Radiological Protection at the Start of the 21st Century: A Progress Report

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I INTRODUCTION

This paper provides an update on the thinking behind the development of protection criteria resulting from the meeting of the Main Commission Task Group at the end of June 2001. The first obvious point is demonstrated by the title of this paper; the Task Group wished to address the preparation of a protection philosophy as the 21st century begins. A number of other important issues were raised and proposals made for progress to the next stage. Some of these are presented here, but the paper also traces the evolution of protection principles and the ethical bases used to establish standards as they now exist. It explains how collective dose and cost-benefit analysis became the recommended methods for optimising protection in the 1970s and why the Commission is now moving towards a more egalitarian, or individual-based ethical approach. This requires the establishment of criteria that might be called Doses for Protective Action, which can be justified in terms of the existence of natural background radiation. These would replace the present complex set of criteria that have been developed from the present Recommendations of 1990. These include,

- Intervention Levels after accidents
- Guidance Levels in diagnostic radiology
- Dose Limits for workers
- Intervention Exemption Levels
- Action Levels for radon in homes or at work
- Clearance Levels
- Dose Limits for the public
- Exemption Levels
- Constraints
- Exclusion criteria

The initiative represents a genuine attempt to simplify the system of protection to one that is more coherent and easily explicable.

II THE PRESENT SITUATION

In 1977 the Commission quantified the process of optimisation of protection and adopted, implicitly, a UTILITARIAN ethical policy when it recommended the use of cost-benefit analysis which aims to answer the question, "How much does it cost and how many lives are saved?" This meant calculating collective dose and thereby emphasised the protection of society over that of individuals. This emphasis, however, does not necessarily provide sufficient protection for each individual. Classical cost-benefit analysis is unable to consider the individual, and the Commission attempted to address this by suggesting a non-linear cost to the unit of collective dose. This still did not recognise sufficiently the individual risk, so the Commission established in its 1990 Recommendations an added restriction on the optimisation process. It modified the principle of optimisation by the introduction of the concept of a constraint. The constraint is an individual-related criterion, applied to a single source in order to ensure that the most exposed individuals are not subjected to excessive risk and to limit the inequity introduced by cost-benefit analysis.

The use of collective dose, aggregated to include all levels of dose and all periods into a single value has distorted the process of optimisation of protection. The Main Commission has made proposals for a possible simplification of the system of protection emphasising the dose to an individual from a controllable source. There would still be requirements to keep the individual dose both below a defined action level and as low as reasonably practicable. The second requirement would not be linked to collective dose in its present form.

III JUSTIFICATION

The Commission's present recommendations for
justification require that the practice should do more good than harm. This procedure implies a quantified balance of costs and benefits, but in practice, governments, physicians, or individuals do not make decisions about courses of action in a predominantly quantitative way. A qualitative approach is more common and usually more appropriate.

The judgement that it would be justifiable to introduce or continue a practice involving exposure to ionising radiation is not usually taken by radiological protection authorities, although they should influence the decision. The responsibility for judging justification usually falls on governments or government agencies.

The medical exposure of patients to a particular technique should be justified in a general sense, as is any other practice. In addition, a more detailed justification has to be introduced. The principal aim of medical exposures is to do more good than harm to the patient, subsidiary account being taken of the radiation detriment from the exposure of the radiological staff or of other patients. If the necessary resources are available, the responsibility for the justification of the particular use of a particular procedure falls on the relevant medical practitioners.

**IV THE SYSTEM OF PROTECTION**

The system of protection for medical exposures will be treated separately. It will consist of a need for individual justification for an examination using a generically justified technique, followed by the specification of Reference Levels as indicators of best practice. It is not considered further here, but will be considered and developed by Committee 3.

For non-medical exposures, it is the control of radiation doses that is the important issue, irrespective of the source. In the first place, therefore, consideration should be given to the dose to an individual from a particular controllable source. The doses may be received as result of work or from radioactive sources in the environment, natural or artificial. The doses may have already been received, or will be received in the future, from the introduction of new sources or following an actual or potential accident.

For each previously justified, controllable source, the first consideration in the proposed system of protection is to provide a minimum level of health protection for individuals by means of **Doses for Protective Action or Protective Action Levels**. The need for protective action is influenced solely by the individual dose, but not by the number of exposed individuals. The second consideration stems from the recognition that there is likely to be some risk to health, even at small doses. This introduces a moral requirement, for each controllable source, to take all reasonable steps to restrict both the individual doses to levels below the action level and the number of exposed individuals. At present, the Optimisation of Protection provides this criterion.

For uncontrollable sources, where it is feasible only to modify the pathways by which people are exposed, consideration can also be given to the development of Doses for Protective Action or Protective Action Levels. Doses for Protective Action do not apply to justified medical exposures.

**V DOSES FOR PROTECTIVE ACTION**

In general, despite the complexity of the present protection philosophy, doses to individuals are kept below about ten times the average background dose. So, occupational dose limits in practices, or intervention levels for the public either in emergencies or for radon in homes, are set at some few tens of mSv. Added doses from environmental releases are kept to about one tenth of background. And, in many regions of the world, exemption from regulatory oversight is allowed if doses are below about one hundredth of background. This suggests the basic Doses for Protective Action as set out below.

Doses for Protective Action or Protective Action Levels

**For people**

Workers, for evacuation of members of the public, radon

$\sim 20 \text{ mSv in a year}$

**For discharges**

Added increments of dose from single sources

$< 300 \mu \text{Sv in a year}$

**Exemption**

From registration or licensing

$10 \mu \text{Sv in a year}$

Doses for Protective Action can be considered as establishing a minimum level of health protection, which may be applicable globally. However, for any particular source there is a need to reduce the doses to a level that is as low as is reasonable under the prevailing circumstance.

**VI OPTIMISATION OF PROTECTION**

The process of taking all reasonable action to reduce exposures is still likely to be called the Optimisation of Protection. The initial proposals suggested that the optimisation of protection as it is now usually understood should be replaced by a different requirement. This would be that the residual doses, after the application of the Doses for Protective Action, should be kept 'as low as reasonably practicable' (ALARP). The Task Group considered that differential equations should not be over-utilised, and that the use of 'common sense' would often be more important.

The process of optimisation in future may best be carried out by Stakeholder involvement to determine or negotiate for the best level of protection in the circumstances. This would involve the presentation of costs and residual doses for a range of options either in the workplace or for exposures of the public. While the Dose for Protective Action thus represents a basic standard of individual health protection, stakeholder involvement...
determines how far below the Dose for Protective Action is as low as reasonably practicable. This would represent the optimum level of protection from the source under control or for an uncontrollable source. The achievement of consensus would replace the previous formal cost-benefit analysis.

VII CONCLUSION

This brief summary indicates how the development of ICRP concepts is progressing. It takes into account the views that were expressed at the inaugural meeting of the Main Commission Task Group, which has been established to proceed with the exposition of 'Protection in the 21st Century'.

The Main Commission will next consider a first draft outline document that expresses its intentions in developing a philosophy for protection at the start of the 21st Century. This will be available for discussion next year.

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