

Radioisotope Production and Radiation Technology

Objective

To strengthen national capabilities for producing radioisotope products and utilizing radiation technology, and contribute to improved health care and safe and clean industrial development in Member States.

Radioisotopes and Radiopharmaceuticals

The Agency works to ensure the worldwide availability of radioisotope products, such as those used for the management of cancer and other chronic diseases. In 2013, it strengthened efforts to promote alternative methods of producing important medical radionuclides, such as technetium-99m, as well as novel radionuclides such as copper-64 and alpha emitters, using cyclotron based technologies. New strategies for designing diagnostic and therapeutic radiopharmaceuticals to exploit the potential of nanostructures were also evaluated. In this context, a CRP devoted to reviewing methods for producing copper-64 was concluded in 2013. The CRP resulted in detailed procedures for the production of high specific activity copper-64 using a conventional medical cyclotron.

At a Technical Meeting on Alpha Emitting Radionuclides and Radiopharmaceuticals for Therapy, researchers discussed the current status of radiopharmaceuticals labelled with alpha emitting radionuclides. The meeting participants found that, although there were still many unresolved issues, including the chemical stability of the final radiocompound and microdosimetry calculations, current scientific and clinical studies on alpha emitting radiopharmaceuticals had the potential to open the way for new, more effective therapeutic agents against different cancers.

In vivo imaging of infection and inflammation sites remains an issue for diagnostic nuclear medicine. The ability to differentiate between sterile and bacterial inflammation is particularly important for countries in hot climates, where the rate of infectious diseases is high. To address this problem, a consultants meeting was held in Vienna in May to begin development of a CRP aimed at identifying ideal positron emission tomography (PET) and single photon emission computed tomography (SPECT) tracers for infection and inflammation imaging. The meeting included participants from Member States where the climate could add to the existing high burden of infectious disease, ensuring that the CRP's aims are in line with current needs.

Applying good manufacturing practice principles and maintaining appropriate levels of quality are important aspects of the production of radiopharmaceuticals. The Agency, WHO and the European Directorate for the

Quality of Medicines and Health Care collaborated on a revision of *The International Pharmacopeia* (Ph. Int.), with a view to updating the general monograph and preparing monographs for individual radiopharmaceuticals. In 2013, the adopted texts were published by WHO in the fourth edition of the Ph. Int. The revised monograph provides Member States with a tool for ensuring appropriate handling of radiopharmaceuticals in conformity with widely accepted international standards (Fig. 1).

“In 2013, [the Agency] strengthened efforts to promote alternative methods of producing important medical radionuclides...using cyclotron based technologies.”

The Agency continued its support of on-line education in radiopharmacy. Participants in a consultants meeting held in April in Vienna developed a syllabus for training technologists and radiopharmacists. Development of a collaborative e-learning programme also began, with the involvement of universities in a number of Member States.



FIG. 1. Good manufacturing practice is a basic requirement in radiopharmaceutical work, both at the manufacturing level and in hospital radiopharmacy.



FIG. 2. Electron beam treatment of industrial wastewater to make it safer for disposal. (Photograph courtesy of EBTech.)

Participating universities will be able to issue appropriate (diploma or master's level) training completion certificates after theoretical and practical evaluation of the candidates.

Radiation Technology Applications

The Agency's activities have long focused on supporting Member States in adopting radiation based technologies for industrial development and environmental remediation. In 2013, a Technical Meeting on Radiation Treatment of Pollutants, Wastewater and Sludges was organized with the active participation of UNIDO, research and development institutions and industry. The meeting focused on assessing the current status of radiation technology applications for environmental remediation, particularly in the field of biosolids and wastewater management (Fig. 2). A scientific research gap analysis was conducted to formulate a strategy for the future implementation of this project. The meeting found that current shortfalls in the removal or destruction of chemicals of concern by conventional treatment processes could be addressed through radiation treatment in the future, as these chemicals have been shown to be easily degraded by radiation. It was also concluded that evidence on the reliable operation of radiation facilities for the treatment of wastewaters should help to overcome current misperceptions concerning the reliability of radiation technology based processing and lead to the further adoption of the technology.

In 2013, a consultants meeting on networking of users of electron beam facilities and the role of the IAEA Collaborating Centres was held at the Institute of Nuclear

Chemistry and Technology in Warsaw. Participants identified areas where cooperation could be enhanced, as well as additional pathways for more effective and efficient implementation of radiation technologies in Member States. The meeting's discussions laid the groundwork for the creation of an Agency web module containing timely and qualified information on implementing quality management protocols at radiation facilities and communicating specific training requirements for radiation processing specialists.

Radiation processing technologies have enabled a number of 'green' production processes for advanced materials development. Considerable success has also been achieved in modifying non-toxic, renewable, readily available natural polymers by radiation processing. In 2013, a Technical Meeting was organized to review recent developments, and to revisit global, regional and national initiatives for preparing natural polymer based products for agricultural applications. The participants concluded that the Agency's support, through its regional courses organized under technical cooperation projects and CRPs, has provided tools for knowledge transfer and information exchange, and for developing general concepts and practical solutions. The Agency has also provided tools, guidance and protocols for the determination of basic physicochemical properties of bio-resourced polymers, and organized interlaboratory studies to test relevant analytical competence.

To assist Member States in the development of radiation technology for industrial processes and to ensure its sustainability, four consultants meetings were held in Vienna in 2013. The first meeting was to

establish the current status of, and to evaluate future trends in, nuclear techniques (radiotracers, sealed sources, nucleonic measurement and control systems) for industrial applications. The second meeting was on radiation protection, safety and regulatory aspects of radiotracer and nucleonic gauge applications. Participants began work on a guidebook on good practices, with the objective being to prepare an IAEA safety standard on the topic. During

the third meeting, on neutron generators for radiotracer applications, experts evaluated the possibility of on-site production of radionuclides with short half-lives, to be used as radiotracers, as well as the replacement of neutron sources in nucleonic measurement systems. The fourth meeting dealt with the establishment of a training and certification system for radiotracers and nucleonic control system applications.