

Programme I. PHYSICAL AND CHEMICAL APPLICATIONS

Rationale: Applications of radioisotopes and ionizing radiation in many spheres of science and technology are contributing significantly towards sustainable development and improving the quality of life. The programme is responding to Member State requests in radiopharmaceutical, radioanalytical and industrial spheres of activity. Radiopharmaceuticals and radiation sources are extensively used in the health sector for the diagnosis of a variety of ailments and for the treatment of cancer. Nuclear methods of analysis contribute to environmental pollution studies and help in certifying contamination levels for international trade of agricultural products. Radioisotope sources and gauges are essential in quality control and trouble shooting in many industrial systems. Gamma ray and electron beam treatment are the preferred modalities for sterilization of single use medical products. Not only does radiation based production of modern polymeric materials for tyres, wires, cables, etc., yield products with superior properties, but their longer life contributes to the conservation of resources. Radiation is also emerging as a tool for treating harmful effluents. These radioisotope and radiation technologies are among the best available and are economically attractive options, constituting a significant proportion of some Member States national nuclear programmes. The use of radioisotopes and radiation technology may be regarded as an indirect measure of technological and industrial development. The emphasis of the Agency's work is on strengthening national capabilities and assisting national nuclear centres achieve sustainability.

Objective: To increase socioeconomic benefits in key sectors of Member States through the application of radioisotopes and radiation technology for producing goods and services which result in improved health care and industrial performance as well as effective quality control processes.

Outcome
— Enhanced Member State capabilities in the application of radioisotopes and radiation processing as tools for sustainable development.
Performance Indicators
— Number of Member State laboratories provided guidance and assistance through Agency CRPs and the TC programme in this field.
— Number of procedures/products developed.

Specific criteria for prioritization:

- New and emerging areas of radiation and isotope technology application;
- Areas where radiation and isotope techniques have an advantage over conventional methods;
- Projects resulting in service, and transfer of know-how, to developing Member States.

Subprogramme I.1. Radiochemical Applications

Rationale: Radioisotopes are the basic tools for nuclear applications and the establishment of national capabilities in their production and use is necessary to sustain and expand their beneficial application in nuclear medicine, industry and nuclear analytical services. Radioisotopes are produced by radiochemical processing of targets irradiated in reactors or cyclotrons, and knowledge regarding the construction and operation of specialized facilities for making radioactive sources in different chemical and physical forms is essential. All applications involve measurement of radioactivity, and quality assurance in accordance with international standards is an essential prerequisite. Improvements in processing methods, developing new products and enhanced quality assurance are worldwide efforts which are facilitated by Agency co-ordination. Developing Member States seek Agency assistance in harnessing this technology.

Objective: To enable Member States to use and sustain radioisotope processing for product development and radioanalytical services to meet national needs, as well as to assimilate new developments and implement QA measures.

Outcome
— Maintenance and expansion in the use of established radiochemical methodologies for radioisotope products and radioanalytical services for the industrial, health and trade sectors.
Performance Indicators
— Number of procedures standardized by Member State laboratories for the preparation and assessment of radiopharmaceuticals.
— Number of Member State laboratories availing themselves of QA services for nuclear analytical techniques.

Programme changes and trends: In the case of radiochemical applications in medicine, liaison will be maintained with Subprogramme F.1 on Nuclear Medicine. There will be increased emphasis on therapeutic radiopharmaceuticals and on diagnostic radiopharmaceuticals based on small bio-molecules with the potential for imaging functional aspects of vital organs. A new CRP on generator technology for therapeutic radionuclides will be initiated. There is also enhanced emphasis on applying good manufacturing practices to radiopharmaceutical production and use. In nuclear analytical techniques, the emphasis on QA/QC in measurements is expected to continue, with downstream benefit for trade and industry.

Resource changes and trends: The proposed resources represent a decrease of \$22 000 in 2004 compared with the 2003 adjusted budget and an increase of \$9 000 for 2005 compared with the 2004 budget. The decrease reflects a redistribution of resources, mainly by a reduction of research contracts, between the subprogrammes.

Financial resources (2003 prices)

I.1.	2003	2004	2005
Reg. budg.	1 756 000	1 733 900	1 742 900

Project I.1.01: Supporting the development of radioisotope sources and generators

Main outputs: This project will result in: methodologies for miniature sealed source and radioisotope generator production; updated cyclotron directory; and reports on radioisotope production and processing.

Duration: 2004–2007

Ranking: 1

Project I.1.02: Nuclear analytical techniques and training in radiochemistry

Main outputs: The project will produce reports of the CRPs on radioimmunoassay and chemical speciation of pollutants and modules for teaching and training in radiochemistry.

Unfunded activities/means of implementation: Technical meeting on challenges in radiochemistry education.

Duration: 2004–2008

Ranking: 5

Project I.1.03: Development, production and QA of radiopharmaceuticals

Main outputs: The main outputs will be: research results on therapeutic radiopharmaceuticals and diagnostic radiopharmaceuticals using small

molecules; and publication of specifications of important radiopharmaceuticals (in co-operation with WHO).

Duration: 2004–2007

Ranking: 3

Recurrent Project I.1.04: Analytical Quality Control Services (AQCS)

Main outputs: The project will produce: certified reference materials; validated analytical procedures; results of proficiency tests and intercomparison exercises; and personnel trained in radioanalytical methods.

Ranking: 8

Subprogramme I.2. Industrial Applications and Nuclear Techniques for Demining

Rationale: Good industrial performance is an important element of sustainable development and nuclear techniques play an important role in this area. Radiation processing has provided value added products to the health care and industrial sectors. Sealed radioisotope sources and tracers are widely used in non-destructive testing, process optimization, on line product control and trouble shooting. Many nuclear institutions in Member States have strong programmes in these areas. Acquiring and sustaining capabilities in these techniques is necessary for industrial development. A large number of Member States with programmes in these areas will benefit from Agency support and co-ordination. Humanitarian demining is a major concern of several Member States as even in peace time the mines continue to kill or maim people. Nuclear techniques have the potential to locate buried mines and help in their demining and disposal in a cost effective way. The detection devices are similar to those used in the industrial sector.

Objective: To enable Member State laboratories to sustain the application of nuclear techniques in national industries, introduce new techniques, and assess the application of nuclear techniques for humanitarian demining.

Outcome
— Increased national competence in using nuclear techniques in industrial processing and trouble shooting, humanitarian demining, and the development of radiation processed products in healthcare and industry.

Performance Indicators
— Number of Member States adopting the methodology developed by the Agency for radiation treatment of polymers, effluents and waste water.
— Number of Member State laboratories assisted to establish nuclear applications for industry.
— Standardized equipment and protocols developed for nuclear techniques for demining applications.

Programme changes and trends: Enhanced emphasis will be given to the use of electron beams for the radiation processing of polymers, industrial effluents and waste water. New development in technology will be introduced in testing and process control, providing more precise and real time information. Nuclear instruments developed in the previous biennium for humanitarian demining will be refined and subjected to field tests.

Resource changes and trends: The proposed resources represent an increase of \$127 000 in 2004 compared with the 2003 adjusted budget and a decrease of \$89 000 for 2005 as compared with the 2004 budget. The increase largely reflects funds made available in 2004 for the modification of demining instruments and field testing. The decrease for 2005 is due to redistribution of funds to Programme F.

Financial resources (2003 prices)

I.2.	2003	2004	2005
Reg. budg.	821 000	948 100	859 100

Project I.2.01: Radioisotope technology for natural resource exploration and exploitation

Main outputs: The main outputs will be documents on tracers in oil reservoir evaluation, and nuclear gauges for the coal and cement industries.

Duration: 2004–2007

Ranking: 6

Project I.2.02: Radiation processing for superior grade polymers and treatment of gaseous effluents/waste water from industry

Main outputs: The project will produce publications containing research results of the CRP on the synthesis of advanced polymers and documentation on recent developments in radiation processing.

Unfunded activities/means of implementation: Co-ordination of a CRP on removal of volatile organic compounds from exhaust gases by electron beam irradiation.

Duration: 2004–2008

Ranking: 2

Project I.2.03: Development of procedures and standard protocols for industrial radiography

Main outputs: The project will result in: progress reports on the CRP for corrosion determination in pipes; and progress in international harmonization of accreditation, training and certification.

Duration: 2004–2007

Ranking: 7

Project I.2.04: Nuclear methods for landmine identification

Main outputs: The project will produce a final report of the CRP on nuclear techniques for landmine identification and the results of tests on instruments suitable for integration in a mine detection device for humanitarian demining.

Duration: 2002–2005

Ranking: 4