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Safe Handling of Radioisotopes

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The Agency's Statute was approved on 26 October 1956 at an international conference held at the United Nations Headquarters. The Agency came into being when the Statute entered into force on 29 July 1957. The first session of the General Conference was held in Vienna, Austria, the permanent headquarters of the Agency, in October, 1957.

The main objective of the Agency is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

One of the means towards this objective is to foster the exchange of scientific and technical information on the peaceful uses of atomic energy.

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FOREWORD

1. Under its Statute the International Atomic Energy Agency is empowered to provide for the application of standards of safety for protection against radiation to its own operations and to operations making use of assistance provided by it or with which it is otherwise directly associated. To this end authorities receiving such assistance are required to observe relevant health and safety measures prescribed by the Agency.
2. As a first step, it has been considered an urgent task to provide users of radioisotopes with a manual of practice for the safe handling of these substances. Such a manual is presented here and represents the first of a series of manuals and codes to be issued by the Agency. It has been prepared after careful consideration of existing national and international codes of radiation safety, by a group of international experts and in consultation with other international bodies.
3. At the same time it is recommended that the manual be taken into account as a basic reference document by Member States of the Agency in the preparation of national health and safety documents covering the use of radioisotopes.
4. This manual is issued by the Agency as a provisional document which will be subject to revision from time to time. Any comments submitted to the International Atomic Energy Agency's secretariat will be welcome.
5. It is intended to provide in due course technical and medical addenda to this manual to give more complete advice to the user on specialized topics.

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1. INTRODUCTION

1.1. SCOPE

- 1.1.1. This Manual is provided as a guide to the safe handling of radioisotopes. It is hoped that it should be helpful particularly to small scale users who may not have direct access to other sources of information.
- 1.1.2. Large scale users and those with specialized experience may prefer to adopt other procedures which are known to provide equivalent or even superior protection. Other published guides can be recommended when appropriate to specialized fields of application. It is presumed that those using radioisotopes in the practice of their profession (radiologists etc.), will supplement the recommendations of the Manual by application of their normal professional training.
- 1.1.3. The Manual does, of course, not prevent the application of more stringent and more extensive instructions that may possibly be in force in some countries.
- 1.1.4. This Manual contains a series of recommendations which should be interpreted with scientific judgement in their application to a particular problem. The choice of wording is intentionally precise and the user must understand its implication before departing from any recommendation.
- 1.1.5. As most natural objects contain some radioactive material, it is clear that the provisions of the Manual are not intended to apply below a certain limiting degree of radioactivity. This lower limit can be taken as a concentration of .002 microcuries per gram of material, or a total activity in the working area less than 0.1 microcuries. These limits are based on the most dangerous radioisotopes so that the use of somewhat higher limiting levels of activity is permissible provided the isotopes present are not the most dangerous. A guide to quantities of the less toxic isotopes which may be handled without special precautions is provided in column one of Table II and the provisions of paragraphs 3.1.10 and 3.1.11. In general, the relaxation of controls must be based on an assessment of the possibi-

lity of hazard, taking into account the nature of the material, operations and working facilities.

- 1.1.6. Treatment of all radioisotopes as potentially dangerous, however, is recommended for its training value and the protection it offers against misidentification.

1.2. DEFINITIONS

In general, technical terms are used with their accepted scientific meanings.

A few definitions of significant terms follow:

- 1.2.1. "Ionizing radiation": electromagnetic or corpuscular radiation capable of producing ions directly or indirectly in its passage through matter (for instance: alpha rays, beta rays, gamma rays, X-rays, neutrons).
- 1.2.2. "Sealed source": means a source of ionizing radiations that is firmly bonded within material or sealed in a cover of sufficient mechanical strength which excludes the possibility of contact with the radioisotope and the dispersion of the radioactive material into the environment under foreseeable conditions of use and wear.
- 1.2.3. "Unsealed source": means any other radioactive source.
- 1.2.4. "External radiation": radiation received by the body from radioactive sources external to it.
- 1.2.5. "Internal radiation": radiation received by the body from radioactive sources within it.
- 1.2.6. "Dose": a measure of the quantity of radiation delivered to a specified absorber.
- 1.2.7. "Radioactive contamination": the undesired presence of radioactive substances in or on any material.
- 1.2.8. "Adequate protection": protection against external radiations and against intake of radioactive material such that the radiation dose received by any person from sources external and/or internal to the body does not exceed the maximum permissible levels set for exposure by the competent authority.
- 1.2.9. "Installation": any accommodation or facility where radioactive substances are produced, processed, used or stored.

- 1.2.10. "Enclosed installation": an installation in which the radiation source and all objects exposed thereto are within a permanent enclosure:
- (a) to which no person has access, or within which no person (except those undergoing treatment) is permitted to remain during irradiation: and
 - (b) which affords under all practical operating conditions adequate protection for all persons outside the enclosure.
- 1.2.11. "Open installation": an installation which, due to operational requirements, e.g. the use of mobile equipment, does not meet the conditions specified for "enclosed installation".
- 1.2.12. "Competent authority": a national or international authority whose jurisdiction in the field of problems concerned applies to the activities of the installation considered.
- 1.2.13. "Controlled area": area in which exposures may exceed the permissible levels for non-occupationally exposed persons and therefore requires the supervision of a radiological officer.
- 1.2.14. The terms "Workers" or "Personnel" are used in the sense of including all persons potentially exposed to radiation or radioactive substances as a result of their occupation.

1.3. MAXIMUM PERMISSIBLE LEVELS FOR EXPOSURE TO EXTERNAL RADIATION AND TO RADIOACTIVE CONTAMINATION

- 1.3.1. Pending the issuing by the International Atomic Energy Agency of regulations on maximum permissible levels for exposure to external radiation and to radioactive contamination, it will be generally acceptable to this Agency if all work performed in installations using radioactive isotopes obtained through the International Atomic Energy Agency is in conformity with maximum permissible levels fixed by the competent authority.

- 1.3.2. As in most countries the setting of maximum permissible levels has been done on the basis of recommendations of the International Commission for Radiological Protection, for countries where such maximum permissible levels have not been fixed the recommendations of the International Commission for Radiological Protection of 1954 as subsequently amended in 1956 and 1958 are recommended as a common basis until such time as the regulations of the International Atomic Energy Agency may be issued.
- 1.3.3. A generally accepted maximum permissible level is often not available with respect to certain specific problems, particularly for surface contamination or waste disposal. The problem involved and useful working guides are given in the applicable sections of the Manual.

1.4. ORGANIZATION

- 1.4.1. *Principles.* Good radiation safety practice depends on an effective health and safety organization. Experience shows that even the most competent worker cannot be relied upon to keep in mind all health and safety requirements while preoccupied with the successful prosecution of his work. Responsibilities and duties must be set out clearly to assure safety.
- 1.4.2. *Responsibility of the authority in charge of the installation* The authority in charge of the installation is customarily held responsible for the radiological safety of both the workers and the general public. To meet those responsibilities it should ensure that the following actions are taken:
- 1.4.2.1. Health and safety rules (in conformity with this Manual) should be prepared for the areas in which radioactive material is to be handled.
- 1.4.2.2. All necessary operating instructions should be provided.
- 1.4.2.3. Suitable installation and equipment should be provided.
- 1.4.2.4. Provisions should be made for necessary medical supervision of the workers and for suitable medical casualty service.

- 1.4.2.5. Only persons medically suitable and adequately trained or experienced should be allowed to work with radioactive material.
- 1.4.2.6. All workers liable to exposure to ionizing radiation in the course of their work should be instructed about the health hazards involved in their duties.
Suitable training with reference to health and safety should be provided for all staff.
- 1.4.2.7. A person technically qualified to advise on all points of radiation safety should be employed or otherwise provided. In this Manual he will be referred to as the "radiological health and safety officer" although various titles are customary in different countries.
The authority in charge of the installation should consult this person on all points of radiation safety.
Appropriate means should be taken to ensure that all persons who may be exposed to radiation hazards know his name and how to get in touch with him. Any necessary alternates should be provided.
- 1.4.3. *Duties of the "radiological health and safety officer"*
The radiological health and safety officer's duties will vary somewhat according to the organizational structure of the group with which he is working and the degree of the hazard of the class of work undertaken. In general he will assist the authority in charge to carry out the latter's responsibilities for radiation protection. In the accomplishment of his duties, the "radiological health and safety officer" should call for advice or help upon professionally competent persons whenever necessary.
His work will usually include the following duties:
- 1.4.3.1. Any necessary administrative, technical and medical instructions concerning the radiation hazards and safe working practices relevant to the nature of the installation and work should be provided to all employees whose duties involve the handling of radioactive material and to all other employees who are not regularly employed in such work but who may occasionally be exposed to radiation and radioactive material. These instructions should be written, understandable, practicable and, whenever possible, posted.

- 1.4.3.2. All persons working with radioactive materials should be instructed in the use of all necessary safeguards and procedures and all visitors should be informed of pertinent precautions to be taken. They should be supplied with such auxiliary devices as may be necessary for protection. The "radiological health and safety officer" should ensure that every visitor has a proper authorization and should recommend that no unnecessary visit is made.
- 1.4.3.3. Radioactive material (including that in patients, animals and equipment) should be prevented from leaving the jurisdiction of the authority in charge under circumstances that may subject other persons to radiation in excess of the limits prescribed by the competent authority. The "radiological health and safety officer" should ensure that the proper arrangements for safe waste disposal are made.
- 1.4.3.4. Any area, inside or outside the installation should be ensured against subjection to radiation levels or concentrations of radioactive material exceeding the maximum permissible levels indicated by the competent authority for such a type of area.
- 1.4.3.5. The appropriate authorities (for instance the Fire Department) should be notified of the existence of any conditions or situations that, while not normally considered a radiation hazard, may become a hazard under special or unusual circumstances.
- 1.4.3.6. Measures should be taken to ensure that no modification of equipment or installations which might lead to unforeseen radiation hazards is made without provision of appropriate safeguards.
- 1.4.3.7. Measures should be taken to ensure that no radioactive material is dealt with by unauthorized people in the installation.
- 1.4.3.8. Suitable alternates or other means should be provided to ensure that necessary advice is available at all times in case of an emergency and the particular safety measures to be taken in such cases are provided for.
- 1.4.3.9. It should be established that suitable records are kept.
- 1.4.3.10. It should be established that the necessary tasks of monitoring, medical supervision and protection measures are carried out and properly co-ordinated.