

DEPARTMENT OF ATOMIC ENERGY

Bombay, the 30th January, 1980

G.S.R. 735 – In pursuance of rule 15 of the Radiation Protection Rules, 1971 the Head, Division of Radiological Protection, Bhabha Atomic Research Centre (Department of Atomic Energy) being the ‘competent authority’ under the said rules, hereby directs that with effect from the date of publication of this notification in the Official Gazette, the **radiation surveillance procedures for persons using sealed sources in industrial radiography**, shall be specified in the Schedule annexed hereto.

SCHEDULE

The Industrial Radiography (Radiation Surveillance) Procedures

1. Definitions-- In this schedule, unless the context otherwise requires, -

- (1) "Act" means the Atomic Energy Act, 1962 (33 of 1962);
- (2) "adequate" means adequate in the opinion of the competent authority;
- (3) "adequate protection" means protection against radiation so provided that the prescribed operational limits on levels of radiation or contamination are specified by the competent authority are not exceeded;
- (4) “applicant” means person who applies for a licence to handle sealed sources for industrial radiography;
- (5) "appropriate" means appropriate in the opinion of the competent authority;

"competent authority" means an officer or authority appointed by the Central Government to be competent authority for the purposes of these rules;

“exposure device” means a device or equipment employed for effecting industrial radiographic exposures and includes a source housing;

"handle" means manufacture, possess, store, use, transfer by sale or otherwise, export, import, transport or dispose of;

“industrial radiography” means the examination of the structure of materials by non-destructive methods, utilising sealed radiography sources;

“industrial radiography installations” means a radiation installation employed for industrial radiography operations;

“Licensee” means a person who has been granted a licence under rule 3 of the rules;

“Operable” means that the equipment is capable of performing its required function in its required manner;

"operational limits" means limits on levels of radiation or on levels of contamination as the competent authority may by notification, specify from time to time;

"person" includes -

- (i) any individual, corporation, association of persons whether incorporated or not, partnership, estate, trust, private or public institution, group, government agency, or any state or any political subdivision thereof, or any political entity within a state, any foreign government or nation or any political subdivision of any such government or nation or other entity;
- (ii) any legal successor, representative and agent of the foregoing;

"radiation worker" means any person who is occupationally exposed to radiation and who, in the opinion of the competent authority, should be subject to radiation surveillance;

“radiographer” means a radiation worker who performs industrial radiography operations employing sealed sources and possesses a valid certificate duly recognised or issued by the competent authority for the specific purpose and meets, the qualifications specified for a radiographer in para 13 of this Schedule.

"radiation surveillance" means measures that may be specified by the competent authority to provide adequate protection either generally or in any individual case;

(18) “radiography site” means a location which is recognised and approved by the competent authority for the conduct of radiography operations;

(19) "Radiological Safety Officer" means any person who is so designated by the, employer and who in the opinion of the competent authority is qualified to discharge the functions outlined in paragraph 13 of this Schedule;

(20) “Rules” means the Radiation Protection Rules, 1971;

(21) “sealed radiography source” means a sealed source employed in industrial radiography

(22) "sealed source" means any radioactive material which for purposes other than storage, transport or disposal is sealed in a container or bonded wholly within

any material, in such a manner as to prevent the escape of the radioactive material having regard to its intended use, and includes the immediate container or the bonding;

(23) "Site-in-charge" means a person who has appropriate qualifications and training and who is appointed by the licensee as the person supervising radiography operations at an authorised radiography site with the concurrence of the competent authority.

(24) "source housing" means a shielding enclosure provided in any device containing a sealed source, in order to -

- (i) define the useful beam; and
- (ii) limit the radiation levels outside of the useful beam to maximum permissible leakage levels for such devices as may be specified by the competent authority by notification;

(25) words and expressions used in these schedules and not defined, but defined in the rules, shall have the meanings respectively assigned to them in the rules.

2. Conditions precedent to the issuance of a licence for handling sealed radiography sources – No licence for handling sealed radiography source shall be granted unless, in the opinion of the competent authority,

(i) the applicant satisfies the general requirements of radiation safety regarding planning, design and operation of the proposed industrial radiography installation as specified in paragraph 3 of this Schedule;

(ii) the applicant has appointed a Radiological Safety Officer who is qualified to discharge the duties and functions which shall be as follows, namely :-

(a) to take all necessary steps aimed at ensuring that the operational limits are not normally exceeded;

(b) to instruct the radiation workers under his charge on the hazards of radiation and on suitable safety measures and work practices aimed at minimising exposure to radiation and contamination;

(c) to carry out such tests for leakage's on sealed sources as outlined in paragraph 5 of this schedule;

(d) to regulate the safe movement of all radioactive materials (including wastes containing radioactive materials) within the area under his charge;

- (e) to investigate and initiate prompt and suitable remedial measures in respect of any situation that could lead to radiation hazards;
 - (f) to ensure that reports on all hazardous situations along with details of any immediate remedial measures that may have been initiated, are made available immediately to his employer;
 - (a) to ensure that the ultimate disposal of wastes containing radioactive materials is carried out in a manner approved by the competent authority.
- (iii) The applicant has site-in-charge and an adequate number of certified radiographers at each radiography site;
 - (iv) the applicant has an adequate number of operable radiation monitoring instruments;
 - (v) the applicant has established and submits to the Competent Authority satisfactory written operating and emergency procedures as enumerated in paragraph 14 of this Schedule;
 - (vi) the applicant has an adequate internal inspection system or other management control to ensure that the applicant's operating and emergency procedures are followed by the radiation workers;
 - (vii) the applicant maintains complete and up to date records of personal medical and occupational histories and reports of medical examination in such form as may be specified by the Competent Authority, in respect of all radiation workers who shall be involved in the use of sealed radiography sources and undertakes to –
 - (a) ensure that every radiation worker who shall be involved in the use of sealed radiography sources, prior to commencing radiation work, and subsequently at intervals not exceeding 12 months, shall be subjected to an X-ray examination of the chest, all general laboratory investigations such as the examinations of blood and excrein, special investigations such as examinations of the skin, hands, fingers, finger nails and eyes and any other examinations which may be specified by the Competent Authority, the frequency and types of all the above examinations may be modified by the Competent Authority. In special cases where such modification is considered by if necessary; and
 - (b) submit such medical reports either generally or in specific cases as he may be required to submit from time to time at such intervals as may be specified by the Competent Authority.

- (viii) the applicant submits a description of organisation structure pertaining to his radiography operations, including proposed delegations of authority and responsibility for operations at each radiography site; and
 - (ix) the applicant submits a signed statement denoting his legal status.
3. General requirements of radiation safety in the planning, design and operation of industrial radiography installations employing sealed sources – For source housing of radiographic exposure devices or containers, with the useful beam cut off, the dose-rate of the leakage radiation shall be such that –
- (a) at a distance of one meter from the surface of the source housing;
 - (i) the maximum dose-rate in any direction does not exceed ten milliroentgens per hour; and
 - (ii) the average dose-rate does not exceed two milliroentgens per hour.
 - (b) at a distance of five centimetres from any point on the surface of the source housing, in any direction –
 - (i) the maximum dose-rate does not exceed one hundred milliroentgens per hour; and
 - (ii) the average dose-rate does not exceed twenty milliroentgens per hour.
4. Locking of exposure devices, and containers containing sealed sources –
- (1) Each industrial radiographic exposure device or container shall be provided with a lock or outer locked container designed to prevent unauthorised or accidental removal or exposure of a sealed radiography source and shall be kept locked except when under the direct supervision of radiographer or site-in-charge or Radiological Safety Officer.
 - (2) Locked radiographic exposure devices and storage containers shall be physically secured to prevent tampering or removal by unauthorised persons.
5. Leak testing of sealed radiography sources :-
- (1) Each sealed radiography source shall be tested for leakage of radioactivity at intervals specified by the Competent Authority as per the terms and conditions of the relevant licence.

- (2) Leak test on sealed radiography sources shall be performed only by person specifically authorised to do so by the Competent Authority.
 - (3) Any dry swipe test conducted on a sealed radiography source which reveals the presence of 0.005 microcurie or more of removable radioactivity shall be considered as evidence that the sealed source is leaky.
 - (4) If sealed radiography source is found to be leaky, the person performing the leak test shall forthwith inform the licensee as well as the Competent Authority.
6. Identification and tagging of sealed radiography sources, Industrial radiographic exposure devices, containers and handling tools –
- (1) The immediate container or bonding (namely, a source pencil) of a sealed radiography source shall have the following particulars engraved, punched or otherwise durably marked on it for purposes of identification and caution, namely:-
 - (a) name of radiography source, namely, Iridium-192, Cobalt-60, etc.;
 - (b) identification number of the source;
 - (c) name and address of the supplier;
 - (d) radiation symbol; and
 - (e) Danger-Radioactive Material “KEEP AWAY”

(The legend in (c) shall in addition, be durably marked in Hindi)
 - (2) In cases where any deviation is proposed to be made from the specification mentioned in sub-paragraph (1), specific written approval of the competent authority shall be obtained.
 - (3) Each industrial radiographic exposure device or container housing a sealed radiography source shall have a fire-proof metal plate permanently fixed on it bearing the name and address of the licensee and the following particulars, namely:-
 - (a) code and serial number;
 - (b) identity of source(s) along with capacity;
 - (c) name and address of the supplier;

- (d) radiation symbol; and
- (e) Danger-Radioactive Material “KEEP AWAY”

(The legend in (e) shall in addition, be durably marked in Hindi)

7. Handling tools :- Each handling tool shall have an identification number. For each source, an exposure device and the related handling tools shall be maintained by the licensee.
8. Inventory:-
 - (1) Each licensee shall conduct a quarterly physical inventory to account for all sealed radiography sources, containers, tools and exposure devices received and possessed by him.
 - (2) Records of the quarterly inventory shall be maintained in such Form as may be specified by the Competent Authority from time to time and shall be made available for inspection by any person duly authorised by the Competent Authority.
 - (3) A copy of the quarterly inventory shall be duly transmitted by the licensee to the Competent Authority.
 - (4) Each licensee shall produce the radiographic exposure devices, containers and tools before the Competent Authority for inspection at intervals not exceeding 12 months or at such intervals as may be specified from time to time by the Competent Authority.
9. Maintenance of log books :- Each licensee shall maintain current log book, which shall be made available for inspection by any person duly authorised by the Competent Authority, showing for each sealed source the following information, namely:-
 - (a) a description (make, model, code and serial number) of the radiographic exposure device or container in which the sealed radiography source is located;
 - (b) identification number of the contained source;
 - (c) the identity and the date of procurement of the radiography source on the said date;
 - (d) the identity of the radiography to whom assigned; and
 - (e) the plant or radiography site where used and dates of use.

10. Inspection, maintenance and repair of radiographic devices and containers
 - (1) Each licensee shall conduct periodical inspection of devices for safe maintenance of radiographic exposure devices and containers to ensure proper functioning of components important for safety and maintain appropriate records.
 - (2) Where any component important for safety is found to be functioning improperly, the use of the radiographic exposure device or container having such component shall be discontinued forthwith and the inspection report transmitted to the competent authority.
 - (3) The licensee shall not undertake any repairs on radiographic exposure devices and containers with the radioactive material contained therein.
 - (4) Repairs of radiographic exposure devices and containers with the radioactive material contained therein shall be undertaken only by a person duly authorised for the purpose by the competent authority.
11. Safe planning, design and operation of industrial radiography installations - In any industrial radiography installation :-
 - (i) the planning, design, construction and operation of facilities involving the use of radiation shall be done with the prior approval of and in accordance with the specifications laid down by, the Competent Authority; and
 - (ii) the working conditions adopted and the monitoring and personnel protective equipment provided shall be in accordance with the specifications laid down by the Competent Authority.
12. Transfer of sealed radiography sources and exposure devices – No radiography source shall be transferred by any person from one exposure device to another, to exposure device or container with the radioactive material contained therein shall be transferred by any person to any other person and no exposure device or container with the source contained therein shall be transferred from one radiography site to another without the specified prior approval of the Competent Authority except under the following situations, namely :-
 - (i) transfer of an Iridium-192 radiography source of strength not exceeding 8 curies from an exposure device to a lead container or vice versa in the course of radiography operations at a radiography site; and
 - (ii) transportation of a decayed radiography source in an exposure device or an appropriate container by the licensee back to the supplier.

13. Radiation safety requirements for personnel – The licensee shall not permit any person to act as a Radiological Safety Officer (RSO), Site-in-charge or as a radiographer until such person –
- (i) possesses a valid certificate (RSO's or Site-in-charge's or as a radiographer's, as the case may be) recognised by the Competent Authority;
 - (ii) has been instructed in the subjects outlined in Annexure I to this Schedule and shall have demonstrated understanding thereof to the satisfaction of the licensee and the Competent Authority;
 - (iii) has received copies of and instructions in the licensee's operating and emergency procedures and shall have demonstrated understanding thereof to the satisfaction of the licensee and the Competent Authority;
 - (iv) has received copies of and instructions in the rules and all notifications and orders, relevant to industrial radiography operations, issued under the provisions of this Schedule from time to time and shall have demonstrated understanding thereof to the satisfaction of the licensee and the Competent Authority; and
 - (v) has demonstrated, to the satisfaction of the licensee and the Competent Authority, competence to use radiographic exposure devices, sealed radiography sources, related handling tools and radiation survey instruments which are to be employed in his assignment.
14. Operating and emergency procedures – The licensee's operating and emergency procedures shall inter alia include the following instructions, namely:-
- (a) the handling and use of sealed sources and radiographic exposure devices in such a manner that no person is likely to be exposed in excess of the operational limits specified by the Competent Authority;
 - (b) procedures and occasions for conducting radiation surveys;
 - (c) procedures for controlling access to radiography site;
 - (d) procedures and occasions for locking and securing radiographic exposure devices and containers and sealed radiography sources;
 - (e) personnel monitoring and the use of personnel monitoring equipment;
 - (f) transportation of sealed radiography sources to field locations, including packing of radiographic exposure devices and containers in the vehicles, posting of vehicles and control of the sealed radiography sources during transportation;

- (g) minimising exposure of persons during normal use and in the event of an accident;
- (h) maintenance of records;
- (i) the inspection and maintenance of radiographic exposure devices and containers; and
- (j) the procedure for notifying proper persons in the event of an accident.

15. Personnel monitoring control :-

- (1) The licensee shall not permit any person to act as a radiographer unless, at all times during radiography operations, each such person wears a personnel monitoring badge and either a pocket dosimeter or pocket chamber capable of measuring doses from zero to at least 200 milliroentgens but not exceeding 500 milliroentgens.
- (2) Separate personnel monitoring badges shall be assigned to and worn by each radiation worker.
- (3) Pocket dosimeters and pocket chambers shall be read and doses recorded daily in respect of each radiation worker.
- (4) If a pocket dosimeter or pocket chamber is discharged beyond its range during normal use, the corresponding personnel monitoring badge shall be sent to Division of Radiological Protection, BARC immediately for urgent processing and, where appropriate, an investigation conducted regarding the circumstances of the exposure.
- (5) Investigation reports regarding all excessive exposures shall be duly transmitted by the licensee to the Competent Authority.

16. Security of sealed radiography sources :-

- (1) During each radiography operation, the licensee shall ensure through his Radiological Safety Officer or Site-in-charge or radiographer that a direct surveillance of the operation, as is considered appropriate, is maintained to prevent unauthorised entry into the radiography room, walled enclosure or cordoned area.
- (2) The licensee shall take adequate measures to ensure the security of the sealed radiography sources at all times.

17. Posting of radiation warning signs – Areas in which radiography is being performed or where sealed radiography sources are stored shall be conspicuously posted with appropriate radiation warning signs as per the directions of the Competent Authority.
18. Radiation survey instruments, radiation monitoring and record –
- (1) No radiography operations shall be conducted unless calibrated and operable radiation survey instrumentation as specified in Annexe II to this Schedule is available and used at each site where radiographic exposures are made.
 - (2) Radiation monitoring equipment shall be used after each radiographic exposure to determine that the sealed radiography source has been duly returned to its shielded condition.
 - (3) Records of radiation monitoring conducted pursuant to sub-paragraph (2) shall be maintained for the inspection of any person duly authorised by Competent Authority.

ANNEXE I

[See paragraph 13(ii)]

Subjects for inclusion in the instructions of radiographer, site-in-charge and Radiological Safety Officer

- (1) Fundamentals of radiation and radiation protection –
 - A. Characteristics of gamma radiation
 - B. Units of radiation dose and quantity of radioactivity
 - C. Biological effects of radiation
 - D. Hazards of excessive exposure to radiation
 - E. Levels of radiation from licensed material
 - F. Methods of controlling radiation dose –
 - (i) Working time
 - (ii) Working distance
 - (iii) Shielding
- (2) Concepts of permissible exposures
- (3) Radiation detection instrumentation to be used
 - A. Use of radiation survey instruments –
 - (i) Operation
 - (ii) Calibration
 - (iii) Limitations

- B. Survey techniques
- C. Use of personnel monitoring equipment -
 - (i) Film badge
 - (ii) Pocket dosimeter
 - (iii) Pocket chamber
 - (iv) Thermoluminescent dosimeter
- (4) Use of radiographic equipment –
 - A. Remote handling equipment
 - B. Storage containers
 - C. Inspection and maintenance
- (5) The requirements of pertinent radiation protection rules, notifications and orders issued thereunder to date.
- (6) The licensee's written operating and emergency procedures

ANNEXE II

[See paragraph 18(1)]

Radiation Survey Instruments required at any radiography site for radiation monitoring

Either

- A. (i) Radiation Survey Meter (G.M. Type 0-20 mR/hr or with other appropriate measurement range)

And

- (ii) Radiation Survey Meter (Ionisation chamber type 0-5 R/hr or with other appropriate measurement range)

Or

- B. Wide Range Survey Meter (G.M. type 0-100 R/hr or with other appropriate measurement range)

Alternatively any single or combination of radiation survey meters recognised by the Competent Authority as equivalent to the above

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S. Swaminathan, Under-Secretary