Changes in International Standards (ICRP) and Potential Implications

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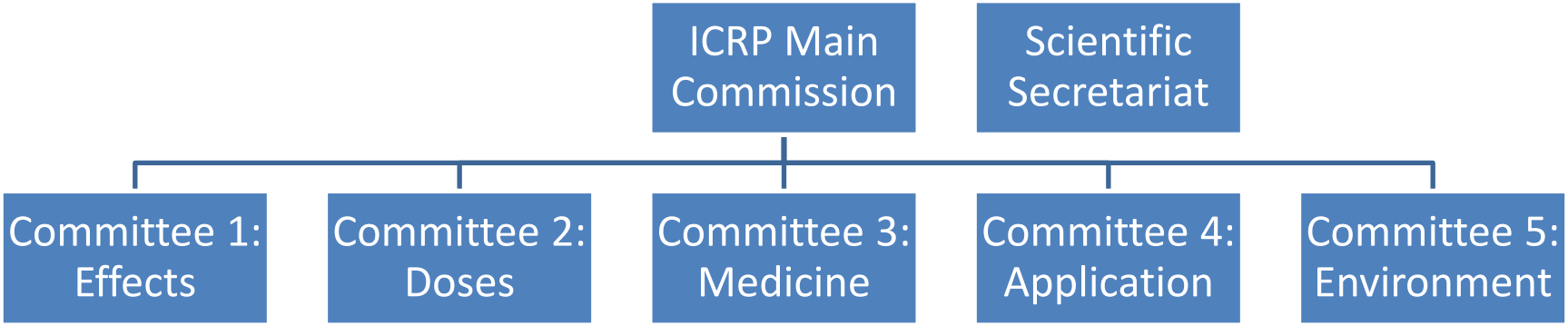
Overview

- Who is the ICRP?
- Brief Sojourn
  - Epidemiology Studies vs. Dosimetric Modelling
- What does the ICRP say about radon?
- What is the ICRP proposing?
- Summary

The ICRP

- The International Commission on Radiological Protection (ICRP) is considered to be the **prime international authority** regarding the safe use of sources of ionizing radiation.
  - Established in 1928 as the International X-ray and Radium Protection Committee
  - In 1950 restructured to take account of uses of radiation outside medicine

The ICRP

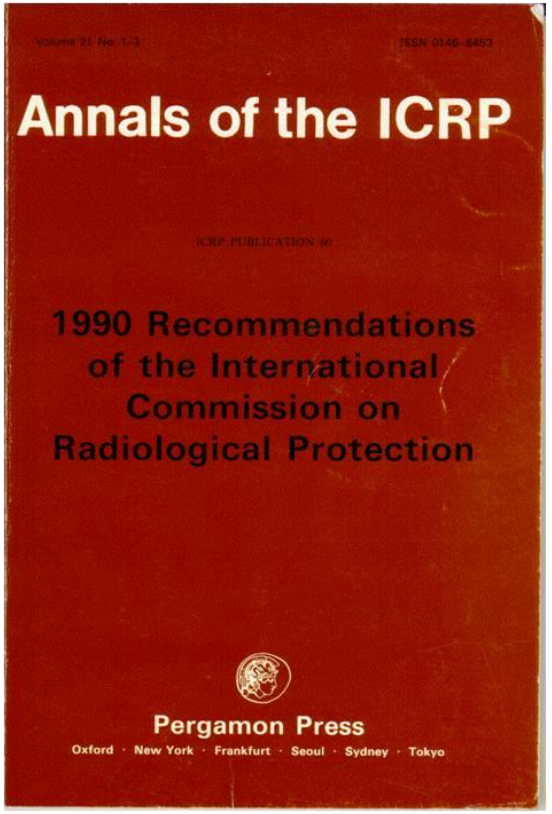


- An independent, international organization of experts with over 200 volunteers from 30 countries
- The ICRP reviews the existing scientific information on radiation exposure and its health effects and recommends dose limits.
  - Most countries adopt their recommendations

The ICRP

- 13 Fundamental Recommendations since 1928
  - **ICRP 60: 1990 Recommendations of the ICRP**
    - Basis of Radiation Protection regulations in Canada
  - **ICRP 103: 2007 Recommendations of the ICRP**
    - 2013 CNSC proposed to amend RP regs to update benchmark

      (DIS-13-01)



Regulatory Framework in Canada

< 1 mSv/a
- Members of the Public

>= 1 mSv/a
- Nuclear Energy Worker
- Requires signed consent about understanding of risk and applicable dose limits.

>5 mSv/a
- Required to use a CNSC Licensed dosimetry service.
- Regulation: S-106 Rev.1 *"Technical and Quality Assurance Requirements for Dosimetry Services".*
- Doses reported to the National Dose Registry

20 mSv/a
- Average annual dose limit for NEW's. (Specifically it is 100 mSv/a over a 5 year dosimetry period, not exceeding 50 mSv in any single year).

Where RSIC fits in

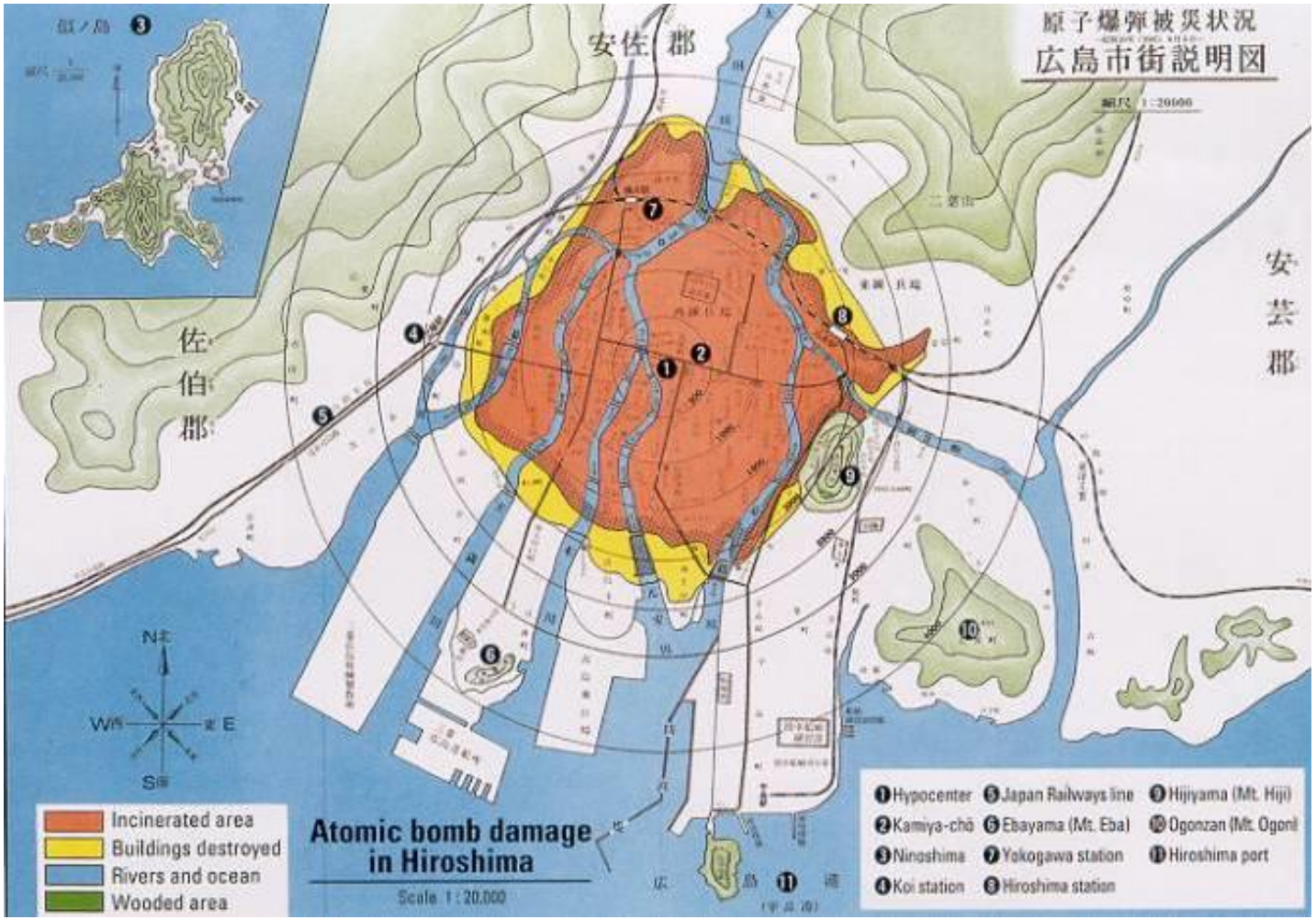
Radiation Protection Regulations (SOR/2000-203)

Current ICRP fatality coefficient: **4% per 1000 mSv**

Personal Alpha Dosimetry

- Is the measurement of individual doses from the inhalation of alpha emitting radionuclides. (Radon Progeny and LLRD)
- Used in:
  - Uranium mining and milling
  - Radioactive waste management facilities and cleanup sites
  - Non-uranium mines
  - NORM affected industries

Epidemiological Studies



Epidemiology: The establishment of statistical associations between exposures and health effects

Dosimetric Modelling

- Model the kinetics of the human body
  - ICRP 66: HRTM
- Calculate DCF's using reference parameters for:
  - Size of inhaled particles
  - Breathing rate of subjects
  - Attached/unnattached fractions

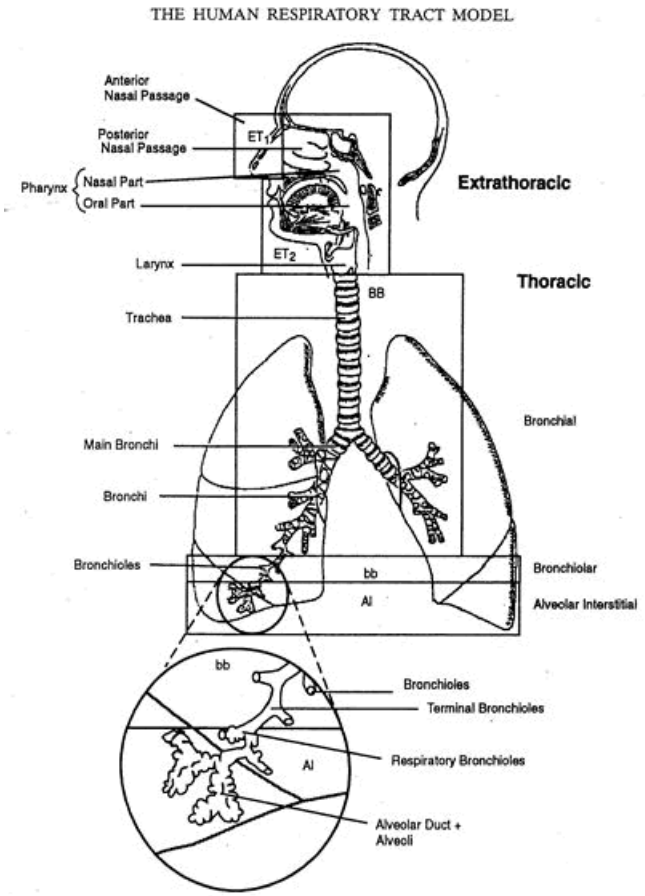
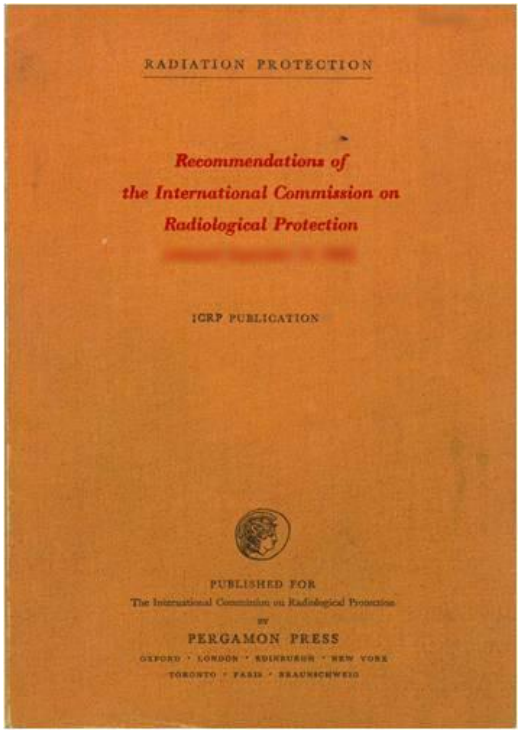


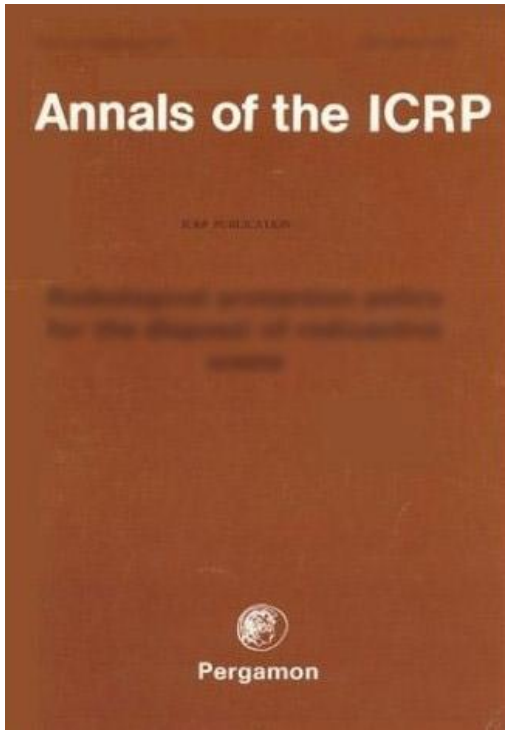
Fig. 1. Anatomical regions of respiratory tract.

Recommendations and Published Reports



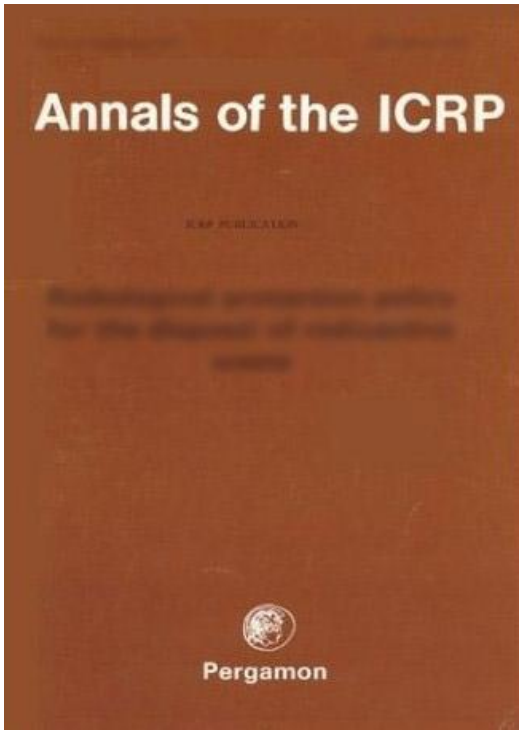
ICRP 1: Recommendations of the International Commission on Radiological Protection

1958



ICRP 24: Radiation Protection in Uranium and Other Mines

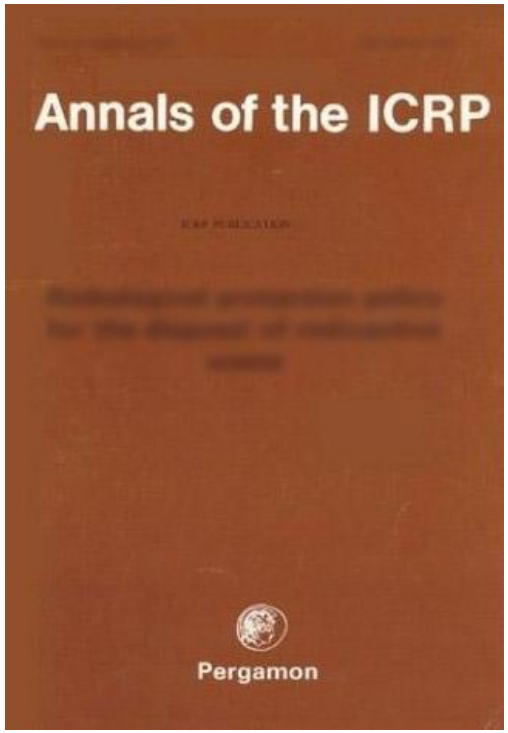
1977



ICRP 32: Limits of Inhalation of Radon Daughters by Workers

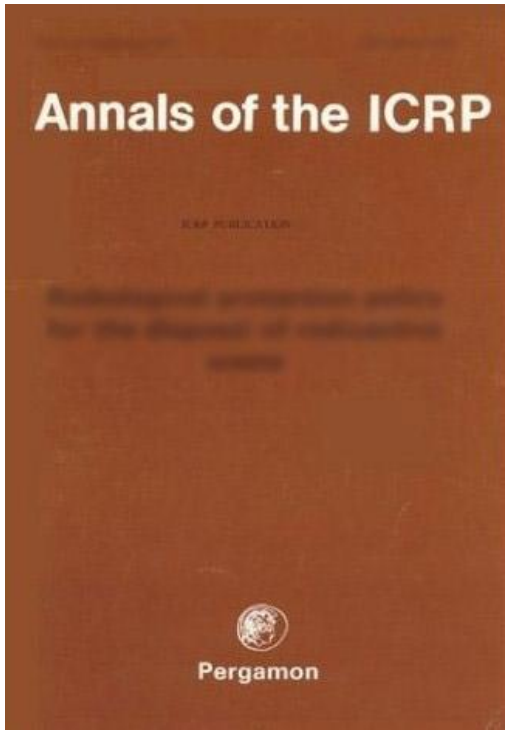
1981

Recommendations and Published Reports



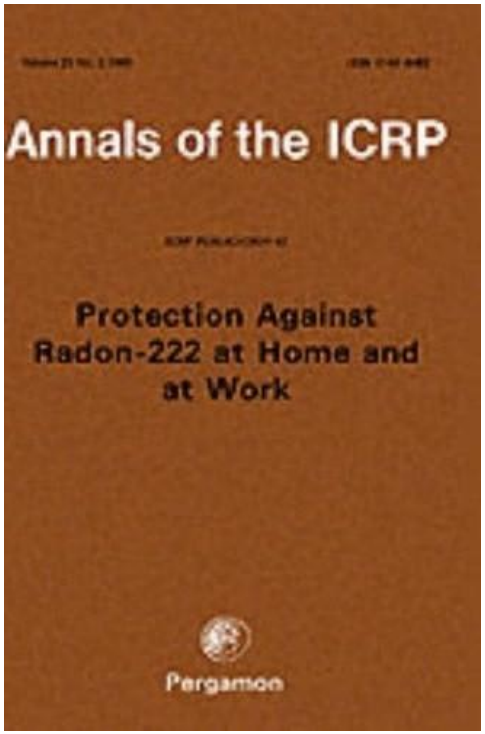
ICRP 39: Principles for Limiting Exposure of the Public to Natural Sources of Radiation

1984



ICRP 50: Lung Cancer Risks from Exposure to Radon Daughters

1987



ICRP 65: Protection against Radon-222 at Home and at Work

1993

ICRP 65 Risk Model

- Epidemiological Studies of 7 cohorts

Cohort	Country	Mine Type	# of Miners	Cumulative Exposure (WLM)	Number of Deaths Observed	Number of Deaths Expected
Colorado	USA	Uranium	2975	510	157	48.7
Ontario	Canada	Uranium	11076	37	87	57.9
New Mexico	USA	Uranium	3469	111	68	17
Beaverlodge	Canada	Uranium	6895	44	65	28.7
West Bohemia	Czech Rep.	Uranium	4042	227	574	122
Cea-Cogema	France	Uranium	1785	70	45	21.1
Malmberget	Sweden	Iron	1292	98	51	14.9

Lifetime Lung Cancer Risk: 2.8E-4 per WLM
DCF: 5 mSv/WLM

ICRP 65 Recommendations

Dwellings

- Recommends Action Levels for initiating interventions
- *"...the best choice of action level may well be that level which defines a significant, but not unmanageable, number of houses in need of remedial work"*
- Limit exposure to **3 – 10 mSv per year** (corresponding radon concentration is 200-600[1] Bq/m^3)

Workplaces

- ICRP 60 dose limits 20 mSv per year averaged over 5 years.
- Dose Limits:
  - 4 WLM per year
  - Can not exceed 10 WLM in any single year

1. Based on 7000 hrs occupancy and F = 0.4

2009 Statement on Radon

- 2007 ICRP created Task Group to review risk related to radon
  - Reviewed new epidemiological studies and dosimetric calculations
  - Recommended doubling the risk of lung cancer from radon (5E-4 per WLM)
  - Plans to use dosimetric modelling instead of epidemiological studies
- Revised the upper reference level to 300 Bq/m^3
  - ALARA with ambition

2009 Statement on Radon

- Revised DCF will be published for different reference conditions
  - Aerosol characteristics
  - Equilibrium ratios
- DCFs will replace those of ICRP 65
  - *"...The commission advises that the change will likely result in an increase in effective dose per unit exposure of around a factor of two"*

Implications for Occupational Settings

- BHP Billiton Olympic Dam
  - Copper Mine (sits on top of the world largest Uranium deposit)
- Internal dose constraint of 10 mSv/yr
  - Need to better quantify worker dose information

Summary

- ICRP is revising it's recommendations on radon risk
- DCF will likely double
  - Direct impacts for occupational settings like Uranium mines/mills
  - Potential update of NORM guidelines
- DCF will be based on dosimetric models

Discussion Points

- Is a dosimetric model a good approach for radon?
  - Radon is one of the few nuclides with extensive epidemiological data
  - The model does not adequately take into account smoking
  - Inputs to the model are not based on modern mines

Questions?