Assuring good irradiation practice

by J.W. Nam*

Applying ionizing radiation in industry is of growing concern to both industrialized and developing countries. Radiation dosimetry provides quality control of all radiation processing: such as sterilization of medical products; preservation of foods; treatment of sewage and waste waters; and radiation treatment of a variety of plastics widely used in modern society. High-dose dosimetry, formerly a rather neglected field, has thus developed into an important means of industrial quality control. The standardization and unification of dosimetry will allow for free international trade and regulatory approval of irradiated products.

This was the first training seminar organized on the subject by the IAEA** since the establishment early in 1977 of a new programme on high-dose standardization and intercomparison for industrial radiation processing. The purpose of the seminar was to provide an opportunity for scientists and technologists to become familiar with the latest advances in the dosimetry of high doses.

Topics of the seminar

Radiation sources: radionuclides and accelerators
Interaction of radiation with matter and absorption of energy
Health physics and environmental control
Dosimetry: fundamentals and concepts
calibration and intercomparison
routine systems
measurements for plant commissioning
Facility design: cobalt-60
accelerator
Plant operation: quality control
legal aspects

The seminar provided detailed and specialized training in the radiation dosimetry techniques that are needed for the efficient operation of a cobalt-60 or electron-beam processing plant. The programme included lectures by invited experts, papers presented by designated participants, experimental work in the laboratory, and discussions on selected topics in the subject in which all participants were encouraged to take an active part.

Practical laboratory experiments were conducted with the most reliable and up-to-date dosimetry systems: Fricke; potassium dichromate; glutamine/lyoluminescence; radiochromic-dye films; ceric-cerous sulphate; ethanol chlorobenzene; and red perspex. For technical reasons, Alanine/ESR was not included. In addition to these experiments, water and graphite calorimeters were demonstrated as reference systems. Improved calibration techniques for high-dose dosimetry were also introduced. The participants had the possibility of familiarizing themselves with the most up-to-date and reliable dosimetry systems and of selecting and using dosimeters suitable for their own purpose and routine work throughout the laboratory experiments.

The problems arising in connection with high-dose dosimetry and plant operation were discussed in detail. The remarkable improvements and developments of the dosimetry technique applied in radiation processing, both for gamma and electron beams, were demonstrated. A new development in dosimetry technique with the fibre-optic light-guide method was reported by the National Bureau of Standards, USA, and the Institute of Nuclear Research, Poland.

This IAEA training seminar on high-dose dosimetry was the first one held and provided a unique forum for persons working in radiation-processing dosimetry to get together and exchange information. The information obtained from the participants, particularly those from developing countries, was considered very important for the development of the future programme.

As the ultimate goal of the programme is an international dose-assurance service which would assist Member States in various high-dose projects, co-operation with the national laboratories is essential to its success. The programme will help meet recommendations by the Joint FAO/WHO Codex Alimentarius Commission which stress the need for keeping adequate dosimetry records at food irradiation facilities. The need for proper dose control as a prerequisite for food irradiation was also emphasized by the 1980 Joint FAO/IAEA/WHO Expert Committee on the wholesomeness of irradiated food.

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** Seminar on high-dose dosimetry in industrial radiation processing, organized by the IAEA and held, at the invitation of the Government of Denmark, in Roskilde (Risø National Laboratory) from 20 September to 1 October 1982.