IMPLICATIONS OF NEW RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION (ICRP)

Brief description and history of the ICRP

1. The International Commission on Radiological Protection (ICRP) was created in 1928, as the International X-Ray and Radium Protection Committee, and restructured in 1950 in order to address protection from emerging health effects of radiation, mostly in researchers and patients from x-rays and radium treatments. The ICRP, which is registered as an independent charity and is financed mainly by voluntary contributions from international and national bodies, is composed of a Main Commission and five standing committees, who are all elected (Main Commission) or are appointed (committees) by the Commission itself under rules set out by the International Society of Radiology.

2. The ICRP works closely with the International Commission on Radiation Units and Measurements (ICRU), maintains important relations with various UN organisations (UNSCEAR, WHO, IAEA, ILO, UNEP) and works with the EC, OECD/NEA, ISO, and the International Electrotechnical Commission (IEC). It also has strong links with the International Radiation Protection Association (IRPA).

3. The ICRP has, since its inception, issued recommendations regarding protection against the hazards of ionising radiation. Since its 1950 restructuring, the ICRP has issued approximately 100 recommendation documents. The most fundamental of these, called the Commission's general recommendations, are issued approximately every 10 to 15 years to take into account new scientific evidence and managerial experience. The first of these general recommendations was ICRP Publication 1 (1959), which was followed by Publication 6 (1964), Publication 9 (1966), Publication 26 (1977) and Publication 60 (1990).

4. Historically, national and international organisations responsible for radiological protection and practitioners using radiation or involved in activities that produce radiation and/or radioactive materials have taken the recommendations and principles issued by the ICRP as a key basis for their protective actions. As such, virtually all national regulations and international standards addressing radiological protection are based on the recommendations of the ICRP. Currently, most national regulations are based on the recommendations of ICRP Publication 60. International standards, such as the International Basic Safety Standards, various ILO labour conventions, and European directives on radiological protection are also based on ICRP Publication 60.

5. The Commission's new general recommendations, whose implications will be discussed by the Steering Committee during its policy debate in October 2007, were approved in March 2007 and are expected to be published soon.

NEA and the development of the new ICRP general recommendations

6. In view of the importance afforded to ICRP recommendations by governments, NEA member countries encouraged the Agency's standing technical committees and Secretariat to accompany the ICRP through a continuous dialogue process in its development of these new recommendations. Clearly, the NEA's role has been to ensure that the Commission's new recommendations adequately and appropriately address national issues and concerns, including those of policy makers, regulators and implementers.

7. In a process that has been much more open than that for the development of the previous ICRP recommendations, the Commission has solicited input from a very broad spectrum of radiological protection stakeholders, ranging from government institutions and international organisations to NGOs. In this process, the NEA has very actively participated, primarily through the Committee on Radiation Protection and Public Health (CRPPH), the expertise of its members and the Secretariat, and by providing fora and opportunities for interaction with interested authorities of member countries as well as dialogue with other stakeholders. Since 1998 the CRPPH has organised seven international workshops, performed four detailed assessments of ICRP draft texts (in 2003, 2004, 2006 and 2007), and has issued 16 reports relevant to this subject. These actions have been complemented by direct interactions with and background briefings from the ICRP chairs and key members of the ICRP Main Commission, and through the NEA Secretariat's expert participation in ICRP subcommittees and task groups.

8. It should be noted that the NEA Steering Committee held a policy debate in May 2003 on the Evolution of the System of Radiological Protection, including a presentation by Prof. Roger Clarke, who was at that time the ICRP Chair. This policy debate concluded *inter alia* by thanking the ICRP for its increased openness, and encouraging continued efforts to work with OECD governments to identify and address their concerns. This level of effort clearly attests to the NEA's interest in assuring the quality and usability of the new ICRP recommendations.

9. This variety of NEA activities associated with the ICRP process was made possible thanks to voluntary contributions provided by the Japanese Government.

The current RP regulatory scheme

10. Following the 1986 reassessment of exposures to victims of the Hiroshima and Nagasaki atomic bombs, the ICRP developed new recommendations in the form of Publication 60, implementing significant changes in dose limits and radiation protection policy.

11. Most importantly, worker dose limits were lowered from 50 mSv per year to 100 mSv over 5 years with a maximum of 50 mSv in any single year. Public dose limits had earlier been reduced from 5 mSv per year to 1 mSv per year, and this was reemphasized in the new recommendations.

12. The other significant change implemented in Publication 60 involved the management of radiological protection. Activities resulting in radiological exposures were divided into what the Commission called "practices", which increased exposures, and "interventions", which reduced exposures. Construction and operation of a nuclear power plant or a nuclear medicine clinic would be examples of practices, and post-accident situations or exposure to high natural levels of radon would be examples of interventions. Two key principles were applied for both practices and interventions: protective actions were to be justified (do more good than harm) as well as optimised. Dose limits were applied only to practices and not to interventions because limits could have resulted in the need for protective actions that were excessively costly (i.e. not optimised).

13. Through various mechanisms, including national policies and regulations as well as international standards, the recommendations in Publication 60 have been broadly implemented in most countries, although in many countries they were only formally included in national regulations starting in 2001 (and in some cases later).

Evolution of the RP system in the new ICRP general recommendations

14. The Commission had explained its decision to update its recommendations as being based on some evolution of scientific knowledge, but more broadly on the need to clarify and consolidate its older recommendations. It noted that, since Publication 60, it had issued approximately 40 other recommendation documents containing over 30 numerical criteria of varying bases and application. Further, the Commission stated that the system based on practices and interventions had caused confusion, and thus merited replacement.

15. As a result of discussions within the ICRP and with numerous other stakeholders, including the NEA (see below), in March 2007 the Commission approved its new recommendations, which are expected to be published in the fall of 2007. The key aspects of the new recommendations that differ significantly from the 1990 Publication 60 recommendations are the following:

- **A situation-based approach**: Instead of organising the protection system based on the type of activity affecting the exposure (i.e. practices or interventions), the Commission now addresses radiological protection aspects based on the characteristics of the exposure situation, now defined as "planned, emergency or existing" and recommends that radiological protection be applied in the same way for each of these situations; that is to say, in all exposure situations protection actions must be justified, protection must be optimised, and exposures should be subject to appropriate limitation (dose limits, dose constraints, reference levels).

- **Dose constraints:** This concept intends to limit any inherent inequity that may be introduced when broadly optimising protection below the dose limit. Source-related dose constraints ensure that planning for protection will not allow the unequal distribution of doses among all those exposed. This concept has been very successfully used in practices (for example, in planning protection of workers at nuclear power plants), and the Commission has now extended this to cover not just planned situations, but to cover all exposure situations.

  The dose constraint is not a regulatory guideline in the same sense as a dose limit. Rather, it is a planning tool for selecting protection options. Exceeding a dose constraint does not mean that a regulatory boundary has been passed, rather, that protective actions should be reviewed and modified if this would result in optimised protection under the circumstances at hand. In extending the application of dose constraints to emergency and existing exposure situations (called reference levels in these situations), as well as to planned exposure situations, the Commission now recommends a system of protection that is uniform in all situations.

- **More focus on optimisation**: The Commission states that its system applies equally to all exposure situations, and that protection should always be optimised. By extending the concept of dose constraints to all exposure situations, the Commission is further emphasizing that under all circumstances protection will be optimised. This does not mean that all exposures will be driven towards zero. Rather, it demonstrates the need to ensure that the benefits and detriments of any protective actions must be appropriately assessed in order to identify the "optimum" protection solution.

  It should also be noted that the Commission mentions, for the first time, the need to account for the views and concerns of stakeholders when optimising protection.

- **Updating risk estimation:** Based on the latest available scientific information of the biology and physics of radiation exposure, in particular from the Radiation Effects Research Foundation (RERF), the Commission's radiation and tissue weighting factors in the quantities equivalent and effective dose have been updated, as has the radiation detriment (relative risk per sievert of exposure).

- **Radiological protection of the environment**: Although the new Commission recommendations do not include specific recommendations for the protection of the environment, they do include an approach for developing a framework to demonstrate radiological protection of the environment. Committee 5 of the ICRP, addressing Protection of the Environment, was recently created to develop specific recommendations in this area.

Questions concerning the implementation of new ICRP recommendations

16. The international community is now seeking to acquire a deeper understanding of the new ICRP recommendations so that they can be appropriately implemented. This will certainly involve an assessment of the possible impacts on existing RP frameworks and practices as well as on subsequent regulatory implementation.

17. Although the Commission stresses its concern to "maintain stability in its recommendations", the new system does present some potentially significant changes that will need to be closely considered by regulatory authorities. These elements are described below.

Policy aspects

- The Commission is now focusing on the radiological protection of the environment. The new recommendations do not contain any specific recommendations in this area, however, the Commission states its "intention" to make recommendations in the future. NEA member countries will need to consider whether the Commission's current text on this subject, and its intention to go further into this area, will affect current policies and regulations regarding the radiological protection of the environment.

- Although the "translation" of ICRP recommendations into regulatory text will most certainly allow some flexibility, the implementation of the new ICRP recommendations will most likely entail the need for at least some modification of existing national regulations and international standards. NEA member countries have in the past implicitly insisted on the need to have only one broad approach to radiological protection, based on the recommendations of the ICRP. However, with the new ICRP recommendations, governments will need to decide whether the changes recommended by the ICRP will result in sufficient safety improvement to warrant the change of national regulations and international standards.

- The first practical application in which this discussion will be of significance is in the development of the new International Basic Safety Standards (BSS). Currently being revised by a Secretariat of co-sponsoring organisations, led by the IAEA and including the NEA, the shift from the ICRP Publication 60 system to the new ICRP recommendations may entail changes that could affect many of the IAEA's safety standards documents. The NEA standing technical committees have pushed to have the new BSS as a complete, stand-alone document reflecting the new ICRP recommendations.

  It should further be noted that the European Commission is also revising its BSS Directive, and will thus also need to consider how to implement the new ICRP recommendations.

- Will there be discussion of a "graded approach" to applying the Commission's recommendations, such that some flexibility will be taken with regard to how the new ICRP recommendations are applied in NEA member countries versus how they may be applied in non-NEA member countries, in particular in developing (non-nuclear) countries?

Practical aspects

- Switching from practice/intervention to a situation-based system raises several questions that will need to be answered or interpreted for implementation. These questions are similar for the three newly defined exposure situations (planned, emergency and existing), yet will still require individual attention.

  Planned exposure situations
  - What will be the regulatory interpretation and use of dose constraints, and what will be the regulatory relationship between dose limits and dose constraints?
  - What effects will the new recommendations have on regulatory organisations and on the nuclear industry? On the non-nuclear industry?
  - What effects will the Commission's new focus on optimisation and stakeholder involvement have on current implementation of the ALARA (as low as reasonably achievable) principle?

  Emergency exposure situations
  - How will the newly recommended reference levels (20-100 mSv per year band) be used in emergency exposure situations?
  - How will the focus on optimisation of protection strategies, rather than single countermeasures, effect emergency response planning and implementation?
  - What effects will the Commission's new focus on optimisation and stakeholder involvement have on optimisation?

  Existing exposure situations
  - How will the newly recommended reference levels (1-20 mSv per year band) be used in existing exposure situations?
  - What effects will the Commission's new focus on optimisation and stakeholder involvement have on the ALARA principle, for example, in the release of contaminated sites after clean-up?
  - What effect will the new reference-level concept have on regulatory approaches to protect against domestic and occupational exposures to radon?

Emerging challenges from RP science

- The new tissue weighting factors and radiation weighting factors will need to be implemented into dose assessment models. In addition to these new scientific results, which have been implemented in the new ICRP recommendations, several other aspects of radiological risk remain, and continue to be studied, but have not as yet been the object of consensus. Many of these issues have been outlined in the NEA's forthcoming report on *Scientific Issues and Emerging Challenges for Radiation Protection.* Regulatory authorities may wish to begin considering the potential impacts that these scientific developments could have. These include:

  - new quantification of risk to the lens of the eye;
  - new risks that ionising radiation may pose in terms of non-cancer effects, such as circulatory diseases;
  - social and regulatory implications that could be posed by deeper scientific understanding of genetic susceptibility to radiation-induced diseases; and
  - social and regulatory implication that could be posed by deeper scientific understanding of the differences in risks between males and females.