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Department:  
Health  
REPUBLIC OF SOUTH AFRICA

**GUIDELINES REGARDING  
ORGANISATIONAL REQUIREMENTS  
FOR AUTHORITY HOLDERS AND THEIR  
APPOINTED RADIATION PROTECTION OFFICERS  
IN RESPECT OF GROUP IV HAZARDOUS SUBSTANCES**

## **ORGANISATIONAL REQUIREMENTS FOR AUTHORITY HOLDERS AND THEIR APPOINTED RADIATION PROTECTION OFFICERS IN RESPECT OF GROUP IV HAZARDOUS SUBSTANCES**

### **1.1 GENERAL**

Good radiation safety practice and the achievement of satisfactory working conditions depend on the effective organisation of health physics and safety. The holder of the authority for the use of radioactive material is responsible for the radiological safety of the workers in his employ and that of members of the public liable to exposure as a result of the use of radioactive material.

### **1.2 RADIATION PROTECTION OFFICER**

A person with the necessary knowledge and experience must be appointed to accept, on behalf of the holder of the authority, the responsibility for the safe use of all radioactive material under the holder's control and to observe any statutory requirements in connection with the use of radioactive material. An alternate for the Radiation Protection Officer, to whom the duties of the Radiation Protection Officer may be delegated, must also be nominated.

The Radiation Protection Officer's knowledge and experience in the field of radiation protection must be adequate, taking into account the potential radiation hazards attached to the use of the radioactive material under his control. For example, complex procedures involving unsealed sources of relatively high activity will require more knowledge and experience than will the handling of equipment containing sealed sources that form an integral part of the equipment.

NOTE: It is recommended that the Radiation Protection Officer attend appropriate courses in radiation protection. Whenever necessary, the Radiation Protection Officer should call for advice or assistance from professionally competent persons.

### **1.3 DUTIES OF THE RADIATION PROTECTION OFFICER**

The Radiation Protection Officer must ensure that:

- a) new personnel are instructed in safe working practices and in the nature of the biological effects resulting from overexposure to radiation;
- b) operational procedures are so established and maintained that the radiation exposure of each worker is kept as far below the authorised limits as is practicable;
- c) each case of excessive or abnormal exposure is investigated to determine its cause and that steps are taken to prevent its reoccurrence;
- d) monitoring devices for personnel are used where required and that records are kept of the results of such monitoring;
- e) adequate records are kept of all sources, indicating the locations of these sources or the name of the person to whom they have been assigned;
- f) periodic radiation surveys are conducted where required and if needed, that records of such surveys, including descriptions of corrective measures, are kept;
- g) all shields, containers and handling equipment are maintained in a satisfactory condition; and
- h) periodic leak tests on sealed sources are performed.

## **1.4 CLASSIFICATION OF WORKERS**

Where persons are employed at institutions where radioactive material is used or at installations, it is necessary to distinguish those persons who as a result of their duties are potentially liable to exposures in excess of three tenths of the whole body annual effective dose limit for radiation workers). All such persons must be classified as radiation workers , other workers must not be so classified.

It is advisable to limit the number of radiation workers as far as practicable. Measures must be taken to ensure that the exposure or non-radiation workers to radiation sources is kept to a minimum, but in any event the exposure may not exceed the authorised limits. This can be achieved by limiting work with radioactive material to controlled areas to which only radiation workers have access.

## **1.5 REGISTER**

The holder must compile, in respect of all radiation workers, a register that contains at least the following information for each radiation worker:

- a) results of pre-employment and routine medical examinations;
- b) a record of effective doses and exposures recorded by personal and pocket dosimeters, respectively; and
- c) any other relevant information.

## **1.6 MEDICAL SURVEILLANCE**

Radiation workers must be medically examined before employment as radiation workers, and then in accordance with regulation 15 of Government Gazette No.R246 promulgated on 26 February 1993. Medical examinations may also be necessary in the event of over-exposure or of radiation incidents where the possibility of over-exposure exists.

Only persons declared by a medical practitioner (registered with the South African Medical and Dental Council) as being medically fit for radiation work may be employed as radiation workers.

## **1.7 REGISTER OF SEALED SOURCES**

The holder must keep, in respect of all sealed sources, a register that contains at least the following

- a) The nuclide, activity and date on which the activity was specified;
- b) the date received;
- c) the manufacturer's name and the identification number of the source;
- d) the purpose for which the source is used;
- e) particulars of leak tests; and
- f) particulars of disposal or discarding of the source.

## **1.8 RADIATION WARNING SIGNS**

Radiation warning signs must be displayed at all entrances to storage places, in areas where radioactive sources are used or installed, and where persons could be exposed to ionising radiation.

A list of the names and telephone numbers of persons who can be telephoned in case of an emergency must be prominently displayed in the locations referred to above.

## **2. MONITORING AND CALIBRATION**

### **2.1 MONITORING OF PERSONS**

#### **2.1.1 General**

By the monitoring of persons is meant that routine measurement of the dose equivalents or persons exposed in the course of their work to radiation from external sources and, where applicable, from internally deposited radioactive material. Measurement of the latter will be required only where unsealed sources are used, or where leakage of a sealed source has occurred, and where the possibility of ingestion of radioactive material exists. Unless specifically exempted by the regulatory authority, all radiation workers must be monitored to determine their dose equivalents due to radiation from external sources (see 2.1.2), but guidance with regard to the need for internal monitoring must be sought from the regulatory authority.

#### **2.1.2 Monitoring for external sources of radiation**

All radiation workers must be issued with personal dosimeters, obtainable from the Radiation Protection Service of the South African Bureau of Standards or NTP at Necsa. In addition, where working conditions are such that the radiation workers are liable to an exposure from gamma radiation in excess of 200  $\mu\text{Sv}$  (20 mR) during any one day, direct-reading dosimeters such as pocket dosimeters must also be issued to the radiation workers.

NOTE: The purpose of the pocket dosimeter is for the worker to establish at intervals during the day the rate at which he is exposed to radiation and to enable him, if necessary, to change working procedures or working conditions to reduce radiation exposures. Pocket-dosimeter readings must be recorded at the end of each working day and these recordings filed in the register (see 1.5) at the end of each week. This record can be an important source of information when incidents indicated by or over-exposures recorded on personal dosimeters are investigated at a later date.

#### **2.1.3 Monitoring for internally deposited radioactive material**

Where unsealed sources are used, it may be necessary, in addition to taking personal dosimeter readings, also to monitor for any ingestion of radioactive material. This may be done by whole body counting or by analysis of body excretions, or both. The techniques involved are of a complicated and specialised nature and it is advisable to consult the regulatory authority in this regard. Whole body counters are available at most of the training hospitals located in the main centres.

## **2.2 MONITORING OF CONTROLLED AREAS**

### **2.2.1 General**

A systematic program of monitoring of controlled areas must be established to ensure satisfactory working conditions and working procedures and thereby limit the exposure of persons to radiation. The three types of monitoring involved are ;

- a) the monitoring of radiation from radioactive sources (see 2.2.2);
- b) the monitoring for surface contamination (see 2.2.3);
- c) the monitoring for air contamination (see 2.2.4).

### **2.2.2 Monitoring of direct and scattered radiation from radioactive sources**

All areas around radioactive sources where persons could be exposed to direct or scattered radiation (or both) must be monitored. Adjoining areas or rooms and, where applicable, areas outside buildings must be included as these could also be occupied. Monitoring must be conducted before the start of a project, during its progress and after significant modifications to existing installations have been made.

Portable ionisation chambers, Geiger-Muller counters and scintillation counters may be used, as applicable. In some cases, thermoluminescent dosimeters, film dosimeters or digital electronic dosimeters mounted at strategic places, could also be used.

### **2.2.3 Monitoring for surface contamination (unsealed sources)**

Every object used for work with unsealed radioactive material is subject to contamination. This includes work surfaces, walls, floors, clothing and equipment. Contamination by radioactive substances of work surfaces, clothing and equipment may be a significant hazard to health and may also interfere with the work being carried out.

All areas where radioactive material has been used and all equipment that has been in contact with radioactive material must be monitored systematically for contamination. Such monitoring must be performed at least when the work has been completed and, if necessary, also at appropriate times during work periods. Whenever they leave the work area, persons (and their clothing) must be monitored so that the spread of contamination is prevented.

The permitted levels of surface contamination as laid down by the regulatory authority are given in Table 1.

Monitoring may be performed with the aid of counting instruments and by the taking of smear samples. The instruments used must be suitable for the type of radiation emitted by the radionuclides used, e.g. alpha emitters and soft beta emitters will make the use of alpha scintillation monitors and thin end-window Geiger-Muller counters essential (see 2.2.5).

**TABLE 1 - PERMITTED LEVELS OF SURFACE CONTAMINATION**

	“Inactive areas”, parts of the body, clothes etc.	Active areas, protective clothing, glassware etc.
alpha emitters:	0.3 Bq/cm <sup>2</sup>	3 Bq/cm <sup>2</sup>
beta/gamma emitters:	3 Bq/cm <sup>2</sup>	30 Bq/cm <sup>2</sup>

The measurement may be averaged over 100 cm<sup>2</sup>

#### **2:2.4 Monitoring for air contamination**

In situations where radioactive gases, aerosols, powders or dusts are handled or produced, the air must be monitored for contamination.

Where it is possible that, notwithstanding filtration of air exhausted to the atmosphere, the activity released might exceed levels set by the regulatory authority, a reliable system of air monitoring must be employed.

#### **NOTE**

- a) When aerosols are to be monitored, the airborne substances are caused to be deposited by electrostatic precipitation, impactors or filtration.
- b) Some radioactive gases can be monitored only after collection by chemical or other means.

#### **2.2.5 Suitability of monitoring equipment**

Monitoring equipment must be carefully selected to ensure that it has an adequate response to the type of radiation to be measured and that the equipment exhibits a minimum of energy dependence over the range of energies concerned. For example, a monitor designed to measure high-energy gamma radiation from, for example, cobalt-60 or iridium-192 sources may well have a very poor response to lower energy radiation emitted by sources such as americium-241 and iodine-125, and will probably not be capable of detecting beta radiation at all. (Detection of the latter would require a thin end-window Geiger-Muller counter or a scintillation monitor.)

#### **2.2.6 Recording of results**

Records must be kept of the results of environmental monitoring and of significant events concerning radiation protection. In investigations, such records will usually be the only available source of data.

### **2.3 ACCIDENTS AND EMERGENCIES**

Any accidents in which workers have been over-exposed to or contaminated with radioactive materials, or in which radioactive material has been spilled, need special action and the procedures set out in the authority holder's internal rules must be followed. Each accident must be reported without delay to the Radiation Protection Officer who in turn must report it to the regulatory authority. Any incident (i.e. an unplanned event that has taken place and that may lead to a hazardous situation) must be reported immediately to the Radiation Protection Officer.

## **2.4 LIMITATION OF EXPOSURE TO RADIATION**

All exposure must be kept as low as is reasonably achievable, economic and social factors being taken into consideration. The exposure must therefore be so optimised that a further reduction in exposure would not be justified by the additional cost entailed.

The radiation dose to individuals must not exceed the effective dose limits laid down by the regulatory authority. These effective dose limits must be viewed as upper limits and must not be interpreted as being necessarily allowable. Furthermore, long-continued exposure of a considerable proportion of workers at or near the dose limits would be acceptable only if a careful analysis has shown that the resulting higher risk is justified.

It will be possible to achieve the above-mentioned goals only if all levels of contamination of work areas and air concentrations of radionuclides are kept as low as is practicable.

## **2.5 CALIBRATION OF MONITORING EQUIPMENT**

All equipment, including pocket dosimeters, used for the monitoring of radiation and contamination, must be regularly tested and calibrated by an institution approved for the purpose (e.g. the Council for Scientific and Industrial Research or the South African Bureau of Standards), as required by the regulatory authority.

The equipment must be calibrated before being brought into use, after repair and at intervals not exceeding the following;

- a) 7 months in the case of radiation monitors used for industrial radiography;
- b) 14 months in the case of radiation monitors used for purposes other than industrial radiography;
- c) 24 months in the case of pocket dosimeters and direct reading dosimeters.

NOTE : It is even more important that monitors are checked as often as possible to ensure that their batteries are adequate, and they respond positively to radiation.