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Measures to Strengthen International Co-operation in Nuclear, Radiation and Transport Safety and Waste Management

Report by the Director General

Purpose

- The purpose of this document is to obtain the Board's approval of draft Action Plans for:
  - the safety and security of radioactive sources; and
  - occupational radiation protection.[1]
- The Action Plans are intended to provide direction for work to be undertaken in future – starting with the 2004-2005 programme and budget cycle - and to indicate the priority levels of the activities involved.

Recommended Action by the Board

- It is recommended that the Board approve, for implementation within the framework of the Agency's approved programme,

(a) the draft Action Plan for the Safety and Security of Radioactive Sources contained in Annex 1, and request the Director General to implement it;

(b) the draft Action Plan for Occupational Radiation Protection contained in Annex 2, and request the Director General to implement it in co-operation with ILO.

[1] The draft Action Plan for Occupational Radiation Protection was prepared in co-operation with the Secretariat of the International Labour Organization (ILO).

Measures to Strengthen International Co-operation in Nuclear, Radiation and Transport Safety and Waste Management

Report by the Director General

A. Background

Safety and Security of Radioactive Sources

1. The International Conference on Security of Radioactive Sources took place from 10 to 13 March 2003 at the Hofburg Palace in Vienna, Austria.[2] It resulted in a number of findings regarding the promotion of greater international co-operation in addressing the security concerns raised by insufficiently controlled radioactive sources, the identification of those sources which pose the greatest risks, and the promotion of strong national action by all States to minimize those risks over the whole life-cycle of radioactive sources. The President of the Conference identified two major findings:

1.1. *High-risk radioactive sources that are not under secure and regulated control, including so-called "orphan" sources, raise serious security and safety concerns. Therefore, an international initiative to facilitate the location, recovery and securing of such radioactive sources throughout the world should be launched under the IAEA's aegis.*

1.2. *Effective national infrastructures for the safe and secure management of vulnerable and dangerous radioactive sources are essential for ensuring the long-term security and control of such sources. In order to promote the establishment and maintenance of such infrastructures, States should make a concerted effort to follow the principles contained in the Code of Conduct on the Safety and Security of Radioactive Sources that is currently being revised as well as the security requirements in the BSS. In this context, the identification of roles and resposibilities of governments, licensees and international organizations is vital. Therefore, an international initiative to encourage and assist governments in their efforts to establish effective national infrastructures and to fulfil their responsibilities should be launched under the IAEA's aegis, and the IAEA should promote broad adherence to the Code of Conduct once its revised version has been approved.*

The complete findings of the President of the Conference are available under the website address http://www.iaea.org/worldatom/Press/Focus/RadSources/PDF/findings.pdf

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[2] United States Secretary of Energy Spencer Abraham presided over the Hofburg Conference, which was co-sponsored by the Government of the Russian Federation and the Government of the United States of America, hosted by the Government of Austria, and organized by the Agency in co-operation with the European Commission, the World Customs Organization, the International Criminal Police Organization (ICPO-Interpol) and the European Police Office (EUROPOL).

2. Work relating to the safety and security of radioactive sources has been part of the Agency's programme for implementing the requirements of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (usually referred to as the BSS)[3]. The Agency's Board of Governors, following the International Conference on the Safety of Radiation Sources and the Security of Radioactive Material held in Dijon, France, in September 1998 (the Dijon Conference), approved the *Action Plan for the Safety of Radiation Sources and the Security of Radioactive Materials* (Attachment 2 to GOV/1999/46-GC(43)/10). Following the International Conference of National Regulatory Authorities with Competence in the Safety of Radiation Sources and the Security of Radioactive Materials held in Buenos Aires in December 2000 (the Buenos Aires Conference), the Board approved the *Revised Action Plan for the Safety and Security of Radiation Sources* (Attachment to GOV/2001/29-GC(45)/12), the status of whose implementation is reported on in the Appendix to Annex 1. Following the events of 11 September 2001, the Board approved a plan of activities for protecting against nuclear terrorism (GOV/2002/10)[4], including activities (Activity Area IV in Annex 2 to that document) designed to strengthen national security measures relating to radioactive material other than nuclear material and to ensure that significant, uncontrolled radioactive sources are brought under regulatory control and are properly secured. The Action Plan and the Nuclear Security Plan of Activities have been supported by a large number of Member States and have been further reinforced in the findings of the President of the Hofburg Conference. Recently, the Heads of States and Government of the Group of Eight (G-8) adopted at Evian, France, a statement in support of securing radioactive sources.[5]

3. The findings of the President of the Hofburg Conference included a recommendation that the Agency "revisit the revised Action Plan for the Safety and Security of Radiation Sources and adjust it as appropriate." Such an adjusted draft Action Plan for the Safety and Security of Radioactive Sources has been prepared by the Secretariat pursuant to this recommendation of the Hofburg Conference and is contained in Annex 1 to this document.

Occupational Radiation Protection

4. The International Conference on Occupational Radiation Protection: Protecting Workers against Exposure to Ionizing Radiation took place at the Headquarters of ILO, Geneva, from 26 to 30 August 2002.[6] The findings and recommendations of the Conference were made available in a Note by the Secretariat (2002/Note 23).

5. In September 2002, the General Conference, in resolution GC(46)/RES/9.A, requested the 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, subject to the availability of resources, an international action plan for occupational radiation protection in the light of, inter alia, the findings and recommendations of the *International Conference on Occupational Radiation Protection* held in Geneva from 26 to 30 August 2002".

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[3] The BSS were approved by the Agency's Board of Governors on 12 September 1994.
[4] This plan is generally referred to as the Nuclear Security Plan of Activities.
[5] In that statement, the G-8 welcomed "the findings of the 2003 Conference on Security of Radioactive Sources" and recognized "the essential role of the International Atomic Energy Agency in combating radiological terrorism" and endorsed "its efforts to establish international standards that ensure the long term security and control of high-risk radioactive sources."
[6] The International Conference on Occupational Radiation Protection: Protecting Workers against Exposure to Ionizing Radiation was hosted by the Government of Switzerland and presided over by Dr. Thomas Zeltner, Director of the Swiss Federal Office of Public Health. It was organized by the Agency, which convened it jointly with ILO, was co-sponsored by the European Commission and was held with the co-operation of the World Health Organization and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) and also of the United Nations Scientific Committee on the Effects of Atomic Radiation, the International Commission on Radiological Protection, the International Commission on Radiation Units and Measurements, the International Electrotechnical Commission, the International Radiation Protection Association and the International Society of Radiology. It was attended by 324 participants from 70 countries and 13 organizations.

6. The draft Action Plan for Occupational Radiation Protection is contained in Annex 2 to this document.

Draft Action Plan for Safety and Security of Radioactive Sources:

Pursuant to the Findings of the President of the International Conference on Security of Radioactive Sources

BACKGROUND

The International Conference on Security of Radioactive Sources took place from 10 to 13 March 2003 at the Hofburg Palace in Vienna, Austria. It resulted in a number of findings of the President of the Conference regarding the promotion of greater international co-operation in addressing the security concerns raised by insufficiently controlled radioactive sources, the identification of those sources which pose the greatest risks, and the promotion of strong national action by all States to minimize those risks over the whole life-cycle of radioactive sources. The findings are available under the website address

http://www.iaea.org/worldatom/Press/Focus/RadSources/PDF/findings.pdf

Work relating to the safety and security of radioactive sources has been part of the Agency's programme for implementing the requirements of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (usually referred to as the BSS). The Agency's Board of Governors, following the International Conference on the Safety of Radiation Sources and the Security of Radioactive Material held in Dijon, France, in September 1998 (the Dijon Conference), approved the *Action Plan for the Safety of Radiation Sources and the Security of Radioactive Materials* (Attachment 2 to GOV/1999/46-GC(43)/10). Following the International Conference of National Regulatory Authorities with Competence in the Safety of Radiation Sources and the Security of Radioactive Materials held in Buenos Aires in December 2000 (the Buenos Aires Conference), the Board approved the *Revised Action Plan for the Safety and Security of Radiation Sources* (Attachment to GOV/2001/29-GC(45)/12), the status of whose implementation is reported on in the Appendix hereto. Following the events of 11 September 2001, the Board approved in principle a list of specific proposals for protecting against nuclear terrorism (GOV/2002/10)[1], including activities designed to strengthen national security measures relating to radioactive material other than nuclear material and to ensure that significant, uncontrolled radioactive sources are brought under regulatory control and are properly secured (Activity Area IV in Annex 2 to that document).

The findings of the President of the Hofburg Conference included a recommendation that the Agency "revisit the revised Action Plan for the Safety and Security of Radioactive Sources and adjust it as appropriate."

[1] This plan is generally referred to as the Nuclear Security Plan of Activities.

Following these developments, the Secretariat has reviewed the Revised Action Plan, and the text of the proposed Action Plan resulting from this review is described below. (A number of actions that relate to the safety and security of radioactive sources, which are included in other Agency plans and programmes, particularly the Nuclear Security Plan of Activities, are also mentioned for completeness). The review was performed with the assistance of senior experts, taking into account lessons learned from the implementation of the Revised Action Plan (Attachment to GOV/2001/29-GC(45)/12), the Nuclear Security Plan of Activities and the Code of Conduct on the Safety and Security of Radioactive Sources.

ACTIVITIES

1. Enhancing control of radioactive sources

One of the two major findings of the President of the Hofburg Conference was that effective national infrastructures for the safe and secure management of vulnerable and dangerous radioactive sources are essential for ensuring the long-term security and control of such sources. In order to promote the establishment and maintenance of such infrastructures, States should make a concerted effort to follow the principles contained in the Code of Conduct on the Safety and Security of Radioactive Sources, as well as the security requirements in the BSS. In this context, the identification of roles and responsibilities of governments, licensees and international organizations is vital.

The activities referred to above are primarily concerned with the prevention of loss of control over radioactive sources and contribute to enhancing security. They cover assistance to countries to help them establish effective regulatory infrastructures and national plans related to both radioactive source safety and security. Given the importance of ensuring that effective control is practised worldwide, non-Member States of the IAEA will be included, whenever possible.

(a) International initiative

The President of the Hofburg Conference also found that "an international initiative[2] should be launched under the aegis of the IAEA to encourage and assist governments in their efforts to establish effective national infrastructures and to fulfil their responsibilities"[3]. Such an initiative will include the following actions:

i. The development of a co-ordinated overall international strategy for the provision of assistance to States where high-risk vulnerable sources are used, stored or transported based on each State's particular needs.

ii. Undertaking assistance activities, upon request by States, to:
   a) appraise the State's legislative and regulatory control of sources;
   b) assist in developing or improving legislative and regulatory infrastructure, and;
   c) assist with the development and implementation of a national plan of action for improved management of radioactive sources throughout their life cycle.

   These activities may be implemented in the form of stand-alone national strategy missions or as part of other missions, such as the Radiation Safety Infrastructure Appraisal (RSIA) service or others specifically tailored to reviewing security arrangements.

iii. The revision of the Agency's Regulatory Authority Information System (RAIS) to meet the management and record-keeping needs of a regulatory authority and, particularly to facilitate States' implementation of the revised Code of Conduct.

iv. The provision of RAIS and necessary supporting software and hardware to assist in the regulatory control of radioactive sources, particularly those posing a high risk.

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[2] The Hofburg Conference also found that IAEA Model Project for upgrading radiation protection infrastructure could serve as a model for implementing these initiatives.

[3] This subject will also be addressed at the International Conference on National Infrastructure for Radiation Safety, Morocco, September 2003.

(b) Implementation of the Code of Conduct

Assistance in the implementation of the Code of Conduct will include:

i. The promotion of the use of appropriate mechanisms (as outlined in Activity Area VII of the Nuclear Security Plan of Activities[4]) to encourage States to adhere to the Code of Conduct.
ii. An assessment by applicable IAEA missions of the degree of implementation of the Code of Conduct by the host country.
iii. The continuation of dialogue with manufacturers and suppliers of radioactive sources, regulatory bodies and users on the appropriate means of controlling the export, use and return of radioactive sources consistent with the relevant provisions of the Code of Conduct.
iv. Assistance to manufacturers and suppliers of radioactive sources in the development of an appropriate Code of Practice that defines their roles and responsibilities during the life cycle of high-risk sources.

(c) Establishing recommendations, guidance, norms and standards

The following additional activities related to documents, which are consistent with the revised Action Plan and the Nuclear Security Plan of Activities, are envisioned:

Guidance in support of the Code of Conduct

i. The development of a standardized format proposed to be used for national registers of radioactive sources in order to facilitate the efficient exchange of information between States.

ii. The promotion of the development of internationally agreed procedures for importing and exporting radioactive sources.

iii. The development of a standardized format proposed to be used in connection with the authorization of radioactive sources to facilitate the exchange of information between Member States, particularly with respect to import/export controls.

iv. The compilation, maintenance and publication of a list of contact details of competent national regulatory bodies.

Guidance on safety and security

v. The completion of the guide on the Safety and Security of Radioactive Sources.

vi. The development of a Safety Guide based on the "Categorization of radioactive sources" (TECDOC-1344).

vii. The completion of the development of recommendations on security in the transport of radioactive material. These recommendations will be complementary to both the Agency's "Regulations for the Safe Transport of Radioactive Material" (TS-R-1) and the recommendations in connection with the security of transports of nuclear material that are currently contained in INFCIRC/225/Rev. 4.

Guidance on assessments and national strategies

viii. The development of a methodology for assessing threats to, and vulnerabilities of radioactive materials consignments as potential targets for terrorist acts.

ix. The development of a threat-based risk assessment methodology for radioactive sources, to assist States wishing to implement the guidance given in document "Security of Radioactive Sources" (TECDOC-1355).

x. The development of a procedure to enable appraisals of security measures for radioactive sources to be conducted in a manner consistent with TECDOC-1355 for use, inter alia, during expanded IPPAS missions.

xi. The finalization of the document on "National strategies for improving control over radioactive sources".

[4] GOV/2002/10, Annex 2.

xii. The development of guidance to assist States in performing their own assessments of their degree of control over radioactive sources.

Practice-specific guidance and technical standards

xiii. The development of guidelines on the application of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources to specific practices involving the use of radioactive sources, including gauges, well logging, and research.

xiv. Support for the work of the International Standards Organization in the development of standards for source design, construction and testing to take into account concerns related to malicious use for high-risk sources.

(d) Promoting research and development

A number of research and development activities are envisaged:

i. In co-operation with national laboratories and radioactive source manufacturers, exploration of the feasibility of source designs and institutional measures that will minimize the consequences from malicious use.
ii. The continuation of co-ordinated research into disposal options for sealed sources, including establishing and gaining international consensus on:
    a) Standards for borehole disposal.
    b) Assessment methods and approaches to demonstrate compliance with standards.
    c) Demonstration of the feasibility of the technology.
    d) Assistance to Member States on development and licensing of facilities.

    [These latter actions are part of the Action Plan on the Safety of Radioactive Waste Management.]

(e) Providing direct technical services and advice to Member States with regard to high-activity disused sources

To deal with high activity disused radioactive sources, particularly those in developing Member States, the following actions will be carried out:

i. Assistance in the development, certification and use of shipping containers for the safe return of disused or conditioned radioactive sources.
ii. Assistance with the design and construction of operational areas for handling and conditioning spent high activity radioactive sources.
iii. Provision of advice on the design and construction of long-term storage containers for radioactive sources.
iv. Assistance on conditioning of long-lived radioactive sources.

2. Enhancing security of high-risk radioactive sources and protecting them against malicious acts

The other major finding of the President of the Hofburg Conference was that high-risk radioactive sources that are not under secure and regulated control, including so-called "orphan" sources, raise serious security and safety concerns. Controls on radioactive sources make a major contribution to ensuring their security. There are however additional measures that enhance security. The required activities, which should address the potential malicious use of *"high-risk radioactive sources that are not under secure and regulated control"*, are primarily remedial and combine work currently being performed as part of the Tripartite Initiative on Securing and Managing Radioactive Sources in the Newly Independent States of the former Soviet Union and in Activity Area IV of the Nuclear Security Plan of Activities.

The President of the Conference also identified the need for an international initiative to facilitate the location, recovery and securing of such radioactive sources throughout the world, under the IAEA's aegis[5]. It is now proposed to incorporate such an initiative in the Action Plan including the following actions:

i. A meeting will be convened of experts from Member States to consider how best to globalize the efforts relating to the security of high-risk radioactive sources.
ii. A project management group will be set up. Its activities will include the facilitation of partnerships between States.
iii. Missions will be conducted, upon request, to identify, locate, and assess the security of radioactive sources, with emphasis on high-risk vulnerable sources.
iv. The application of IAEA guidance, including that given in TECDOC-1355, and the national design basis threat methodology, to determine upgraded security needs will be promoted.
v. Appraisals of security measures for radioactive sources based on TECDOC-1355 will be conducted (e.g. using expanded IPPAS missions).
vi. Assistance to implement the recommendations from the appraisal missions will be provided.

An associated programme of work is being performed to combat illicit trafficking of radioactive sources. These activities are included in Activity Area II and VIII of the Nuclear Security Plan of Activities[6]. They aim at helping States establish effective measures to detect, interdict and respond to incidents of theft, illicit possession and illicit nuclear trafficking by providing, on request, assessment services, advisory services on border monitoring, training and technical support, including state of the art detection equipment.

3. Promoting education and training

Education and training have always been seen by the various relevant Conferences as fundamental to safety and security of radioactive sources. The relevant activities in this Action Plan will be done in a manner consistent with the Agency's current 'Strategy for Education and Training in Radiation Protection and Waste Safety' and with the training envisaged in the Nuclear Security Plan of Activities. The activities are:

i. The organization of national strategy workshops on a regional basis.
ii. The development of practice-specific training modules for those involved in the use of gauges, radioisotope production and well logging.
iii. The organization of regional and/or national training workshops on the search and recovery of high-risk orphan radioactive sources.
iv. The organization of workshops on the establishment of a design basis threat for the protection of radioactive sources.
v. The organization of training courses on the control and physical protection of radioactive sources, consistent with TECDOC-1355 and with the guidance on security in transport being developed.
vi. The provision of training in public information skills in connection with radiological threats, including any actions to be taken when a radioactive source or device is found.
vii. The development of a roster of qualified experts that can contribute to the above courses and workshops.

4. Response to emergencies

The President of the Conference recommended that States develop comprehensive plans for preparing for and responding to radiological emergencies involving sources. The findings particularly envisage more co-operation in and strengthening of the mechanism within States for the provision of assistance under the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

[5] The finding also noted that the recent so-called Tripartite Initiative of the Governments of the Russian Federation and the United States of America and the IAEA to secure radioactive sources in the Newly Independent States of the former USSR could serve as a model for the implementation of these activities.
[6] GOV/2002/10, Annex 2.

Some of these activities are included in Activity Area VI of the Nuclear Security Plan of Activities, while others are being developed as a follow up to the meetings of the Competent Authorities identified under this Convention and the Convention on Early Notification of a Nuclear Accident. The following two activities are highlighted here since they were part of the Revised Action Plan of 2001.

i. The completion of the development of the organizational structure and the criteria for emergency teams as well as the training of responders.
ii. The completion of the establishment of the Emergency Response Network (ERNET) and the further development of its operational capability.

5. Fostering information exchange

Information exchange will continue to be an important part of the work and will include the following activities:

i. The convening of an international conference in France in 2005 to review progress in improving the safety and security of radioactive sources and the experience gained with the implementation of the Code of Conduct and this Action Plan.
ii. The completion and distribution of the radiation events database software (RADEV).
iii. The completion of the development of the radiation-warning symbol for high activity sources, in conjunction with the ISO.

STATUS OF PROGRESS IN THE IMPLEMENTATION OF THE ACTIONS CONTAINED IN THE REVISED ACTION PLAN FOR THE SAFETY AND SECURITY OF RADIATION SOURCES

(Attachment to GOV/2001/21-GC(45)/12)

REGULATORY INFRASTRUCTURE

Completed Actions

- The following documents have been completed or are nearing completion:
  - A Safety Guide on regulatory infrastructure for radiation protection and for the safety of radiation sources in medicine, agriculture, research, industry and education. This was renamed "A Safety Guide on the Organization and Implementation of a System for the Control of Radiation Sources in Medicine, Agriculture, Research, Industry and Education", and is awaiting approval by the Committee on Safety Standards.
  - A Safety Report on approaches for the establishment of regulatory infrastructure for radiation safety. This was completed as "A Safety Report on Legislation and Establishment of a Regulatory Body for the Control of Radiation Safety".
  - Safety Reports on model regulations for specific practices. Reports were produced for industrial irradiators, industrial radiography and nuclear gauges.
- A Radiation Safety Regulatory Infrastructure (RSRI) review service has been established with the purpose of assisting in the development of, or assessing the effectiveness of, regulatory infrastructure for radiation safety. A brochure advertising this service has been published. This service has since been renamed the Radiation Safety Infrastructure Appraisal (RSIA) service.
- A document on 'Review of Radiation Safety at Industrial Irradiator Facilities' has been completed.
- A feedback mechanism for peer review services was developed.

Ongoing Actions

The following actions are continuing:

- The development of a methodology and supporting documentation to enable Member States to perform self-assessment of their radiation protection infrastructures. The feasibility and utility of using the document "Assessment by Peer Review of the Effectiveness of a Regulatory Programme for Radiation Safety, Interim Report for Comment" (TECDOC-1217) is being considered in this regard.
- Encouragement of Member States to perform such self-assessments with the purpose of identifying weaknesses in their radiation protection infrastructures.
- Promotion of mutual assistance between States with the purpose of improving radiation protection infrastructures using regional networks.
- Work on the Model Project for Upgrading Radiation Protection Infrastructure.

SOURCE MANAGEMENT AND CONTROL, INCLUDING THE MANAGEMENT OF DISUSED SOURCES

Completed Actions

The following documents or activities have been completed:

- A document on the management of high-activity disused sources, which has been published (TECDOC-1301).

- Procedures for the conditioning and storage of long-lived spent sealed sources, which has also been published (TECDOC-1357).
- The Technical Committee report on the Return of Disused Sealed Sources to Suppliers/Manufacturers.
- A meeting with manufacturers and suppliers to discuss the return of spent sources, ways to enhance tracking of sources during their lifecycle, compliance with the Revised Code of Conduct and the development of sources less vulnerable to dispersion.

Ongoing Actions

- Development of guidance that includes the essential components of a quality management system relating to the life cycle of Category 1 and 2 radioactive sources (as defined in document "Categorization of Sources" (TECDOC-1191)) and associated devices, including computerized devices. This was investigated but, following the advice of consultants, this action is indefinitely postponed (Standards organizations have already produced similar documents).
- Coordination of research and advice to Member States on the management of disused sources, including disposal in boreholes.
- Completion of a Safety Guide on the Safety and Security of Radiation Sources after comments are received on TECDOC-1355, "Security of radioactive sources".
- Development of the infrastructure to provide direct assistance to condition sealed sources in Member states that do not have the required infrastructure (mobile kit).

CATEGORIZATION OF SOURCES

Completed Actions

A revised Categorization of radioactive sources (TECDOC-1344) has been published.

RESPONSE TO ABNORMAL EVENTS

Completed Actions

- Three documents on prevention (TECDOC-1311), detection (TECDOC-1312) and response (TECDOC-1313) to inadvertent movement and illicit trafficking in radioactive material have been published.
- Standardized regional and national radiological emergency response training courses are being finalized for publication.
- The following reports were also completed and, in a number of cases, both 2000 and 2002 versions issued.
    - Nuclear Accident/Radiological Emergency Assistance Plan (EPR-NAREAP 2000).
    - IAEA Emergency Response Network (EPR-ERNET 2000 and 2002).
    - Joint Radiation Emergency Management Plan of the International Organizations (EPR-JPLAN 2000 and 2002).
    - Emergency Notification and Assistance Technical Operations Manual (EPR-ENATOM 2000 and 2002).
- The Emergency Notification and Assistance web-site (ENAC) is operational.
- A first meeting of the Competent Authorities identified under the Early Notification and Assistance Conventions was held as planned and a second meeting took place in June 2003.
- The Emergency Preparedness Review Service was made available to all Member States, and especially those with identified regulatory infrastructure weaknesses.
- A TECDOC on emergency response exercises with off-the-shelf exercises for radiological response along with associated training material was prepared and is expected to be published in 2003.

- Ten teams were established under ERNET.
- In collaboration with WHO, standardized training material on medical response preparedness was published as a CD ROM.

Ongoing Actions

- A TECDOC on "National Strategies for Detecting and Locating Orphan Sources and their Subsequent Management" is being completed and should be issued in 2003.
- A TECDOC on public information management during radiological emergencies is in an advanced draft and is being supplemented by material for deliberate acts.
- Completion of the establishment of ERNET and further development of its operational capability is under way.
- The development of the organizational structure and criteria for emergency teams and the training of IAEA responders is continuing.

INFORMATION EXCHANGE

Completed actions:

- An International Conference on Security of Radioactive Sources was held in March 2003.
- Regional Action Plan workshops to raise the regional level of awareness of the objectives of the Action Plan were held in Vienna, Bangkok, Kazakhstan, Mexico City and Tokyo.
- The action requiring an international database on missing and found orphan sources was completed as a simple list on the ENAC web page.
- A catalogue of information on the characteristics of sources and of devices containing sources, including transport containers has been created. Dissemination of this information is being considered.
- A list server to facilitate communication amongst those involved with radiation source safety both on a regional and world wide basis was developed and made available.
- An integrated web site devoted to the safety of radiation sources and security of radioactive materials with information on relevant meetings, courses and workshops as well as links to related documents and databases, has been created.
- Lessons learned from all the information exchange processes are routinely being incorporated into the development and revision of training material.

Ongoing Actions

- The development of an international database on unusual radiation events (RADEV) is almost completed. Periodic reports from the RADEV data, covering trends and lessons to be learned, will be distributed. The software will then be made available to Member States for them to use in establishing their own national database. Member States will be encouraged to use RADEV to collect and disseminate information and lessons learned from unusual events.
- Consideration was given to ways to clarify, modify and rationalize where necessary, the objectives and inter-relationships among the different IAEA databases concerning radiation sources and events. The objectives and distinctions of the databases were clarified and are described on OASIS but consolidation of the databases was not considered feasible.
- No action has been taken on the proposal to establish and support regional networks to promote further informal mutual assistance, pending further feedback on the effectiveness of the similar regional ALARA networks.

- Development of an adaptable communications "tool kit" both in print and CD-ROM to enable Member States to effectively communicate key messages regarding the safety and security of radioactive sources to groups such as: government authorities, users, customs officers, scrap metal and foundry workers, emergency response personnel, magistrates and the general public, is almost complete.
- Additional data continue to be added to the catalogue of radioactive sources.

EDUCATION AND TRAINING

Education and training have been seen by the Agency, for many years, as an essential pre-requisite to any successful radiation protection programme. Standardized practice-specific training modules with special consideration to the practices covered by Category 1 and 2 sources from the Categorization of radiation sources (TECDOC-1191 version) were developed and others are ongoing.

INTERNATIONAL UNDERTAKINGS

Completed Actions

- Member States were consulted on their experience in implementing the Code of Conduct with the purpose of compiling and disseminating a list of best practices.
- Following the consultations on the effectiveness of the Code of Conduct a meeting was convened in 2002, with a follow up meeting in March 2003 and a Revised Code of Conduct on the Safety and Security of Radioactive Sources was developed for Member State comment.
- A final meeting to review a draft Revised Code of Conduct on the Safety and Security of Radioactive Sources in July 2003 resulted in a revised Code to be submitted to the Board and General Conference in September 2003 (GOV/2003/49-GC(47)/9).

Ongoing Actions

- A project to develop a universal system of labelling for high activity sources was initiated and meetings held in 2002 and 2003. Agreement with ISO was obtained for this project. Candidate signs are now being prepared for wider testing. A communications plan to raise public awareness regarding the labelling system is being considered.

Draft 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.*

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 draft Action Plan.

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

* The proceedings of the Geneva Conference will be published by the Agency in the near future.

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 4th 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.