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NEW ICRP RECOMMENDATIONS 2005: WITHOUT FULL CONSENSUS?

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INTRODUCTION

Ionising radiation is currently viewed as one of the most studied of all known carcinogens. The system of radiation protection that has been created to protect the public and workers from the harmful effects of ionising radiation has been evolved over the years, new radiological challenges have been identified and addressed. Although it is seen as robust and extensive this evolution has resulted in a system that is increasingly complicated.

Of relevance to the system of radiation protection is the increasing social desire/need to understand decision made by governments, regulatory bodies and industry, and to participate more actively in decision-making processes involving environmental and health issues. Scientific rationale that was earlier sufficient to explain radiation protection theory and practice is no longer adequate.

The leading body in radiological protection is ICRP (International Commission for Radiological Protection). It was formed in 1928 as the International X-ray and Radium Protection Committee, but adopted its present name in 1950 to reflect its growing involvement in areas outside that of medicine, where it originated. According to its constitution, ICRP is established to advance for the public benefit the science of Radiological Protection, in particular by providing Recommendations and guidance on all aspects of radiation protection. ICRP works closely with its sister Commission, ICRU, and has relationship with many other bodies, e.g. within the United Nations structure (IAEA, ILO, PAHO, UNSCEAR and WHO). ICRP has always been an advisory body, offering its recommendations to regulatory and advisory agencies at international, regional and national levels.

For the 21st century the Commission aims to make the system more coherent and less confusing. As part of this process ICRP proposed a series of ideas for simplifying the system of radiation protection, in line with modern societal needs. Over the last few years ICRP developed these ideas, and more importantly has invited the radiation protection community, and beyond, to discuss the future system of radiation of protection in order to move towards a broadly based consensus on which to build new ICRP recommendations. This process is finished and it is expected the new ICRP recommendations to be published in the 2005.

The paper presents essential issues of the outcome of the Commission discussions and improvement of the current system of radiation protection.

THE PRESENT SITUATION - THE 1990 SYSTEM OF PROTECTION

The current Recommendations of radiation protection, set out in the Annals of the ICRP as Publication 60 in 1991, were developed over last 30 years. The previous 1977 Recommendations established the three principles of the system of dose limitation as Justification, Optimisation and Limitation. Optimisation of protection was to be applied to a source and a formal cost-benefit procedure was recommended to address the question "How much does it cost and how many lives are saved?". This introduced quantity Collective Dose, which emphasised the protection of society and was unable to take in account of the distribution of individual doses within it. The issue was resolved in the 1990 Recommendations when fundamental changes were made to the principle of optimisation. The dose limit is considered as a boundary above which the consequential risk would be deemed unacceptable and introduction of the dose constraint was in order to optimise radiation protection to include the recognition of the need for individual protection. The exposure restrictions to sources are termed dose constraints; the exposure restrictions to practices are termed dose limits. The constraint would be set at a fraction of the dose limit, as a boundary on the optimisation of that source.

The principles of justification and optimisation aim at doing more good than harm and at maximising the margin of good over harm for Society as a whole. They therefore satisfy **the utilitarian principle of ethics**, whereby actions are judged by their overall consequences, usually by comparing in monetary terms the relevant benefits (e.g. statistical estimates of lives saved) obtained by a particular protective measure with the net cost of introducing that measure.

ICRP has made clear that the present system of protection distinguishes between practices, which add doses and risks, and intervention, which reduces doses and risks. For both Practices and Interventions, the Recommendations from ICRP in the last 15 years have been made in terms of controlling the maximum risk to the individual. There has been a corresponding reduction in the emphasis on collective dose and cost-benefit analysis. Overall this reflects a shift from utilitarian values to an equity-based policy (**the egalitarian principle of ethics**), which starts with the premise that all individuals have unconditional rights to certain levels of protection.

MAJOR CHANGES FROM THE 1990 RECOMMENDATIONS

In protecting individuals from the harmful effects of ionising radiation, it is the control of radiation doses that is important, no matter what the source. Such doses could be received at work, in medical applications and in the environment from the use of artificial sources, or could arise from elevated levels of natural radiation and radionuclides, including radon. It does not apply to exposures that are

not amenable to control, such as cosmic radiation at ground level, but would apply to high terrestrial levels of natural exposure.

The 2005 Recommendations establish restrictions on individual dose from specified sources in all situations within their scope. The most fundamental level of protection is the source-related restriction called a dose constraint. These constraints represent the level of dose where action to avert the dose is virtually certain to be justified. It is proposed that the existing concept of a constraint be extended to embrace a range of situations to give the levels that bound the optimisation process for a single source. They would replace a range of terms that include intervention levels, action levels, constraints, clearance levels and exemption levels as well as the dose limits for workers and the public. Table 1 presents the Commission's recommended maximum values of dose constraints.

The starting point for selecting the levels at which any revised constraints are set is the annual dose from natural sources. The fact that natural background varies by at least a factor of ten around the world, supports the view that concern should begin to be raised at the higher end of the range. Doses of towards 100 times the global average dose are likely to be a matter of some concern. At the other extreme, additional doses far below the natural annual doses should not be of concern to the individual. The Commission is satisfied that protection is already optimised if the effective dose to the most exposed is, or will be, less then about 0.01 mSv in a year. In the intermediate region, the doses are sometimes a legitimate matter for significant concern, calling for action.

Table 1. Maximum dose constraints recommended for workers and members of the public from single dominant sources for all types of exposure situations that can be controlled

Maximum constraint (effective dose, mSv in a year)	**Situation to which it applies**
100	For workers, other than saving life or preventing serious injury, or preventing catastrophic circumstances, and for public evacuation and relocation in emergency situations, and for high levels of controllable existing exposures. There is neither individual nor societal benefit from levels of individual exposure above this constraint
20	For situations where there is direct or indirect benefit for exposed individuals, who receive information and training and monitoring or assessment. It applies into occupational exposure, for countermeasures such as sheltering, iodine prophylaxis in accidents, and for controllable existing exposures such as radon, and for comforters and carers to patients undergoing therapy with radionuclides

1	For situations having societal benefit, but without individual direct benefit, and there is no information, no training and no individual assessment for the exposed individuals in normal situations
0.01	Minimum value of any constraint

It is agreed that the broad based "Justification" of, for example, nuclear power as a practice, is of no particular practical use to operational radiation protection, it is also felt that justification of choices of actions, on a case by case basis, may be essential. This is evident in decisions relating to medical diagnosis and treatments, or in deciding whether a particular operation involving radionuclides should be allowed. These types of "justifications" are much more useful in practice. In 2005 recommendations the Commission 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, medical and defence considerations in which the radiological considerations, while present, are not always the determining feature of the decision. The Commission now apply the system of protection to practices only when they have been declared justified and to natural sources that are controllable.

There are many sources for which the resulting levels of annual effective doses are very low, or for which the combination of dose and difficulty of applying controls are such that protection may be assumed to be optimised and the sources are therefore excluded. In its restated policy the Commission defines what sources and exposures are to be excluded from the system of the protection and will not use the term "exemption". Table 2 presents the Commission's recommended exclusion levels.

Table 2. Recommended Exclusion Levels

Nuclides	**Exclusion activity concentration**
Artificial α-emitters	0.01 Bq g^{-1}
Artificial β/γ emitters	0.1 Bq g^{-1}
Head of chain activity level, ^{238}U, ^{2}Th	1.0 Bq g^{-1}
^{40}K	10 Bq g^{-1}

There have been some persistent difficulties and misunderstandings of, the definitions of the Commission's dosimetric quantities. Again averaged absorbed dose in an organ or tissue is the basic quantity used. The weighting factor for radiation quality is applied directly to **the tissue absorbed dose**. The Commission now avoids the term used for weighted tissue: **dose equivalent** or **equivalent dose** and uses **radiation weighted dose** in a tissue or organ. When, more then one tissue is exposed, it is necessary to use the tissue weighting factor. The application of both the radiation and the tissue weighting factors to the tissue absorbed doses

leads to the effective dose. The Commission has reviewed the epidemiological data that can be used to assess nominal risk factors for cancer and hereditary diseases. From these it has developed a new estimate of detriment resulting from radiation exposure which has been used to specify its recommended W_T values presented in Table 3.

Table 3. Tissue weighting factors

Tissue	W_T	ΣW_T
Bone –Marrow, Breast, Colon, Lung, Stomach	**0.12**	0.60
Bladder, Esophagus, Gonads, Liver, Thyroid	**0.05**	0.25
Bone Surface, Brain, Kidneys, Salivary Glands, Skin	**0.01**	0.05
Remainder Tissues (14 in total)	**0.10**	0.10

In ICRP 60 it was stated 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." However, there are some circumstances where humans are absent or have been removed and situations where distribution of radionuclides in the environment is such that exposure to humans would be minimal, but other organisms could be exposed. In the new recommendations a radiation protection policy is designed so that it is harmonized with the proposed approach for the protection of human beings. This will ensure that both humans and other organisms are protected on the same scientific basis.

CONCLUSION

The new recommendations should be seen as a consolidation of recommendations from Publication 60 to give a single unified set that can be simply and coherently expressed. The opportunity is also being taken to give clarification of dosimetric quantities for protection purposes, to include coherent philosophy for natural radiation exposures and to introduce a clear policy for radiological protection of the environment. Very broad discussions of major radiation concepts over last four year showed many different opinions of the experts and it is certain that the discussion of these basic concepts will continue for some time before full consensus is reached within the international community. Nevertheless, the new ICRP recommendations will appear this year.

REFERENCES

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ABSTRACT

Ionising radiation is viewed as one of the most studied of all known carcinogens. Over the last 50 years Recommendations of International Commission for Radiological Protection (ICRP) have been changed regularly every 10 years. At the beginning these changes were significant, sometimes even radical, according to quick acquiring of new scientific evidence on physical, biological and health effects of radiation. In order to handle each new situation evolution of the radiation protection system has been extended and new portions have been added (the ubiquitous exposure of public to radon gas and its progeny, and the need to develop an appropriate response to emergency situations, increasing social desire to participate in decision making processes, concern for the protection of non-human species and environment), that resulted in a system that is increasingly complicated. Over the last few years very broad discussions of major radiation protection concepts have been encouraged by the ICRP in order to achieve consensus on a more operational and coherent system of radiation protection elaborated in a transparent fashion, and presented in readily understandable terms. This process for the first time involves a broad spectrum of stakeholders in these discussions. It is further assumed that these debates will eventually result in consensus on the basis for the next round of ICRP general recommendations, probably in the 2005. While now it is certain that the consensus is not yet reached within the international community and the discussion of these issues will continue for some time the new recommendations should be seen as a consolidation of recommendations from 1990 to give a single unified set that can be simply and coherently expressed. The paper presents essential issues of the outcome of the Commission discussions and improvement of the current system of radiation protection.