ICRP AND RADIOLOGICAL PROTECTION OF NON-HUMAN SPECIES

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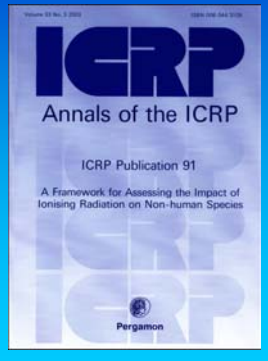
ICRP AND THE ENVIRONMENT



ICRP has decided to develop a framework for assessing the radiological impact on non-human species.

ENVIRONMENTAL MILESTONES

1962 "Silent Spring" by Rachel Carson.

1968 UN General Assembly decides to convene an international conference to protect and improve the human environment.

1972 UN Conference on the Human Environment in Stockholm.

UN creates UNEP.

ENVIRONMENTAL MILESTONES

1980 World Conservation Strategy (UNEP, IUCN)

1987 World Commission on Environment and Development: "Our Common Future"

- The Brundtland Report defines the concept of SUSTAINABLE DEVELOPMENT and emphasizes the need to preserve BIOLOGICAL DIVERSITY.

ENVIRONMENTAL MILESTONES

1992 UN Conference on Environment and Development in Rio de Janeiro lays down general principles for environmental protection, e.g.

- the Rio Declaration
- the Convention on Biological Diversity
- the Agenda 21 Programme of Action.

Biodiversity: *"the variability among living organisms within within species, between species, and of ecosystems."*

PROTECTION OF THE ENVIRONMENT

Environmental management includes

- Environmental exploitation (populations)
- Conservation and protection of the natural environment (individuals, populations, habitats, ecosystems)
- Pollution control (environmental quality standards)

(Pentreath 2002)

PROTECTION OF THE ENVIRONMENT

There is no single ethic for protection of the environment.

The basis can be traced back to

- scientific evidence
- social and cultural concerns (based on religious or philosophical tenets and beliefs)
- the need to comply with international and national legislation.

SPECTRUM OF ETHICS

Anthropocentric: Humans are the main thing of moral standing. The environment is of concern only as it affects humans.

Biocentric: Moral standing is extended to individual members of other species, and obligations pertaining to such individuals arise as a consequence.

Ecocentric: Moral standing can be extended to virtually everything in the environment. The focus lies more with the entirety and diversity of the ecosystem rather than the moral significance of each and every individual component of it.

(IAEA, 2002)

OPERATIONAL STRATEGIES FOR SUSTAINABLE DEVELOPMENT

- The pollution prevention principle
- The precautionary principle
- The substitution principle
- The polluter-pays principle

ICRP AND THE ENVIRONMENT

"The Commission concerns itself with mankind's environment only with regard to the transfer of radionuclides through the environment, since this directly affects the radiological protection of man."

(ICRP 60, 1991)

ICRP AND THE ENVIRONMENT

"The Commission believes that the standards of environmental control needed to protect man to the degree currently thought desirable will ensure that other species are not put at risk."

(ICRP 60, 1991)

PERCEIVED PROBLEMS WITH ICRP's STATEMENTS

- No explicit scientific evidence quoted
- What about habitats where humans are absent?
- What if humans have been removed for their own safety?
- How do the statements meet the needs of regulators, in terms of direct evidence of environmental protection?

RADIOLOGICAL PROTECTION OF THE ENVIRONMENT

- International conventions
- UNSCEAR
- ICRP
- IAEA
- European Community
- IUR
- OECD/NEA
- National initiatives

THE JOINT CONVENTION

Convention on the Management of Spent Nuclear Fuel and Radioactive Waste

- Protection of individuals, society and the environment.

THE OSPAR CONVENTION

Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic

- Concentrations of artificial radionuclides in the marine environment should be reduced towards zero.
- **Ultimate aim:** near background values for naturally occurring radioactive substances, and close to zero for artificial radioactive substances.

(Sintra 1998)

RADIOLOGICAL PROTECTION OF THE ENVIRONMENT

INTERNATIONAL CONFERENCES

- STOCKHOLM 1996
- OTTAWA 1999
- DARWIN 2002
- STOCKHOLM 2003

APPROACHES TO ADDRESS ICRP's CURRENT POSITION

- Arguments that because man is protected, the environment is protected (axiomatic).
- Calculations to demonstrate that, if man would receive <1mSv/a, other organisms would unlikely be harmed at the population level (human food chain).
- Environmental concentrations derived in a tiered approach, based on environmental dose rates considered safe (generic population protection standards).

APPROACHES TO ADDRESS ICRP's CURRENT POSITION

- Target dose rates developed for biota based on an eco-toxicological approach applying safety factors ('no-effects standards').
- Systematic frameworks for assessing environmental impact of radiation in specific geographic areas.
- A hierarchical system with 'derived consideration levels'(Discrete Reference Fauna & Flora).

RADIOLOGICAL PROTECTION OF THE ENVIRONMENT

- The environment needs protection from harmful effects of radiation.
- The shift from a purely anthropocentric view to include other aspects is reflected in conventions that emphasize sustainability and biological diversity.
- The need and goals for protection of the environment have been defined by society.

PROTECTION OF INDIVIDUALS OR POPULATIONS?

- The question no longer so important, because of existing legal requirements.
- Many animals, plants, areas, and habitats are afforded legal protection from 'harm' from all manner of activities, including radiation.

PROTECTION OF INDIVIDUALS OR POPULATIONS?

In the UK, many common species are protected at the individual level:

- 30 mammals;
- 500 birds and (>200 species) their eggs;
- 40 invertebrates; and
- 130 plants.

This reflects changes in attitudes and values.

ICRP's SYSTEM OF PROTECTION

The system is achieved in practice by the use of:

- Reference anatomical and physiological models of humans to derive practical information on the anticipated 'dose per unit intake' of radionuclides.
- Scientific studies to estimate risks associated with the external and internal exposure to radionuclides.

REFERENCE MAN

- Dose calculations require reference values to describe anatomical/physiological characteristics of an exposed individual.
- Such values for tissues/organs define a reference individual.
- A reference individual is not intended to describe an 'average' individual.
- The purpose is to create a standard and a point of reference for the procedure of dose estimation.
- The concept of a Reference Man is one of the cornerstones in radiological protection.

RADIOLOGICAL PROTECTION OF THE ENVIRONMENT

- Many international agreements call for protection against pollution, incl. radiation.
- There are no agreed criteria that address radiological protection of the environment.
- This lack makes it difficult to determine or demonstrate whether or not the environment is adequately protected from potential impacts of radiation.

RADIATION AND THE ENVIRONMENT

- The human habitat has been afforded protection through the application of ICRP's current system of protection.

HOW CAN WE DEMONSTRATE THAT THE ENVIRONMENT IS ADEQUATELY PROTECTED?

ICRP AND THE ENVIRONMENT

ICRP's decision has not been driven by any particular concern over environmental radiation hazards, but by the need to fill a conceptual gap in the system of radiological protection.

ICRP AND THE ENVIRONMENT

ICRP intends to

- recommend a practical framework that can be used to give advice and guidance, thereby
- helping regulators and operators demonstrate compliance with environmental legislation.

ICRP AND THE ENVIRONMENT

ICRP is developing

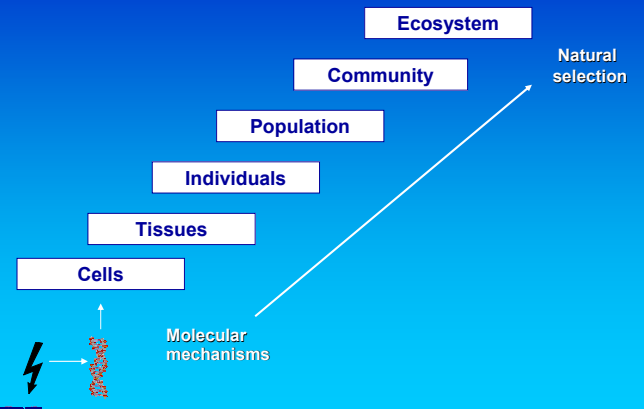
- a reference set of ***dosimetric models;***
- a reference set of ***environmental geometries that are***
- applied to ***Reference Animals and Plants.***

This will allow an assessment of the likely consequences for individuals, the population, or of the local environment.

POINTS OF REFERENCE TO DESCRIBE RELEVANCE OF RADIATION DOSES IN NON-HUMAN ORGANISMS

- Dose rates required to observe:
  - early mortality
  - morbidity
  - reduced reproductive success
  - chromosomal damage
- Typical background dose rate for that type of animal or plant.

RADIATION EFFECTS



CRITERIA FOR REFERENCE ANIMALS AND PLANTS

- Are they typical of an ecosystem?
- Are they likely to be exposed to radiation?
- What stage(s) in their life cycle are of relevance for the dose or dose rate?
- Can their exposure to radiation be modelled and be related to effects in the individual organism?
- What radiobiological information is available?
- Are they amenable to future research?

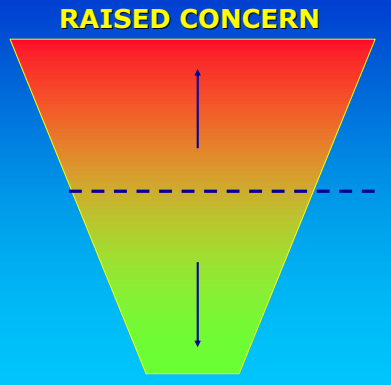
ICRP's REFERENCE ANIMALS AND PLANTS

Rat	Earthworm
Duck	Marine snail
Frog	Crab
Freshwater fish	Grass
Marine flat fish	Brown seaweed
Bee	Pine tree

ICRP's REFERENCE ANIMALS AND PLANTS

Organism	Terrestrial	Freshwater	Marine
Rodent	X		
Duck	X	X	
Frog	X	X	
Freshwater fish		X	X
Marine flat fish			X
Bee	X		
Marine snail	X	X	X
Crab		X	X
Earthworm	X	X	X
Pine Tree	X		
Grass	X	X	
Brown seaweed			x

DERIVED CONSIDERATION LEVELS



> Several times the natural background

Natural background for a reference organism

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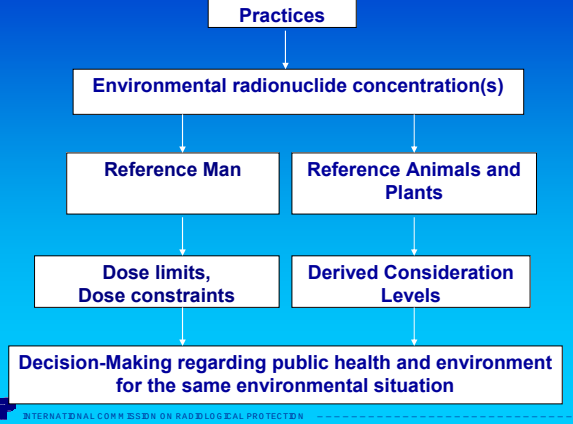
A COMMON APPROACH