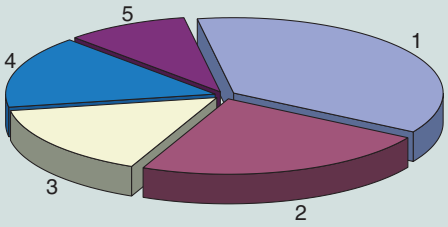
RADIATION SAFETY

PROGRAMME OBJECTIVE

To establish, in consultation and — where appropriate — in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for the protection of health, including standards relating to radiological protection, radiation source safety, radioactive materials security and the safe transport of radioactive materials; to provide for the application of those standards through, inter alia, support for the Agency's technical co-operation programme, the rendering of services, the promotion of education and training, the fostering of information exchange and the co-ordination of research and development — all in the field of radiation safety; to service the Early Notification and Assistance Conventions; and to ensure an appropriate level of radiation safety in the Agency's own operations.

Regular budget expenditure: $3 675 857

Extrabudgetary programme expenditure (not included in chart): $299 508



1. Radiation Protection: $1 340 455
2. Safety of Radiation Sources and Security of Radioactive Material: $843 507
3. Safe Transport of Radioactive Material: $574 442
4. Radiation Emergencies: $566 649
5. Operational Services for Radiation Monitoring and Protection: $350 804

KEY ISSUES AND HIGHLIGHTS

- The action plan on the safety of radiation sources and the security of radioactive materials was updated to take account of recommendations from an Agency conference of national regulators held in Buenos Aires in December 2000.
- An Agency conference on the radiological protection of patients, held in Málaga, Spain, recommended that a group of experts be convened to develop an international action plan in this area.
- Proposals for changes to the Agency's Transport Regulations were agreed, with an updated edition of the Regulations planned for issue in 2003.
- The framework for responding to nuclear and radiological emergencies was reviewed by representatives of competent authorities from Member States.
- The achievements of the Agency's technical co-operation Model Project on upgrading radiation protection infrastructure were reviewed. As a result of this review, the project was split into two, with one part concentrating on the most basic infrastructure elements and the other on the more advanced milestones.
- A new Occupational Radiation Protection Appraisal Service was launched and the first review was conducted.

RADIATION PROTECTION

A technical document published in 2001, *Assessment by Peer Review of the Effectiveness of a Regulatory Programme for Radiation Safety* (IAEA-TECDOC-1217), sets out a methodology by which the status of a regulatory programme for radiation safety can be assessed so that areas where improvements are necessary or useful can be identified. The methodology was initially developed in 1997–1999, and was subsequently refined on the basis of experience gained during Agency peer review missions in 1999 and 2000. In 2001, Radiation Safety Regulatory Infrastructure (RSRI) peer review missions visited Niger, Philippines, Thailand and Venezuela.

The technical co-operation Model Project on upgrading radiation protection infrastructure was initiated in 1995 with the aim of assisting Member States in establishing the infrastructure elements regarded as prerequisites for implementing the requirements of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). In November, the Secretariat reported to the Board of Governors on the implementation of the Model Project between 1995 and 2001. The levels of attainment among the 52 participating States of milestone 1, the basic legal and regulatory infrastructure for the control of radiation sources, and milestone 2, a system for controlling occupational radiation exposure, were much lower than originally expected. Although various difficulties had been foreseen, the time needed to overcome them was in some cases underestimated. The Secretariat has informed the participating Member States that new technical co-operation projects involving the use of radiation sources would be proposed to the Board of Governors as fully funded projects only after States have attained these two milestones. In this regard, new technical co-operation projects were started in 2001 to assist Member States in reaching these milestones. One project each in Europe, Latin America, Africa, West Asia, and East Asia and the Pacific addresses milestones 1 and 2, while the others relate to milestones 3–5 (systems for controlling medical exposure and public exposure, and for emergency preparedness and response). In addition, 29 other Member States have requested assistance through these new projects.

Medical practice involving the use of ionizing radiation accounts for about 95% of human exposure from human made sources of radiation. Furthermore, accidents during medical treatment with radiation continue to occur occasionally, with severe and sometimes fatal consequences. A conference on the radiological protection of patients in diagnostic and interventional radiology, nuclear medicine and radiotherapy, held in Málaga, Spain, in March, confirmed that there was scope for reducing the radiological risks involved in both diagnostic and therapeutic uses of radiation without reducing the medical benefits. The conference's overall conclusion was that the "relevant international organizations should convene a group of experts, including experts from professional societies and regulatory bodies, to formulate an action plan based on the findings of the conference for future work relating to the radiological protection of patients." The Board of Governors and General Conference endorsed this conclusion; the action plan will be developed in 2002.

Under the terms of the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Member States can request the Agency to provide support and assistance, and conduct follow-up investigations in the event of a radiological accident. In response, the Agency published a report entitled *Investigation of an Accidental Exposure of Radiotherapy Patients in Panama*. Compiled by a team of experts, the report contains the assessment of a radiological accident that led to the serious overexposure of 28 radiotherapy patients in Panama. From August 2000 to February 2001, as the result of a calculational error in the data entry of a treatment plan, patients were treated with doses up to 100% higher than those prescribed. The report evaluates the doses incurred, provides a medical evaluation of the affected patients' prognosis and treatment, and presents a number of findings, conclusions and lessons to be learned. The Agency also issued advisory material for Member States describing the causes of the accident.

SAFETY OF RADIATION SOURCES AND SECURITY OF RADIOACTIVE MATERIAL

At the request of the Board of Governors, the Agency's 'Action Plan for the Safety and Security of Radiation Sources' was revised, taking into consideration the findings of an Agency conference on 'National Regulatory Authorities with Competence in the Safety of Radiation Sources and the Security of Radioactive Materials', which was held in Buenos Aires in December 2000. As well as adjusting or emphasizing ongoing activities, a number of additional tasks were added. Several of these are aimed at improving the exchange of information and experience on various topics covered by the action plan between the Agency, regulatory bodies, source manufacturers and suppliers, and users of sources. Other new tasks emphasize the promotion of self-assessment of protection arrangements/infrastructure by States and mutual assistance between States, review of the use of the Agency's system for categorizing sources, more guidance and assistance to Member States on locating orphan sources and responding to emergencies, and rationalization of the Agency's databases on radiation sources and events. "As a highest priority", the revised action plan calls on the Agency to "explore the possibility of developing and implementing a universal system of labelling such that any member of the public is immediately aware of the dangers associated with hazardous radiation sources". It should be emphasized that the plan continues to focus on measures to prevent and respond to the unintended absence or loss of control over radiation sources. Although some of these measures might also contribute to preventing or responding to malicious acts involving radiation sources, the proper consideration of this latter issue calls for different expertise and measures, and should be treated separately.

In April, the Secretariat organized the First Africa Workshop on the Establishment of a Legal Framework Governing Radiation Protection, the Safety of Radiation Sources and the Safe Management of Radioactive Waste in Addis Ababa. The workshop adopted a "Common Position", in which the participants called upon the Agency to "create a forum for African countries to consider the Code of Conduct on the Safety and Security of Radioactive Sources and give it a legally binding effect so that the safe and peaceful use of nuclear technology is not compromised". The main elements of the Common Position were taken into account in drawing up the revised action plan for the safety and security of radiation sources referred to in the previous paragraph.

SAFE TRANSPORT OF RADIOACTIVE MATERIAL

In accordance with the review cycle for the Agency's Transport Regulations, a panel meeting in November 2001 recommended the publication of a revised version of the Regulations in 2003 as the '1996 Edition (As Amended 2003)'. The amendments in this new version will then be incorporated into the mode specific regulations of other international organizations with effect from 2005.

TranSAS (Transport Safety Appraisal Service) was established by the Agency in 1999 to provide, at the request of a Member State, an appraisal of that State's national implementation of the Agency's Transport Regulations. The first TranSAS mission was to Slovenia and was completed in 1999. Requests for further TranSAS missions were received from Brazil in 2000 and from Panama, Turkey and the United Kingdom in 2001. Pre-TranSAS missions to Brazil, Turkey and the United Kingdom had been completed by the end of 2001, and full TranSAS missions to all three countries are planned for 2002 (the mission to Panama is expected to be carried out in 2003).

The final report of a CRP on the severity, probability and risk of accidents during the maritime transport of radioactive material was published in 2001. The report, prepared by the participants from the five Member States, provides estimates of the frequencies of ship collisions and ship fires. Models of ship collisions led to the conclusion that even if crush forces were applied to a flask due to deep penetration of the hold, the forces would be relieved by the collapse of ship structures rather than that of the flask (Fig. 1). With regard to fires, shipboard tests and analytical modelling indicated that a fire

was not likely to spread to a hold containing radioactive material. If a fire did reach the hold, it was unlikely to burn at a sufficiently high temperature or for long enough to cause the release of radioactive material from a Type B flask. Finally, illustrative analyses indicated that neither the loss of a flask into the ocean nor the release of radioactive material to the atmosphere as the result of a severe ship collision that initiated a severe fire would be likely to subject exposed individuals to radiation doses that were significant by comparison with normal background doses.

RADIATION EMERGENCIES

In response to requests for assistance under the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, missions were sent to Panama and Poland in relation to accidents involving radiotherapy patients. In each case the Agency advised on the medical treatment of the victims, assisted in assessing the causes and consequences of the accidents and ensured that the equipment involved in the accidents was in a safe and secure condition.

Safety Requirements on preparedness and response to a nuclear or radiological emergency were endorsed by the Commission on Safety Standards and, if approved by the Board of Governors, will be published in 2002. The Requirements are sponsored by the Agency, FAO, ILO, OECD NEA, UN OCHA, PAHO and WHO.

In May 2001, the Agency participated in an international nuclear emergency exercise, JINEX 1. Involving 55 States and jointly sponsored and co-ordinated by the Agency, the European Commission, OECD NEA, WHO and WMO, the exercise was based on a hypothetical accident at the Gravelines nuclear power plant in northern France. The main objectives of the exercise were to: test existing national and international procedures and arrangements for responding to a nuclear emergency; co-ordinate the release of information; and assess the effectiveness of advisory and decision making mechanisms.

The Secretariat held a 'First Meeting of Representatives of the National Competent Authorities', identified under the Convention on Early Notification of a Nuclear Accident and the Assistance Convention, to evaluate the effectiveness of arrangements given in the latest edition of the *Emergency Notification and Assistance Technical Operations Manual* (ENATOM), and to identify problems that should be resolved before

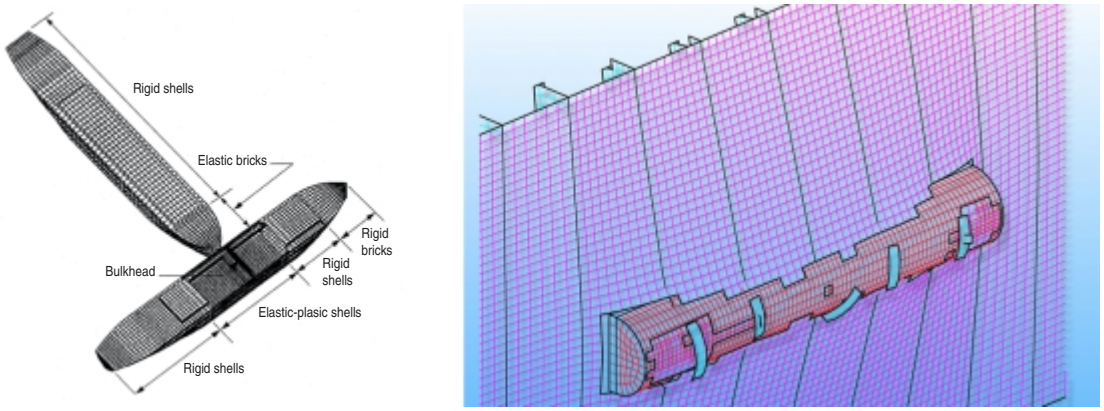


FIG. 1. Modelling of ship collisions (left) has indicated that the magnitude of crush forces that radioactive material packages transported by sea are likely to be subjected during even the most severe ship-to-ship collisions is limited by the strength of the side structure of the transporting vessel. The graphic on the right shows the undamaged container emerging from the side of a ship.

the next edition is issued in December 2002. The meeting suggested a number of operational changes to the system described in ENATOM, provided detailed comments on the ENATOM documentation and recommended a number of actions to be considered by the Secretariat in developing its future plans for strengthening and harmonizing international emergency preparedness and response arrangements for nuclear and radiological emergencies.

OPERATIONAL SERVICES FOR RADIATION MONITORING AND PROTECTION

A new Occupational Radiation Protection Appraisal Service (ORPAS) was developed to 'audit', against the Agency's relevant radiation safety standards, the regulatory and practical implementation of occupational radiation protection arrangements in the requesting Member State. The key objectives of the appraisal are to: provide the host country with an objective assessment of the provisions for occupational radiation protection; identify the strengths in the host country that are unique and worth bringing to the attention of others; promote the use of self-assessment by the host country; identify areas where performance should be improved to meet international standards; and make recommendations on actions to be taken to achieve such improvements. The first appraisal was carried out in Slovenia in July.

Quality management has become an important issue not only in Member State laboratories, but also in those operated by the Agency. In this connection, quality management documentation was prepared for the Agency's radiation monitoring and protection services. The material is consistent with the relevant ISO standards and Agency safety standards, and comprises the policy, scope, objectives, technical procedures, work instructions and checklists applicable to the Agency's operational activities in this area. It also provides guidance on the mechanisms and procedures for reviewing and assessing the effectiveness of protection and safety measures of the services rendered.

The organization of regional ALARA (as low as reasonably achievable) networks was initiated with the purpose of providing forums for information exchange on current practical experience in occupational exposure control. ALARA networks will assist Member States participating in the Model Project on upgrading radiation protection infrastructure in meeting the requirements of milestone 2 on occupational radiation control.

Exposure to natural radiation sources is estimated to account for more than 80% of the annual collective dose worldwide from occupational exposure (uranium mining excluded). An expert committee prepared a report on the assessment of occupational protection conditions in work places with high levels of exposure to natural radiation to provide further guidance to the Agency on priority areas for its work. The experts recommended that the highest priority be placed on developing safety reports for a number of specific industrial sectors where natural radioactive materials may cause a problem, and on developing detailed guidance on the identification of work places with potentially high radon levels and the necessary remedial actions.

An international intercomparison of measurements of the activity of gamma emitting radionuclides in human urine samples found no major inconsistencies in the activity values measured, but some inconsistencies were observed in the uncertainty calculations. Overall, the results showed that occupational monitoring assessment in the case of an intake of gamma emitters and measurement of urine samples is highly satisfactory.

In an ARCAL project on the promotion of nuclear science and technology in Latin America and the Caribbean, two intercomparisons were carried out. One related to measurements of ambient dose equivalent with radiation protection survey equipment. The results of this intercomparison showed that the majority of the equipment performed within a 10% deviation, but it also revealed the inadequacy of legal requirements for equipment calibration and a lack of calibration facilities in the region. The other project focused on measurement of the activity of radionuclides in food and environmental samples. Nine laboratories reported results and performed well in the determination of gamma activity, although some inconsisten-

cies were found in the uncertainty calculations of the activity values.

External experts conducted a peer review of the Agency's radiation monitoring and protection services. The goal was to help improve the relevance, effectiveness, efficiency and impact of existing projects and formulate better projects for the future. The experts recognized the importance of the Country Radiation and Waste Safety Profiles, acknowledging them as a useful tool for prioritizing and optimizing the use of limited Agency resources. However, they identified some concerns related to the ownership and maintenance of the profiles that are being addressed.