A Critical Review of the System of Radiation Protection

First Reflections of the
OECD Nuclear Energy Agency's
Committee on Radiation Protection and Public Health
(CRPPH)

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FOREWORD

The NEA Committee on Radiation Protection and Public Health (CRPPH) has for several years devoted a significant portion of its programme of work to various issues concerning the foundations of the “System of Radiation Protection”, as laid out in ICRP Publication 60. This has included work in the areas of general guidance, radioactive materials in consumer products, intervention levels, potential exposure, dose constraints and biological effects. The CRPPH has focused its work in these areas on interpretation of the conceptual aspects of the system, and on guidance for the practical and operational implementation.

In general, the CRPPH has found the ICRP system to be robust and extensive, noting in its 1994 Collective Opinion that: “The present conceptual framework of radiation protection, as proposed by the International Commission on Radiological Protection (ICRP), provides the basis for operational criteria and guidance, applicable to various protection situations…” However, the Committee has continued to focus its attention on those aspects of the system which it judges to need further refinement.

In mid-1999, Professor Roger Clarke, Chairman of the ICRP, suggested that a new line of thinking might significantly improve the system. In an open paper on what he terms “controllable dose” (Clarke99), he suggests that the “apparent incoherence” of the system of radiation protection should be addressed, particularly in light of current concerns over radiation exposures which may be received in different social contexts. By incoherence, he means such things as the lack of international guidance for the withdrawal of countermeasures, the difficulty in classifying certain situations as practice or intervention and, in a larger public perception context, the fact that what the public sees as “safe” under “normal” conditions (public dose limit of 1 mSv) is totally different under accident situations (very high intervention levels), or under prolonged exposure (formerly referred to as chronic exposure) situations.

The increasing involvement of a variety of stakeholders in the evolution of the system of radiation protection makes it timely that a very broad critical review of the current system should now be undertaken. The intent of the Committee is that this work should serve as a contribution to ongoing debates concerning the system of radiation protection. 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 to 2010 time frame.

Certain members of the CRPPH have also noted that in recent years the interpretation of collective dose, specifically as the integral of very small doses over extremely large populations and long time periods, has been somewhat problematic. The Committee felt that collective dose is an important radiation protection tool, and that considerations of its use and interpretation were an important part of discussions of the system of radiation protection, and thus should be fully addressed.

The CRPPH agreed at its 57th meeting in April 1999 to create the Working Party on Controllable Dose and the Use of Collective Dose (see Annex 1 for membership and Annex 2 for Terms of Reference). The Working Party prepared a critical review paper, which was discussed and approved by the CRPPH at its April 2000 meeting. The final results are presented herein.

This material should be considered as a contribution to the evolving debate over the future direction of the international system of radiation protection. It is hoped that there will be sufficient time to develop an appropriate international consensus, such that the next set of recommendations from the ICRP will be based on solid arguments, a common opinion on the issues, and involve all interested parties in the development process.

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1. INTRODUCTION

The protection of the public and workers from the harmful effects of ionising radiation has been a concern of radiation protection professionals since the early part of the 20th century when harmful effects were first observed. Since that time, the detrimental effects of ionising radiation have been extensively studied: from the fundamental nature of radiation's effects on cells, organs and organisms, to the epidemiological study of large populations who have been exposed to various levels of ionising radiation. Based on these studies, over time an international system of radiation protection has been built largely through the work of the International Commission on Radiological Protection (ICRP).

Radiation is currently viewed as one of the most studied of all known carcinogens. The system of radiation protection that has been built to protect the public and workers from its harmful effects is seen as extensive and robust, but is less well developed for the protection of the environment and non-human species. The system is also viewed by some as being overly demanding of resources.

As this system has evolved over the years, new radiological challenges have been identified and addressed. The ubiquitous exposure of the public to radon gas and its progeny, and the need to develop an appropriate response to emergency situations causing widespread environmental contamination and public exposure are two examples. However, this evolution has resulted in a system that is increasingly complicated. The framework of the system of radiation protection has been extended, and new portions have been added to handle each new situation, all within one single system.

These extensions and additions have brought most of the currently identified radiological protection challenges within the system of radiation protection. However, in addressing an ever-increasing number of fairly diverse radiological problems, the complexity of the system has resulted in incoherence. The radiological criteria used for optimising protection in, for example, normal circumstances are inappropriate for judging optimisation in post-accidental situations. Releases of slightly contaminated materials from the nuclear industry are addressed differently than similar, but naturally occurring radioactive material from other industries, such as fertiliser, oil and gas, or phosphogypsum. Exposure to radon gas is viewed differently than exposure to the uranium and radium that produce the radon gas. While radiation protection experts understand these differences in terms of optimisation logic, the public, politicians and decision makers often are less able to understand the different approaches. Public concern over radiation exposure does not seem to be related to the level of dose incurred, as shown by the low concern over medical exposures as compared with the public outcry over very low exposures from the clearance of radioactive waste.

Of relevance to the system of radiation protection is the increasing social desire/need to understand decisions made by governments, regulatory bodies and industry, and to participate more actively in decision-making processes involving environmental and health issues. To address this need, industry, governments and regulatory bodies are becoming increasingly transparent in terms of their operations.

Radiation protection is no exception to this trend. Scientific rationale that was once sufficient to explain radiation protection theory and practice is no longer adequate. The need to address and communicate theory, practice and the decision-making process to a wider audience has given rise to numerous debates and led the radiation protection community to revisit the framework of the system of radiation protection. The very fundamentals of the system of radiation protection continue to be questioned in a healthy fashion, and many aspects have been identified which could better serve stakeholders given some additional thought in the light of modern societal needs.

As part of this process, in mid-1999 Professor Roger Clarke, the chairman of the ICRP, proposed a series of interesting and provocative ideas for simplifying the system of radiation protection (Clarke99), in line with the modern societal needs and perspectives described above. He has continued to develop these ideas, and more importantly has invited the radiation protection community, and beyond, to discuss the future development of the system of radiation protection in order to move towards a broadly based consensus on which to build future ICRP recommendations.

Practically since its inception, the NEA Committee on Radiation Protection and Public Health (CRPPH) has played a part in the evolution of the system of radiation protection, and has welcomed this very open opportunity to participate in the process. The CRPPH has reviewed a number of specific aspects of the current system of radiation protection, particularly in light of modern views of stakeholder issues, and feels that significant clarification and improvement of the current system can be achieved.

This report presents the outcome of the Committee's discussions of how the current system could be improved. It is hoped that these two lines of thinking – the ongoing development of concepts from Professor Clarke and others, and an evolutionary approach to revision based on the current system – will converge into a broad consensus to achieve significant clarification and improvement in the system of radiation protection. While it is certain that the discussion of these issues will continue for some time before consensus is reached within the international community, the CRPPH hopes that the following thoughts will facilitate progress towards this goal.

2. THE SYSTEM OF RADIATION PROTECTION: FIRST REFLECTIONS BY THE CRPPH FOR FUTURE DIRECTIONS

Most radiation protection experts can list several areas of the current system of radiation protection that could be clarified, could be made more coherent with other aspects, could be made easier to apply, etc. The first reflections on these issues by the CRPPH are not intended to resolve these problems, but simply to clearly identify areas that could be improved, and to begin to discuss directions that could lead to a more simplified, more coherent overall framework. To this end, eight areas have been discussed and are presented here.

Clarity and Coherence

One of the most common complaints heard when discussing the system of radiation protection, from experts and laypersons alike, is the complexity of the terminology used. Although any technical discipline will develop its own set of precise vocabulary, the radiation protection community, particularly with ICRP Publication 60, has adopted a large set of common words that require detailed definitions to be understood within the context of radiation protection. Some examples of such works are: risk; constraint; potential exposure; exemption; exclusion; clearance; practice; intervention; tolerable; acceptable; unacceptable; limit; justification; optimisation; guidance level; intervention level; investigation level; action level. The precise and internationally agreed upon definitions of a few of these terms are still the subject of discussion among radiation protection professionals, almost ten years after their introduction in ICPR Publication 60.

The complexity of radiation protection terminology, and the seeming lack of consensus with regard to “simple definitions”, has contributed to a general decline in public and decision-maker confidence in the system of radiation protection. As such, the ability of the radiation protection community to effectively pass on messages, and to recommend appropriate levels of public protection, has been eroded.

Although much easier said than done, one possible approach to reversing this decline in public and decision-maker confidence might be to more clearly separate technical issues from policy and decision-making issues, and to present these separately. This will require some detailed discussions within the radiation protection community, and importantly, with other stakeholders. Such an approach, however, could prove fruitful.

Regarding technical issues, one clear need is an internationally agreed-upon glossary of terms. The intent of such a glossary should be to provide both the philosophical and operational information necessary to appropriately understand and apply the terminology used in radiation protection. This document should be aimed at technical specialists. It is encouraged that, as necessary new radiation protection terminology is introduced, strong consideration should be given to the retirement of old terminology.

In parallel to this glossary development, the utility of using terms that require precise definitions could be reviewed, particularly in the light of operational usage. Several practical examples can be cited:

- The concept of dose constraints was introduced in ICRP Publication 60 in 1990, and the precise definition of this term did not emerge until 1996 with the publication of a short document jointly sponsored by the NEA and the European Commission (NEA96). Today, three years further on, it is not clear that the concept of dose constraint is used operationally or consistently, or is widely understood within the radiation protection community. The utility of this definition, certainly in operational terms, is thus somewhat questionable.

- Terms such as "tolerable", "acceptable" and "unacceptable" are inherently subjective, and do not seem to be useful in discussions with stakeholders, particularly when discussing risks. More meaningful and objective comparisons, e.g. to natural background radiation levels, should be explored.

- The term "practice" has been a source of great confusion. It has been said that practices should be justified. If one considers practices to be very large in scale, such as "nuclear power", then, for example, are lower-level activities such as steam generator replacements also "practices" which in themselves also need to be justified?

A complete and coherent system should address the rationale for radiation protection of the public, workers and medical patients. It should address environmental concerns, i.e. protection of flora and fauna. It should explain the treatment of detailed aspects such as release of materials (exclusion, exemption, clearance, Naturally Occurring Radioactive Material (NORM), emissions, consumer products), and the rationale behind its recommendations should be clear and defensible in the context of today's society. **One of the most important characteristics of any new or modified system of radiation protection should be a high level of self-coherence.**

Justification

While it is agreed that the broad based "Justification" (with a capital "J") 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 or actions, on a case by case basis, may be essential. This is evident, for example, in decisions relating to medical diagnoses and treatments, or in deciding whether a particular activity involving radioactivity should be allowed (regardless of doses). These types of "justification" (with a small "j") are much more useful in practice, and in the context of modern society are becoming increasingly important for choices involving stakeholders.

It should also be noted that in some situations, particularly for public exposure, the radiation protection component of justification considerations may be trivial with respect to other socio-political dimensions. Full consideration of the benefits from the practice resulting in the exposure is often an essential element of the justification of an activity, and in the choice of the most appropriate radiation protection option by stakeholders. Thus, **the ICRP should give full consideration in the future to the roles and interactions between justification (with a small "j") and optimisation principles in complex situations.** The current system of radiation protection does not achieve this goal. Evolution should be aimed at moving the current system towards coherence.

Optimisation

Optimisation of protection is one of the cornerstones of the system of radiation protection as presented in ICRP Publication 60. In the broadest terms, optimisation of protection is the process of identifying the radiation protection option to keep exposures ALARA.

While optimisation of protection is a fundamental step to almost any radiation protection "process", the application of optimisation in some practical situations is relatively difficult, and little guidance exists at this level. Benefits and detriments may be perceived differently for different sectors (e.g. nuclear power plants and nuclear medical departments) and this needs to be taken into account in the optimisation process. A concerted effort to provide additional, specific examples of optimisation in various situations would be of great use to the radiation protection community, and would also serve to enhance the transparency issues previously discussed. There are several common cases where additional guidance would be useful.

For example, what does it mean to optimise the releases from a nuclear power plant? How is the release of a formerly contaminated site performed and authorised in an optimised fashion? It would be very useful to illustrate the process of optimisation for various practical cases using specific examples. Operators and regulators alike could use such case studies as guidance.

In addition, various situations exist in which risks are transferred from one population to another, and there is currently very little guidance as to how radiation protection considerations of this transfer should be taken into account when selecting the optimum protection solution. The classic example of this is worker exposure versus public exposure. In situations where nuclear safety enhancements are being considered to reduce the risk of environmental releases of radionuclides, workers receive doses in order to reduce potential public exposures. There are currently no practical tools or criteria for judging whether the proposed worker doses are optimised with respect to the reduced potential public exposures. A similar situation exists with regard to the concentration of radioactive waste. Workers receive exposures when concentrating, handling and storing of radioactive waste, which in some cases could alternatively been diluted and dispersed into the environment, causing public exposures.

A very broad question concerns whether non-radiological risks should be taken into account in the process of optimisation, and, if so, how? Although some work has been done in the area of risk inter-comparison, particularly from the perspective of resource allocation, this is a field that is very new.

A final example of the difficulties in applying optimisation in a practical sense is the protection against various accidents. Accidents can be characterised by their probability of occurrence and by the severity of their consequences. However, in terms of potential exposure, an accident of low probability with high consequences has the same numerical potential exposure as an accident of higher probability but with lower consequences. Additional tools are needed to make meaningful comparisons between these two cases.

In all these cases, **practical guidance is needed to better apply the principle of optimisation.**

Collective Dose

In recent years the use of collective dose has been increasingly a subject of discussion and debate. Problems have stemmed from the use of collective doses to predict excess numbers of fatalities based on very small doses summed over large populations and thousands of years. While the mathematics of the LNT allow the valid summation of such doses over such populations and time-scales, the interpretation and usefulness of the results have been questioned.

For example, carbon-14, which has a half life of 5 730 years is naturally occurring and is also released to the environment during normal reprocessing operations, and eventually from repositories of high-level nuclear waste and spent nuclear fuel. The lifetime dose to any individual from carbon-14 from the nuclear fuel cycle is very small; orders of magnitude less than exposure from natural background. However, due to its long half-life, carbon-14 diffuses rather uniformly over vast portions of the planet and thus exposes large populations both geographically and over time. Summing very small individual doses to extremely large populations over several thousand years would then result in very large collective doses. Using LNT, these large collective doses can be translated into a number of predicted excess fatalities. Such numbers, unqualified in terms of their associated uncertainties and out of their original context, have sometimes been used to "demonstrate" the hazards of nuclear power. The validity and usefulness of the predicted number of fatalities, however, is questionable.

In addition to these concerns over "invalid" uses of collective dose, there are further concerns over current trends in ICRP, whose recent recommendations (Publications 77 and 81) are useful with regard to these "invalid" uses of collective dose, yet seem to imply less reliance on collective dose in the justification and optimisation of radiation protection options. Collective dose is regarded as a useful tool, in the comparative sense, for the optimisation process. This is particularly true in terms of selection protection options for occupational exposures. Also, the use of collective dose for worker groups inhibits the unreasonable use of dose sharing, and aids tracking trends for repeated operations (e.g. steam-generator replacement) so that lessons can be learned. Collective dose is not, however, seen as a particularly useful tool from the viewpoint of absolute detriment.

The use of collective dose in the area of public exposures is somewhat problematic due to inherent uncertainties. Specifically, as the size of exposed populations becomes larger, and the time period over which the doses are summed becomes longer, uncertainties in terms of the dose estimate also become very large. Individual habits become very difficult to predict over long periods and geographic regions. In addition, assuming that modelled populations are similar to the exposed Japanese populations of Hiroshima and Nagasaki, from whom risk coefficients are calculated, becomes increasingly difficult. Because of such uncertain figures, the validity of using these summations in an absolute sense to quantify detriment becomes questionable. In such situations, collective dose would be better applied in a "disaggregated" fashion. In this context, disaggregation would mean presentation in terms of individual dose (e.g. average dose to the critical group, maximum dose to the critical group, individual dose distribution curve within the exposed population, etc.), of the number of people exposed, and of population temporal and geographic distribution. This should not, however, give the impression that the total detriment due to the total collective dose is without significance. Uncertainties, however, need to be much more explicitly expressed.

It should also be noted that public collective dose for the characterisation of the radiological impact of particular activities, for option selection purposes, can be a very useful tool when applied to specific populations over a limited time period.

In an issue related to both the use of collective dose and the application of the optimisation process, views on both sides of the argument have been expressed as to whether the summation of collective doses, even for comparative purposes, should be truncated at some predetermined lower level, and/or after a limited number of years. The suggestion that doses should not be summed if they are "trivial" follows from current debates regarding optimisation and triviality.

If, as discussed above, collective doses are presented in a disaggregated fashion, and if the concept of triviality is seen as not particularly useful, it would seem that summations of collective dose might not need to be truncated. Rather, collective disaggregated doses would be just one of the factors considered in making comparisons during optimisation. Another important factor would be the dose to critical groups. Collective dose should be viewed as part of a "toolkit" for the selection of optimum radiation protection options. **Clear, objective operational guidance for the valid application of collective dose is important.**

Dose Limits

The ICRP has developed its recommendations based on the scientific study of the effects of radiation on human populations, with supplemental information from the animal and other biological studies. Various works, including, but not limited to, the study of survivors of the atomic bombs dropped at Hiroshima and Nagasaki, have contributed significantly to the scientific understanding of doses and risks. This body of scientific knowledge, periodically summarised by the UNSCEAR, is used to quantify as best possible the risks and uncertainties associated with exposure to ionising radiation.

Based on this knowledge, the ICRP has made a series of recommendations regarding, among other things, public and worker dose limits. These recommendations have been made assuming that quantifiable risks seen in populations exposed to very high dose rates, and in some cases high doses, can be extrapolated to low doses and dose rates by assuming that they are linear with exposure, and have no threshold. This assumption forms part of the basis for the selection of the radiation exposure limits that are recommended by the ICRP. Dose limits, for both the public and workers, are recommended by the ICRP on the following basis:

> ***ICRP Publication 60, paragraph 123***: *It is the Commission's intention to choose the values of dose limits so that any continued exposure just above the dose limits would result in additional risks from the defined practice that could reasonably be described as "unacceptable" in normal circumstances. Thus the definition and choice of dose limits* involve social judgements.
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> ***ICRP Publication 60, paragraph 150***: …*The Commission has found it useful to use three words to indicate the degree of tolerability of an exposure (or risk). They are necessarily subjective in character and must be interpreted in relation to the type and source of exposure under consideration. The first word is "unacceptable", which is used to indicate that the exposure would, in the Commission's view, not be acceptable on any reasonable basis in the normal operation of any practice of which the use was a matter of choice. Such exposures might have to be accepted in abnormal situations, such as those during accidents. Exposures that are not unacceptable are then subdivided into those that are "tolerable", meaning that they are not*

welcome but can reasonable be tolerated, and "acceptable", meaning that they can be accepted without further improvement, i.e. when the protection has been optimised. In this framework, a dose limit represents a selected boundary in the region between "unacceptable" and "tolerable" for the situation to which the dose limit is to apply, i.e. for the control of practices.

The ICRP recognises, in fact, that the selection of the boundary between unacceptable and tolerable is a societal judgement, however, the rationale that is used to assign a numerical value to limits is presented in mainly scientific terms. For occupational dose limits, arguments discuss the probability of attributable-death (%) and the mean loss of life expectancy at age 18 years (paragraphs 151 to 175, and Annex C). For public dose limits, similar arguments, with a brief discussion of natural background levels are presented (paragraphs 188 to 194). In both cases, the presentation of the selected dose limits appears to be based on the science of risk assessment more than on the societal aspects of the judgement being made.

While it is not the intention of the CRPPH to suggest that the public and occupational dose limits chosen are inappropriate, their presentation in Publication 60 may lead to the conclusion that they are solely based on scientific considerations. Although the scientific considerations presented by the ICRP are essential inputs, they alone can not provide sufficient rationale for the selection of numerical dose limits. Hence, the ICRP recommendation process does not respond to the societal desire to better understand the rationale and underlying uncertainties behind current radiation protection regulatory requirements. Further consideration of this issue, in the light of current societal approaches to risk communication, is warranted. Whether organisations such as the ICRP should consider social and economic aspects when setting numerical dose limits is a question that should also be discussed.

It should also be noted that there is no discussion in ICRP Publication 60 of why worker dose limits differ from public dose limits. Although it is not the intention of the CRPPH to suggest that these two limits should be numerically equal, and recognising that worker and public populations could differ markedly in age and sensitivity to radiation exposure, it would be useful to more clearly explain such rationale for the difference in ICRP publications.

The Commission itself recommends that economic and social aspects must be taken into account. **In today's societal context, the transparency of recommendations is as important as the numerical values of dose limits,**

and is essential to foster stakeholder confidence in the entire system of radiation protection.

Triviality

Triviality, and similar concepts such as “de minimis”, and “Below Regulatory Concern”, have been discussed within the system of radiation protection for some time. In general, presentation of these concepts in a regulatory context has met with at best limited success, but more often with significant opposition.

In a societal framework, the concept of triviality is inherently judgmental. This has lead to the failure of the use of this concept in several circumstances where, for example, experts and regulators judge radiation exposures to be “trivial”, while members of exposed populations, and often other stakeholders, feel that doses are from quite significant to unacceptable. The use of other terms, such as “radiologically insignificant”, or “below the need for regulatory action” could perhaps better express the risk in a less judgmental fashion, however **the utility and necessity of the concept of “triviality” in the context of radiation protection regulation should continue to be discussed. Regulators are, in fact “concerned” with all exposures, however may judge that some low levels of exposure do not require regulatory actions.**

One of the most significant issues to be addressed in this regard is the use of triviality as the basis on which materials may be authorised for release. What is termed, in the International Basis Safety Standard (IAEA96) as trivial dose has been used as the basis for clearance, that is, the authorised release of materials for unrestricted use. However, some discussions at the political level in some countries have hinted that “zero release” might be a desirable social goal. In a coherent scheme, the philosophical approach to the release of materials should be based on a transparent logic that is consistent at all levels. **Thus, how optimisation, dose constraints, “zero release” and triviality should be applied within the process of authorisation for release should be re-examined in the future.**

Public Protection

Somewhat related to the issue of transparency in the setting of dose limits, there is a need to better define the role and use of the Linear Non-threshold (LNT) hypothesis within the system of radiation protection. One of the current debates in radiation protection concerns the validity of using the LNT in defining the detriment associated with very small doses. This discussion, while valid, has contributed significantly to a decline in trust of radiation protection by various stakeholders, as well as a general decline in understanding of radiation protection issues. Debate concerning the use of the LNT has often focused on its scientific validity. The CRPPH feels that such discussions of LNT are of little use, because LNT will never be "proven or disproved" through epidemiological studies (NEA98). Scientific research into radiobiological mechanisms of carcinogenesis appears promising and should continue with the aim of establishing more precise forms of the dose/effect relationship or relationships.

Public discussion should focus on how societal concerns and the precautionary principle could be reflected in the regulation of industries that cause public and worker exposure to ionising radiation and other carcinogens. In this same context, it would be useful to discuss the level of conservatism to build into regulations to apply "appropriately" the precautionary principle.

The CRPPH feels that one way to move towards better understanding of the system of radiation protection is to better highlight the distinctions between the various stages of protection of the public welfare. One stage of protecting the public from the harmful effects of ionising radiation is to understand the scientific aspects and uncertainties of radiation risk assessment. The hazardous effects of ionising radiation are among the most studied and most well characterised of any hazard known to man. This knowledge base continues to grow, and represents a significant attribute for the system of radiation protection.

Another stage in public protection is the development of regulations. However, because significant uncertainties remain in the scientific understanding of radiation hazards at low doses, when translating from scientific knowledge to regulation a precautionary, conservative approach is taken by regulators to protect the public and workers from the harmful effects of ionising radiation. The use of the LNT is part of this precautionary, regulatory interpretation of the body of scientific knowledge of the harmful effects of ionising radiation. However, because of scientific uncertainties, regulators are obliged to act with prudence, perhaps overprotecting the public and workers. Thus the LNT is not as much a scientific instrument which is "correct" or "incorrect", as a regulatory tool for the interpretation of quantitative and qualitative data in a conservative fashion.

Another stage of public protection is political decision making, incorporating social and economic factors. In some cases, environmental cleanup or allowable discharge levels for example, political decisions may lead to solutions which protect the public well beyond what regulatory organisations would recommend as necessary, and can result in high expenditures that may be disproportionate to the radiological benefits gained.

Currently, the distinctions between these three aspects of public protection are often blurred. As with the setting of numerical values for public and worker dose limits, discussions of the use of LNT and of the system of radiation protection in general would profit from a better distinction of those aspects which are scientific and should be discussed as pure science, and those aspects which involve social judgement and should be resolved via social dialogue. **The role of the radiation protection expert (as scientist, as regulator or as decision maker) needs to be redefined, and effective methods of involving stakeholders need to be developed.**

Protection of the Environment

An area where the ICRP has provided relatively little guidance is that of environmental protection. Publication 60 addresses this issue very early, but only briefly:

> ***ICRP Publication 60, paragraph 16***: *The Commission believes that the standard of environmental control needed to protect man to the degree currently thought desirable will ensure that other species are not put at risk. Occasionally, individual members of non-human species might be harmed, but not to the extent of endangering whole species or creating imbalance between species. At the present time, 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.*

For some time, pressure has been building on the Commission to reconsider this statement. The Rio Convention of 1992 noted that, with respect to sustainable development, it is necessary to protect the environment in order to safeguard the future well being of people. This is not to presuppose that additional ICRP recommendations will be necessary for protection of the environment, but **the rationale for making or for not making recommendations should be more thoroughly and openly discussed by the ICRP and other stakeholders.** Modifications, as appropriate, of the Commission's recommendations should flow from these discussions.

3. CONCLUSIONS

This is the first time that very broad discussions of major radiation protection concepts have been encouraged. This process is very welcome, particularly in that it has been initiated by the Chairman of the ICRP. The CRPPH feels that discussions of this type provide a good opportunity to engage the international radiation protection community in a critical review of the merits and drawbacks of the current system of radiation protection. It is essential to include a broad spectrum of stakeholders in these discussions, and to ensure that this open, transparent process continues.

The CRPPH should engage in, and should promote and facilitate an iterative and interactive process, based on an evolutionary approach to revising the current system, and drawing on new approaches. This should lead to a consensus on a more operational and coherent system of radiation protection elaborated in a transparent fashion, and presented in readily understandable terms.

While it is certain that the discussion of these issues will continue for some time before consensus is reached within the international community, the CRPPH considers that these thoughts will facilitate progress towards this goal. The Committee endorses the findings presented in this report and will use them as a basis for its future programmes of work.

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Annex 1

MEMBERS OF THE WORKING PARTY ON CONTROLLABLE DOSE AND THE USE OF COLLECTIVE DOSE

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Annex 2

TERMS OF REFERENCE FOR THE WORKING PARTY ON CONTROLLABLE DOSE AND THE USE OF COLLECTIVE DOSE

1. Discuss the ideas and concepts presented in the paper by Professor Roger Clarke, “Control of Low-Level Radiation Exposure: Time for a Change?” This should include such issues as the use of terminology, as well as the use of collective dose in the justification and optimisation of radiation protection. The recommended use of collective dose is reflected in various ICRP documents (for example, ICRP Publications 55, 60, 77, and upcoming publications on long-lived solid waste management, and on protection of the public against prolonged exposures), in the IAEA Basic Safety Standards, and in the European Union’s Basic Safety Standards.

2. Based on discussions, develop a draft issues paper on these ideas and concepts.

3. Submit the draft issues paper to CRPPH Members for comment, with the objective of documenting the Committee’s views and preparing a final paper following the 58th meeting of the CRPPH (11-13 April, 2000). It should be noted that the final issue paper will include both Committee consensus and divergent views.

4. The resulting CRPPH issues paper should be submitted to the international community as a contribution to the debate on the controllable dose approach, and on the use of collective dose. Opportunities for presentation of this work, such as the IRPA-10 meeting in mid-May, 2000, will be explored.