Adequate radiation protection: a lingering problem

Programmes in developing countries in particular fall far short of the need

by Morris Rosen

The mishandling of radioactive sources and equipment widely used in medicine, agriculture, industry, and research is by no means a rare event nor is it restricted to countries with limited nuclear applications or experience. A combination of technical faults and human errors claimed a technician's life in late 1982 at a sterilization plant; a failure to observe prescribed procedures caused a fatality at a research facility in 1983, and in the same year the careless discard of a medical source led to exceedingly high levels of exposure to a number of people. In 1984, contaminated pipe fittings were unknowingly exported; in 1985 eight persons died from overexposure to an unmarked industrial source taken home, and gross contamination from radium was found in a medical physicist's home; and in 1986 a significant tritium overexposure of a worker occurred. All these events in the non-power applications of nuclear energy have, over the years, been openly reported in the IAEA annual *Nuclear Safety Review.*

The radiological contamination of dozens of people in the city of Goiania, Brazil, is an unfortunate recent addition to the chronology of reported events.

In response to the increasing reports of significant incidents, IAEA Director General Dr Hans Blix announced in September 1984 the creation of Radiation Protection Advisory Teams (RAPAT) to assist Member States in assessing the existing state of their radiation protection activities and in determining their immediate and future needs. What have been the results? The cumulative findings of these missions, which by mid-1987 have visited 23 developing countries, amply demonstrate that a great deal needs to be done just to ensure minimal controls to reduce the unnecessary and growing risk of injury, death, and property damage. In most of these countries there is no effective national radiation protection authority. In some there are multiple institutions claiming the responsibility, while in others, national authorities have yet to be established. To compound the problem, there is an obvious lack of trained and knowledgeable personnel and no long-term plan to correct the general situation.

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The expanding use of ionizing radiation in over 70 developing countries, frequently in the absence of minimal surveillance, calls for vigorous international promotion of effective radiation protection efforts. The reported incidents, within the context of existing conditions, can be considered symptomatic of a serious and pervasive problem.

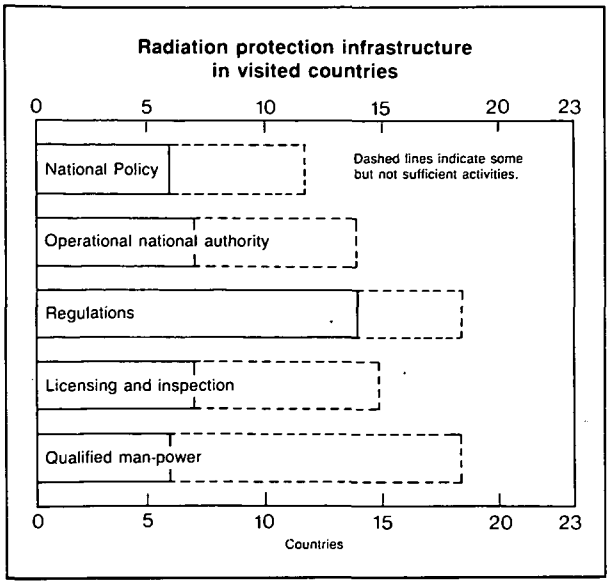
Scope of a RAPAT

RAPATs generally consist of recruited internationally recognized experts and IAEA staff. The team expertise covers a wide range of areas from regulation to operational activities to allow for up-to-date advice on all matters involving ionizing radiation. Participation by the World Health Organization (WHO) and the International Commission on Radiological Protection (ICRP) in the missions has been particularly welcome. WHO as a health organization normally deals with national ministries of health, which in many countries in parallel with an atomic energy commission, oversee radiation protection activities. The ICRP has developed the scientific basis that underlies the IAEA's Basic Safety Standards for Radiation Protection. A number of countries with the necessary expertise have shown a special interest in assisting the missions and this has aided the selection of external experts. *(See accompanying table.)*

RAPAT is not an international inspection authority; it visits at the request of governments. During a week's stay, the main task is, first, to assess the current situation by direct discussions with government officials and those using radioactive materials; next, to identify specific needs and priorities to ensure the safety of ongoing activities; and finally, to suggest a practical long-term programme with the necessary trained personnel and controls to provide for a safe introduction and continuing use of radiation techniques.

Findings so far

The RAPAT experience so far unambiguously establishes that many developing countries simply lack the necessary infrastructure to implement a radiation protection policy based on international standards. *(See accompanying chart.)* They lack the basic legislation and supporting regulations, as well as effective national



authorities, qualified manpower, and necessary equipment.

To start with, only six of the 23 countries visited had any coherent policy or long-term strategy covering the uses of ionizing radiation or for its control. An equal number had some conceptual idea of what had to be done, but were not actively formulating a comprehensive programme. Nuclear techniques have been introduced almost randomly as they have become available. Even the least developed countries extensively use X-ray machines and radioisotope diagnostics along with radiotherapy units and industrial radiography sources, most located in private facilities and under the control of no one. They are neither licensed nor inspected.

A national policy must call for authorities responsible for establishing regulations to include licensing and inspection requirements, along with guidance on the use and handling of material and equipment. Adherence to the IAEA Basic Safety Standards for Radiation Protection requires such an approach. Yet only seven countries had a truly operational authority; nine had none at all. In many, more than one institution claimed exclusive responsibility. In one, there were five ministries responsible under several legal acts and with varying regulations, the atomic energy commission following current ICRP recommendations, and others using older approaches.

Only 14 countries had on paper a sufficient set of regulations, and of these only half had adequate licensing and inspection capability. The Ministry of Health and Public Welfare in one country estimates that as many as 3000 X-ray machines, primarily in dental offices, are neither licensed nor inspected. In several countries there are sophisticated particle accelerators and neutron generators without adequate operational procedures or monitoring. Many lack the simplest radiation detectors and personal dosimeters and needless to say, no special attention has been given to planning the handling of radiation accidents and overexposures. It is likely that, in such circumstances, no trained personnel would be available to make preliminary assessments or to provide initial treatment.

One aspect of currently existing deficiencies became vividly apparent after the Chernobyl accident. Although there was a need in some countries to monitor radiation in environmental and food samples and to assess the potential doses to their population, not all were in a position to do this. *(See accompanying chart.)* A basic monitoring ability is an integral component for effective participation in the post-Chernobyl *Convention on Early Notification of a Nuclear Accident.* It is necessary for State Parties to the Convention to have some capability to obtain data, to interpret it, and to share it with the international community.

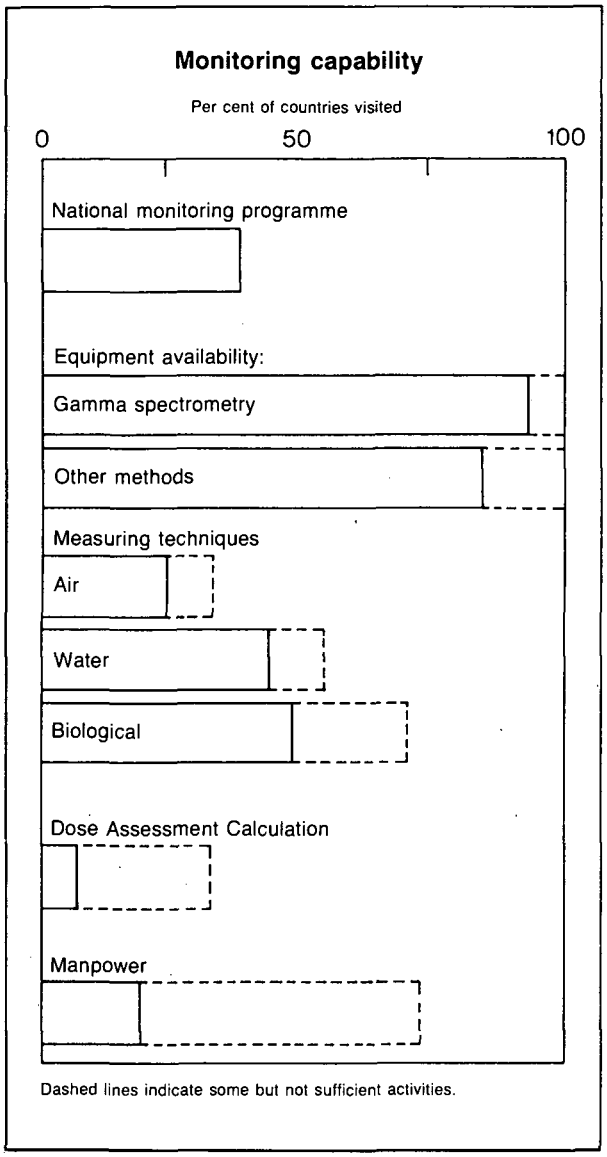
RAPAT missions, 1984–87

Country	Participants
1984	
China	ICRP* (3), IAEA
Iraq	Egypt, USA, IAEA
1985	
Nicaragua	Sweden, Argentina, Ecuador, IAEA
Malaysia	Argentina, USA, WHO, IAEA
Turkey	IAEA (3)
Chile	Argentina, WHO, IAEA
1986	
Egypt	Italy, IAEA (2)
Portugal	Hungary, IAEA (2)
Dominican Republic	IAEA (2)
Panama	IAEA (2)
Venezuela	Chile, WHO, IAEA (2)
Ecuador	Chile, WHO, IAEA (2)
Iceland	IAEA (2)
Zambia	FRG, IAEA (3)
Kenya	FRG, IAEA (3)
Zaire	FRG, IAEA (3)
Mexico	Spain, USA, IAEA (2)
1987	
Columbia	Mexico, IAEA (3)
Peru	Mexico, IAEA (3)
Sudan	UK, IAEA (3)
Tanzania	UK, IAEA (2)
Philippines	Canada, Japan, IAEA (3)
Republic of Korea	Canada, Japan, IAEA (3)
Jordan	Hungary, IAEA (2)
Syrian Arab Republic	Hungary, IAEA (2)

* ICRP members from Argentina, Sweden, and UK

Qualified manpower

Even where appropriate national regulations exist and equipment is available, there is often a shortage of trained personnel. This shortage of manpower and the need for considerable training was obvious in virtually



all countries visited by the advisory teams. Only six were judged to have sufficiently qualified personnel, 12 were judged insufficient, and five were assessed as having essentially no adequately qualified personnel at all.

There is a need for training and three approaches are available: the training of future local trainers, the organization of general training in radiation protection, and the organization of specific courses or workshops. The Agency's approach of the last 3 years, "to train-the-trainers", has not yielded the hoped for results. Up to now none of the participants in the courses organized in Bombay and Buenos Aires has initiated training schemes in his or her home country. This is partly due to the candidate selection process for such courses. There was no precondition that a participant was expected to organize radiation protection training upon his return.

In addition to the obvious benefit of general training, specific topics must be treated. Among those frequently mentioned to the RAPAT missions were: regulations and standards, licensing and inspection, environmental monitoring, early diagnosis and handling of overexposed persons, and emergency planning and preparedness. Specialized technical subjects are especially suited for national training courses which accomodate many candidates from one country. These efforts must be supplemented by the customary means of fellowships and other learning opportunities abroad, such activities undertaken with a clear requirement and committment for national service. Once in service, efforts are also necessary to maintain and to improve levels of expertise.

The IAEA's role

In Article III of its Statute, the Agency is authorized: "... to establish or adopt ... standards of safety for protection of health and minimization of danger to life and property ... and to provide for the application of these standards to its own operations as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency ...". In those Member States with technical assistance projects, in essence, the Statute dictates radiation protection practices in agreement with the IAEA Basic Safety Standards for Radiation Protection.

In view of this clear mandate, technical assistance offers a mechanism to improve the current situation. As radiation protection is implicitly involved in most nuclear activities, a national programme to meet the Agency's health and safety requirements should be a precondition for much of the technical assistance. National practices must be based on, or at least consistent with, the IAEA standards and recommendations. With an annually rising percentage of resources being devoted to safety in nuclear energy (currently 17% of all disbursements), requests for this specific type of assistance should certainly be subjected to an evaluation which takes into account the capability for safe use and maintenance of associated facilities and equipment.

This suggests the need to improve the procedure of selecting projects to be financed by the Agency so that safety measures are a prerequisite. With a large proportion of assistance in the form of sophisticated equipment, it is necessary to prevent, as has been the case, delivery of neutron generators to countries with no relevant regulations and with no appropriate dosimetry equipment. Within the IAEA, it will call for better interaction and communication between staff of the various technical divisions and those co-ordinating and administering assistance projects. Steps must be taken to assure that programmes are adjusted to meet what should be one of the real priorities of developing Member States, to build national infrastructures for the safe use of nuclear technology.