GOVERNMENT OF INDIA

PERSONNEL MONITORING OF RADIATION WORKERS IN RADIATION FACILITIES

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ATOMIC ENERGY REGULATORY BOARD

PREFACE

Activities concerning establishment and operation of radiation sources and installations are to be carried out in India in accordance with the provisions of the Atomic Energy Act, 1962. In pursuance of the objective to ensure safety of members of the public and occupational workers, the Atomic Energy Regulatory Board has been entrusted with the responsibility of laying down safety standards and framing rules and regulations for such activities. The Board therefore develops Safety Standards, Safety Codes and related Safety Guides and Safety Manuals to cover the regulation aspects of these facilities

Radiation facilities in India cover a wide spectrum of radioactive sources and radiation generating equipment, spanning low to high hazard potential sources and activities. To ensure the safety of radiation workers and general public, these facilities are required to abide by the design and operation requirements specified in the relevant AERB Safety Codes and Standards. Further, it is required that the workers be subjected to personnel monitoring during their course of work.

The work profile of radiation workers engaged in differing types radiation facilities is widely varying, depending on the type of work in radiation area, i.e. time spent, activity/ intensity of the radiation source, distance at which the radiation source is handled . Accordingly, monitoring for occupational exposures may be either through determination or through estimation of the radiation dose, depending on the potential exposure associated with type of practice, radiation sources/activity handled and work profile, among various other factors.

This document provides a practice wise suggestions for appropriate personnel monitoring in radiation facilities, taking into account the operational safety aspects, hazard potential and work profile of the radiation workers involved in the practice. It is expected to help the Radiological Safety Officers to advise the Licencee on provision of personnel monitoring, training of radiation workers and maintenance of their dose records.

To arrive at these guidelines AERB has utilised its regulatory insight garnered over several regulatory inspections and reviews carried out at radiation facilities, feedback from utilities, Radiological Safety Officers of institutions and others.

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Personnel Monitoring of Radiation Workers in Radiation Facilities

1. INTRODUCTION:

1.1 General:

A Radiation Facility is any installation/equipment or a practice involving use of radiation-generating units or use of radioisotopes in the field of research, industry, medicine and agriculture. These facilities handle radioactive sources ranging from a few kBq to several PBq, and Radiation Generating Equipment (RGE) which operate at few kV to tens of MV or more. These facilities are generally located in public domain. Any person who is occupationally exposed to radiation is called as a radiation worker. The radiation workers are required to handle the radiation sources as per the procedures laid down by AERB to ensure that their radiation doses are "As low As Reasonably Achievable (ALARA)", while ensuring that exposures remain within the dose limits prescribed by the Regulatory Body. The dose to radiation workers shall not exceed the following limits;

a) an effective dose of 20 mSv/year averaged over five consecutive years (calculated on a sliding scale of five years, i.e. current year and previous 4 years) b) an effective dose of 30 mSv in any year c) an equivalent dose to the extremities (hands and feet) of 500 mSv in a year d) an equivalent dose to the lens of the eye of 150 mSv in a year;

In some of the practices, trainees such as students, Interns and apprentices, who are in the age group of 16 to 18 years are also involved in handling radiation sources. However, such trainees/apprentices are required to work under the supervision of trained radiation workers and their radiation dose should be controlled so that they do not exceed an effective dose limit of 6 mSv in a year. Individuals below the age of 16 years should in no case be allowed to work with radiation.

To monitor the dose received by the radiation workers, they are required to be subjected to Personnel Monitoring. As per the provisions of Atomic Energy (Radiation Protection) Rules, 2004 [(AE (RP) R, 2004)], Personnel monitoring can be carried out either by "*estimation or determination"* of the radiation dose to workers. "Determination of radiation dose" involves use of individual personnel monitoring devices (i.e. TLD and DRD) while "estimation" is a assessment of radiation dose by using radiation survey instrument at the work place, design parameters of the equipment, work profile and operating conditions. Further details are provided in this document.

1.2 Objective

This document is intended to help the Licensee/Radiological Safety Officers of radiation facilities in identifying radiation workers who need to be subjected to individual personnel monitoring i.e. 'determination' of radiation dose through provision of individual personnel monitoring devices (TLDs), and those workers whose personnel monitoring can be carried out through 'estimation' of their radiation doses.

1.3 Scope

This document is expected to help the Radiological Safety Officers (RSO)/Licensees on personnel monitoring aspects and issuance of TLDs to personnel who are qualified, trained and occupationally exposed to radiation, as per the practice/work profiles. Internal dosimetry and eye lens dose determination are not part of this document. Directives in this regard issued by the Regulatory Body are required to be implemented by the radiation facilities. Although this document does not cover aspects of internal dose monitoring, it should be recalled that the contribution arising from both external and internal radiation should be considered while comparing the radiation dose received by the worker to the dose limits prescribed by the Regulatory Body.

Note-1: *This document is for reference purpose only. It does not prevent the Licensee, in consultation with RSO, from issuing TLDs to staff other than those mentioned here, if and wherever felt necessary. Issuance of TLDs to auxiliary/unskilled staff should be with appropriate rationale, provision of adequate training in radiation protection (including in the use and storage of TLD badge), and with due maintenance of dose records.*

Note-2: Provision of TLD is NOT an alternative to safe work practice. *Personnel monitoring badges should not be provided as an assurance against unsafe design and/or operational practices. TLD badge is not a protection device, it is a only a measurement device to determine radiation doses received by individuals during their work. All the practice specific radiation safety measures should necessarily be followed by the radiation workers irrespective of the method of personnel monitoring.*

Note-3: *Atomic Energy (Radiation Protection) Rules, 2004 {AE(RP)R, 2004} does not stipulate any allowance, leave or compensation to be paid for persons designated as radiation workers or for any other staff provided with TLDs.*

Note-*4: Trained radiation workers are those having requisite training towards a) Operational radiation safety in handling the source; b) Emergency procedures; and c) proper use of individual personnel monitoring devices*

Annexure-1 provides the legal framework with respect to personnel monitoring as per Atomic Energy (Radiation Protection) Rules, 2004. Annexure-2 gives general instructions for safe work practice and proper use of TLDs.

2. GUIDING PRINCIPLES FOR PERSONNEL MONITORING

As per the AE(RP)R, 2004, "personnel monitoring" means determination or estimation of the dose received by an individual from external and/or internal radiation. When considering the need for personnel monitoring, attention must be paid to the total radiation exposure to which a worker might be subjected, i.e. to all work and radiation sources which may cause radiation exposure. The need for personnel monitoring must always be considered in the light of local working conditions and the anticipated radiation exposure. Personnel monitoring can be either by determination or estimation of doses to the workers, based on the work practices/work profiles, as elaborated below. Based on these criteria, Table of this document further elaborates the practice specific aspects of personnel monitoring.

2.1 **Personnel monitoring through "Determination" of radiation dose:** Determination of radiation dose involves use of individual personnel monitoring devices (i.e. TLD badges, pocket dosimeters) and is generally required for those workers who are occupationally exposed to radiation and, in their course of work are required to be engaged in the following activities. Some of these workers are *likely* to receive a dose greater than 3/10th of the annual dose limit are designated "Classified workers", as per AE(RP) R,2004.

a) Handle high hazard potential sources
b) Routinely Access **Controlled areas**
c) Work in close proximity to radiation sources
d) Take part in radiation emergency handling procedures(e.g. Emergency handling procedures in tele-cobalt unit etc.)
e) Work at a place with significant varying radiation fields
f) Encounter situations with a possibility of receiving dose in excess of their dose limit in routine or an off-normal condition (e.g. Extended interventional radiology procedures)
g) Involved in servicing and maintenance of devices housing radioactive sources or Radiation Generating Equipment.

Controlled area is the area in which in which specific protection measures and safety provisions are or could be required for (i) Controlling exposures or preventing the spread of contamination during normal working conditions; and (ii) Preventing or limiting the extent of potential exposures

Based on the work practice, the above mentioned activities are generally undertaken by persons operating the equipment/devices containing radioactive sources or RGE, medical practitioners carrying out radiological procedures in close proximity to radiation sources, service engineers, Radiological Safety Officers etc. and hence, they should normally be provided with TLD Badges for determination of radiation dose on a periodic basis (e.g. monthly, quarterly). Further details on the practices and the personnel whose dose should be determined using individual personnel monitoring devices are provided in the Table under section 3 of this document.

2.2 **Personnel monitoring through "Estimation" of radiation dose:** This involves estimation of the likely radiation dose to a worker through radiation survey of the work place or assessment based on design parameters of the equipment, work profile and operating conditions. This practice is generally suggested for those workers who:

a) Have Limited /Non-routine access to **Controlled areas**, in which radiation sources are stored or handled
b) Have no access to controlled areas and likely to access **Supervised areas** where no radiation sources are present, such as control console room (e.g. medical attendants accompanying patients). Supervised area is any area not already designated as a controlled area but where occupational exposure conditions are kept under review even though specific protection measures and safety provisions are normally needed
c) Work with radiation sources/ equipment where radiation levels encountered are too low, or equipment is so designed that it offers complete protection by design itself, or by the nature of practice no significant exposure to individuals is envisaged

When personnel monitoring is through "Estimation", Licensee should maintain details of the basis for monitoring through estimation, the estimated individual doses based on design parameters and measurement(s), and time spent by the individual in controlled areas, where applicable. It is the responsibility of the Licensee to ensure through periodic assessments that the work patterns of the concerned individuals continue to be in conformity with the assumptions made in the estimation.

The personnel for whom radiation dose can be estimated are: attendants/staff working in supervised areas with occasional entry to Controlled areas, Medical practitioners with occasional entry to Controlled areas, Operators of Gamma Irradiation Chambers (GIC, i.e. laboratory irradiator, gamma cell), etc;

2.3 **Situations not warranting personnel monitoring (either by determination or by estimation):**

In some situations, personnel monitoring either by determination or estimation may not be required considering that the dose received by the concerned personnel are expected to be within the dose limits prescribed for members of public. These include personnel in the vicinity of the radioactive sources/radiation generating equipment who

a) Work in areas where the doses are within the public dose limits (such as security personnel).
b) Do not enter the controlled areas and only occasionally enter the supervised areas, such as receptionists, factory personnel in Industrial Radiography institutions, Nucleonic Gauging facilities;
c) Handle Category-5 sources, exempt quantities of radioactivity, low kV X-rays or self-shielded X-ray equipment, alpha and low energy beta sources, such as C-14, H-3*

d) Work in areas where the estimated dose to individuals is below the detection limit of TLD badges

**Internal dose monitoring should be carried out as applicable.*

2.4 **Personnel monitoring either through Determination or Estimation of radiation dose**

In some cases, the Licensee is required to take an informed decision in consultation with the RSO, on the issuance of TLDs on a case by case basis depending on the work profile of the individual. Such cases are elaborated in the following sub-paras.

a) **Auxiliary staff # :** Auxiliary staff include Nurses, Assistants, Attendants who escort patients into controlled area on routine basis, Drivers of vehicles carrying radioactive sources, Helpers in Industrial Radiography, etc. They normally assist in the handling of radiation source, are present in controlled areas during irradiation, but can be also assigned with jobs in other areas not related to radiation sources. Provision of TLDs for auxiliary staff should be based on the assessment by the RSO of individual work profile and probable doses, supported with appropriate rationale (as mentioned in para 2.1 & 2.2). In some cases, TLD badges may need to be issued temporarily for confirmation of necessity of personnel monitoring in some cases, such as for drivers involved in routine transport of radioactive material. Such staff should be provided with adequate training in radiation safety and proper use of TLDs. General Instructions for safe work practice and proper use of individual personnel monitoring devices (TLDs) is provided in Annexure-2.

For optimum utilization of the trained resources and the Personnel Monitoring Services, trained auxiliary staff provided with TLDs may not be shifted frequently or at short notice, due to staff rotation scheme of duties.

b) **Unskilled staff***: Unskilled staff includes attenders, housekeeping staff etc. who may be occasionally required to enter the controlled area for a brief period of time (for cleaning, attending to patient), and are usually assigned jobs that are not related to radiation work. Provision of TLDs for unskilled staff is generally not required as they are not expected to be assigned any work related to radiation sources on routine basis and thereby would not be prone to significant exposure to radiation.

However, based on the assessment of their work profiles by the RSO, if it is deemed necessary, TLD may be issued to these staff. The issuance of TLD should be with appropriate rationale (as mentioned in para 2.1 & 2.2) and such staff should be provided with adequate training in radiation safety and proper use of TLDs. General instructions for safe work practice and proper use of individual personnel monitoring devices is provided in Annexure-2.

**For optimum utilization of the trained resources and the Personnel Monitoring Services, unskilled staff provided with TLDs may not be shifted frequently or at short notice, due to staff rotation scheme of duties.*

2.5 **Personnel Monitoring for Interns/Students:** Students/Interns/research scholars/apprentices who are routinely involved in handling of radiation sources under supervision of trained personnel, need to be issued TLDs with the rationale similar to that for radiation workers in the relevant practice.

In some cases, it may not be feasible to provide TLDs to interns/students who are posted for practical training for very short durations at radiation installations. In such cases, the doses may be determined

using Direct Reading Dosimeters (DRDs). "Determination", by issuance of DRDs may be required in those practices wherein the regular radiation workers are being monitored by TLDs. The records of measured doses should be maintained by the institution till the training is completed. The copy of records should then be provided to the respective trainee, for his records and future use in employment involving use of radiation.

IMPORTANT*: In case the personnel monitoring is through "Estimation", institution should maintain details of estimated individual doses which may include the basis for estimation and measurement(s), where applicable.*

2.6 **Personnel Monitoring in Special Situations:**

a) ***Radiation workers employed in multiple centres*****:** If professionals/ workers are working in multiple radiation facilities (part time employees/ consultants etc.), the Licencee of each facility has to separately provide TLD to such workers, to be used while working at his/her premises.

b) ***Personnel Monitoring of pregnant workers*****:** Once a female worker declares her pregnancy, her working conditions should be re-assessed and personnel monitoring should be made available to her (if not already available) to ensure that the radiation dose to the foetus during the entire pregnancy term is less than 1 mSv.

c) ***Monitoring of extremity dose(s):*** Personnel working in practices, which require handling of source from close proximity i.e. the hands are near the radiation source and the exposure to hands are expected to be more than 10 times the exposure to the body, as it is normally protected by appropriate shielding (handling manual brachytherapy sources, nuclear medicine sources, interventional radiology etc.) the workers should be provided with wrist badges to monitor the extremity dose (i.e. hands), in addition to the whole body dose monitoring (chest badge)

d) ***Monitoring of Neutron Doses:*** Certain practices with likely neutron exposures such as Well-logging operations, hadron therapy etc, also require neutron dose monitoring.

3. Practice Wise Personnel Monitoring

Practice wise category of personnel who need to be monitored through issuance of TLDs is provided in the Table. Typical controlled areas and supervised areas are also elaborated.

Table: Typical Controlled Area/Supervised Area in various practices and examples of personnel whose doses are to be determined through issuance of TLDs and examples of personnel whose doses may be estimated.

Practice/ type of equipment	Controlled area	Supervised area (See Note-4 below)	Potential hazard	Examples of Personnel whose doses are to be determined (by issuance of TLDs)	Examples of Personnel whose doses may be estimated (see Note-5 below)
MEDICAL APPLICATIONS					
Radiotherapy-Radioactive Source/& Radiation Generating Equipment (RGE) based	Treatment room (when the unit is energized, in case of RGE)	Control console room (when the unit is energized, in case of RGE)	Possibility of source related accidents/ / working in proximity to radioactive source(s)/ Possibility of accidental exposure when the beam is energized	Technologists, Medical Physicist and Oncologists. Auxiliary staff (e.g. Nurse in brachytherapy), if required	#Oncologists, anaesthetists etc. who may only occasionally visit the treatment room containing with Tele-cobalt/ HDR source #Unskilled staff (such as attenders and cleaning staff) with occasional entry to treatment room with Tele-cobalt/ HDR source (# Estimation is not required for the above personnel, occasionally entering treatment room with RGE)
Hadron therapy	Treatment room, (when the unit is energized) Beam transport systems, cyclotron vault	Control console room	Possibility of accidental exposure when the beam is energized. Exposure due to activated products.	Technologists, Medical Physicists, Oncologists. Auxiliary staff, if required Neutron dose monitoring badge may be also needed for some personnel & practices (Pl see 2.6 (d))	Oncologists, anaesthetists etc. who may only occasionally visit the treatment room Unskilled staff (such as attenders and cleaning staff) with occasional entry to treatment room
Nuclear Medicine (NM) (SPECT/Gamma Camera/PET/ NM Therapy)	Isotope preparation room/Patient administration room/ patient waiting room and NM Equipment room during procedure	Waiting area/ Doctors area	Radioactive Source i.e. patient, is mobile. Accidental exposure due to spillage etc.	NM Technologist, NM Physician, Associated auxiliary staff (example: nurse), those involved in radio-pharmaceutical administration, Unskilled staff (if required)	Unskilled staff (example: cleaning staff) not involved in radiation related jobs Other medical practitioner, nurses who may have to attend to any clinical emergencies for the patients post-administration of radio-pharmaceutical

Practice/ type of equipment	Controlled area	Supervised area (See Note-4 below)	Potential hazard	Examples of Personnel whose doses are to be determined (by issuance of TLDs)	Examples of Personnel whose doses may be estimated (see Note-5 below)
Interventional Radiology / fluoroscopy ***(Refer Note-6 below)***	Room housing the X-ray equipment (when the unit is energized)	Control Console room (when the unit is energized*) **applicable only in case(s) where the equipment is energized from a separate control console room)*	Presence in the area near the patient which, during irradiation, may expose personnel to primary radiation, leakage radiation from the X-ray tube or radiation scattered directly from the patient)	Personnel who are required to work in close proximity to the patient when the X-ray unit is energised. Medical practitioner, technologist, trained nurses & assistants engaged in working inside the Cath lab/C-Arm room during procedures medical practitioners involved in Interventional Radiology procedures should preferably also be provided with pocket dosimeters (DRDs)	-
CT/conventional Fixed X-ray)	Room housing the X-ray equipment (when the unit is energized)	Control Console room (when the unit is energized*) **applicable only in case(s) where the equipment is energized from a separate control console room)*	The personnel may receive scattered radiation from the patient and leakage radiation from the X-ray tube.	X-ray Technologists, medical practitioners carrying out radiological procedures, if they are operating the X-ray equipment	-
X-ray Mobile and X-ray Portable. ***(Refer Note 6 below)***	Area covered by primary, scattered radiation (i.e area next to the patient which, during irradiation, is exposed to primary radiation or radiation scattered directly from the patient – generally area 2m around the patient)	Not applicable	Proximity X-ray during procedure	X-ray Technologist	-

Practice/ type of equipment	Controlled area	Supervised area (See Note-4 below)	Potential hazard	Examples of Personnel whose doses are to be determined (by issuance of TLDs)	Examples of Personnel whose doses may be estimated (see Note-5 below)
Dental X-ray (Intra Oral/ OPG/CBCT)	Area covered by primary, scattered beam or room housing the X-ray unit (when energized)	Control console room (for applicable equipment)	Limited radiation field/small irradiated area. OPG & CBCT units operated from behind protective barrier or form separate control console room	Operators of dental X-ray equipment in institutions only in institutions handling high work load (such as academic institutions)	-
X-ray Mammography/ BMD	Area near the patient, when the X-ray unit is energized	Not applicable	Very low energy X-ray beam, no detectable radiation level at operator position	-	-

INDUSTRIAL APPLICATIONS					
Practice/ type of equipment	**Controlled area**	**Supervised area (See Note-4 below)**	**Potential hazard**	**Examples of Personnel whose doses are to be determined (by issuance of TLDs)**	**Examples of Personnel whose doses may be estimated (see Note-5 below)**
Industrial Radiography (IR)-(Enclosure/open field) ***(Refer Note-7 below)***	The IR Enclosure/ Area around the X-ray or IR device, that is cordoned off during exposure	Area outside the enclosure/ beyond the cordoned off area	Proximity to source, emergency handling	Site in charge, RSO, Radiographers & trainees/assistants	
Radiation Processing Facilities (radioactive source and accelerator based)	Irradiation Chamber/room	Control Console room	High active source Possibility of emergency handling	Operator, RSO, Servicing and maintenance personnel	
Irradiation Chamber (Gamma and X-ray based)	Not applicable	Not applicable	High activity Source and high potential dose rate	Operator (if identified for routine operation)	RSO, Research scholars and similar others with access to the radiation equipment, only under supervision of the RSO

Practice/ type of equipment	Controlled area	Supervised area (See Note-4 below)	Potential hazard	Examples of Personnel whose doses are to be determined (by issuance of TLDs)	Examples of Personnel whose doses may be estimated (see Note-5 below)
Nucleonic gauges (NG)	If the primary beam of the equipment can be directed outside of the appliance, the area next to the beam is controlled area.	Not applicable	High activity sources (applicable for NGs with category-2 sources)	RSO of institutions possessing Category-2 Nucleonic Gauges.	RSO of NG facilities with low hazard potential/ low activity sources
Well logging and other facilities using Neutron sources (Materials research, activation analysis etc)	Source storage room	Not applicable	Handling of Neutron sources	Operator, RSO of well logging facilities should be provided with Neutron dose monitoring badges and TLDs	-
Medical cyclotron	Cyclotron vault, Radioisotope delivery room, radiopharmaceutical preparation room	Control Console room and other demarcated areas	Handling of radioisotopes; Exposure to activation products	Operator, RSO, Radiochemists, Service & maintenance engineers, technicians handling radioactive materials, consignments	-
Source based or X-ray Baggage/Cargo scanner/X-ray (Non-Medical)/X-ray Analysers	Irradiation/scanning cell	Control room (if not remote)	Moderate hazard	Servicing & Maintenance personnel	

RESEARCH APPLICATIONS

Practice/ type of equipment	Controlled area	Supervised area	Potential hazard	Examples of Personnel whose doses are to be determined (by issuance of TLDs)	Examples of Personnel whose doses may be estimated
Research accelerators	Accelerator room (when unit energised)	Control console area (when energized)	Working in controlled area	RSO, in facilities with high energy accelerators. Research Scholars.	Research Scholars

Practice/ type of equipment	Controlled area	Supervised area (See Note-4 below)	Potential hazard	Examples of Personnel whose doses are to be determined (by issuance of TLDs)	Examples of Personnel whose doses may be estimated (see Note-5 below)
Academic/Research Facilities using Sealed/Unsealed sources ***Not applicable for Type I laboratories and institutions handling low activity check sources, category 5 sources, low energy beta sources***	Source storage/preparation area (generally applicable only for Type II and Type III laboratories)	Not Applicable	Moderate to high activity sources - Type II and Type III Laboratories	RSO and research scholars routinely handling sources as part of their research work in Type II & Type III laboratories	Personnel/research scholars in Type II/III laboratories only occasionally handling sources.
Calibration laboratories (Survey meters/dosimeters)	Calibration room	Control Console room	High activity radiation source//fields	RSO and personnel involved in calibration of instruments	Personnel in the control console room

MANUFACTURERS/SUPPLIERS OF RADIOACTIVE SOURCES/RGE & PERSONNEL INVOLVED IN TRANSPORT OF RADIOACTIVE MATERIAL

Practice/ type of equipment	Controlled area	Supervised area (See Note-4 below)	Potential hazard	Examples of Personnel whose doses are to be determined (by issuance of TLDs)
Manufacturer/ supplier of RGE	X-ray equipment testing room	Not applicable	Presence in controlled area during exposure	RSO, Service Engineers, maintenance engineers of and personnel involved in radiation testing of RGE.
Manufacturer of Radioactive sources (Integrated Facility for Radiation Technology)	Hot cell, Room for operating the Master-slave manipulator	-	High activity Source & High potential dose rate	Operators, RSO, Cask Handlers and other associated staff involved in handling of sources.
Supplier of Radioactive sources/Equipment housing radioactive sources	Storage facility for in transit storage	-	Handling container/packages of radioactive sources. Moderate hazard	Personnel handling radioactive source/equipment containers/packages.
Manufacturers of Consumer product facilities	Testing enclosure, manufacturing workshops using radioisotopes	-	Moderate hazard	Service Engineers, RSO
Drivers routinely engaged in transport of radioactive material	Not Applicable	Not applicable	Case by case basis.	To be established on a case by case basis. Generally TLD is required for a regular driver

Note-4: *The supervised areas should be regularly monitored to confirm that there are no changes in conditions under which the doses were originally estimated.*

Note-5: *Unskilled and auxiliary staff should enter the controlled area under supervision. RSO, based on a study/assessment of the dose that is likely to be received by these individuals in the course of their work can advise the Licensee on issuance of TLDs or otherwise*

Note-6: *Personnel of the hospital (technologist/attender/maid (ayah))* ***shall not hold*** *the patient during procedures. A family member or accompanying adult should hold the patient after being briefed by the RSO and duly wearing the protective apron.*

Note-7: *Industrial Radiography trainees (16-18 years of age) should also be issued with TLDs. However, as their dose limit is only 6 mSv, they should not be allowed to carry out radiography work independently.*

Annexure-1

Regulatory framework towards personnel monitoring

Personnel monitoring of radiation workers is an integral part of effective radiation protection programme and is a regulatory requirement as per the Atomic Energy (Radiation Protection) Rules, [2004 AE(RP)R, 2004], promulgated under Atomic Energy Act, 1962

As per the AE(RP)R, 2004, Rule 27, (2) the radiation workers are to be subjected to "personnel monitoring". In this context, it is important to better understand both the terms "Radiation workers" and "personnel monitoring".

Radiation workers are those who are occupationally exposed to radiation. Such persons have recognized rights and duties in relation to occupational radiation protection. The practice-specific regulatory documents also give the qualification/ training requirements of such radiation workers along with their work profile.

Personnel Monitoring means "determination or estimation of the dose received by an individual from external and/or internal radiation".

The responsibilities as stated in AE (RP) R, 2004, with respect to personnel monitoring and dose records is given in detail further. Given the specific responsibilities of Licencee with respect to radiation workers and their personnel monitoring requirements, it is important that qualified and trained personnel and who are occupationally exposed to radiation are designated as radiation workers, subject to personnel monitoring (whether individual or work place), ensure that their doses are within prescribed limits and the dose records are maintained for a stipulated time period.

Responsibilities Assigned as per Atomic Energy (Radiation Protection) Rules, 2004

Responsibilities of Employer/ Licencee/ RSO/ Worker stipulated in AE (RP)R, 2004 with respect to Personnel Monitoring and dose records are as follows:

- **Responsibilities of Employer**

As per Rule 20(1)

(c) prior to employment of a worker, procure from his former employer, where applicable, the dose records and health surveillance reports,

(d) upon termination of service of worker provide to his new employer on request his dose records and health surveillance reports,

(e) furnish to each worker dose records and health surveillance reports of the worker in his employment annually, as and when requested by the worker and at the termination of his service.

As per Rule 25,

Health surveillance of workers:-

(1) Every Employer shall provide the services of a physician with appropriate qualifications to undertake occupational health surveillance of **Classified workers$**

(2) Every worker, initially on employment, and classified worker, thereafter at least once in three years as long as the individual is employed, shall be subjected to (a) general medical

examination and (b) health surveillance to decide on the fitness of each worker for the intended task

(3) The health surveillance shall include -

(a) special tests or medical examinations as specified by order by the competent authority, for workers who have received dose in excess of regulatory constraints; and

(b) counselling of pregnant workers.

$ ***Classified worker**: The Employer shall designate as classified workers, those of his employees, who are likely to receive an effective dose in excess of three-tenths of the average annual dose limits notified by the competent authority and shall forthwith inform those employees that they have been so designated.*

- **Responsibilities of Licencee**

As per Rule 21 (5) (b): the licensee shall maintain records of workers as specified under Rule 24

(1) Every licensee shall maintain complete and up-to-date records of -

(a) personnel monitoring under Clause (b) of sub-rule (2) of rule 27, in the format as specified by order by the competent authority; and

(b) the health surveillance specified in Rule 25.

(2) Such records shall be preserved during the working life of each worker, and afterwards until the worker attains or would have attained the age of seventy five years, or not less than thirty years after the termination of the work involving occupational exposure whichever is later.

(3) A worker shall have access to his personnel monitoring and the health surveillance records.

- **Responsibilities of Radiological Safety Officer**

As per Rule 22 (2)

a) Advise the Employer regarding (i)the necessary steps aimed at ensuring that the regulatory constraints and the terms and conditions of the licence are adhered to;

- **Responsibilities of the Radiation Worker:**

As per Rule 23 (2)

(a) The worker shall provide to the Employer information about his previous occupations including radiation work, if any;

(b) make proper use of such protective equipment, radiation monitors and Personnel monitoring devices as provided

ANNEXURE-2

General Instructions for Safe Work Practice and Proper Use of Individual Personnel Monitoring Devices (TLDs)

The Licensee should

i. ensure that adequate training is provided to any person who is designated as a radiation worker in the institution and issued with TLD badge, so that he/she can handle the designated radiation work safely.

ii. arrange for radiation safety training to be provided by the RSO of the institution to all radiation workers. The training is to be provided at the time of issuance of TLD and periodically thereafter. In addition to operational safety aspects, the training should also include instructions on Do's and Don'ts for proper use & storage of TLDs and their prompt return at the end of monitoring period.

iii. ensure that records of the radiation safety training, evaluation and the list of attendees are maintained by the RSO.

iv. make necessary arrangements so that there are no interruptions to personnel monitoring services between monitoring periods.

v. make proper arrangement in radiation free area to store the Control TLD badge and TLD badges of the worker when they are not used.

vi. ensure that in case any TLD badge was left (fallen) inadvertently in any radiation area, the same may be informed to RSO/Licensee so that arrangement is made to send the TLD badge to the concerned Laboratory for urgent processing, marking a copy of such communication to AERB.

vii. ensure required arrangements are in place for the prompt return of TLDs at the end of the monitoring period and for informing the radiation workers about their dose reports.

viii. investigate any occurrence (incident of excessive exposure) wherein the dose recorded in a TLD has exceeded the investigation levels recommended by the regulatory body and promptly submit the investigation report.

ix. take all the required corrective measures to prevent recurrence of incidents of excessive exposure.

x. maintain the dose records as per the requirements of Atomic Energy (Radiation Protection) Rules, 2004 and provide the dose records to the employee as and when required by him/her and when he/she leaves employment.

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