

# Radiation protection: A consensus emerges

by Abel González

Today a common approach to radiation protection is taken worldwide that emphasizes development of modern radiation protection concepts, particularly optimization of radiation protection. In recent years, significant attention also has been paid to exposures from natural radiation, especially those from radon and its daughter products in dwellings, as well as to the health effects of non-ionizing radiation.

Recently the IAEA participated in an assembly of international radiation protection specialists who provided a concise overview of these and other current thoughts and practices in the field. Besides IAEA representatives, the gathering – the 6th International Congress of the International Radiation Protection Association (IRPA) – attracted nine other international organizations and more than 1000 participants from 38 countries.\*

## Consensus regarding waste disposal

One outcome of the Congress was the emerging consensus on radiation protection principles to be applied to the disposal of radioactive wastes. There were several common views on the possible application of the dose limitation system recommended by the International Commission on Radiological Protection (ICRP) and adopted by IAEA. Wide agreement arose on the use of the system's individual-related requirement, not only to normal release situations from repositories but also to potential disruptive events.

For application of the individual-related requirement to the normal release situation, it seems the only remaining problem is proper selection of the dose-upperbound for each repository. Two, but not necessarily opposing, views emerged: The first one favours pragmatic selection of a fraction of the dose limits as the relevant dose-upperbound: the second one claims that the upper-bound level should necessarily be linked to the fraction of the total available uranium, which gives rise to the fission products to be disposed in the repository.

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\* The Congress was held in Berlin at the International Congress Centre 7–12 May 1984.

For application of source-related requirements to the normal release situation, the following views emerged: The principle of justification should be applied *a priori* of the generation of wastes. As such, it is not a specific requirement for waste disposal.

There was a clear consensus on the manner of applying the individual-related requirement to potential disruptive events. Although the existence of complex technical problems was recognized in applying the source-related (optimization) requirement, if disruptive events were to be taken into account no agreed solution to the problem arose from the Congress.

It was recognized and agreed that there are some intrinsic uncertainties involved in the assessment of expectation of harm for low-probability disruptive events and that, therefore, other inputs would be needed. Thus, there were proposals for using multi-criteria, decision-aiding techniques, rather than cost-benefit analysis (on the basis of harm expectation versus protection efforts) alone. However, no consensus was reached on this critical matter.

## Other Highlights

In all, the Congress featured 360 reports, four plenary sessions, and 18 specialized sessions. Highlights of several important scientific and technical presentations follow.

### Worker radiation protection

Optimization of radiation protection was the focal point in these presentations.

From the sessions, it appeared that good radiation protection programmes have three common ingredients: (1) existence of a management attitude seeing beyond regulatory requirements, (2) qualified staff, and (3) implementation of the optimization requirement. It was found that in particular the uranium milling industry needs further special attention.

External and internal radiation monitoring, area monitoring, decontamination, and decommissioning also were main subjects of discussion. None of the results of current routine monitoring programmes yields effective dose equivalents or mean organ doses. Rather, results demonstrate the effectiveness of radiation protection measures and compliance with the system



IAEA was one of 10 international organizations and more than 1000 participants who gathered at Berlin's International Congress Centre for the radiation protection Congress. (Photos by: F.N. Flakus)

of dose limitation. This situation makes the use of monitoring results as input data for epidemiological studies quite questionable.

A special effort will have to be devoted to arrive at a widely accepted approach to external radiation monitoring and recording of monitoring results. Similar difficulties (e.g., in the interpretation of measurements of internal contamination) are experienced in assessment of internal exposure, where the situation is even more complex than in external exposure assessment.

Also presented was a summary report of a study directed at balancing nuclear safety and worker protection. This study, being done by the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development, is very complex and inherently difficult, and understanding is not mature enough yet for a solution to this issue. However, the debate among nuclear safety and radiation protection experts, in which the IAEA is participating, is now actively engaged.

### Radiation protection of the public

Based on Congress reports, current surveys in a number of countries (Australia, Federal Republic of Germany, Greece, Italy, Sweden, Switzerland, and the USA) are revealing information showing that exposure to radon daughters in dwellings can be very significant and, in some cases, exceed the occupational limit.

Another topic gaining substantial attention was the health effects of non-ionizing radiation, such as ultra-violet, radiofrequency waves, microwaves, extremely low-frequency electric and magnetic fields, ultra sound,

and laser radiation. Quite revealing at the Congress was that non-ionizing radiation, which was believed to be harmless, can produce significant health hazards. However, divergent opinions exist on the nature and degree of hazards from exposure to radiofrequency radiation, a divergence reflected in widely differing national exposure standards.

### Medical aspects: studies reviewed

Several ongoing studies were reviewed.

The thorostrast study, conducted in the Federal Republic of Germany and examining 5000 patients over the last 16 years, has confirmed that liver, bone, and lung are the primary targets of exposure, with frequency of malignancies being particularly high for liver.

The Los Alamos study on plutonium workers for the period 1968-75, which has been completed, included workers of the Manhattan Project, Los Alamos Laboratories, and Rocky Flats plants. In all instances, no deleterious effects have been discovered to be associated with plutonium exposure. These investigations, however, have suffered from the small population of exposed workers available for studies and from limited periods of follow-up.

The Hiroshima and Nagasaki study is almost completed and some preliminary conclusions have been drawn. The most general one is that, in both cases, the contribution of neutrons to the dose has been largely overestimated. The second conclusion is that chromosomal aberrations still can be demonstrated after