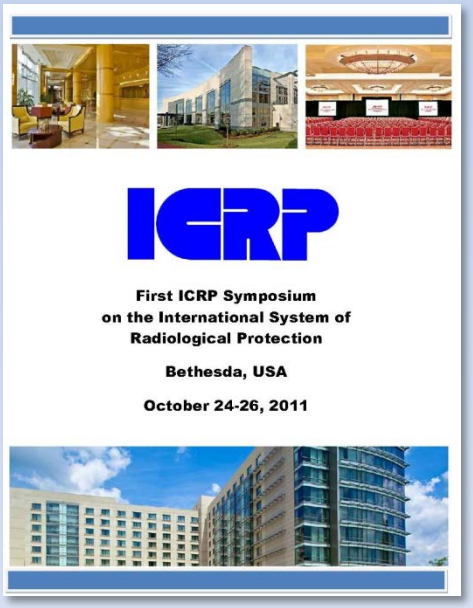
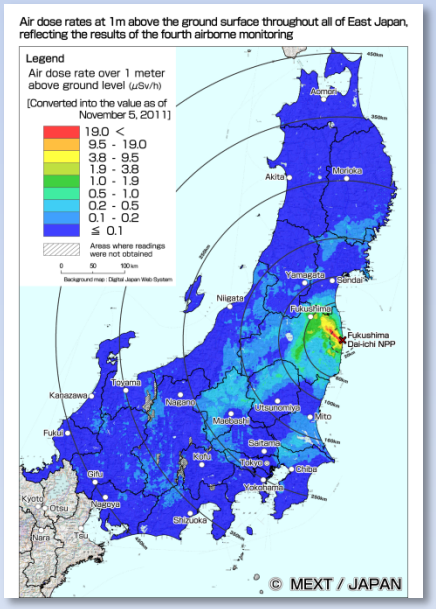
International Commission on Radiological Protection

2011 Annual Report





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On the cover, from left to right:

- The programme for the first ICRP Symposium on the International System of Radiological Protection, “ICRP 2011”
- ICRP’s first formal strategic plan, released in October 2011
- A dose rate map of the area around the Fukushima Daiichi nuclear power station as a result of releases during the accident in March 2011 (reproduced with permission of MEXT)

ICRP 2011 Annual Report

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Chair's Foreword

2011 was a challenging year for everyone involved in radiological protection, in particular those in Japan who experienced first-hand the accident at the Fukushima Daiichi nuclear power station that resulted in the release of radioactive materials into the environment. Many organisations, including ICRP, responded rapidly in different ways to offer much needed assistance.

During the year ICRP and its members did everything possible to help the people and government of Japan during the recovery phase of this accident. This included making available free of charge ICRP *Publication 111* Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency. This, and another relevant report ICRP *Publication 109* Application of the Commission's Recommendations for the Protection of People in Emergency Exposure Situations, had been published only about one year earlier. It had not been anticipated that this advice and guidance would be called upon quite so soon.

With the establishment of ICRP Main Commission Task Group 84 on the initial lessons from the NPS accident in Japan, ICRP has also begun to compile lessons that will hopefully lead to improvements in the system of radiological protection.

In addition, we established a dialogue initiative, a cooperative effort to share the recommendations and guidance of ICRP *Publication 111* directly with those affected. The objective is to help the people of Japan, while at the same time gaining a deeper insight into the situation to ensure that future recommendations of ICRP will benefit from this experience. Other endeavours in relation to the Fukushima Daiichi accident are described in this annual report.

The Main Commission held two meetings during 2011, the first in Seoul, Korea in April and the second in Bethesda (Rockville), USA in October/November. Each was particularly noteworthy: the former because of a special session on Fukushima held only four weeks after the accident, which involved delegates from the Nuclear Safety Commission of Japan, Japan Atomic Energy Agency, Kyoto College of Medical Science, Oita University of Nursing and Health Science, and Tokyo Electric Power Company; the latter because it was held in conjunction with the first ICRP Symposium on the International System of Radiological Protection (ICRP 2011).

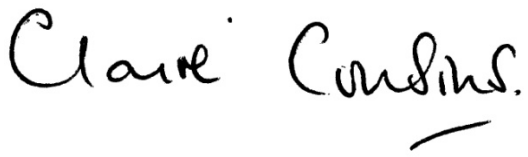
ICRP 2011 was a major milestone for ICRP and a great success, attracting approximately 400 participants from about 35 countries and garnering much positive feedback. Seventeen sessions were held, sometimes in parallel, over 3 days, presenting a broad spectrum of issues in radiological protection. It was an excellent opportunity to present the current work of ICRP, to discuss challenging topics and to get direct feedback from the delegates.

ICRP 2011 was not an isolated event, but was the first in what we hope will be a series of biennial symposia, a cornerstone in our continued efforts to be open and transparent, and to more fully engage with all professionals interested in radiological protection. Indeed, holding regular symposia is one of the five key initiatives outlined in the ICRP Strategic Plan 2011-2017 released during ICRP 2011.

This Strategic Plan was also a major milestone for ICRP. It evolved from an initiative during 2009 and 2010 to undertake an internal review of the structure and working methods of ICRP, which included input and opinions from members and observer organisations. Reviewing our strengths and challenges, six key objectives for the period were identified, along with five associated initiatives:

- Making ICRP publications available at low or no cost;
- Recommending research needed to strengthen the System of Radiological Protection;
- Holding regular ICRP symposia;
- Increasing ICRP participation in radiological protection and other forums; and,
- Openly seeking nominations for new members.

Achieving these key initiatives will require considerable resources, certainly more than ICRP, a registered charity relying on voluntary contributions, currently has available. This will be a significant challenge to overcome in the next few years, among the many others we face, as we continue to work in the public interest to promote radiological protection.



Dr Claire Cousins
ICRP Chair

The International Commission on Radiological Protection

Since 1928, the International Commission on Radiological Protection (ICRP) has successfully developed the System of Radiological Protection as the basis for radiological protection standards, legislation, guidance, programmes and practice worldwide.

ICRP is a charity established to provide independent recommendations and guidance on radiological protection for the public benefit.

In preparing its recommendations, ICRP considers advances in scientific knowledge, evolving social values, and practical experience. Formulating standards, regulations, and codes of practice is the responsibility of other national and international organisations.

The objective of the work of ICRP is to contribute to an appropriate level of protection against the detrimental effects of ionising radiation exposure without unduly limiting the benefits associated with the use of radiation.

The primary aim of the Commission's Recommendations is to contribute to an appropriate level of protection for people and the environment against the detrimental effects of radiation exposure without unduly limiting the desirable human actions that may be associated with such exposure.

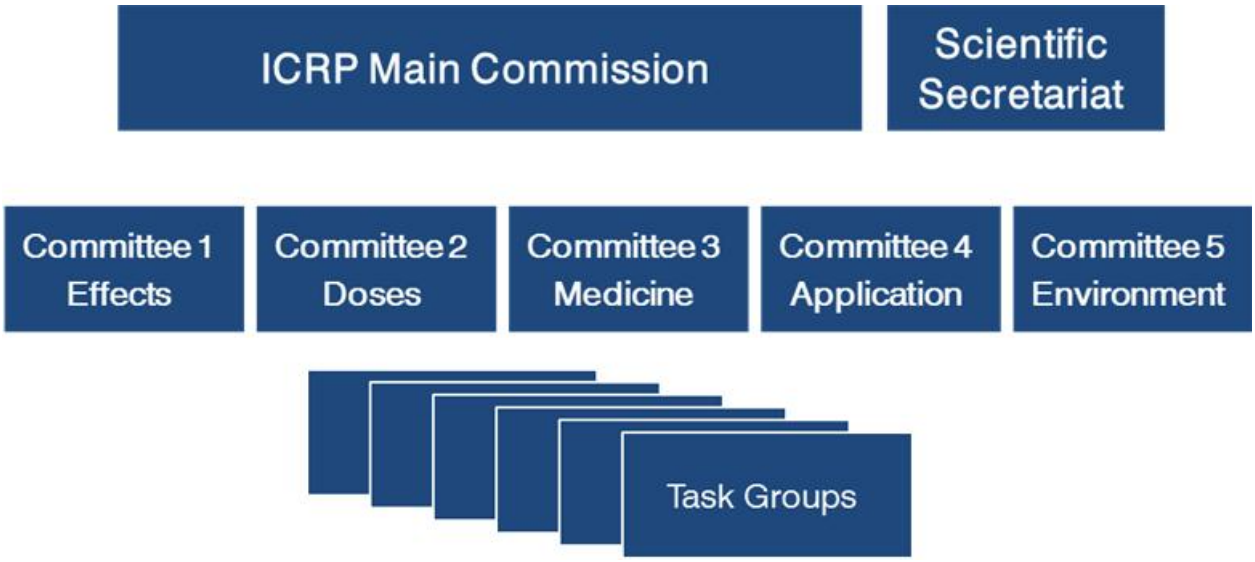
ICRP provides recommendations and guidance on protection against risks associated with exposure to ionising radiation from artificial sources widely used in medicine, general industry and nuclear enterprises, and from naturally occurring sources. These recommendations are published on behalf of the ICRP in the Annals of the ICRP. Each issue provides in-depth coverage of a specific subject area.

Structure

ICRP comprises the Main Commission, Scientific Secretariat; five standing Committees on: Radiation Effects, Doses from Radiation Exposure, Protection in Medicine, Application of ICRP Recommendations, and Protection of the Environment; and Task Groups established as needed to undertake specific work.

The Main Commission consists of the Chair, up to twelve other members, and the Scientific Secretary. The Main Commission is the governing body, setting the policy and programme of work, and approving all official publications.

The Scientific Secretariat manages the daily business of ICRP. It is led by the Scientific Secretary, who is also the Editor of the Annals of the ICRP, and often represents the organisation in international forums.



The general structure of ICRP

Committee 1 on Radiation Effects assesses scientific knowledge on radiation risk, examining possible implications on the System of Radiological Protection.

Committee 2 on Doses from Radiation Exposure develops reference models and data, including dose coefficients, for the assessment of exposure to radiation.

Committee 3 on Protection in Medicine develops recommendations and guidance on the protection of patients, staff, and the public against radiation exposure in medicine.

Committee 4 on Application of the Commission's Recommendations develops principles and recommendations on radiological protection of people in all exposure situations.

Committee 5 on Protection of the Environment develops reference models and data, and guidance on radiological protection of the environment.

Task Groups write reports, and normally consist of Committee members and experts from outside the Main Commission and Committees.

This multi-tier structure provides a rigorous quality management system of peer review for the production of ICRP publications. The work of Task Groups is reviewed by the relevant Committee(s), and then by the Main Commission. 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 through the ICRP web site.

Membership

Members come from over 30 countries on six continents and from all disciplines relevant to radiological protection. Selected on the basis of their recognised competence and experience, members are volunteers invited to join ICRP as independent experts for four year terms.

On each occasion of a new term, 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. The current period runs from 2009 July 1st to 2013 June 30th.

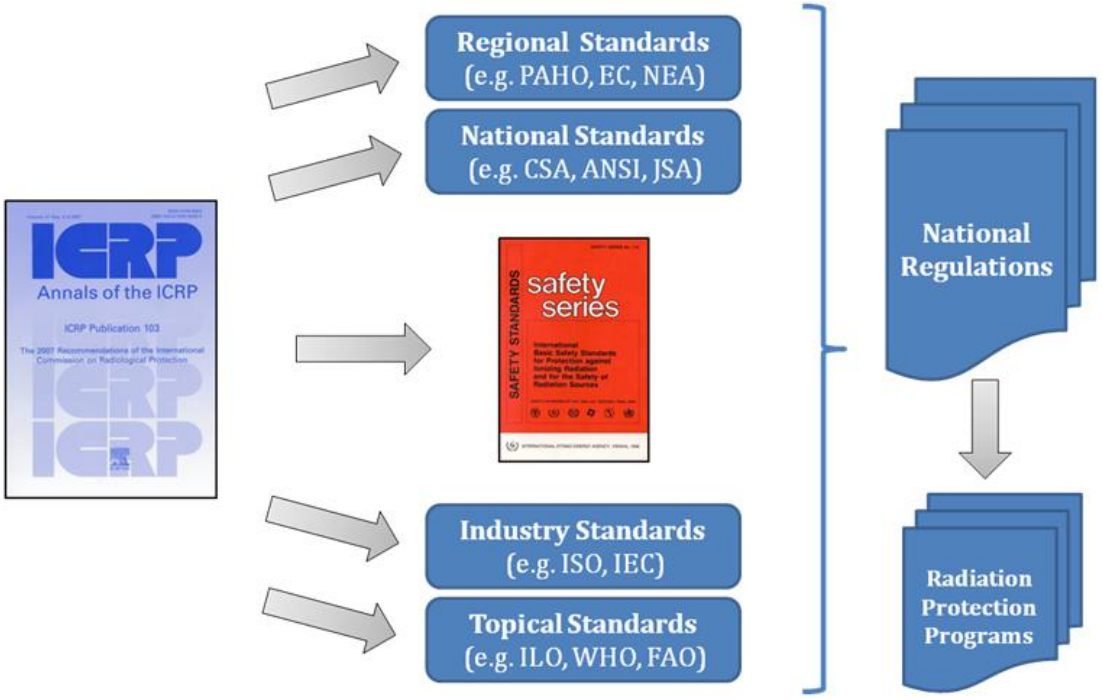
The Work of ICRP

ICRP recommendations are based on scientific knowledge and on expert judgement. Scientific data, such as those concerning health risks attributable to radiation exposure, are a necessary prerequisite, but philosophical and ethical considerations are similarly necessary, through which societal and economic aspects of protection must be considered. All of those concerned with radiological protection have to make value judgements about the relative importance of different kinds of risk and about the balancing of risks and benefits. In this, radiological protection is no different from other fields concerned with the control of hazards. The Commission believes that the basis for, and distinction between, scientific estimations and value judgements should be made clear whenever possible, so as to increase the transparency, and thus the understanding, of how decisions have been reached.

ICRP has published over one hundred publications on all aspects of radiological protection. Most address a particular area, but a handful of publications, the so-called fundamental recommendations, describe the overall system of radiological protection. The system of radiological protection is based on the current understanding of the science of radiation exposures and effects, value judgements, and experience. The value judgements take into account societal expectations, ethics, and experience gained in application of the system. As science and societal expectations have evolved over time, so too has the system of radiological protection. The recommendations also continue to take into account novel uses of radiation in medicine and other fields to help ensure an adequate level of protection in all circumstances.

ICRP offers its recommendations to regulatory and advisory agencies and provides advice intended to be of help to management and professional staff with responsibilities

for radiological protection. Legislation in most countries adheres closely to ICRP recommendations. The International Atomic Energy Agency (IAEA) International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources is based heavily on ICRP recommendations, and the International Labour Organisation (ILO) Convention 115, Radiation Protection Convention, General Observation 1992, refers specifically to the recommendations of ICRP. ICRP recommendations form the basis of radiological protection standards, regulations, programmes, and practice worldwide.



The ICRP System of Radiological Protection forms the basis of radiological protection standards, regulations, programmes and practice world-wide

Meetings

The Main Commission normally meets once or twice a year. Each Committee meets once a year. In alternate years a biennial meeting of ICRP is conducted jointly with the Main Commission and all of the Committees. Active Task Groups generally meet annually.

Finances

ICRP is primarily financed through voluntary contributions from organisations with an interest in radiological protection. All contributions are accepted with the understanding that they do not influence the ICRP membership or programme of work.

Some additional funds accrue from royalties on ICRP publications. Members' institutions also provide in-kind support to ICRP by making the members' time available without charge and, in many cases, by covering their costs of attending ICRP meetings.

The Work Programme of ICRP and Its Committees

Main Commission

The Main Commission consists of the Chair, up to twelve other members, and the Scientific Secretary. The Main Commission is the governing body, setting the policy and programme of work, and approving all official publications.

The Main Commission in Seoul, Korea, April 2011

Main Commission members and the Scientific Secretary continued to play a key role in the dissemination of information beyond the Annals of the ICRP, through presentations and discussions at many seminars, meetings, conferences, workshops and other forums.

Thus, contact was maintained with the International Atomic Energy Agency (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 (OECD-NEA), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), The World Health Organisation (WHO), the International Labour Organisation (ILO), the International Electrotechnical Commission (IEC), and the International Standards Organization (ISO), and many other international, regional, and national organisations.

A key output from the Main Commission in 2011 was the first formal ICRP Strategic Plan. It is available for download from the home page of the ICRP website, www.icrp.org. This plan, covering the period 2011-2017 i.e. to the end of the next term, provides a concise outline of the mandate, structure, and work of ICRP, and identifies ICRP strengths and challenges being faced. It concludes with a series of objectives and initiatives specific to this period:

OBJECTIVES

- Improved dissemination of ICRP recommendations
- Scientific work focused on improving the System of Radiological Protection
- Raised awareness of radiological protection in medicine
- Protection of the environment fully integrated into the System of Radiological Protection
- Positive relationships with organisations interested in radiological protection
- Best practices applied to the governance of ICRP

INITIATIVES

- Making ICRP publications available at low or no cost
- Recommending research needed to strengthen the System of Radiological Protection
- Holding regular ICRP symposia
- Increasing ICRP participation in radiological protection and other forums
- Openly seeking nominations for new members.

These initiatives cannot all be implemented with current funding. Therefore, ICRP will seek increased financial support through additional on-going and one-time contributions with the aim of achieving these objectives.

Task Group 84 on Initial Lessons Learned from the NPP Accident in Japan vis-à-vis the ICRP System of Radiological Protection

Chair: Abel Julio González

Task Groups are usually organised under the Committees. Exceptionally, in 2011 Task Group 84 was established under the Main Commission.

This Task Group (TG) will compile lessons learned related to the efforts carried out to protect people against radiation exposure during and after the emergency exposure situation caused by the Nuclear Power Station accident in Japan. In light of these lessons, the report of the TG will consider the suitability of ad hoc recommendations for the ICRP system of radiological protection for dealing with this type of emergency

exposure. The TG will prepare a report containing its findings and assessment, and make recommendations to the ICRP Main Commission on any other follow up actions, including potential improvements to the System of Radiological Protection. TG 84 will prepare a final draft for review at the October 2012 Main Commission meeting.

Scientific Secretariat

ICRP operates its Scientific Secretariat in Ottawa, Canada, in an office provided as an in-kind contribution from the Canadian Nuclear Safety Commission. The seat of ICRP remains in the United Kingdom where ICRP is an independent Registered Charity.

The Scientific Secretariat manages the daily business of ICRP. It is led by Christopher Clement, Scientific Secretary, the 5th since the position became full-time in 1962 and the 10th since ICRP was first established in 1928. He is assisted by Lynn Lemaire, Executive Assistant.

As ICRP's Chief Executive, Editor of the Annals of the ICRP, and head of the ICRP Scientific Secretariat, the Scientific Secretary oversees the daily operations of ICRP; prepares, organizes, and participates in all Main Commission meetings; is directly involved in aspects of the scientific and policy work of ICRP; often represents ICRP at international meetings; speaks on behalf of ICRP at workshops, symposia, and other forums; responds to requests for information about the work of ICRP; and coordinates the publication of ICRP reports including working with the authors, final editing of the reports, and various discussions and negotiations with the publisher.

Toshihiro Higuchi, a historian of science at Stanford University interested in radiological protection, has started working on a volunteer part-time basis as the ICRP Historian. He assists with the organisation of ICRP archives, and is undertaking an oral history project on behalf of ICRP.

Starting 2011 September 1, the Canadian Nuclear Safety Commission has arranged to have interns placed with the Scientific Secretariat on four-month terms.

Following discussions initiated in December of 2010, ICRP has made an agreement with Central Research Institute of Electric Power Industry of Japan (CRIEPI) for the loan of a cost-free expert. The new staff member will join the Scientific Secretariat in early 2012 on a one-year term, renewable up to three years.

Committee 1 (Radiation Effects)

Committee 1 assesses scientific knowledge on radiation risk, examining possible implications on the System of Radiological Protection.

ICRP Committee 1 in Amsterdam, Netherlands, October 2010

Committee 1 addresses issues of tissue reactions, risks of cancer and heritable diseases including dose responses, effects of dose-rate and radiation quality, effects in the embryo/foetus and genetic factors in radiation response, as well as uncertainties in providing judgements on radiation-induced health effects. The Committee advises the Main Commission on the biological basis of radiation-induced health effects and how epidemiological, experimental and theoretical data can be combined to make quantitative judgements on health risks to humans, particularly at low doses, in the form of detriment-adjusted nominal risk coefficients. The members have expertise in epidemiology, statistics, medical sciences, animal sciences, molecular and cellular biology, biophysics, genetics, and 'omics technologies. Dr. William Morgan became new Committee 1 Chair effective October 31, 2011. In particular, Committee 1 reviews recently published data from radiation epidemiology studies and new data on molecular and cellular effects of ionizing radiations that are pertinent to updating the basis for the 2007 Recommendations found in ICRP *Publication 103*. This work is undertaken through several Task Groups as described below.

Task Group 63 on Tissue Reactions and Other Non-cancer Effects of Radiation

Chair: Fiona Stewart

This Task Group has revisited the basis and the new data for establishing revised threshold doses for non-cancer effects. ICRP has not addressed this issue for about 30

years and there are some indications that there is a much greater sensitivity than previously thought for some tissues (e.g., lens of the eye) that must be considered. The report was posted on the ICRP web site for open consultation in May. The final publication is due to be published in 2012.

Task Group 64: Alpha Emitters

Chair: Margot Tirmarche

This Task Group has reviewed the recent reports on epidemiological data pertaining to lung cancer risk for uranium miners and residential radon exposed populations and has developed a revised detriment-adjusted nominal risk coefficient. The Task Group is now considering the cancer risks for alpha emitters other than radon. A report of the Task Group on lung cancer and radon has been created. All the studies other than the Mayak studies evaluated for possible inclusion are listed in an Annex.

Task Group 75: Stem Cell Radiobiology

Chairs: Ohtsura Niwa and Jolyon Hendry

This Task Group was established in 2007 to review the current state of knowledge of stem cell biology and radiobiology and the potential impact of stem cell effects on radiation cancer risks. There has been an enormous increase in knowledge of stem cell biology in the past 3-5 years although much less on radiation effects. The Task Group is reviewing the literature on stem cell radiobiology in relation to cancer risk estimation and establishing how knowledge of stem cell response can address uncertainties in risk estimation. The completion of the report has been delayed, mainly by the recent events in Japan but also the sheer volume of information to be evaluated. Nonetheless, the full members of the task group met in New York for a 2.5 day meeting from June 29 to July 1, 2011. Revisions are currently in progress. It is anticipated that the report will be completed by the end of 2012.

Working Party on DDREF

Chair: Julian Preston

This Working Party has continued its development of a short report on the assessment of DDREF with an emphasis on the selection of data used to support the estimation of DDREF and the specific model used for its estimation, with an emphasis on Bayesian models. The discussions have been led by Dale Preston following the untimely death of Elaine Ron who had chaired the Working Party. The discussions have been facilitated by use of an extensive review that was developed by SENES Consultants for NIOSH. A draft report has been developed and is undergoing review and revision. It is anticipated that the effort will be completed in 2013.

Other Review Activities

Committee 1 continues to review the recent literature on a number of topics related to the 2007 Recommendations in ICRP *Publication 103*.

- Radiation epidemiology
- Tissue reactions and non-cancer effects
- Susceptible populations
- Dosimetry and exposure
- Radiobiology
- Heritable effects
- Epigenetics
- DNA Repair and non-targeted effects

Committee 2 (Doses from Radiation Exposures)

Committee 2 develops reference models and data, including dose coefficients, for the assessment of exposure to radiation.

ICRP Committee 2 in Gatlinburg, USA, October 2010

Over many years, ICRP Committee 2 has provided sets of dose coefficients (dose per unit exposure) to allow users to evaluate equivalent and effective doses for intakes of radionuclides or exposure to external radiation for comparison with dose limits, constraints and reference levels as recommended by ICRP. Following from the 2007 Recommendations, Committee 2 and its Task Groups are engaged in a substantial programme of work to provide new dose coefficients for various conditions of radiation exposure. In preparation for the calculation of new dose coefficients, Committee 2 and its Task Groups have provided updated nuclear decay data (ICRP *Publication 107*) and adult reference computational phantoms (ICRP *Publication 110*).

The programme of work of ICRP Committee 2 to provide new dose coefficients following from the 2007 Recommendations is considerable. The methodology being applied in the calculation of doses can be regarded as state-of-the-art, in terms of the biokinetic models used to describe the behaviour of inhaled and ingested radionuclides and the dosimetric models used to model radiation transport for external and internal exposures. It could be argued that the level of sophistication of these models is greater than required for the calculation of the protection quantities with their inherent simplifications and approximations, introduced necessarily for example by the use of radiation and tissue weighting factors. However, ICRP is at the forefront of developments in this area and its models are used for scientific as well as protection purposes. Thus, ICRP models can provide best estimates of organ and tissue absorbed dose for use in epidemiological studies and assessments of risk to individuals.

Furthermore, it is important that methodology is continually refined and improved in response to suggestions that ICRP dose assessments underestimate risks, particularly for internal exposures.

The Committee continues to cooperate with the International Commission on Radiation Units and Measurements (ICRU) and issues joint reports as appropriate. The Committee leads a Task Group on considerations of the applicability of the protection quantities, in particular effective dose, and proposals for alternatives where assessments of individual risk are required, for example in medical radiological procedures. Committee members support the work of the other ICRP Committees, providing members for Task Groups of Committees 1, 3 and 5.

Task Group 21: Internal Dosimetry (INDOS)

Chair: François Paquet

The primary objective of the ICRP Committee 2 Task Group on Internal Dosimetry (INDOS) is to develop biokinetic models for the behaviour of inhaled and ingested radionuclides. Biokinetic models for individual elements and their radioisotopes are used to calculate the total number of radioactive decays (transformations) occurring within specific tissues, organs or body regions (source regions) during a given period of time (usually to age 70). Dosimetric models are then used to calculate the deposition of energy in all important organs/tissues (targets) for emissions in each source region, and hence absorbed and equivalent doses to organs and tissues and effective dose. All dose coefficients require revision following the modifications made in the 2007 Recommendations and the adoption of adult reference phantoms (ICRP *Publication 110*). The opportunity is also being taken to update biokinetic models for the new calculations. Doses will be calculated using the ICRP *Publication 100* Human Alimentary Tract Model and changes are being made to the ICRP Human Respiratory Tract Model, taking account of more recent data. In addition, revisions are being made to models for the systemic behaviour of individual elements following absorption to blood, making them more physiologically realistic. Work continues on a series of reports to replace ICRP *Publications 30* and *68* on doses to workers. As well as giving dose coefficients, these reports will provide data for the interpretation of bioassay measurements, replacing ICRP *Publications 54* and *78*. It is anticipated that the first set of new dose coefficients for occupational exposures will be published in 2013. Attention will then be focussed on doses to members of the public.

Task Group 4: Dose Calculations (DOCAL)

Chair: Wesley Bolch

DOCAL is responsible for developing methods, computational models, and associated reference data for the calculation of absorbed, equivalent, and effective doses from both external and internal sources of radiation. Following the modifications of tissue and radiation weighting factors in ICRP *Publication 103* and the release of ICRP *Publication 110* Adult Reference Computational Phantoms, a major focus of DOCAL activities this past year was to assemble new reference data on external radiation dose coefficients using the revised values of the weighting factors and the ICRP adult reference computational phantoms. A subset of these data has been provided to a joint ICRP/ICRU Task Group of on radiation doses to aircraft crew and DOCAL also provided calculational support to the Task Group on Radiation Protection in Space. Progress has been made on improving skeletal dosimetry using paired macro- and micro-CT images to define dose delivery within target regions of red bone marrow and bone endosteum. DOCAL continues to develop paediatric phantoms for use by Committees 2 and 3 in dose assessments for both environmental and medical exposures. The Task Group is working closely with the Task Group on Internal Dosimetry (INDOS) on the generation of dose coefficients for the upcoming series of reports on occupational and public exposures to radionuclides.

Task Group 67: Assessment of Radiation Exposure of Astronauts in Space

Chair: Günther Dietze

This Task Group is concerned with the radiation exposure of astronauts during space missions. The complex primary cosmic radiation field in space includes a wide range of very high-energy charged particles with heavy ions up to high values of Z and secondary particles produced in nuclear reactions of the primary field with structural material of the space vehicles. The report focuses on providing data on the radiation fields, for the assessment of doses to astronauts and will describe methods of radiation monitoring, of measuring radiation field parameters, and of individual monitoring of astronauts. The absorbed dose coefficients for organs and tissues of the human body used in the report are being calculated using the new ICRP reference anatomical models, in cooperation with the DOCAL Task Group. The preparation of the report is close to completion and publication is scheduled for 2013.

Task Group 79: The Use of Effective Dose

Chair: John Harrison

This Committee 2 led Task Group has members from Committees 1, 3 and 4 as well as external experts, in recognition of the central importance of this issue. Experience has shown that ‘effective dose’, which has been defined and introduced by ICRP for radiological protection purposes, i.e. for risk limitation and optimization, is widely used in radiological protection but also in related fields, in particular for risk assessments for exposures of individuals beyond its original purpose, incorrectly in some cases.

Useful guidance on restrictions on the use of the quantity is provided by Committee 2 in Annex B to the 2007 Recommendations. This guidance needs to be further expanded, and proposals made for the control of exposures and risk management as well as risk assessment in situations where ‘effective dose’ should not be used. An important focus of the report will be medical exposures. Effective dose can be a useful tool for comparisons of, for example, different diagnostic examinations and interventional procedures, the use of different technologies for the same medical examinations, and the use of similar technologies and procedures in different hospitals and countries. However, the use of ‘effective dose’ for patient exposures is problematic when it is used to assess risk in specific individuals, including children. Further guidance is required for this important area.

Committee 3 (Protection in Medicine)

Committee 3 develops recommendations and guidance on the protection of patients, staff, and the public against radiation exposure in medicine.

ICRP Committee 3 in Hong Kong, China, October 2010

Committee 3 evaluates aspects of radiological protection relevant to medicine with on-going Task Groups and Working Parties as described below.

Working Party on Education and Training in Radiological Protection for Diagnostic and Interventional Procedures

Chair: Eliseo Vano

Public consultation on this document resulted in about 300 comments from 19 individuals and 15 organizations or societies. The comments were addressed and the document was approved for publication by the Main Commission in October 2010 and published in April 2011, as ICRP *publication 113*.

Task Group 62: Radiological Protection in Cardiology

Chairs: Donald Miller and Claire Cousins

A draft document prepared by this Task Group initially chaired by Claire Cousins was further developed under the co-chairmanship of Donald Miller. The updated document includes new chapters on radiological protection for Nuclear Cardiology and Cardiac CT. Public consultation of the document report was completed in August 2011 and resulted in a total of 217 comments from 11 organizations and two individuals. The document was approved at the October 2011 meeting of the Main Commission. It will be published in the Annals of the ICRP in 2012.

Task Group 78: Radiological Protection in Fluoroscopically Guided Procedures Performed outside the Imaging Department

Chair: Madan Rehani

This document covers radiological protection of patients and staff in procedures performed outside the imaging departments by clinical specialists such as orthopaedic surgeons, urologists, vascular surgeons, gastroenterologists and others. Public consultation was completed in August 2011 and resulted in a total of 108 comments from 6 organizations and one individual. The document was approved at the October 2011 meeting of the Main Commission. It will be published as ICRP *Publication 117* in 2012.

Working Party on Radiological Protection in Paediatric Diagnostic and Interventional Radiology

Chairs: Pek-Lan Khong and Hans Ringertz

A draft document prepared by this Working Party initially chaired by Hans Ringertz was further developed under the co-chairmanship of Pek-Lan Khong. Public consultation of the document was completed in August 2011. The document was approved at the October 2011 meeting of the Main Commission. It will be published in the Annals of the ICRP in 2012.

Task Group 36: Doses to Patients from Radiopharmaceuticals

Chair: Sören Mattsson

Dose coefficients for the new computational phantoms for adults and children from DOCAL are being completed. A number of options were discussed for dissemination of material. These included making free use via the ICRP website of a newly developed viewer for indexing the document available on the ICRP website with provision to allow a subscription to use a viewer for indexing and retrieval of available information. The new biokinetic and dosimetric models for the following substances were approved by the C3 and will be sent to the Main Commission for approval prior to public consultation: 18F- FET, 18F- FLT, 18F- choline, 11C- raclopride, 18F-fluoride.

Task Group 85: Radiological Protection Recommendations on Mitigating Secondary Cancer Risks in Modern Radiation Oncology

Chair: Mario Baeza

This Task Group will continue to develop the final report based upon on the work already done by the ICRP/ICRU Task Group Chaired by J.M. Cosset and also consider NCRP & AAPM work in this area.

Task Group 97: Radiological Protection in Ion Beam Therapy

Chair: Yoshiharu Yonekura

This Task Group is refining an advanced draft document developed by an initial Working Party to provide information necessary for radiation protection in ion beam radiotherapy, specifically with proton and carbon ions. A final draft of this report is expected in 2012.

Task Group 86: Justification of imaging of Asymptomatic Individuals with Ionising Radiation

Chairs: Katrine Ahlstrom Riklund and Hans Ringertz

A working party was started in 2009 to review the risks and benefits of imaging asymptomatic individuals, including position statements of professional societies, and to prepare recommendations on radiation protection. This Task Group was established at the Committee 3 2011 meeting to carry on this work. The document will review current knowledge and provide a framework for guiding decisions as to whether the examination of asymptomatic individuals is warranted in order to make an early diagnosis of certain diseases. A draft of this report is expected in 2012.

Task Group 88: Radiological Protection in Cone Beam CT

Chair: Madan M. Rehani

ICRP had produced *Publication 102* in 2007 on managing patient dose in multi-detector CT (MDCT). In recent years cone beam CT (CBCT) has been introduced which utilizes different technology and has newer applications. CBCT machines are much smaller and they can be placed in a doctor's consulting facility. This is leading to rapid growth and has potential for overuse (unjustified use) in uncontrolled areas and in untrained hands (mostly non-radiologists).

There are prospects of dose reductions through the application of the justification and optimization principles of ICRP. This document will provide guidance to doctors, medical

staff and medical physicists concerned with CBCT. Applications in diverse fields such as interventional radiology, intraoperative surgery, radiotherapy, breast imaging, head and neck imaging and further emerging areas will be covered. The document will review current knowledge on radiation doses to patients and staff and provide guidance and recommendations in line with ICRP principles and links with other publications of ICRP. An initial draft is expected by end of 2012.

Task Group 89: Occupational Radiological Protection in Brachytherapy

Chair: Lawrence Dauer

This Task Group will develop an ICRP publication related specifically to staff radiological protection in brachytherapy. There is a need for relevant and practical recommendations for staff radiological protection in brachytherapy. The target audience will be clinicians, staff, medical physicists, radiation protection officers, and the regulatory authorities. A first draft is expected during 2012.

Topics to be explored by working parties during 2012:

- Framework for Justification in Medical Uses of Ionizing Radiation (Chaired by Hans Ringertz and Katrine Åhlström Riklund)
- Occupational Protection Issues in Fluoroscopically Guided Interventional Procedures (Chaired by Pedro Ortiz)
- Radiological Protection in Therapy with Radiopharmaceuticals (Chaired by Sören Mattsson)
- Diagnostic Reference Levels for Diagnostic and Interventional Imaging (Chaired by Eliseo Vaño)

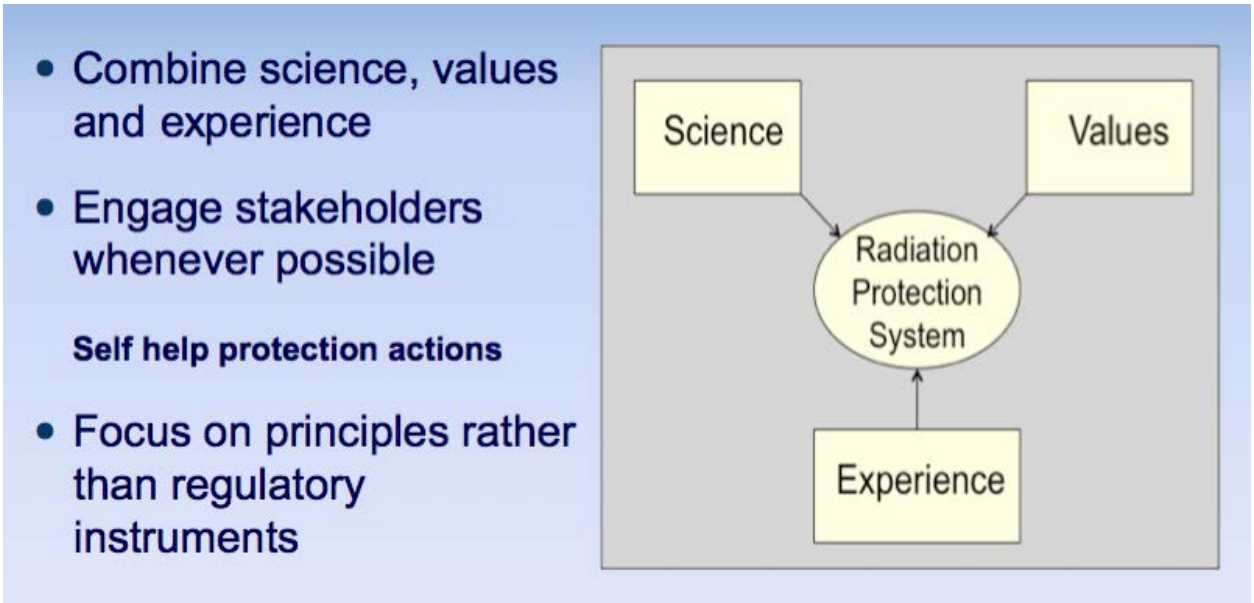
Committee 4 (Application of the Commission's Recommendations)

Committee 4 develops principles and recommendations on radiological protection of people in all exposure situations.

ICRP Committee 4 in Geneva, Switzerland, November 2010

During the current 4-year term the work of Committee 4 is structured according three priorities:

- To develop advice on implementation of the recommendations in ICRP *Publication 103* and to contribute to their dissemination i.e. to review and update past publications, and develop recommendations for the application of the radiological protection principles in particular exposure situations;
- To review the ethical and social values underlying the principles and concepts of the system of radiological protection e.g.: precautionary principle, tolerability of risk, equity, sustainable development;
- To enhance the dialogue and cooperation with international organisations and professional societies.



Considerations in developing principles and recommendations

Following the Fukushima accident, Committee 4 has been strengthened by the addition of a new member, Toshimitsu Homma, in June 2011. In October, the Committee met in Bethesda, USA, in conjunction with the annual meetings of the Main Commission and the other ICRP Committees as well as the first ICRP Symposium on the International System of Radiological Protection.

In addition to reviewing its current programme of work including several draft reports under preparation the Committee further clarified how the basic radiation protection principles and the dose criteria apply to the protection of the public and workers according to the three exposure situations defined in ICRP *Publication 103*, i.e. planned, existing and emergency exposure situations. The Committee also considered working mechanisms to improve in practice its cooperation with the international and professional organisations involved as observers.

The program of work of Committee 4 in 2011 is described below.

Task Group 71: Protection of the Public and Workers in the Use of Ionizing Radiation in Screening Activities Applied to Persons and Cargo for Security Purposes

Chair: Donald A. Cool

Established by the Main Commission in Suzhou in 2010, the Task Group is building on the results of a former Working Party which reviewed the topic for several years. Its objective is to examine how the radiation protection principles recommended by ICRP should be interpreted and applied within the context of security screening. In particular the Task Group will discuss how the principles for planned exposure situations, including optimization with the use of constraints and the concept of limitation apply within a security screening context. The Task Group will also examine the application of the Commission's recommendations to groups of individuals who may be exposed as a consequence of cargo screening. These groups may include the occupationally exposed individuals 'in set up for use start' (this does not make sense and needs correcting), operation and maintenance of the screening equipment, individuals such as drivers, who have been permitted in the cab of the vehicle, and other individuals who may unintentionally be exposed as a "stow-away" in a cargo container. The report should be submitted for public consultation in 2012.

Task Group 76: Application of the Commission's Recommendations to NORM (Naturally Occurring Radioactive Materials)

Chair: Peter Burns

Established by the Main Commission in Berlin in 2007, the Task Group was re-launched in Porto in 2009 with a refined objective and a new membership. Its objective is to develop a framework for the practical application of the Commission's recommendations, in particular the optimisation principle, for the protection of workers, the public and the environment in cases of exposure arising from Naturally Occurring Radioactive Material (NORM). Taking into account publications and documents of other international organisations, the Task Group report will cover the entire range of activities associated with the processing, production or use of bulk materials with enhanced levels of naturally occurring radionuclides, as well as the presence of such materials in consumer products, particularly in construction materials. The application of such a framework should also be illustrated to a few relevant activities that are currently a concern (oil, coal, rare earths, and phosphate). The report should be submitted for public consultation in 2013.

Task Group 80: Application of the Commission's Recommendations to the Geological Disposal of Long-lived Solid Radioactive Waste

Chair: Wolfgang Weiss

This Task Group was established by the Main Commission Porto in November 2009. Its objective is to prepare a publication that describes in plain language and clarifies the application of the new recommendations for the protection against occupational and public exposures that may result from the geological disposal of long-lived solid radioactive waste. Taking into account previous ICRP recommendations (ICRP *Publications 77* and *81*) and relevant materials from international organisations, the publication will discuss how the key radiological protection principles for planned exposure situation apply to the successive phases of managing such type of disposal of long-lived solid radioactive waste. It will also address the transition from a planned to an existing exposure situation in cases of loss of control as well as the applicability of estimated individual and collective effective doses as a means for making decisions about the different time scales in the lifetime of a repository. Public consultation of the report on Radiological Protection in Geological Disposal of Long-Lived Solid Radioactive Waste radiology was completed in 2011. The report should be accepted for publication in 2012.

Task Group 81: Application of the Commission's Recommendations to Radon Exposure

Chair: Jean-François Lecomte

The Commission established this Task Group on radon exposure in 2009. The objective is to prepare a publication that describes and clarifies the application of the new recommendations (ICRP *Publication 103*) for the protection of the public and workers (notably workers in uranium mines and other mines) against radon and thoron exposures in dwellings, workplaces and other locations. The publication will discuss in which cases exposure to radon is either a planned exposure situation or an existing exposure situation with the relevant application of the radiological protection principles, as well as the dosimetric reference and rationale. The publication will also address the setting of reference levels and dose constraints. The publication will build on the previous ICRP *Publications 65*, *101* and *103*, the joint C1-C2-C4 report on assessment and control of lung cancer risk from radon and the November 2009 Commission's Statement on radon as well as experience from many countries and organisations. Public consultation of the report on the Application of the Commission's Recommendations to Radon Exposure will be completed in 2012. The report should be published in 2013.

Task Group 83: Protection from Cosmic Radiation in Aviation

Chair: Jacques Lochard

This Task Group was proposed by the Main Commission in Porto in 2009 and its Terms of Reference approved in Cape Town in 2010. Its objective is to prepare a publication that describes and clarifies the application of the new recommendations (ICRP *Publication 103*) for the protection of aircrews against cosmic rays. The publication will discuss the type of exposure situations relevant to control aircrew exposures and the appropriate radiation protection principles to be implemented. Particular attention will be given to the practical implementation of the optimization principle with the associated reference levels. Renaming of the TG to Protection from Cosmic Radiation in Aviation was approved. The final report is expected in 2013.

Working Party on the Implementation of ICRP *Publications 109* and *111*

Chair: Michiaki Kai

The objectives of this working party are first to learn from the lessons of Fukushima in order to address the issues relevant to the implementation of the recommendations in *Publication*s *109* and *111* on the protection of people in emergency and existing exposure situations after a nuclear accident, and secondly to serve as an interactive mechanism for Committee 4 to stay engaged on the issues and questions related to the management of the Fukushima situation with Japanese colleagues.

Working Party on the Ethics of Radiological Protection

Chair: Jacques Lochard

The objective of this working party is to explore the ethical basis supporting the system of protection in order to improve the communication of the Commission on radiological protection issues by recognizing and utilizing this basis. To be explored will be key values like the precautionary principle, equity, the tolerability of radiation risk as well as procedural issues as for example informed consent, right to know, stakeholder involvement.

Committee 5 (Protection of the Environment)

Committee 5 develops reference models and data, and guidance on radiological protection of the environment.

ICRP Committee 5 in Bethesda, USA, September 2011

The work of Committee 5 continues to put the ICRP's objective of protecting the environment into practical effect. Five papers were presented by Committee 5 members at the first ICRP Symposium in Bethesda, covering areas of work that were on-going within the Committee itself, but reflecting the personal views of the authors.

The science base relating to environmental protection is also being further reviewed, particularly with regard to radiation weighting factors, and to the utility of more realistic dosimetry for some biotic types.

Task Group 73: Environmental Protection: Transfer Parameters for Reference Animals and Plants

Chair: Per Strand

This report was approved for publication by the Commission in April 2011 (ICRP *Publication 114*). The report describes the formulation of a database on whole body Concentration Ratios for use with the ICRP's set of Reference Animals and Plants.

Emphasis was placed on data from field studies, although data from laboratory experiments were also included. The database is structured in terms of generic wildlife groups, but the data have been attributed to the Reference Animals and Plants wherever possible. In this way Concentration Ratios specifically for the Reference Animals and Plants were extracted and, in cases where transfer data were lacking, a data-gap filling methodology was used to derive suitable surrogate values. Statistical summaries of the datasets are provided, and Concentration Ratio values given for 39 elements. The data coverage, reliance on derived values, and applicability of this approach for each of the Reference Animals and Plants is also discussed.

Task Group 72: RBE and Reference Animals and Plants

Chair: Kathryn Higley

The objective of this Task Group is to explore the necessity and feasibility of dose-modifying values suitable for application in the protection of non-human biota, considering both deterministic and stochastic effects. The Task Group has reviewed the data bases with regard to RBE and the Reference Animals and Plants, particularly in relation to alpha emitting nuclides, and tritium. Early conclusions were discussed in 2011, and a final draft report will be considered at the Committee 5 meeting in 2012.

Task Group 74: More Realistic Dosimetry for Non-human Species

Chair: Alexander V. Ulanovsky

The work of this Task Group continues to concentrate on issues relating to exposures resulting from contaminated air (cloudshine) and the inhalation of radionuclides by mammals.

Joint C5/C4 Task Group 82: Application of the ICRP's Approach to Environmental Protection under Different Exposure Situations

Chair: R Jan Pentreath

Although ICRP *Publication 103* had introduced a new ‘environmental protection’ requirement into its Recommendations (following on from ICRP *Publication 91*), the subsequent ICRP *Publication 108* has now made it necessary to demonstrate, explicitly, how the expanded ICRP framework collectively fits together in a coherent way. The report from this Task Group was approved at the 2011 meeting in Bethesda by both Committee 4 and Committee 5. It considers how the subject of protection of the environment fits within the Commission’s overall framework of Justification, Optimisation of protection, and the application of Dose Limits, and how best to apply it to all three

exposure situations via the derivation of Environmental Reference Levels. The Task Group Report, together with a supporting Annex from Committee 5 which provides more detailed guidance in relation to its practical application, will be discussed by the Main Commission in 2012.

Response to the Fukushima Daiichi Nuclear Power Station Accident

On March 21, 2011, ten days after the tsunami and earthquake, ICRP released an open message meant primarily as a condolence to those in Japan dealing with a very difficult situation. It also contained a brief reminder of some of the basic recommendations of ICRP relating to this terrible situation.

Two weeks later, on April 4, 2011, with the full support of the ICRP Main Commission and ICRP's publisher, Elsevier, ICRP *Publication 111* was made openly available for free.

Later in the year, ICRP began a Dialogue Initiative with a meeting held in Fukushima City November 26-27, 2011. Titled "Dialogue on the Rehabilitation of Living Conditions after the Fukushima Accident: Lessons from Chernobyl and ICRP Recommendations", this was a cooperative effort between ICRP, Fukushima Prefecture, Fukushima Medical University, Radiation Safety Forum (Japan), the Institute of Radiation Protection and Nuclear Safety (France), the Norwegian Radiation Protection Authority, the French Nuclear Safety Authority, and the Committee of Radiation Protection and Pubic Health of the OECD Nuclear Energy Agency. For ICRP this was as much an initiative to help the understanding of the recommendations and guidance of ICRP *Publication 111* as a learning exercise. The objective was to help the people of Japan in this very difficult time, while at the same time gaining a deeper insight into the situation to ensure that future recommendations of ICRP would benefit from this experience.

ICRP also responded to requests for assistance. For instance, 16 ICRP members were among 31 international experts, invited to participate in the "International Expert Symposium in Fukushima: Radiation and Health Risks at the Fukushima Medical University", organized by the Nippon Foundation on September 11-12, 2011. The following day, most of the experts accompanied Parliamentary Secretary Yasuhiro Sonoda as advisors during a visit to the J-Village staging area, the 20 km evacuated zone, and the Fukushima Daiichi Nuclear Power Station.

As well, on October 8, 2011, eleven ICRP members were invited, by formal request for advice from the Japanese Government Cabinet Secretariat, to share information for the mutual understanding of the situation, and to provide opinions to aid decisions for countermeasures in Japan. Goshi Hosono, Minister of State for Nuclear Power Policy and Administration, was charged with this special mission by the Japanese Prime Minister, Yoshihiko Noda. This included a meeting on November 28 with Minister Hosono and his advisors to explain aspects of the ICRP *Publications 109* and *111* and to provide experience gained following the Chernobyl accident.

First ICRP Symposium on the International System of Radiological Protection

The first ICRP Symposium on the International System of Radiological Protection, ICRP 2011, was held in Bethesda, USA, October 24-26, 2011. Approximately four hundred people came from thirty-five countries to participate in the three-day event. In addition to providing an overview of the work of ICRP, sessions covered a wide range of subjects within ICRP's scope of work:

- The System of Radiological Protection – Is it Fit for Purpose?
- Tissue Reactions: Low Dose Risks
- Radiation Effects: Modulating Factors and Risk Assessment
- Applications of Effective Dose
- Radiation Protection in Space
- Environmental Protection in Practice
- The Scientific Basis for Reference Animals and Plants
- RP in Computed Tomography
- Prevention of Accidents in Radiation Therapy
- RP in NORM
- RP in Waste Management
- Protection against Radon in Workplaces
- Dose Constraints and Reference Levels
- Experience in Implementing ICRP Recommendations

ICRP 2011 was a key activity in ICRP's continuing efforts to more fully engage with all professionals interested in radiological protection. Presentations were made by ICRP members and many other experts in radiological protection. This and future such symposia are opportunities to share the work of ICRP, published and in progress, with a wide audience, and to hear directly from radiological protection professionals from around the world.

ICRP is a registered charity with limited resources. This symposium was made possible in part through the support of all organisations providing grants to ICRP (listed later in this report), and in particular through the support of several organisations who provided financial contributions specifically for ICRP 2011:

- US Nuclear Regulatory Commission
- US Environmental Protection Agency
- Cameco
- Canadian Nuclear Safety Commission
- Japan Radioisotope Association
- National Council on Radiation Protection and Measurements

Given the success of this first symposium, ICRP has begun to plan a second. It will be held in conjunction with the next biennial joint meetings of the Main Commission and Committees in Abu Dhabi, United Arab Emirates, in October 2013.

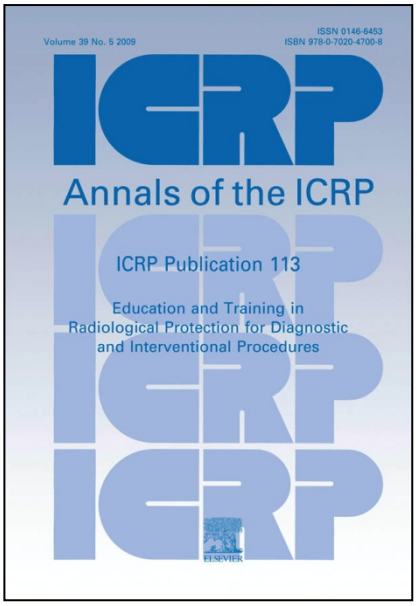
ICRP Publications in 2011

ICRP released three reports in 2011, published in the Annals of the ICRP:

- ICRP *Publication 113*: Education and Training in Radiological Protection for Diagnostic and Interventional Procedures
- ICRP *Publication 114*: Environmental Protection: Transfer Parameters for Reference Animals and Plants
- ICRP *Publication 115*: Lung Cancer Risk from Radon and Progeny and Statement on Radon

In addition, permission was granted for organisations to prepare and distribute translations of ICRP publications in various languages. Italian, Arabic, Russian and French translations of ICRP *Publication 105*, a Romanian translation of ICRP *Publication 104*, and a Chinese translation of ICRP *Publication 102* became available in 2011. Furthermore, ICRP *Publication 111* Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency was made available for free download through the ICRP web site.

The three ICRP publications released in 2012 are described below.



ICRP *Publication 113*: Education and Training in Radiological Protection for Diagnostic and Interventional Procedures

E. Vaño, M. Rosenstein, J. Liniecki, M. Rehani, C.J. Martin, R.J. Vetter

The number of diagnostic and interventional medical procedures using ionising radiations is rising steadily, and procedures resulting in higher patient and staff doses are being performed more frequently. As such, the need for education and training of medical staff (including medical students) and other healthcare professionals in the principles of radiation protection is even more compelling than in the past. The Commission has made basic recommendations for such education and training of these individuals in ICRP *Publications 103* and *105*. The present

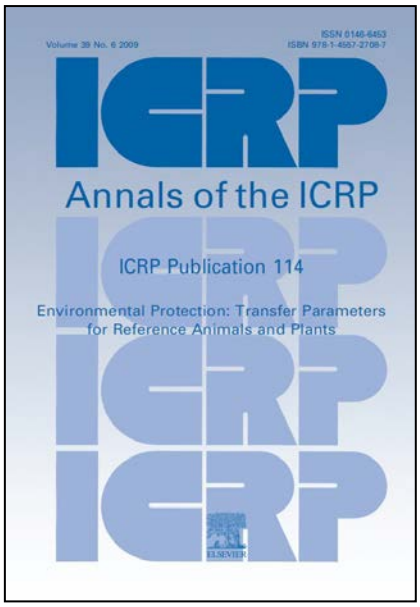
publication expands considerably on these basic recommendations with regard to various categories of medical practitioners and other healthcare professionals who perform or provide support for diagnostic and interventional procedures utilising ionising radiation and nuclear medicine therapy. It provides guidance regarding the necessary radiological protection education and training for use by:

- cognisant regulators, health authorities, medical institutions, and professional bodies with responsibility for radiological protection in medicine;
- the industry that produces and markets the equipment used in these procedures; and
- universities and other academic institutions responsible for the education of professionals involved in the use of ionising radiation in health care.

In the context of this publication, the term ‘education’ refers to imparting knowledge and understanding on the topics of radiation health effects, radiation quantities and units, principles of radiological protection, radiological protection legislation, and the factors in practice that affect patient and staff doses. Such education should be part of the curriculum in pursuit of medical, dental, radiography and other health care degrees, and for specialists such as radiologists, nuclear medicine specialists and medical physicists as part of the curriculum of postgraduate degrees. The term ‘training’ refers to providing instruction with regard to radiological protection for the justified application of the specific ionising radiation modalities (e.g. computed tomography, fluoroscopy) that a medical practitioner or other healthcare or support professional will utilise in that individual’s role during medical practice.

Advice is also provided on the accreditation and certification of the recommended education and training. In the context of this publication, the term ‘accreditation’ means that an organisation has been approved by an authorised body to provide education or training on the radiological protection aspects of the use of diagnostic or interventional radiation procedures in medicine. The accredited organisation is required to meet standards that have been set by the authorised body.

The term ‘certification’ means that an individual medical or clinical professional has successfully completed the education or training provided by an accredited organisation for the diagnostic or interventional procedures to be practised by the individual. The individual must demonstrate competence in the subject matter in a manner required by the accredited body.



ICRP *Publication 114*: Environmental Protection: Transfer Parameters for Reference Animals and Plants

P. Strand, N. Beresford, D. Copplestone, J. Godoy, L. Jianguo, R. Saxén, T. Yankovich, J. Brown

In *Publication 103*, the Commission included a section on the protection of the environment, and indicated that it would be further developing its approach to this difficult subject by way of a set of Reference Animals and Plants (RAPs) as the basis for relating exposure to dose, and dose to radiation effects, for different types of animals and plants.

Subsequently, a set of 12 RAPs has been described in some detail, particularly with regard to estimation of the doses received by them, at a whole-body level, in relation to internal and external radionuclide concentrations; and what is known about the effects of radiation on such types of animals and plants. A set of dose conversion factors for all of the RAPs has been derived, and the resultant dose rates can be compared with evaluations of the effects of dose rates using derived consideration reference levels (DCRLs). Each DCRL constitutes a band of dose rates for each RAP within which there is likely to be some chance of the occurrence of deleterious effects. Site-specific data on Representative Organisms (i.e. organisms of specific interest for an assessment) can then be compared with such values and used as a basis for decision making.

It is intended that the Commission's approach to protection of the environment be applied to all exposure situations. In some situations, the relevant radionuclide concentrations can be measured directly, but this is not always possible or feasible. In such cases, modelling techniques are used to estimate the radionuclide concentrations. This report is an initial step in addressing the needs of such modelling techniques.

After briefly reviewing the basic factors relating to the accumulation of radionuclides by different types of biota, in different habitats, and at different stages in the life cycle, this report focuses on the approaches used to model the transfer of radionuclides through the environment. It concludes that equilibrium concentration ratios (CRs) are most commonly used to model such transfers, and that they currently offer the most comprehensive data coverage.

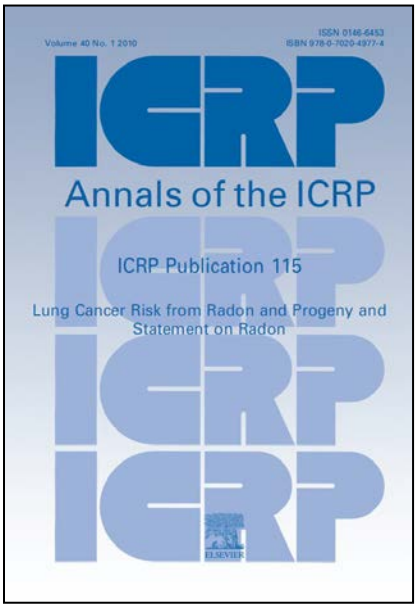
The report also reviews the methods used to derive CRs, and describes a means of summarising statistical information from empirical data sets. Emphasis has been placed

on using data from field studies, although some data from laboratory experiments have been included for some RAPs.

There are, inevitably, many data gaps for each RAP, and other data have been used to help fill these gaps. CRs specific to each RAP were extracted from a larger database, structured in terms of generic wildlife groups. In cases where data were lacking, values from taxonomically related organisms were used to derive suitable surrogate values. The full set of rules which have been applied for filling gaps in RAP-specific CRs is described.

Statistical summaries of the data sets are provided, and CR values for 39 elements and 12 RAP combinations are given. The data coverage, reliance on derived values, and applicability of the CR approach for each of the RAPs is discussed.

Finally, some consideration is given to approaches where RAPs and their life stages could be measured for the elements of interest under more rigorously controlled conditions to help fill the current data gaps.



ICRP *Publication 115*: Lung Cancer Risk from Radon and Progeny and Statement on Radon

M. Tirmarche, J.D. Harrison, D. Laurier, F. Paquet, E. Blanchardon, J.W. Marsh

Recent epidemiological studies of the association between lung cancer and exposure to radon and its decay products are reviewed. Particular emphasis is given to pooled case-control studies of residential exposures and to cohorts of underground miners exposed to relatively low levels of radon. The residential and miner epidemiological studies provide consistent estimates of lung cancer risk with statistically significant associations observed at average annual concentrations of about 200 Bq m^{-3} and cumulative occupational levels of about 50 WLM, respectively. Based on recent results from combined analyses of epidemiological studies of miners, a lifetime excess absolute risk of 5×10^{-4} per WLM (14×10^{-5} per mJ h m^{-3}) should now be used as the nominal probability coefficient for radon and radon progeny induced lung cancer, replacing the previous ICRP *Publication 65* value of 2.8×10^{-4} per WLM (8×10^{-5} per mJ h m^{-3}). Current knowledge of radon associated risks for organs other than the

lungs does not justify the selection of a detriment coefficient different from the fatality coefficient for radon-induced lung cancer.

ICRP *Publication 65* recommended that doses from radon and its progeny should be calculated using a dose conversion convention based on epidemiological data. It is now concluded that radon and its progeny should be treated in the same way as other radionuclides within the ICRP system of protection; that is, doses from radon and radon progeny should be calculated using ICRP biokinetic and dosimetric models. ICRP will provide dose coefficients per unit exposure to radon and radon progeny for different reference conditions of domestic and occupational exposure, with specified equilibrium factors and aerosol characteristics.

Obtaining ICRP Publications

An index to all ICRP publications can be found at www.icrp.org. Click on “publications”.

ICRP publications are available from reputable booksellers or directly from the Commission’s publishers, Elsevier Science:

Web sites: www.elsevier.com
www.sciencedirect.com/science/journal/00742740
(for ICRP *Publication 23* and earlier)
www.sciencedirect.com/science/journal/01466453
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Ranajit Chakraborty
Sarah Darby
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Sisko Salomaa
Alice Sigurdson
Fiona Stewart
Dan Stram
Margot Tirmarche
Richard Wakeford
Ping-Kun Zhou

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Igor Gusev
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Pedro Ortiz Lopez
Sören Mattsson
Donald Miller
Katrine Åhlström Riklund
Hans Ringertz
Marvin Rosenstein
Yoshiharu Yonekura
Baorong Yue

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Jean-François Lecomte (Secretary)
Peter Burns
Pedro Carboneras Martinez
Donald Cool
Toshimitsu Homma
Michiaki Kai
Senlin Liu
Hua Liu
Sigurður Magnússon
Gustavo Massera
Ann McGarry
Khammar Mrabit
Sergey Shinkarev
Jane Simmonds
Alex Simanga Tsela
Werner Zeller

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Carl-Magnus Larsson (Vice-chair)
Almudena Real (Secretary)
Francois Bréchignac
David Copplestone
Kathryn Higley
Kazuo Sakai
Per Strand
Alexander V Ulanovsky

Summary Financial Information 2007-2011

ITEM	2011	2010	2009	2008	2007
INCOME STATEMENT					
Incoming Resources					
Grants Received	650,955	617 168	418 408	412 100	472 703
Royalties	70,071	107 551	107 231	84 596	112 589
Interest	78	0	1 138	5 935	14 996
Other Income	0	0	2 109	1 516	925
Total Incoming Resources	721,104	724 719	528 886	504 147	601 213
Resources Expended					
Promotion of Radiological Protection	627,326	552 953	532 464	326 444	386 541
Governance Costs *	288,646	169 027	133 095	140 175	152 942
Other Resources Expended	21,873	2 752	(22 834)	33 418	(13 079)
Total Resources Expended	937,845	724 732	642 725	500 037	526 404
Net Movement in Resources †	(216,741)	(13)	(113 839)	4 110	74 809
Total Funds Carried Forward	**173,399**	**390 140**	**390 153**	**503 922**	**499 882**
BALANCE SHEET					
Tangible Fixed Assets	2,680	4 329	5 977	3 109	1 516
Current Assets	236,567	391 445	400 563	529 296	511 375
Debtors (falling due within one year)	38,498	168 413	0	0	0
Creditors (falling due within the year)	(104,346)	(174 047)	(16 387)	(28 413)	(13 009)
Net Assets	**173,399**	**390 140**	**390 153**	**503 992**	**499 882**

This is a summary of ICRP annual financial statements as audited by Tudor John Chartered Accountants, Epsom, UK. All amounts are expressed in US dollars.

* The increase in governance costs in 2011 relates primarily to an adjustment to more appropriately allocate secretariat costs.

† The unusually high shortfall in 2011 relates primarily to: two anticipated significant contributions not received in 2011, one of which is anticipated to arrive in 2012; significantly lower than usual royalties from the sales of the Annals, due to having only published two issues in 2010; and, a one-time cost of USD 20k in relation to scanning the ICRP archives in late 2010, billed and paid in early 2011.

Organisations Providing Grants to ICRP in 2011

Australian Radiation Protection and Nuclear Safety Agency

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Germany

Cameco Corporation, Canada

Canadian Nuclear Safety Commission & Health Canada

Chinese Society of Radiation Protection

Consejo de Seguridad Nuclear, Spain

Geislavarnir Rikisins, Iceland

Institut de Protection et de Sûreté Nucléaire, France

International Atomic Energy Agency

International Radiation Protection Association

International Society of Radiology

Japan Atomic Energy Agency

Japan NUS Co. Ltd.

Japan Radioisotope Association

Korea Nuclear International Cooperation Foundation

Miljödepartementet, Sweden

Nuclear Regulatory Commission & Environmental Protection Agency, USA

Organisation of Economic Cooperation and Development: Nuclear Energy Agency

Säteilyturvakeskus, Finland

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