BUILDING COMPETENCE

SUSTAINABLE EDUCATION & TRAINING IN RADIATION PROTECTION

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Applications of ionizing radiation in medicine, industry, agriculture and research continue to increase worldwide. As the uses grow, the need for qualified and well-trained staff in all these fields takes on added importance. On the front line are staff responsible for nuclear, radiation, transport or radioactive waste safety. They should all have an adequate level of understanding of concepts related to radiation protection and be acquainted with the safe and secure use of radiation sources. Other types of personnel -- even though they may not work directly with sources of ionizing radiation -- also may require training to perform their duties competently.

The primary responsibility for the safety of radiation sources rests with the employers/registrants or licencees authorized to conduct practices that cause radiation exposure, or to intervene to reduce existing exposure. One of the responsibilities, *inter alia*, includes the provision of suitable and adequate human resources and appropriate training in protection and safety, as well as periodic retraining and updating as required in order to ensure the necessary level of competence.

An essential part of a national infrastructure for radiation safety is an adequate number of skilled/trained personnel within the facilities using radiation sources and the regulatory body. In some circumstances, the regulatory authority would authorize qualified persons to assume responsibilities or carry out certain functions only if they are trained in radiation protection. The level of required training would depend on the application or use of radiation sources and its associated hazard. It is therefore expected that building competence in radiation protection and safety as well as the exchange of information in this area will require more attention and effort from the IAEA. One way for the Agency to do that is to assist its Member States in establishing and strengthening national and regional training centres in education and training in radiation protection and the safe use of radiation sources.

CONTEXT OF IAEA ACTIVITIES

Education and training is a major component of the IAEA's programme for the application of safety standards and for strengthening radiation safety infrastructures in its Member States. The activities follow resolutions of the IAEA General Conference and reflect the latest recommendations in several areas of radiation protection and safety of radiation sources.

In 1999, the General Conference adopted a resolution (GC(43)/RES/13 (1999), which recalled the 1992 Resolution and the report GC(XXXVII)/1067 submitted pursuant to that Resolution in 1993) which requested the IAEA Secretariat to strengthen, within existing resources, the role of regional training centers and to facilitate cooperation between these centers and national and regional authorities and professional bodies, with a view to encouraging the harmonization of training for protection against ionizing radiation, for the safety of

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radiation sources and for the application of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS).

In response to this resolution, the IAEA established an action plan (GOV/2000/34-GC(44)/7, with education and training activities described in Attachment 6). In September 2000, the General Conference adopted a resolution (GC(44)/RES/13) that took note of this plan, urged its implementation and the strengthening of efforts in training. In particular, the resolution urged assistance to Member States through regional and national centers to arrange such education and training in the relevant languages of the Agency.

TRAINING MECHANISMS

In line with this resolution, the IAEA has developed a number of different training mechanisms. They include:

■ Post-Graduate Educational Courses (PGECs). These courses in radiation protection and safety of radiation sources constitute a comprehensive and multidisciplinary programme with theoretical and practical training aims. The course is aimed to train young professionals; some of them would be expected to become the trainers in due time.

The IAEA has been assisting the organization of PGECs conducted in different languages in different countries. They include Argentina (Spanish), Syria (Arabic), Germany, India and South Africa (English), and France and Morocco (French). The original version of the standard syllabus published in 1995 in UN languages was revised in 2000. The revision takes into account the requirements and recommendations of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), IAEA Safety Series No.115 (1996) and related Safety Guides and reports, as well as experience gained from the PGECs held in several regions in recent years.

The improvements in the present version include specifications of learning objectives and prerequisites; revision of content and technical terms in light of the BSS; and the inclusion of practical training sessions relative to demonstrations, laboratory exercises, case studies, technical visits and, simulations. Also available is guidance for the preparation of training material for the PGEC in radiation protection and safe use of radiation sources.

Actions being proposed for the future include the translation of the standard syllabus into the IAEA's official languages; completion of the training material with learning objectives for all parts of the course, including workshops and practical exercises.

Upon completion of this work, the training material would be available in a standardized form to the lecturers. In this way, the same message can be delivered to all participants in different regions, and the participants would have access to the correct material prior to the course. The materials would be prepared in such a way that they could also be used for planning and conducting task-specific and practice-specific courses. The procedures for delivery of such courses now are being harmonized to ensure that the courses are effectively organized.

■ Specialized Training Courses & Workshops. These types of training courses are usually shorter in duration. They last one or two weeks and sometimes one month and are in principle for students who already have attended PGECs. Workshops are task- or practice -specific and provide more opportunity to the participants for hands-on training and exchange of information.

Topics covered are wide-ranging, and include the regulatory framework, occupational exposure (external and internal), patient protection (diagnostic radiology, radiotherapy and nuclear medicine), radioactive waste management, transport of radioactive materials, emergency response and preparedness, safety and security of radioactive sources, and safety in industrial applications. They are frequently organized as national, regional or inter-regional courses for different target audiences, such as regulators, radiation protection officers, or technicians.

Each year more than 50 such regional training events are organized in different Member States. Customized training materials are being developed that can be used on a regional basis in training programmes.

■ Fellowships & Scientific Visits. Fellowships and scientific visits are important supplements to courses in education and training. They are meant to provide individual practical training in well-recognized national and/or international centers. The duration of fellowships ranges from one month to one year (in some special cases). Scientific visits are shorter in duration, ranging from one week to a maximum of one month for visiting one or more centers in other organizations abroad. They are usually meant for decision makers/managers, senior officers, and specialists requiring specific information often related to joint projects or other cooperative activities. Each year, the IAEA arranges more than 150 fellowships and scientific visits on radiation and waste safety for candidates from approximately 100 countries.

■ Distance Learning. Distance learning is another complementary element of IAEA programmes to strengthen national infrastructures for radiation protection. It is proving useful for people who live far from training centers or where only small numbers of people need training. It additionally can serve as refresher training or be used to prepare an individual to attend a training course.

Countries participating in this IAEA regional initiative for the Asia and the Pacific are Australia (coordinator), Republic of Korea, Indonesia, Mongolia, Thailand, the Philippines, and New Zealand; participation now extends to 61 students. The course material, which remains under development, is divided into modules on basic knowledge, occupational and environmental radiation protection, radiation protection infrastructure and radiation protection for applications in industry and medicine. At the conclusion of each module, the student completes an assessment task. Some modules also contain practical tasks and research assignments. The training material has been successfully tested in five participating countries. Examinations demonstrated the students' high performance and levels of interest. The draft material is now available on CD-ROM and has been supplied on request to radiation protection trainers in Viet Nam and Argentina for further review.

Overall, the distance learning method appears to be an effective mechanism for delivery of radiation safety training. It would reduce the global resources required and would potentially address a much larger audience.

KEY ROLE OF MEMBER STATES

Although the IAEA's provision of training is playing an important role in Member States, it is no substitute for the vital involvement of national authorities in this field. In the end, it is their involvement that determines the sustainability of radiation education and training at a national level.

A national strategy for building competence in radiation protection and safety consists of interrelated phases. They are the analysis of training needs and the training capabilities in the country; the design of a national training programme in a realistic time frame; the development and implementation of such a programme; and finally the evaluation of the effectiveness of the national strategy and its individual components.

The role of universities and other educational institutions in a country should be well recognized. They can play a key role in developing a core of graduates with fundamental knowledge and specialization, at degree levels.

Through the "train-the-trainers" approach, the IAEA is seeking to build an international cadre of qualified personnel that can become trainers or lecturers at the national level in programmes on radiation safety.

Another good approach focuses on the establishment of regional and national centers for training. Initially regional training centres could provide training to trainees from neighboring countries. The national training center would then continue the training, in the national language if required.

THE WAY FORWARD

To assist Member States in fulfilling their responsibilities to achieve radiation education and training in a sustainable way, the IAEA will provide support in various ways. They include:

■ Preparation of publications that provide guidelines for establishing and improving national training programmes;

■ Standardization of training manuals and visual aids and their promotion worldwide;

■ Implementation of training courses under the train-the-trainers concept to encourage

trainees to organize their own training courses in their countries;

- Improvement of infrastructures at institutions that host IAEA training courses by the provision of publications, equipment and materials for classes;
- Support for the establishment of national/regional training centers. Several centers already have been set up that provide training based on IAEA syllabuses.
- Provision of computer-based training through the Internet. This includes on-line training modules ranging from a basic guide for users of ionizing radiation to the safety of radiation sources in industrial and medical applications. Examples are on the radiation safety pages of the IAEA's Web site at: http://www.iaea.org/ns/rasanet/training/index.htm.
- Development of distance learning materials.
- Arranging on-the-job training at institutions in Member States.

The ultimate effectiveness of these and other IAEA initiatives rest upon the commitment of Member States to develop sustainable training programmes in radiation safety. By working cooperatively together, more progress can be made towards the realization of a harmonized approach for education and training courses; the preparation and use of standardized education and training materials; and the establishment of an information exchange network of participating national and regional training centers. These steps are essential ingredients for raising and maintaining high standards of radiation safety worldwide. ❐

RELATED IAEA PUBLICATIONS

■ *Safety Standards Series RS-G-1.4, Building Competence in Radiation Protection and the Safe Use of Radiation Sources,* IAEA, Vienna, 2001. This Safety Guide provides guidance for the regulatory bodies for the establishment of training and qualification requirements and a strategy for building competence. The Safety Guide is jointly sponsored by the World Health Organization (WHO), Pan-American Health Organization (PAHO), and International Labour Organization (ILO).

■ *Safety Report Series No.20, Training Courses on Radiation Protection and Safe Use of Radiation Sources,* IAEA, Vienna 2001. This report provides assistance to trainers and training providers on how to set up training courses, distance learning and on the job training as well as to establish training centers. It addresses the development and provision of training in protection and safety in a range of activities involving work with ionizing radiation. It supersedes the IAEA Technical Reports Series No. 280, *Training Courses on Radiation Protection* which was publishedin 1988.

■ *Standard Syllabus for the Postgraduate Educational Course in Radiation Protection and the Safe Use of Radiation Sources,* IAEA, Vienna 2001. This publication is intended to facilitate the implementation of such courses by universities and training centers. The course is aimed at professionals in the early stage of their careers. The structure of the syllabus follows the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources. This syllabus supersedes the one published in 1995.

DISTANCE LEARNING: INITIATIVES FOR HEALTH CARE

Training and education related to radiation applications in health care are benefiting from Distance Learning Programmes established by the IAEA. Initiatives over the past two years include extending an existing programme for nuclear medicine technologists in the African and Latin American regions. Other actions include:

■ *Distribution of a Distance Learning Package, "IAEA Curriculum on Radiation and Tissue Banking," completed under a Regional Asia and Pacific Project in cooperation with Singapore.* Containing photos, slides, audio and videotapes, this multimedia package provides the latest knowledge to tissue bank operators. Eight modules are included that cover the historical background to the curriculum; rules and regulations; organization; quality assurance; procurement; processing; distribution and utilization; and future developments in tissue banking. The package emphasizes practical knowledge to complement existing textbooks (such as *Advances in Tissue Banking Vol. 1*, edited by G.O. Phillips et al., World Scientific, 1997). The package has been extensively used in the regional training courses and plans now are to translate the modules into other languages, including Spanish and Chinese.

■ *Distance Learning Programme in Radiation Oncology.* Specialist training in this field is a mixture of practical experience and book learning. In particular, the fields of medical physics, radiobiology, molecular biology and cancer pathology are beyond the scope of usual undergraduate medical training. The objective in developing a Distance Learning Programme in these and other subjects is to supplement training in basic sciences of radiotherapy that is most often available in developing countries or in relatively isolated institutions. The material facilitates the students' study of textbooks to prepare for examinations in this speciality. This will considerably shorten the time required for overseas studies for students requiring long-term training to obtain a degree registerable with their local medical councils.

■ *Medical Radiation in Physics.* To overcome the acute shortage of medical physics professionals throughout countries of East Asia and Pacific, a new regional project is planned within the framework of the Regional Cooperative Agreement (RCA) for Asia and Pacific countries. The package will include Master of Science post-graduate courses, thematic workshops, specialized training courses, seminars, distance-learning resources, fellowships and on-the job-training in high level medical institutions abroad. Students being targeted are holders of university degrees in sciences (primarily physics) already working in medical centers and science graduates who wish to start careers in medical radiation physics.

-- *More information about the programmes is available from the IAEA Division of Human Health Department of Nuclear Sciences and Applications.*

Photo: Sri Lanka is among countries where medical facilities known as tissue banks have been established.