The development of radiation safety standards is the concern of various national and international organizations, among which the International Commission on Radiological Protection (ICRP) occupies a leading position. Periodically issued recommendations of the ICRP, based on thorough analysis of existing information on the biological effects of radiation, serve as a basis for the creation and alteration of national and international standards and rules for protection against ionizing radiation.

The work of the ICRP, which was established at the II International Radiological Congress in 1928, began to acquire particular importance after 1950 when its organizational structure was changed, and the members of the ICRP were regularly selected from the outstanding scientists of the world. Soviet scientists have participated actively in the work of the ICRP since that time.

The most important recommendations of the ICRP are those adopted in 1955 — Publication 1 [1], Publication 6 (1962), which contained the recommendations of 1958 with corrections introduced up to 1962 [2], and Publication 9 (1966) with the new, and significantly revised, recommendations of 1965 [3]. In that same year (1965), the managing directorate of IAEA approved a revision of "Basic Safety Standards for Radiation Protection" (1963) [4]. Based on an analysis of the new ICRP recommendations and of comments by IAEA member-governments on the 1963 standards, IAEA issued a revised version of "Basic Safety Standards for Radiation Protection" [5].

Considering the existence of new fundamental positions in the ICRP recommendations and in "Basic Safety Standards", it is useful to consider also the changes in viewpoint which led to the issuance of the documents mentioned.

**Purpose of Radiological Protection**

Since 1958, the basic problems dealt with in the ICRP recommendations have always been the development of radiological protection principles for the purpose of preventing acute radiation damage and reducing the risk of effects following the irradiation of individuals, and the limitation to a minimum of possible genetic consequences from irradiation of the entire population.

Acute damage ordinarily appears in the course of a few weeks after irradiation; remote sequelae may have latent periods of decades. Radiation damage is called somatic if it appears in the individuals who have been exposed to radiation; it is called genetic if it harms their descendants.

Brief irradiation of all, or a large part, of the body for several minutes or hours by doses of the order of hundreds of rads gives rise to the acute radiation syndrome, the extreme manifestation of which can be the death of an individual because of damage to the blood-forming tissues. At higher doses, death may be the result of damage to the gastrointestinal tract; doses of tens of thousands of rads cause rapid death because of damage to the nervous system.

Despite the fact that some time intervenes between irradiation and acute damage, there is no doubt of the connection between these events.

Long-term somatic damage includes leukemia and other malignancies, cataracts, skin damage, loss of fertility, and, possibly, premature aging (aging leading to early death not associated with any definite cause). Because of the lack of specificity in long-term damage, it is difficult, and sometimes even impossible, to associate it with previous irradiation.

Although the effects mentioned result from comparatively large doses of radiation, this does not exclude the possibility that small doses of radiation may also lead to shortening of lifetime independently of the production of leukemias and other malignancies.

Taking into account the inadequacy of the knowledge in this field, the UN Scientific Committee on the Effects of Atomic Radiation took a cautious view of this question. It can be formulated in the following manner: shortening of the lifetime of an individual will not be unexpected for a whole-body short-term dose exceeding 200 rad; however, it is impossible to predict the effect of chronic irradiation by small doses on the lifetime of an individual [6].

Genetic damage, which appears in the descendants of irradiated people, may be of various kinds — from insignificant (for example, a lock of gray hair or the absence of upper lateral incisors) to lethal. Some mutations may persist for many generations; others quickly disappear.

In its recommendations, the ICRP proceeded on the basis of a possible risk of somatic and genetic damage through the action of any dose of ionizing radiation. The maximum dose recommended by the Commission refers only to irradiation which is the result of the occupational activity of an individual and is to be added to the irradiation resulting from the natural radiation background. This dose also does not include the irradiation to which an individual is exposed in treatment and examination. However, it is pointed out in the ICRP recommendations that, as far as possible, such irradiation should be held to a minimum.

### The Concept of "Acceptable Risk"

The ICRP assumes a linear dependence between radiation dose and effect (the hypothesis of nonthreshold effect of ionizing radiation), which leads one to conclude there is no noninjurious radiation dose, including that from the natural radiation background. Noting a certain conservatism in this concept, the ICRP nevertheless considers it the best basis for evaluating radiation protection at the present level of knowledge. Thus the ICRP considers it necessary to limit the radiation dose from controlled sources to levels for which the probable radiation risk can be considered insignificant (both for the individual and for society as a whole) in comparison with the advantages which the use of radiation offers to society. The radiation risk to the population from controlled sources must be less than, or equal to, the risk associated with other causes, and must be justified by the advantages which the use of controlled sources of ionizing radiation offers.

Since 1965, the ICRP has recommended the use of the term "maximum permissible dose" (MPD) only for evaluating radiation from controlled sources. At the same time, it introduced the terms "maximum dose" for planned irradiation of individuals in the population (residents) and "level requiring protective action" for unplanned irradiation from uncontrolled sources. Such a distinction is completely practical because the use of only the concept of MPD for all cases of planned irradiation is associated with definite difficulties both in the selection of the radiation levels and in the accomplishment of control over them.

### Dose Equivalent

It is well known that a radiobiological effect depends not only on energy absorption, but also on its distribution in organs and tissues, the type of radiation, and other parameters. To take these factors into account, the concept of dose equivalent, $D_{eq}$, was introduced. The dose equivalent is the product of the absorbed dose, measured in rad units, by the radiation quality factor (QF), the dose distribution factor.