

Draft Recommendations from International Commission on Radiological Protection at the start of the 21st century

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Introduction

In the last three years ICRP has been stimulating discussion on the best way of expressing protection philosophy for the next publication of its Recommendations, which it hopes will be by 2005. The Commission has been encouraged by the support it has received from around the world for the strategies it is pursuing, both on the scientific front and for its openness in engaging in the debate. It is therefore beginning to prepare the first draft of these recommendations with a view to distributing an early version for comment, even though the background work is incomplete.

Major changes from the 1990 Recommendations

Where exposures can be avoided, or controlled by human action, there is a requirement to provide an appropriate basic level of protection both for the exposed individuals and for society as a whole. Because it is assumed that there is some risk, even from small radiation exposures, there is a further duty to take steps to provide higher levels of protection when these steps are effective and reasonably practicable. While the primary emphasis is now on protection of individuals, it is then followed by the requirement to optimise protection to achieve the best available under the prevailing circumstances.

The existing concept of dose limits has been extended to embrace a range of protective actions and the level above which each action should be taken, called Protective Action Levels. Protective actions can be applied to the source and to the pathways leading from the source to the doses in individuals. They replace a range of terms that include intervention levels, action levels, constraints and exemption levels as well as the dose limits for workers and the public.

The opportunity is also being taken to give a clarification of dosimetric quantities needed for protection purposes, to include a coherent philosophy for natural radiation exposures and to introduce a clear policy for radiological protection of the environment.

Exclusion of sources and associated exposures

The Commission's Recommendations can be applied when either the source or the pathways from the source to the exposed individuals can be controlled by some reasonable means. Sources that do not fall within this definition of a controllable source are excluded. When action is taken directly at the source it is referred to as "direct action". When that action is applied in an exposure pathway it is called "pathway action". In its restated policy the Commission defines what sources and exposures are to be

excluded from the system of protection and will not use the term "exemption". Exemption is seen as a regulatory term applied to non-excluded sources, but which the regulatory body decides can be released from its control.

Natural sources

The Commission intends to include recommendations for protection from natural radiation sources. It is clear that it is the controllability of the exposures which determines whether the exposures are excluded from, or included in, the system of protection. In particular, the control of radon-222 is a special case because of its ubiquitous nature.

The Commission's Recommendations for radon-222 in Publication 65 have been widely accepted and the Commission proposes they should continue. These suggested ranges of activity concentration within which an optimised action level would be found. For the future, single levels for members of the public and workers might be recommended (what might the level be? – 500 Bq/m³ for homes and 1,000 Bq/m³ for work?). As now, the recommendation would be that for exposures above the action level, the system of protection is applied. Exposures below the designated action level are then excluded from the system.

When considering the other natural sources it is again activity concentration that is probably the most appropriate quantity and the criterion, as with radon, should not be dosimetric but rather a value at the upper end of the existing natural range. The Commission will recommend an exclusion level for natural sources (the value may be around a fraction of a Bq/g).

Scope of the Recommendations

Apart from these exclusions, the Commission has aimed to make its recommendations applicable as widely and as consistently as is possible. Irrespective of the origins of the sources, the Commission's recommendations cover exposures to both natural and artificial sources, so far as they are controllable.

Justification of a practice

"Justification" was treated as the first principle of radiological protection for the Recommendations in Publication 60. The Commission now recognises that there is a distribution of responsibilities for judging justification, which lies primarily with the appropriate authorities. They make decisions for reasons that include economic, strategic or defence considerations and in which the radiological considerations, while present, are not always the determining feature of the decision. The Commission now deals with this requirement and the system of protection is applied to practices only when they have been declared justified.

The justification of patient exposures is included in the recommendations but has to be treated separately, because it involves two stages of decision making. Firstly, the generic procedure must be justified for use in medicine and, secondly, the referring physician must justify the exposure of the individual patient in terms of the benefit to that patient. It is then followed by a requirement to optimise patient protection and the

Commission has advocated the specification of Diagnostic Reference Levels as indicators of good practice.

Health effects of radiation

The Commission will present its views on the quantitative estimates of health risks following exposure. There is a need to be clear about the range of dose over which information needed for stochastic effects. People are exposed, inevitably, to natural background radiation and this is from a few to a few tens of millisieverts in a year. It is at this range of dose that risk factors are required and the effects of added increments of dose above that background.

For deterministic effects, the major factor is the degree of loss of function in a tissue. The distributions of the dose both within the tissue, and in time, are usually of considerable importance. These will be covered in the Recommendations.

Dosimetric quantities

There have been some persistent difficulties with, and misunderstandings of, the definitions of the Commission's dosimetric quantities. The Commission will remove these by clarifying its definitions and specifying their application.

The Commission uses the averaged absorbed dose in an organ or tissue. The implicit averaging is valid only if the range of doses is such that the proportional dose-effect relationship applies. There is no proposal to move away from the use of effective dose as currently defined,

$$E = \sum_T w_T \sum_R w_R D_{T,R}$$

There is however a need to reconsider the definition of detriment used to derive the tissue weighting factors and the numerical values of both w_T and w_R . Publication 60 had nine groups for w_R , while the w_T values for ten tissues and the "remainder" lie generally within a factor of two from 0.1. Only bone surfaces and skin lie outside this range. The Commission considers that some simplification is warranted.

For deterministic effects it is now thought that no weighting factors are necessary, because the RBE rarely exceeds a value of 2. Absorbed dose in Gray is considered to be an adequate quantity for assessing deterministic effects.

General basis of a system of protection

This system of protecting individuals and groups is intended to provide a higher standard than the previous one. A necessary basic standard of protection from each relevant source is achieved for individuals by setting Protective Action Levels which are values of quantities, usually dose, but may be activity concentrations, and are usually annual values, but may be a single value depending on the circumstances.

Table 1: Levels of concern and individual effective dose as a function of the natural background, excluding radon exposures.

level of concern	effective dose
high	> 100x
raised	> 10x
normal	average natural background
low	< 0.1x
none	< 0.01x

Factors in the choice of protective action levels

The starting point for selecting levels for action is the concern that can reasonably be felt about the annual dose from natural sources. The existence of natural background radiation provides no justification for additional exposures, but it can be a basis of judgement about importance.

Table 1 illustrates suggested levels of concern at fractions or multiples of the natural background. Having dealt with radon separately under the Exclusion section of this paper, the natural background exposures now exclude the contribution from radon. The remaining effective dose from natural sources varies by at least an order of magnitude around the world and demonstrably leads to no major hazard to human health.

Additional doses far below the natural annual dose should not be of concern to the individual and should also be of no concern to society. An illustrative set of Protective Action Levels and the associated actions are set out in Table 2. All the numerical values and actions are taken from the Commission's recommendations in Publications 60, 63, 64, 77 and 82.

Optimisation of protection

The Commission wishes to retain the words "Optimisation of protection" and applies it both to single individuals and to groups. However, it is applied only after the meeting the restrictions on individual dose defined by the Protective Action Levels. It is now used as a short description of the process of obtaining the best level of protection from a single source, taking account of all the prevailing circumstances.

The previous procedure had become too closely linked to formal cost-benefit analysis. The product of the mean dose and the number of individuals in a group, the collective dose, is a legitimate arithmetic quantity, but is of limited utility. It aggregates information excessively and for making decisions, a large dose to a few people is not equivalent to a small dose to many people. The highest individual dose is useful to check that the Protective Action Levels have been successfully applied, but contributes little to optimisation of protection. The necessary information should be presented in the form of a matrix.

Table 2: Illustrative Protective Action Levels and the associated actions for prolonged situations (effective dose in a year) and single events (effective dose).

exposed group	protective action level	required action
<i>all situations</i>		
all groups	< 0.01 mSv	exclude from the system of protection
<i>prolonged situations</i>		
members of the public and general workers	0.1 mSv	reduce doses by direct and environmental action
specialty trained workers	20 mSv	reduce doses by direct and action and by modifying working procedures
<i>single events and accidents</i>		
members of the public including general workers	5 mSv	advise sheltering in buildings, issue stable iodine if relevant
	50 mSv	arrange short-term evacuation
	1000 mSv (long-term)	arrange long-term relocation
specialty trained workers	1000 mSv	upper limit of planned emergency work

The process of optimisation in future may best be carried out by involving all the bodies most directly concerned, including representatives of those exposed, in determining, or in negotiating, the best level of protection in the circumstances. It is not obvious how the Commission's recommendations will deal with this degree of societal process.

Radiological protection of the living environment

In ICRP 60 it was stated that "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". The human habitat has probably been afforded protection through the application of the current system of protection. However, there are circumstances where the ICRP statement is insufficient or wrong. These include environments where humans are absent or have been removed and situations where the distribution of radionuclides in the environment is such that exposure to humans would be minimal, but other organisms could be exposed.

The need and goals for protection of the environment have been defined by society. The role of ICRP should be to define how radiological protection can contribute to achieve these goals. This would help regulators demonstrate compliance with existing international and national environmental requirements and demonstrate that radiological protection is consistent with international principles. It would provide advice with respect to intervention situations and help to inform stakeholders. ICRP should develop a system

of radiological protection for humans and the environment and reflect its commitment for the environment in its organisation of work and composition of experts.

Proposed timescales

The Main Commission has invited its four Committees to discuss its draft recommendations at their meetings in mid-2002. The Commission then expects to take account of the views expressed at its meeting in October 2002, after which a version should be made widely available for comment in 2003. The intention is to have a well-developed draft in 2004.