Radiation protection of workers

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The purpose of this Information note is to provide information about the size of the workforce affected by, and the occupational activities associated with, exposure to radiation and the relevant ILO instruments on the protection of workers.

Radiation and the world of work

Ionizing radiations are part of the human environment (for example, cosmic rays and naturally occurring radioactive materials). They include X-rays and gamma rays (electromagnetic radiations) as well as corpuscular radiations (subatomic particles: alpha, beta and neutron radiations). Ionizing radiations can induce acute effects (for example, burns) and long-term effects (for example, cancer and hereditary diseases), which are also known as non-stochastic (deterministic) and stochastic effects.

Radioactive sources are used throughout the world for a wide variety of beneficial purposes in industry, medicine, research, agriculture and education. The combination of improved health services and an ageing population has resulted in an increased use of radionuclides and radiation in diagnosis and treatment. The threat of terrorism, the potential malicious use of radioactive sources, cost-related pressure and the spread of the use of nuclear devices oblige government authorities to take radiation protection and safety more seriously than ever before.

Green energy production and the rise of nuclear power

The demand for electricity is rapidly increasing in many developing countries. The use of nuclear power to produce electricity involves almost no CO₂ emissions. Climate change and
concerns about natural fossil fuels have thus once again put the use of nuclear power in the spotlight of political and public debate. Sufficient and affordable energy is essential for sustainable economic and social development in any society and is critical for poverty reduction and decent work.

In many industrialized countries, nuclear power is already a major source of electricity. Some developing countries, in particular those in transition, are increasingly relying on nuclear power to solve their shortages. In April 2011, 1 439 nuclear power reactors, with an installed electric net capacity of about 375 GW, were in operation in 31 countries.

At present 60 nuclear power reactors, with an installed capacity of 64 GW, are under construction in 14 countries, as follows: 27 in China, ten in the Russian Federation, five each in the Republic of Korea and India, two each in Canada, Japan and Slovakia, and one each in Argentina, Brazil, Finland, France, the Islamic Republic of Iran, Pakistan and the United States.

Table 1. Nuclear share in electricity production, 2009 (per cent)

<table>
<thead>
<tr>
<th>&gt; 70</th>
<th>&gt; 50</th>
<th>&gt; 40</th>
<th>&gt; 30</th>
<th>&gt; 20</th>
<th>&gt; 10</th>
<th>&lt; 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithuania 76.2</td>
<td>Slovakia 53.5</td>
<td>Ukraine 48.6</td>
<td>Switzerland 39.5</td>
<td>Japan 28.9</td>
<td>United Kingdom 17.9</td>
<td>Argentina 7.0</td>
</tr>
<tr>
<td>France 75.2</td>
<td>Belgium 51.7</td>
<td>Armenia 45.0</td>
<td>Slovenia 37.9</td>
<td>Germany 26.1</td>
<td>Russian Federation 17.8</td>
<td>Mexico 4.8</td>
</tr>
<tr>
<td>Hungary 43.0</td>
<td>Bulgaria 35.9</td>
<td>Romania 20.6</td>
<td>Spain 17.5</td>
<td>South Africa 4.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korea, Rep. of 34.8</td>
<td>United States 20.2</td>
<td>Canada 14.8</td>
<td>Netherlands 3.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden 34.7</td>
<td>United States 20.2</td>
<td>Canada 14.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Rep. 33.8</td>
<td>Brazil 3.0</td>
<td>Pakistan 2.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finland 32.9</td>
<td>India 2.2</td>
<td>China 1.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: http://www.world-nuclear.org/info/reactors.html

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Worker exposure to radiation in the world of work

The use of radioactive sources involves risks due to radiation exposure. Exposure to ionizing radiation occurs in many occupations. Artificial sources of radiation are commonly used in the manufacturing and service industries, in defence industries, in research institutions and universities, and in the nuclear power industry. They are extensively used by physicians and health professionals in diagnosis and in the treatment of diseases.

Some workers are also exposed to natural sources of radiation. This is particularly true of exposure to radon in mines and in ordinary workplaces in areas where radon levels are high. The dose limits are 20 mSv/year for occupational exposure (for workers engaged in radiation work) and 1 mSv/year for the general public (see Appendix I).

Table 2. Global occupational exposures associated with artificial and natural sources of radiation

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of workers monitored (2000–2002)</th>
<th>Average level of exposure (mSv/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear fuel cycle</td>
<td>660 000</td>
<td>1</td>
</tr>
<tr>
<td>Natural radiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal mining</td>
<td>13 050 000</td>
<td>2.9</td>
</tr>
<tr>
<td>Other mining</td>
<td>6 900 000</td>
<td>2.4</td>
</tr>
<tr>
<td>Workplaces other than mines</td>
<td>4 600 000</td>
<td>3.0</td>
</tr>
<tr>
<td>Aircrew</td>
<td>1 250 000</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>300 000</td>
<td>3.0</td>
</tr>
<tr>
<td>Medical uses</td>
<td>7 440 000</td>
<td>0.5</td>
</tr>
<tr>
<td>Industrial activities</td>
<td>869 000</td>
<td>0.3</td>
</tr>
<tr>
<td>Military activities</td>
<td>331 000</td>
<td>0.1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>565 000</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>22 915 000</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Note: “Nuclear fuel cycle” includes uranium mining, milling and enrichment, fuel fabrication, reactor operation, reprocessing and research; “natural radiation” includes civil aviation, coal mining, other mineral mining, oil and natural gas industries, and workplace exposure to radon other than in mines; “medical uses” includes diagnostic radiology, dental radiology, nuclear medicine, radiotherapy and all other medical uses; “industrial activities” includes industrial irradiation, industrial radiography, luminizing, radioisotope production, well logging, accelerator operation and all other industrial uses; “miscellaneous” includes educational establishments, veterinary uses and other occupations.

With the exception of mining, average doses from most types of occupational exposure from artificial sources, including the nuclear industry, are now below 2 mSv per year. The dose in some mines could be much higher than the average doses shown in table 2. For example, in underground gold mines in South Africa the average annual dose in 2000 was 7 mSv and among the 123,333 workers in gold mines, 3,700 workers received doses above 20 mSv/year. The estimated average dose rate using individual monitoring for the mineworkers in Abu-Tartur phosphate mine tunnels is 15.55 mSv/year. While doses in the health professions – medical, dental and veterinary – are generally very low, some clinical procedures involving diagnostic radiology require the physician to be close to the patient and at risk of appreciable exposure. For example, the occupational dose per procedure (at thyroid level) for coronary angiography and percutaneous transluminal coronary angioplasty (PTCA) is 0.43 mSv, and for cardiac catheter ablation it is 0.28 mSv (left eye) and 0.2 mSv (thyroid). The annual effective doses incurred by positron emission tomography (PET) workers were reported to be 8 mSv.

About one fifth of the people considered to be occupationally exposed to enhanced natural radiation work in shops, offices, schools and other premises in radon-prone areas. Within these areas, the average dose is appreciable. The average dose for such workers is almost 5 mSv per year – higher than for the other groups of occupationally exposed workers.

Doses to aircrew from cosmic rays depend on the routes flown and the flying time. On average, the annual dose is around 3 mSv, but could be twice as much for long flights continually at high altitudes. By the nature of the radiation and the operations, such doses are unavoidable. With the relatively high dose rates experienced in air travel as a result of the elevated levels of cosmic rays at flying altitudes, some authorities consider that supervision is also required for aircrew.

The international regulation of the protection of workers against radiation

Radiation protection is part of the ILO’s action on the protection of workers against sickness, disease and injury arising out of employment, as mandated by the Organization’s Constitution.
In June 1960, the International Labour Conference adopted the Radiation Protection Convention, 1960 (No. 115), and its accompanying Recommendation (No. 114) (see Appendix II). The Convention applies to all activities involving the exposure of workers to ionizing radiations in the course of their work and provides that each Member of the ILO which ratifies it shall give effect to its provisions by means of laws or regulations, codes of practice or other appropriate means. So far, this ILO Convention has been the only international legal instrument on the protection of workers against radiation.

The requirements stipulated in Convention No. 115 and Recommendation No. 114 include restricting the exposure of workers to ionizing radiations to the lowest practicable level and avoiding any unnecessary exposure, keeping dose limits for various categories of workers under constant review in the light of current knowledge, fixing appropriate dose limits for workers aged 18 and over and for workers under the age of 18, and prohibiting workers under the age of 16 from working with ionizing radiations. A major contribution by the ILO to radiation protection is the promotion of the right of workers to safety and health while working with radiation, which includes participation, employer and worker cooperation, training and information.

Convention No. 115 has been ratified by 48 countries. Of these, the following have nuclear power plants: Argentina, Belgium, Brazil, Czech Republic, Finland, France, Germany, Hungary, India, Japan, Mexico, Netherlands, Russian Federation, Slovakia, Spain, Sweden, Switzerland, Ukraine and United Kingdom. A further four are planning and proposing to have nuclear power reactors: Egypt, Italy, Poland and Turkey.

Harmonized international standards and guidance not only allow resources to be used effectively and prevent duplication of efforts, but also create synergy and maximize the impact of the relevant standards formulated separately by the collaborating organizations. The ILO attaches importance to cooperation with other international organizations on the protection of workers against radiation through joint development and the preparation of international standards and guidance.

ILO participation in the work of the Radiation Safety Standards Committee (RASSC) established by the International Atomic
Energy Agency (IAEA) ensures that employers’ and workers’ representatives and organizations participate directly in the formulation by the IAEA and other international organizations of international standards on radiation safety and on protection against occupational exposure to radiation. In the past, employers and workers did not have the opportunity to participate fully and systematically in developing the international standards which they were to apply.

An important outcome of the international cooperation in the field of radiation safety and protection has been the development of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). The BSS are co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the IAEA, the ILO, the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), the Pan American Health Organization (PAHO) and the World Health Organization (WHO), and were formally published in 1996. The BSS provide a worldwide basis for harmonized radiation protection standards that complement the ILO Convention. All the sponsoring organizations of the BSS have worked closely in the harmonization and development of international standards and policies on radiation protection and safety, and have promoted the application of the BSS in their own fields of competence. Operations undertaken with the assistance of one of the other co-sponsoring organizations apply the BSS in the light of the relevant rules and regulations of the particular organization concerned.

For the ILO, the BSS are used to support the implementation of Convention No. 115 and guide those whose duty it is to promote protection against occupational exposure to radiation at the national and enterprise levels. The BSS are also used by the ILO supervisory machinery to review and examine the application and implementation of Convention No. 115 and Recommendation No. 114 by member States.

Given their co-sponsorship by four United Nations (UN) specialized agencies and two international organizations, the BSS are regarded as “the” UN system requirements concerning radiation protection. The same is now true for Convention No. 115.

It is worth pointing out that the BSS are part of the IAEA safety standards. According to the established rules of the IAEA,
its safety standards are binding on the IAEA in relation to its own operations and on countries in relation to operations assisted by the IAEA. The IAEA has been promoting these standards through its technical cooperation Model Project on Upgrading Radiation Protection Infrastructure in more than 100 countries. This Model Project helps member States to establish the infrastructure needed to adhere to the BSS. A concrete outcome of the IAEA Model Project is that the project countries have incorporated the BSS into their national laws, regulations and standards, providing a good basis to meet the requirements embodied in Convention No. 115 and Recommendation No. 114.

Within this framework of international cooperation, a variety of technical standards, requirements, guidelines, guides and technical documents have been developed. For example, the FAO and the WHO have established, through the Codex Alimentarius Commission, guideline levels for radioactive substances in foodstuffs moving in international trade. The WHO produces guidelines for drinking water quality that include criteria to assess safety with respect to radionuclide content. In the event of nuclear and radiological emergencies, both the IAEA and the WHO have a role to play in providing technical assistance in relation to safety and health. In the field of the protection of workers (including emergency workers) against radiation, the IAEA and the ILO have jointly prepared a number of international guides on protection against occupational exposure to radiation, which include guidance on: protecting against occupational exposure to radiation in general; assessing occupational exposure, whether internal or external; protecting workers against radiation in the mining and milling of radioactive ores; controlling exposure to natural radiations at work; protecting emergency workers; monitoring the health of persons exposed to ionizing radiation at work; and protecting against radiation in hospitals and general practices. A more detailed listing of the IAEA/ILO joint publications can be found in Appendix III.
Appendix I

Excerpt from the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996, co-sponsored by the FAO, IAEA, ILO, OECD/NEA, PAHO and WHO)

Schedule II

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Occupational exposure

Dose limits

II-5. The occupational exposure of any worker shall be so controlled that the following limits be not exceeded:
   (a) an effective dose of 20 mSv per year averaged over five consecutive years;¹
   (b) an effective dose of 50 mSv in any single year;
   (c) an equivalent dose to the lens of the eye of 150 mSv in a year; and
   (d) an equivalent dose to the extremities (hands and feet) or the skin² of 500 mSv in a year.

II-6. For apprentices of 16 to 18 years of age who are training for employment involving exposure to radiation and for students of age 16 to 18 who are required to use sources in the course of their studies, the occupational exposure shall be so controlled that the following limits be not exceeded:
   (a) an effective dose of 6 mSv in a year;

¹ The start of the averaging period shall be coincident with the first day of the relevant annual period after the date of entry into force of the Standards, with no retroactive averaging.

² The equivalent dose limits for the skin apply to the average dose over 1 cm² of the most highly irradiated area of the skin. Skin dose also contributes to the effective dose, this contribution being the average dose to the entire skin multiplied by the tissue weighting factor for the skin.
(b) an equivalent dose to the lens of the eye of 50 mSv in a year; and
(c) an equivalent dose to the extremities or the skin\textsuperscript{2} 1 of 150 mSv in a year.

Special circumstances

II-7. When, in special circumstances,\textsuperscript{3} a temporary change in the dose limitation requirements is approved pursuant to Appendix I:

(a) the dose averaging period mentioned in paragraph II-5(a) may exceptionally be up to ten consecutive years as specified by the Regulatory Authority, and the effective dose for any worker shall not exceed 20 mSv per year averaged over this period and shall not exceed 50 mSv in any single year, and the circumstances shall be reviewed when the dose accumulated by any worker since the start of the extended averaging period reaches 100 mSv; or

(b) the temporary change in the dose limitation shall be as specified by the Regulatory Authority but shall not exceed 50 mSv in any year and the period of the temporary change shall not exceed five years.

Public exposure

Dose limits

II-8. The estimated average doses to the relevant critical groups of members of the public that are attributable to practices shall not exceed the following limits:

(a) an effective dose of 1 mSv in a year;

(b) in special circumstances, an effective dose of up to 5 mSv in a single year provided that the average dose over five consecutive years does not exceed 1 mSv per year;

\textsuperscript{3} See Appendix I: the provisions for “alternative employment” set out in paragraph 418 may be relevant.
(c) an equivalent dose to the lens of the eye of 15 mSv in a year; and
(d) an equivalent dose to the skin of 50 mSv in a year.
Appendix II

**Convention 115**

**CONVENTION CONCERNING THE PROTECTION OF WORKERS AGAINST IONISING RADIATIONS**

The General Conference of the International Labour Organisation,

Having been convened at Geneva by the Governing Body of the International Labour Office, and having met in its Forty-fourth Session on 1 June 1960, and

Having decided upon the adoption of certain proposals with regard to the protection of workers against ionising radiations, which is the fourth item on the agenda of the session, and

Having determined that these proposals shall take the form of an international Convention,

adopts this twenty-second day of June of the year one thousand nine hundred and sixty the following Convention, which may be cited as the Radiation Protection Convention, 1960:

**PART I. GENERAL PROVISIONS**

*Article 1*

Each Member of the International Labour Organisation which ratifies this Convention undertakes to give effect thereto by means of laws or regulations, codes of practice or other appropriate means. In applying the provisions of the Convention the competent authority shall consult with representatives of employers and workers.

*Article 2*

1. This Convention applies to all activities involving exposure of workers to ionising radiations in the course of their work.

2. This Convention does not apply to radioactive substances, whether sealed or unsealed, nor to apparatus generating ionising radiations which substances or apparatus, owing to the limited doses of ionising radiations which can be received from them, are exempted from its provisions by one of the methods of giving effect to the Convention mentioned in Article 1.

*Article 3*

1. In the light of knowledge available at the time, all appropriate steps shall be taken to ensure effective protection of workers, as regards their health and safety, against ionising radiations.

*Ed.: This Convention came into force on 17 June 1962.*
2. Rules and measures necessary for this purpose shall be adopted, and data essential for effective protection shall be made available.

3. With a view to ensuring such effective protection:
   (a) measures for the protection of workers against ionising radiations adopted after ratification of the Convention by the Member concerned shall comply with the provisions thereof;
   (b) the Member concerned shall notify, as soon as practicable, measures adopted by it prior to the ratification of the Convention, so as to comply with the provisions thereof, and shall promote such modification of other measures existing at the time of ratification;
   (c) the Member concerned shall communicate to the Director-General of the International Labour Office, when ratifying the Convention, a statement indicating the manner in which and the categories of workers to which the provisions of the Convention are applied, and shall indicate in its reports on the application of the Convention any further progress made in the matter;
   (d) at the expiration of three years from the date on which this Convention first enters into force the Governing Body of the International Labour Office shall submit to the Conference a special report concerning the application of subparagraph (b) of this paragraph and containing such proposals as it may think appropriate for further action in regard to the matter.

PART II. PROTECTIVE MEASURES

Article 4

The activities referred to in Article 2 shall be so arranged and conducted as to afford the protection envisaged in this Part of the Convention.

Article 5

Every effort shall be made to restrict the exposure of workers to ionising radiations to the lowest practicable level, and any unnecessary exposure shall be avoided by all parties concerned.

Article 6

1. Maximum permissible doses of ionising radiations which may be received from sources external to or internal to the body and maximum permissible amounts of radioactive substances which can be taken into the body shall be fixed in accordance with Part I of this Convention for various categories of workers.

2. Such maximum permissible doses and amounts shall be kept under constant review in the light of current knowledge.

Article 7

1. Appropriate levels shall be fixed in accordance with Article 6 for workers who are directly engaged in radiation work and are:
   (a) aged 18 and over;
   (b) under the age of 18.
2. No worker under the age of 16 shall be engaged in work involving ionising radiations.

Article 8

Appropriate levels shall be fixed in accordance with Article 6 for workers who are not directly engaged in radiation work, but who remain or pass where they may be exposed to ionising radiations or radioactive substances.

Article 9

1. Appropriate warnings shall be used to indicate the presence of hazards from ionising radiations. Any information necessary in this connection shall be supplied to the workers.

2. All workers directly engaged in radiation work shall be adequately instructed, before and during such employment, in the precautions to be taken for their protection, as regards their health and safety, and the reasons therefor.

Article 10

Laws or regulations shall require the notification in a manner prescribed thereby of work involving exposure of workers to ionising radiations in the course of their work.

Article 11

Appropriate monitoring of workers and places of work shall be carried out in order to measure the exposure of workers to ionising radiations and radioactive substances, with a view to ascertaining that the applicable levels are respected.

Article 12

All workers directly engaged in radiation work shall undergo an appropriate medical examination prior to or shortly after taking up such work and subsequently undergo further medical examinations at appropriate intervals.

Article 13

Circumstances shall be specified, by one of the methods of giving effect to the Convention mentioned in Article 1, in which, because of the nature or degree of the exposure or a combination of both, the following action shall be taken promptly:

(a) the worker shall undergo an appropriate medical examination;

(b) the employer shall notify the competent authority in accordance with its requirements;

(c) persons competent in radiation protection shall examine the conditions in which the worker’s duties are performed;

(d) the employer shall take any necessary remedial action on the basis of the technical findings and the medical advice.

Article 14

No worker shall be employed or shall continue to be employed in work by reason of which the worker could be subject to exposure to ionising radiations contrary to qualified medical advice.
Article 15

Each Member which ratifies this Convention undertakes to provide appropriate inspection services for the purpose of supervising the application of its provisions, or to satisfy itself that appropriate inspection is carried out.

Part III. Final provisions

Article 16

The formal ratifications of this Convention shall be communicated to the Director-General of the International Labour Office for registration.

Article 17

1. This Convention shall be binding only upon those Members of the International Labour Organisation whose ratifications have been registered with the Director-General.

2. It shall come into force twelve months after the date on which the ratifications of two Members have been registered with the Director-General.

3. Thereafter, this Convention shall come into force for any Member twelve months after the date on which its ratification has been registered.

Article 18

1. A Member which has ratified this Convention may denounce it after the expiration of five years from the date on which the Convention first comes into force, by an act communicated to the Director-General of the International Labour Office for registration. Such denunciation shall not take effect until one year after the date on which it is registered.

2. Each Member which has ratified this Convention and which does not, within the year following the expiration of the period of five years mentioned in the preceding paragraph, exercise the right of denunciation provided for in this Article, will be bound for another period of five years and, thereafter, may denounce this Convention at the expiration of each period of five years under the terms provided for in this Article.

Article 19

1. The Director-General of the International Labour Office shall notify all Members of the International Labour Organisation of the registration of all ratifications and denunciations communicated to him by the Members of the Organisation.

2. When notifying the Members of the Organisation of the registration of the second ratification communicated to him, the Director-General shall draw the attention of the Members of the Organisation to the date upon which the Convention will come into force.

Article 20

The Director-General of the International Labour Office shall communicate to the Secretary-General of the United Nations for registration in accordance with Article 102 of the Charter of the United Nations full particulars of
all ratifications and acts of denunciation registered by him in accordance with the provisions of the preceding Articles.

\textit{Article 21}

At such times as it may consider necessary the Governing Body of the International Labour Office shall present to the General Conference a report on the working of this Convention and shall examine the desirability of placing on the agenda of the Conference the question of its revision in whole or in part.

\textit{Article 22}

1. Should the Conference adopt a new Convention revising this Convention in whole or in part, then, unless the new Convention otherwise provides:
   (a) the ratification by a Member of the new revising Convention shall ipso jure involve the immediate denunciation of this Convention, notwithstanding the provisions of Article 18 above, if and when the new revising Convention shall have come into force;
   (b) as from the date when the new revising Convention comes into force this Convention shall cease to be open to ratification by the Members.

2. This Convention shall in any case remain in force in its actual form and content for those Members which have ratified it but have not ratified the revising Convention.

\textit{Article 23}

The English and French versions of the text of this Convention are equally authoritative.
Recommendation 114

RECOMMENDATION CONCERNING THE PROTECTION OF WORKERS AGAINST IONISING RADIATIONS

The General Conference of the International Labour Organisation,
Having been convened at Geneva by the Governing Body of the International Labour Office, and having met in its Forty-fourth Session on 1 June 1960, and
Having decided upon the adoption of certain proposals with regard to the protection of workers against ionising radiations, which is the fourth item on the agenda of the session, and
Having determined that these proposals shall take the form of a Recommendation supplementing the Radiation Protection Convention, 1960, adopts this twenty-second day of June of the year one thousand nine hundred and sixty the following Recommendation, which may be cited as the Radiation Protection Recommendation, 1960:

I. General provisions

1. This Recommendation should be given effect to by means of laws or regulations, codes of practice or other appropriate means. In applying the provisions of the Recommendation the competent authority should consult with representatives of employers and workers.

2. (1) This Recommendation applies to all activities involving exposure of workers to ionising radiations in the course of their work.

   (2) This Recommendation does not apply to radioactive substances, whether sealed or unsealed, nor to apparatus generating ionising radiations which substances or apparatus, owing to the limited doses of ionising radiations which can be received from them, are exempted from its provisions by one of the methods of giving effect to the Recommendation mentioned in Paragraph 1.

3. For the purpose of giving effect to paragraph 2 of Article 3 of the Radiation Protection Convention, 1960, every Member should have due regard to the recommendations made from time to time by the International Commission on Radiological Protection and standards adopted by other competent organisations.

II. Maximum permissible levels

4. The levels referred to in Articles 6, 7 and 8 of the Radiation Protection Convention, 1960, should be fixed with due regard to the relevant values recommended from time to time by the International Commission on Radiological Protection. In addition, maximum permissible concentrations of radioactive substances in such air and water as can be taken into the body should be fixed on the basis of these levels.

5. Appropriate measures of collective and individual protection should be taken to ensure that the maximum permissible levels referred to in Articles 6, 7 and 8 of the Radiation Protection Convention, 1960, are not exceeded and
that the maximum permissible concentrations referred to in Paragraph 4 are not exceeded for such air and water as may be taken into the body.

III. COMPETENT PERSON

6. The employer should appoint a competent person to deal on behalf of the undertaking with questions of protection against ionising radiations.

IV. METHODS OF PROTECTION

7. (1) In cases where they ensure effective protection preference should be given to methods of collective protection, both physical and operational.

(2) Wherever methods of collective protection are inadequate, personal protective equipment and, as necessary, appropriate protective procedures should be used.

8. (1) All protective devices, appliances and apparatus should be so designed or modified as to fulfil their intended purpose.

(2) All appropriate measures should be taken to provide for regular examination of these devices, appliances and apparatus, in order to determine whether they are in good condition, are operating satisfactorily, are properly sited and provide the required protection; in particular they should be examined before being put into use and whenever changes are made in procedures, equipment or shielding.

(3) Any defects found in these devices, appliances and apparatus should be remedied at once; if necessary, the equipment to which they are fitted should be taken immediately out of service and kept out of service until the defects have been remedied.

(4) The competent authority should require the inspection in an appropriate manner and at regular intervals of major items of protective equipment and in particular of monitoring equipment.

9. (1) Unsealed sources should be manipulated with due regard to their toxicity.

(2) The methods of manipulation should be chosen with a view to minimising the risk of entry of radioactive substances into the body and the spread of radioactive contamination.

10. Plans should be made in advance for measures:

(a) to detect as promptly as possible any leakage from, or breakage of, a sealed source of radioactive substances which may involve a risk of radioactive contamination; and

(b) to take prompt remedial action to prevent the further spread of radioactive contamination and to apply other appropriate safety precautions, including decontamination procedures, with, as necessary, the immediate collaboration of all authorities concerned.

11. Sources which may involve exposure of workers to ionising radiations, and the areas in which such an exposure may occur or where workers may be exposed to radioactive contamination, should be identified, in appropriate cases, by means of easily recognisable warnings.

12. All sources of radioactive substances, whether sealed or unsealed, in use or stored by an undertaking, should be appropriately recorded.
13. (1) The competent authority should require any employer or undertaking using or having possession of radioactive substances to make reports as prescribed by it on the use of these substances.

(2) The competent authority should prescribe the conditions under which such substances should be stored when not in use.

14. No radioactive substance should be transferred to another employer or undertaking without such notification as may be required by the competent authority.

15. (1) Any person who has reason to believe that a radioactive source has been lost, mislaid, stolen or damaged should immediately notify the competent person referred to in Paragraph 6 above or, if this is not possible, another responsible person who should pass the information to the competent person as soon as possible.

(2) If the loss, theft or damage is confirmed, the competent authority should be notified without delay.

16. In view of the special medical problems involved in the employment of women of child-bearing age in radiation work every care should be taken to ensure that they are not exposed to high radiation risks.

V. Monitoring

17. (1) Appropriate monitoring of workers and places of work should be carried out in order to measure the exposure of workers to ionising radiations and radioactive substances, with a view to ascertaining that the applicable levels are respected.

(2) In the case of external radiation, this monitoring should be effected by films, dosemeters or other suitable means.

(3) In the case of internal radiation, when there is reason to believe that the maximum permissible levels may be approached or have been exceeded, this monitoring should include tests:

(a) for radioactive contamination;

(b) if practicable, for body burden.

(4) In addition to measurement of the exposure of the whole body, the monitoring should make it possible to determine the partial exposure of that part of the body where the greatest harm could be done.

18. The competent authority should, where appropriate, require tests to be made for the purpose of detecting contamination of the hands, the body and the clothes of persons leaving a workplace.

19. Persons who carry out monitoring in pursuance of the provisions of the Radiation Protection Convention, 1960, and of this Recommendation, should be afforded adequate equipment and facilities for carrying out this work.

VI. Medical examinations

20. All medical examinations referred to in the Radiation Protection Convention, 1960, should be carried out by a suitably qualified physician.

21. In the cases referred to in Article 13 of the Radiation Protection Convention, 1960, all necessary special medical examinations should be carried out.
22. The medical examinations referred to in the preceding Paragraphs should not involve the workers in any expense.

23. Physicians who carry out such medical examinations should be afforded adequate facilities for ascertaining the conditions of work of the workers concerned.

24. For all workers who undergo such medical examinations health records should be established and kept in accordance with the requirements of the competent authority.

25. These health records should be in a form standardised at the national level.

26. So far as practicable a complete record of all doses received in the course of work by every worker specified in Paragraph 24 of this Recommendation should be kept so that the cumulative dose may be taken into account for employment purposes.

27. If, as the result of such medical advice as is envisaged in Article 14 of the Radiation Protection Convention, 1960, it is inadvisable to subject a worker to further exposure to ionising radiations in that worker's normal employment, every reasonable effort should be made to provide such a worker with suitable alternative employment.

VII. Inspection and notification

28. The inspection services referred to in Article 15 of the Radiation Protection Convention, 1960, should include, or have readily available, a sufficient number of persons fully conversant with radiation hazards and qualified to advise on protection against ionising radiations.

29. (1) Representatives of these inspection services should be empowered to take steps with a view to the remedying of defects observed in installations, apparatus or working methods which they may have reasonable cause to believe constitute a threat to the health or safety of the workers by reason of ionising radiations.

(2) In order to enable representatives of the inspection services to take such steps they should be empowered, subject to any right of appeal to a judicial or administrative authority which may be provided by laws or regulations, to make or to have made orders requiring:

(a) such alterations to the installation or plant, to be carried out within a specified time limit, as may be necessary to secure compliance with the provisions relating to the health or safety of the workers;

(b) measures with immediate executory force if the danger to the health or safety of the workers makes this necessary.

30. (1) Every member should provide for measures to control the distribution and use of sources of ionising radiations.

(2) These measures should include —

(a) the notification to the competent authority, as prescribed by it, of the delivery of such sources;

(b) before work involving exposure of workers to ionising radiations is undertaken for the first time and before substantial extensions or alterations to
apparatus or installations emitting ionising radiations or affording pro-
tection against them are carried out, the notification to the competent
authority, as prescribed by it, of information concerning the nature of
the apparatus or installation and of the measures provided for protection
against ionising radiations.

31. The employer should notify the competent authority, as prescribed
by it, of a final cessation of work involving exposure of workers to ionising
radiations.

VIII. CO-OPERATION OF EMPLOYERS AND WORKERS

32. Every effort should be made by both the employers and the workers
to secure the closest co-operation in carrying out the measures for protection
against ionising radiations.
Appendix III

ILO instruments and publications on the protection of workers against radiation

Radiation Protection Convention, 1960 (No. 115)
Radiation Protection Recommendation, 1960 (No. 114)
Employment Injury Benefits Convention, 1964 (No. 121)
Employment Injury Benefits Recommendation, 1964 (No. 121)
List of Occupational Diseases Recommendation, 2002 (No. 194)
Occupational Cancer Convention, 1974 (No. 139)
Occupational Cancer Recommendation, 1974 (No. 147)


—: Technical and ethical guidelines for workers’ health surveillance, Occupational Safety and Health Series No. 72 (Geneva, 1998).

—: Radiation protection of workers (ionising radiations), an ILO code of practice (Geneva, 1987).

—: Guidelines for the radiation protection of workers in industry (ionising radiations): Requirements for control of exposure to radiation of workers engaged in radiation work in specific installations and practices, Occupational Safety and Health Series No. 62 (Geneva, 1989).

—: Radiation protection in the mining and milling of uranium and thorium, proceedings of a symposium organized by the ILO and the French Atomic Energy Commission, in cooperation with the WHO and IAEA and held in Bordeaux, France, 9–11 September 1974, Occupational Safety and Health Series No. 32 (Geneva, 1976).

Main publications jointly developed by the ILO and other international organizations


IAEA: Arrangements for preparedness for a nuclear or radiological emergency: Safety guide, Safety Standards Series No. GS-G-2.1
(Vienna, 2007). Jointly sponsored by the FAO, IAEA, ILO, OCHA, PAHO and WHO.


—: *Occupational radiation protection in the mining and processing of raw materials: Safety guide*, Safety Standards Series No. RS-G-1.6 (Vienna, 2004). Jointly sponsored by the IAEA and ILO.


—: *Radiation monitoring in the mining and milling of radioactive ores*, Safety Series No. 95 (Vienna, 1989). Jointly sponsored by the IAEA, ILO and WHO.


—: *Radiation protection against radon in workplaces other than mines*, Safety Reports Series No. 33 (Vienna, 2003). Jointly sponsored by the IAEA and ILO.


Radiation protection of workers
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