

# **Action Plan for Occupational Radiation Protection**

Prepared by the  
International Atomic Energy Agency

In co-operation with the International Labour Office

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## Action Plan for Occupational Radiation Protection

### INTRODUCTION

According to the latest (2000) report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), an estimated 11 million workers worldwide are monitored for exposure to ionizing radiation. They incur radiation doses attributable to their occupation ranging from a small fraction of the global average background exposure to natural radiation up to several times that value. It should be noted that the UNSCEAR 2000 report describes a downward trend in the exposure of several groups of workers, but it also indicates that an increasing number of people worldwide are receiving occupational exposures.

The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS), which are co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the International Labour Organization (ILO), the OECD Nuclear Energy Agency (NEA), the Pan American Health Organization (PAHO) and the World Health Organization (WHO), establish a system of radiation protection of which the provisions relating to occupational exposure are a substantial component. Guidance supporting the requirements of the BSS for occupational protection is provided in three interrelated safety guides, jointly sponsored by the IAEA and ILO. These safety guides describe, for example, the implications for employers of discharging their main responsibilities (such as setting up appropriate radiation protection programmes) and those for workers of discharging their main responsibilities (such as properly using the radiation monitoring devices provided to them).

It should be noted, however, that radiation protection is only one factor that must be addressed in order to protect the worker's overall health and safety. The occupational radiation protection programme should be established and managed in co-ordination with other health and safety disciplines, such as industrial hygiene, industrial safety and fire safety.

In order to address current occupational radiation protection issues, the first International Conference on Occupational Radiation Protection, hosted by the Government of Switzerland, was organized by the IAEA, which convened it jointly with ILO. It was co-sponsored by the European Commission (EC) and held in co-operation with WHO and NEA and also with UNSCEAR, the International Commission on Radiological Protection (ICRP), the International Commission on Radiation Units and Measurements (ICRU), the International Electrotechnical Commission (IEC), the International Radiation Protection Association (IRPA) and the International Society of Radiology (ISR). The Conference was held at the Headquarters of ILO, in Geneva, from 26 to 30 August 2002. It was structured so

as to obtain the views of stakeholders - i.e. regulators, employers, workers and radiation protection professionals<sup>1</sup>.

The findings and recommendations of the Geneva Conference were made available as a Note by the IAEA Secretariat (2002/Note 23). They were considered in September 2002 by the IAEA General Conference, which requested the IAEA's Director General "...to look into the possibility of the IAEA co-operating with the International Labour Organization and other relevant bodies in formulating and implementing...an international action plan for occupational radiation protection".

In December 2002 the Secretariat convened, in consultation with ILO, a group of consultants to begin drafting the requested action plan. The resulting draft was refined through a consultancy in February 2003. The refined draft was then reviewed by the organizations involved in the Geneva Conference, and also by the programme committee, chairpersons, keynote speakers, rapporteurs and panellists, to produce the following agreed Action Plan, which was approved by the IAEA Board of Governors on 8 September 2003.

## **BACKGROUND**

The term "occupational exposure" refers to the radiation exposure incurred by a worker attributable to the worker's occupation and received or committed during a period of work. Occupational exposures to ionizing radiation result from activities involving all types of natural and artificial radiation sources, and can occur in a range of industries including mining and milling, medical institutions, educational and research establishments and nuclear fuel cycle facilities.

Less than half of the world's occupationally exposed workers are exposed to artificial radiation sources - most are exposed to elevated levels of natural radionuclides. Notably, this latter group receives a higher average annual dose than workers exposed to artificial sources. The principal natural sources of radiation exposure, other than the mining and processing of uranium ores, are radon in buildings, raw materials (other than uranium or thorium ores) containing elevated concentrations of natural radionuclides, other underground workplaces, and cosmic rays at aircraft altitudes. Some of these exposures are amenable to control but others are not. The BSS provide for the exclusion of those exposures, the magnitude or likelihood of which is essentially unamenable to control.

The efforts of the relevant international organizations need to cover all sources of occupational radiation exposure. However, for these efforts to be effective, they need to be focused on the sources or circumstances of exposure leading to the highest doses, where the potential for accidents is greatest or where radiation protection is most difficult to achieve in practice. Thus, emphasis needs to be given to the control of exposures to high levels of natural radiation, especially in difficult circumstances such as those associated with mining, in certain industrial activities such as industrial radiography, and in medical procedures involving high doses to medical staff such as interventional radiology.

As part of the development of an effective infrastructure there is a need to develop mechanisms for the education and training, in accordance with the existing IAEA strategic approach in this matter, of all those involved - regulators, managers and workers. It has also

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<sup>1</sup> The Proceedings of the Conference were published by the IAEA in 2003 under the symbol STI/PUB/1145.

been found very conducive to safety improvements in other areas to provide for effective exchanges of information on safety problems and their solutions.

The exposure of workers to radiation is presumed, in current radiation protection thinking, to increase the risk that they will develop radiation-induced cancer. The probability that any particular cancer is partially or substantially attributable to cumulative occupational exposure can be assessed using agreed protocols and dose records. International agreements on such protocols would assist their implementation and contribute to a more rapid and equitable settlement of claims for compensation, to the benefit both of workers and of employers.

## **OBJECTIVE**

The overall objective of this action plan is to focus the efforts of the relevant international organizations, in particular the IAEA and ILO, and to assist their Member States in establishing, maintaining and, where necessary, improving programmes for the radiation protection of workers. Implementation of the proposed actions will strengthen international efforts in nine high-priority areas (listed in the action plan) identified as areas of major concern by the International Conference on Occupational Radiation Protection held in Geneva in 2002.

## **SCOPE**

This action plan covers important aspects of the control of occupational exposures that have an international dimension, as identified at the Geneva Conference. It therefore deals with matters such as the strengthening of relevant international conventions, the development and maintenance of effective safety infrastructures, the fostering of a safety culture among managements and workers, and the harmonization of international radiation protection requirements that are compatible with other provisions for health and safety at work. The development of education and training and the promotion of information exchange form an important part of the action plan, which proposes joint international efforts in support of decision-making with regard to the attribution of health effects to occupational radiation exposure. The protection of specific groups, including pregnant workers and their embryos and foetuses, is also addressed.

## **PRINCIPLES OF THE ACTION PLAN**

The elements of the action plan:

- (a) strengthen the application of international radiation safety standards for the protection of occupationally exposed workers;
- (b) are compatible, coherent and consistent with the existing programmes of the IAEA and ILO; and
- (c) intend to implement the recommendations of the International Conference on Occupational Radiation Protection that were distributed by the IAEA's Secretariat in 2002/Note 23.

To provide some structure to the action plan, the recommendations of the Conference have been grouped into thematic areas and the individual actions have been prioritized in terms of timescale. In each case it is made clear to whom the recommendation to take action is addressed.

## **RELEVANT CURRENT IAEA AND ILO ACTIVITIES**

The main activities being carried out by the IAEA and ILO relevant to the implementation of this action plan are described briefly in this section. It should be noted that the arrangements for collaboration between the two organizations were formalized by an agreement that came into force on 21 November 1958.

### **Promoting and servicing the Radiation Protection Convention, 1960 (No. 115)**

International conventions are mechanisms in international law for motivating States to implement, demonstrably, safety provisions that comply with current international standards. ILO Convention 115 has been and remains very effective in this respect, and recommendations are made in the action plan for increasing its effectiveness by working towards its more widespread ratification by and implementation in States.

Prime responsibility for promoting and servicing ILO Convention 115 lies with ILO. The mechanism involves detailed reporting each year by the States that have ratified the Convention on the measures taken by them to give effect to the provisions of the Convention. The reports are considered by an ILO committee of experts, and the IAEA has an opportunity to comment on the reports and take part in the deliberations of the committee. To promote the implementation of ILO conventions, the Governing Body of ILO, in March 2002, invited ILO's Member States to contemplate ratifying the existing conventions, including ILO Convention 115, and requested them to provide information on any obstacles and difficulties that might prevent or delay ratification.

### **Establishment of occupational safety standards and development of supporting publications**

The main standards, including the primary occupational safety requirements, were established in the BSS. They have been supplemented by other safety standards, including *Occupational Radiation Protection* (IAEA Safety Guide No. RS-G-1.1), *Assessment of Occupational Exposure due to External Sources of Radiation* (IAEA Safety Guide No. RS-G-1.3) and *Assessment of Occupational Exposure due to Intakes of Radionuclides* (IAEA Safety Guide No. RS-G-1.2). These three safety standards were co-sponsored by ILO and published by the IAEA in 1999. There are also some safety standards relating to specific sectors, particularly *Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants* (IAEA Safety Guide No. NS-G-2.7, published in 2002) and *Occupational Radiation Protection in the Mining and Processing of Raw Materials* (IAEA Safety Guide No. RS-G-1.6, co-sponsored by ILO and about to be published).

Much effort is being devoted to the production of supporting material, especially safety reports. A general report, entitled *Optimization of Radiation Protection in the Control of Occupational Exposure* (IAEA Safety Reports Series No. 21), was published in 2002. Reports on Workplace Monitoring, Dosimetry Services for Individual Monitoring of Occupational Exposure, and Assessment of Radiation Doses from Radionuclides in the Human Body are being prepared. A number of sector-specific safety reports are at various stages of preparation. Some of them relate to aspects of the problems of exposure to naturally occurring radioactive materials (NORM) - *Radiation Protection and Radioactive Waste Management in the Oil and Gas Industry* and *Radiation Protection against Radon in Workplaces other than Mines* are about to be published, and reports on industrial uses of

thorium, and radiation protection in the zircon, phosphates, titanium dioxide and monazite/rare earths industries are being drafted.

### **Support for strengthening regulatory infrastructures**

Such support is being provided mainly through the IAEA Model Projects on upgrading radiation protection infrastructures to comply with the BSS. The Model Projects are now being implemented in 89 IAEA Member States, and the establishment of occupational radiation protection programmes is the second Model Project “milestone”. In many of these countries there are ILO Country Offices, and consideration is being given to whether they might become more involved in occupational radiation protection.

Additional regulatory infrastructure requirements are specified in *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety* (IAEA Requirements document No. GS-R-1) with supporting guidance on *Building Competence in Radiation Protection and the Safe Use of Radiation Sources* (IAEA Safety Guide No. RS-G-1.4, co-sponsored by ILO).

### **Peer review missions to appraise occupational radiation protection**

The IAEA has established an Occupational Radiation Protection Appraisal Service (ORPAS). In ORPAS peer review missions, use is made of a detailed checklist based on the aforementioned safety guides in appraising all aspects of occupational radiation protection in the host countries. In some cases, ILO has collaborated with the IAEA in identifying suitable persons to take part in such missions.

### **Intercomparisons of monitoring methods for assessing occupational exposure**

Since 1987 the IAEA’s Secretariat has conducted several such intercomparisons for the purpose of helping IAEA Member States to comply with dose limitation requirements and harmonizing the use of internationally agreed quantities and assessment methods. In external dosimetry, the first intercomparison focused on the impact of the possible adoption of a new set of operational quantities introduced by ICRU, while later intercomparisons focused on the performance of personnel dosimetry services when the operational quantity  $H_p(d)$  was used. In internal dosimetry, intercalibrations of facilities with different sets of phantoms simulating the human body and intercomparisons of methods for measuring radionuclides in human excreta and of dose estimation methodologies were performed. Currently three intercomparisons are ongoing at the international level and two at the regional level - in Latin America and Asia.

### **Promotion of information exchange**

A highly effective means of improving radiation protection is information exchange between people facing similar work situations and problems. An important information exchange mechanism operated jointly by NEA and the IAEA is the Information System on Occupational Exposure (ISOE), which contains data from more than 90% of the world’s operating nuclear power reactors. The IAEA is creating a further mechanism by establishing regional ALARA networks similar to the European ALARA Network, which organizes workshops focusing on occupational exposure. Databases like the IAEA’s Radiation Events Database (RADEV), which contains information on accidents (or near misses or other unusual

events) involving radiation sources not directly connected with the production of nuclear power or with the nuclear fuel cycle, are being developed.

The *ILO Encyclopaedia of Occupational Health and Safety* is a substantial reference work, and the International Occupational Safety and Health Information Centre and the International Occupational Safety and Health Hazard Alert System are two important information exchange mechanisms operated by ILO.

## **Education and training**

In 2002, the General Conference of the IAEA urged the IAEA's Secretariat to continue implementing its Strategic Plan for a long-term and sustainable programme of education and training in radiation safety and waste management. The Strategic Plan provides for modalities such as postgraduate educational courses, specialized training courses, on-the-job training, scientific visits, workshops, seminars and distance learning. The IAEA has issued a safety report entitled *Training in Radiation Protection and the Safe Use of Radiation Sources* (IAEA Safety Reports Series No. 20) and is developing materials suitable for use in the training of trainers and in national and regional training courses. More emphasis is now being placed on, inter alia, practice-specific training in occupational radiation protection.

## **PROPOSED ACTIONS**

The proposed actions for strengthening occupational radiation protection worldwide are grouped according to nine areas that provide a logical division of tasks to be carried out.

### **ILO Convention 115**

The Geneva Conference noted that ILO had the overall responsibility for occupational safety and health, which it discharges in the radiation protection context mainly through the promotion of ILO Convention 115 - a powerful tool for enhancing occupation radiation protection.

It concluded that:

The international organizations should harmonize and, if possible, simplify their terminologies and interpretations of requirements, especially those set out in conventions (including ILO Convention 115) and standards. Given the statutory responsibilities and the long tradition of the IAEA in the relevant field, this organization may wish to take the lead in this international harmonization effort. As part of this effort, the internationally recommended quantities and units should be used worldwide.

It also concluded that:

To achieve the goal of better integrating radiation protection with general health and safety, the IAEA, with its specific radiation safety remit, and ILO, with its overall worker safety remit, should consider collaborating more closely, especially in establishing and strengthening occupational radiation protection in developing countries.

However, the Geneva Conference also noted that:

The international organizations should avoid unnecessary changes in standards of occupational radiation protection, so that regulatory stability can be maintained and implementation carried through.

**Action:** ILO, supported by the IAEA, to take steps to further promote the ratification and implementation of ILO Convention 115.

*Desired outcome:* Increased Member State ratification and implementation.

**Action:** ILO to consider whether there is a need to review the procedures for requesting from Member States information on the implementation of ILO Convention 115 and to review the types of information being requested, so that peer reviews of occupational radiation protection programmes become more effective. Lessons learned from the application of the reporting criteria applied under the Convention on Nuclear Safety (IAEA document INFCIRC/449) may be a useful input.

*Desired outcomes:*

- Strengthened ability of ILO, the IAEA and particular stakeholders such as regulators, employers, workers and radiation protection professionals to highlight areas where further action might appropriately be taken to strengthen occupational radiation protection, particularly in developing countries.
- Strengthened capacity in Member States to demonstrate that their occupational radiation protection programmes are ensuring the required standards of protection.
- More widespread good practices following peer reviews.

*Timing:* Both actions should commence within a year of the approval of the action plan.

**Action:** The IAEA and ILO to continue to co-operate in the development of guidance and informatory material that will assist in the interpretation of requirements set out in conventions and standards, and in the conduct of further IAEA intercomparisons of monitoring methods for assessing occupational exposure.

*Desired outcome:* Strengthened application of international standards, and harmonization of the use of internationally agreed quantities and assessment methods.

*Timing:* The action should commence as soon as the action plan is approved.

### **The ILO code of practice on “Radiation protection of workers (ionising radiations)”**

This code of practice, published in 1987, has continued to be used by all three parties in ILO (workers, employers and governments) as the basis for protection standards to be observed in activities involving exposure of workers to ionizing radiation. However, there are differences between the terminology used in this code of practice and that used in more recent ICRP advice/guidance and in IAEA Safety Series documents and safety guides on occupational radiation protection that have been co-sponsored by ILO, and the view has been expressed that the terminology used in the code of practice may need further consideration.



**Action:** ILO, in consultation with the IAEA, to consider the concerns over the terminology used in the code of practice and determine the most appropriate means of addressing them.

*Desired outcome:* Harmonized and, if possible, simplified terminologies and interpretations of requirements.

*Timing:* The action should commence within a year of approval of the action plan.

### **Co-operation between the IAEA and ILO in reaching developing countries**

The Geneva Conference called for closer co-operation between the IAEA and ILO in strengthening occupational radiation protection in developing countries. The IAEA's programme for strengthening radiation protection infrastructures was described above under "Relevant Current IAEA and ILO Activities". The IAEA has a contact/focal point in each country receiving assistance through this programme, while ILO has a well-established field structure that could be of use to the programme. The ILO regional, sub-regional and country offices maintain close links with departments of labour and social security and workers' and employers' organizations in various sectors, including ones of direct relevance to radiation protection such as health care, nuclear power and mining. Through the ILO field structure, the IAEA could reach a wider range of stakeholders in implementing its occupational radiation protection programme; in addition, it could reach organizations in countries that are Member States of ILO but not of the IAEA.

**Action:** ILO to make the list of contact points in its Member States and field structure available to the IAEA, which should inform the contact points about the latest available standards, guidance and advice developed at the international level and invite their representatives to relevant workshops, seminars and conferences.

The participation of labour departments and of workers' and employers' organizations in the establishment of occupational radiation protection programmes as part of the IAEA Model Projects on upgrading radiation protection infrastructure should always be sought by the IAEA.

*Desired outcome:* Improved occupational radiation protection through the more effective utilization of in-country contacts.

*Timing:* The action should commence as soon as the action plan is approved.

### **Information exchange to promote greater awareness and understanding**

Several of the findings of the Geneva Conference relate to information exchange between interested parties: "better dissemination of information and lessons learned...", "...make widely available in appropriate forms, including via the internet and in local languages, analyses of and lessons learned from accidents...", "...consider whether systems similar to the ISOE could be established...".

Wider dissemination of information and more active involvement of workers, employers, regulators and radiation protection specialists in information exchange should lead

to a better and broader understanding of radiation protection practices and promote the evolution of safety cultures in the workplace.

**Action:** The IAEA, in consultation with ILO, to develop publicity materials in the form of posters and leaflets that target groups of workers identified as likely to benefit directly from the information provided - for example, workplace material designed to reduce the number of near misses and the risk of serious accidents.

The materials could include cautionary posters intended for display in areas where high-activity or high-dose rate sources such as irradiators and industrial radiography devices are used. They could contain arresting images that bring home the consequences of accidental exposure at high doses, in order to reinforce the need for safety procedures to be followed at all times. They would need to be prepared in local languages.

*Desired outcome:* Reduced occurrence of serious radiation accidents in the workplace.

*Timing:* The action should commence as soon as the action plan is approved.

**Action:** The IAEA to provide a focal point, on a website, where networks may be established for exchanges of information, experience and lessons learned between interested parties.

This action is designed to provide a forum for the exchange of information and experience. The Internet is now widely accessible from most parts of the world and provides an ideal medium for networking among people with shared interests. The European ALARA Network and the ISOE are good examples of such networks, as is ILO's International Occupational Safety and Health Information Centre with its national collaborating centres. Participants in the forum could exchange experience relating to, for example, the implementation and effectiveness of safety practices and strategies. The website should provide pages from which information can be downloaded and include links to other relevant websites, especially those of other international organizations, such as ILO and WHO.

*Desired outcome:* Shared practical radiation protection experience worldwide through networking, encouraging the evolution of international good practice in all workplaces.

*Timing:* The action should commence as soon as the action plan is approved.

## **Education and awareness**

### *Basic education for workers*

Occupationally exposed workers need to have a basic awareness and understanding of the risks posed by exposure to radiation and of the measures for managing those risks, so as:

- to enable them to understand the purpose of specific rules and procedures that they may be required to follow as part of the radiation protection programme, helping to ensure that the rules and procedures are followed and to foster a safety culture within the workforce;

- to allay any unnecessary concerns about their safety and health; and
- to enable them to play the role that corresponds to their importance as stakeholders.

**Action:** The IAEA, in consultation with ILO and drawing on the experience of trade unions and other stakeholder organizations, to prepare and disseminate suitable information materials to workers' representatives and labour educators in order to promote a better informed workforce and better understanding generally among those concerned with exposure to radiation.

This action will involve the development of education packages on the basic principles and terminology of radiation protection, the health risks associated with exposure to radiation, and the measures for managing those risks. In addition, it should include the development of packages tailored to specific sectors (e.g. mining, oil and gas production, raw materials processing and medicine) and to specific practices (e.g. industrial radiography and interventional radiology). The IAEA should continue to have prime responsibility for the implementation of such education packages, which should be done on a "train the trainers" basis, through regional training courses, workers' organizations or employers' organizations, and should make use of existing ILO structures. The materials should be suitable for specific target audiences (end users) and be translated as necessary (they should be available at least in the six official languages of the United Nations).

*Desired outcome:* A better informed and more involved workforce, leading to improved safety systems and to the evolution of a strong safety culture in the workplace.

*Timing:* The action should commence within a year of approval of the action plan.

#### *Education and awareness-raising of medical professionals*

Exposures of workers in conventional radiology, both radiodiagnosis and radiotherapy, are generally well controlled. There are, however, new areas of medical practice, especially interventional radiology, in which there is a potential for very high exposures to be received.

Attention needs to be paid to the control and reduction of such exposures, and this requires continued efforts in graduate and postgraduate education and in awareness-raising of the medical professionals involved.

**Action:** The IAEA, in consultation with professional medical bodies such as the International Society of Radiology, to critically examine existing postgraduate education and awareness-raising packages for medical professionals, including those now being produced by ICRP, to establish the need for the development of further material, to develop further material as necessary and to disseminate the material developed.

*Desired outcome:* Increased awareness of particularly hazardous procedures among medical staff involved in applying those procedures.

*Timing:* The action should commence within a year of approval of the action plan.

A *Manual on Radiation Protection in Hospitals and in General Practice*, jointly sponsored by the EC, the IAEA, ILO, PAHO and WHO, is to be published by WHO in due course. Although the drafting of the Manual has apparently reached an advanced stage, there is uncertainty about when the Manual will be finalized.

**Action:** The IAEA, together with other co-sponsoring organizations, to engage with WHO in establishing the status of the draft Manual, and to encourage its finalization, publication and use as soon as possible.

*Desired outcome:* Effective use of the Manual.

*Timing:* The action should commence immediately the action plan is approved.

### **Exposure to enhanced natural radiation in the workplace**

The Geneva Conference concluded that clearer guidance was needed to assist regulatory bodies in deciding what activities to regulate and how to apply a suitable graded approach to the regulation of enhanced natural radiation that is compatible with protection against exposures from artificial sources.

The IAEA has already initiated a programme of work on exposure to natural radiation, based on recommendations made at a technical committee meeting on *The Assessment of Occupational Protection Conditions in Workplaces with High Levels of Exposure to Natural Radiation* held in May 2001. Some aspects of that programme have been described above under “Relevant Current IAEA and ILO Activities”, with an indication of those industries which are being given priority attention.

**Action:** In support of this programme, the IAEA to assist authorities in identifying activities involving exposure to natural radiation that may need to be controlled, and to generate and disseminate additional sector-specific information on radioactivity levels, exposure conditions, and chemical and physical characteristics of airborne pollutants in workplaces involving naturally occurring radioactive material.

Some aspects of this action could be covered in a co-ordinated research programme planned for 2004-2005.

*Desired outcome:* A completed programme of work related to natural radiation and dissemination of the relevant guidance.

*Timing:* The action should commence within a year of approval of the action plan.

### **Promotion of a holistic approach to workplace safety**

It is important that radiation protection and other safety measures in the workplace not conflict with each other - that, more positively, they reinforce each other in the overall context of safety awareness and safety culture. Considerable information relevant to a holistic approach to workplace safety can be obtained from meetings such as the 4<sup>th</sup> European ALARA Network meeting on “Management of occupational radiological and non-radiological risks” held in November 2000, which considered - inter alia - risks associated with asbestos, carbon monoxide, acrylamides and non-ionizing radiation.

A related question discussed during the Geneva Conference was the level of ambition in countries with widely different available resources. It was concluded that the basic limitation of risk through dose limits should be the same everywhere, but that the results of optimization of protection could differ in the light of the local availability of resources and the competing social demands on resources - especially when the resources are very scarce.

**Action:** The IAEA and ILO to collaborate in devising strategies for achieving a better understanding between radiation protection practitioners on one hand and occupational health and safety practitioners on the other and for developing coherent approaches to safety in the workplace.

*Desired outcome:* A better co-ordinated and integrated occupational health and safety approach covering all hazards in the workplace.

*Timing:* The action should commence within a year of approval of the action plan.

### **Formulation and application of standards for the protection of pregnant workers and their embryos and foetuses**

Presentations were made at the Geneva Conference which indicated that, in the case of certain radionuclides, some possible exposure routes for pregnant workers and their embryos and foetuses might not have been properly identified and that there might be a need for further international guidance on the formulation and application of standards for their protection.

Although there is no firm evidence that this issue has become one of major concern in most countries, it is important to determine whether it needs to be considered at the international level.

**Action:** The IAEA to review current information on this issue in order to determine whether the issue warrants action at the international level. In addition to the work described in the presentations made at the Geneva Conference, relevant work has been done in a number of countries and by a number of bodies (such as ICRP).

**Further action:** If the review shows that the issue needs to be considered at the international level, the IAEA to design and circulate a questionnaire with the objective of determining how countries are currently addressing the issue and what problems they are encountering and, on the basis of the responses to the questionnaire, determine whether it would be appropriate to develop international guidance.

*Desired outcome:* A report clarifying whether the issue requires action at the international level and, if the conclusion is that it does, further appropriate action.

*Timing:* The action should commence within a year of approval of the action plan.

### **Probability of causation of occupational harm attributable to radiation exposure**

ILO Convention 121 (1964), concerning benefits in cases of employment injury, provides, in its Schedule 1, for compensation for diseases caused by ionizing radiation. The

Geneva Conference noted, however, that occupationally exposed workers may develop diseases similar to those developed by members of the general public, including cancers. Some of these diseases may be attributable to radiation exposure at work, and a mechanism for deciding on attributability is essential. In several countries, mechanisms using probability-of-causation schemes based on dose records and agreed risk factors are being applied. Such schemes, which need to be agreed between employers and workers, can provide for rapid and appropriate compensation to workers or their dependents.

At the Geneva Conference, it was noted that dose reconstruction is an essential component of compensation schemes and the view was expressed that the international organizations should continue discussions directed towards the preparation of guidelines for assisting in the establishment of compensation schemes. An informal IAEA/ILO/WHO meeting was held in December 2000 to develop joint international guidance for decision aiding on the probability of causation from occupational exposure. The meeting produced a report on *The potential for developing joint international guidance for aiding decision making on attributing cases of detrimental health effects to occupational exposure to ionizing radiations*, including concrete recommendations for further work on this issue.

**Action:** The IAEA, in collaboration with ILO, WHO, NEA and other relevant bodies and drawing on the experience of other stakeholders, to continue its work on developing international guidance for aiding decision-making on the attribution of cases of detrimental health effects to occupational exposure to ionizing radiation.

*Desired outcome:* Internationally agreed protocols and procedures assisting in the implementation of probability-of-causation agreements.

*Timing:* The action should commence within a year of approval of the action plan.