/NEA;  
Canada: CNSC and Health Canada;  
Germany: Bundesmin UNR;  
Japan: JAERI and PNC;  
Norway: NRPA;  
USA: NIH and NRC.

Australia: ARPANSA; Denmark: NBH; Finland: STUK; France: IPSN and SFRP; Iceland: GR; Spain: CSN, Sweden: Min. Env.; Switzerland: Fed.Off. Energy; and UK HSE, all regular contributors to ICRP, provided unrestricted grants totalling about 63 000 US dollars which related wholly or partly to calendar year 2001 but were paid out early in 2002.

No restricted funds were received in 2001.



**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