

## **NIGERIAN NUCLEAR REGULATORY AUTHORITY**

### **MINIMUM REQUIREMENTS FOR AUTHORIZING INDUSTRIAL RADIOGRAPHY FACILITY**

#### **ADMINISTRATIVE AND MEDICAL REQUIREMENTS**

- 2.1 An application for a licence to possess and use a X-ray unit must be submitted to the Directorate on form HT001. The applicant must show that he possesses the necessary equipment, facilities and trained personnel to ensure that the radiographic work will be performed in a safe manner.
- 2.2 Should a Responsible Person change at any stage, the Directorate must be informed of the change in writing.
- 2.3 An application for registration with the Directorate as an industrial radiographer must be made. Certified copies of documents must be included to show that a course at an approved educational institution has been successfully completed, and that 6 months practical experience (under the direct supervision of a qualified industrial radiographer) has been acquired subsequent to the completion of the course.
- 2.4 The holder of the licence must ensure that a document is drawn up outlining correct working procedures. The document must include details of all relevant safety procedures laid down by the Directorate (i.e. it is recommended that this code form a major part of the document) and must specify what actions are to be taken in the event of an emergency. The holder of the licence must take steps to ensure that his employees adhere to the correct working procedures.
- 2.5 A separate health register must be established for each radiation worker, and must be retained by the holder of the licence.
- 2.6 When the SABS reports to the licence holder that an employee's personal dosimeter (TLD) has registered more than the pro rata dose allocation for the wearing period, the holder must complete form G6/10 and forward it to the Directorate. The holder must furthermore ensure that a copy of this form is entered into the health register of the worker in question.
- 2.7 Radiation workers must be declared medically fit by a company appointed doctor before employment. A copy of this pre-employment medical evaluation must be entered into the health register of the worker concerned.
- 2.8 Medical examinations must also be carried out:
  - 2.8.1 where it is confirmed or suspected that a worker has, in any one year, received a radiation dose which exceeds twice the annual limit (i.e 20 mSv per year, averaged over 5 years, and not more than 50 mSv in any 1 year);
  - 2.8.2 where a medical practitioner deems it necessary;
  - 2.8.3 where the licence holder or the Director-General deems it necessary; or
  - 2.8.4 where a worker suspects that his health has been or will be detrimentally affected by occupational factors and such worker deems a medical examination necessary and requests such examination from the licence holder concerned.
- 2.9 When a radiation worker ceases to be employed by the licence holder, the holder must provide that worker with a copy of his complete dose record. Such complete records can be obtained from the SABS on request.

#### **EQUIPMENT SPECIFICATIONS AND PERIODIC TESTING**

3.1 An X-ray tube must be enclosed in a tube housing in such a way that the dose equivalent rate from leakage radiation measured at a distance of one meter from the focus does not exceed the following values for the given applied voltages and the corresponding maximum tube currents:

- up to 150 kV:1 000  $\mu$ Sv/h (100 mR/h)
- above 150 up to 200 kV:2500  $\mu$ Sv/h (250 mR/h)
- above 200 kV:5000  $\mu$ Sv/h (500 mR/h)

For discharge X-ray equipment, the dose equivalent rate shall be defined as the dose equivalent in one hour at the highest pulse rate.

3.2 A lead cap to be used for covering the radiation window during testing and start up preparation of the tube must be supplied. The lead cap must attenuate the primary beam so that the leakage radiation limits are not exceeded.

3.3 The lead cap must be easy to mount correctly. For panoramic X-ray equipment the lead cap (belt) must be mechanically strong.

3.4 Diaphragms giving different field sizes of the primary beam must be supplied.

3.5 The diaphragms must be easy to mount correctly. Panoramic X-ray equipment must be supplied with diaphragms enabling directional beam exposure. This is not required for X-ray crawlers.

3.6 X-ray equipment must be equipped with an extension cable for remote exposure control. The length of this cable must be at least 20 m for X-ray equipment exceeding 200 kV, and 10 m for kV's of 200 and lower.

3.7 The control panel must be provided with a key activated control. Without this key the control panel must be inoperable. Removal of the key after exposure must not result in any damage to the equipment, e.g. overheating.

3.8 Proper operation of the unit via the control panel must be the only way of controlling exposures. Accidental grounding of an electrical conductor must not result in generation of X-rays.

3.9 Two independent means which indicate when X-rays are being generated must be provided on the control panel. One of these indicators must be a red lamp of reliable design.

3.10 The control panel must be provided with door switch connectors for use on enclosed installations. This system must be designed in such a way that, when exposure has been interrupted by the opening of a door altering the switch circuit status, it shall be possible to resume generation of X-rays only by activation from the control panel after all doors have been closed again.

3.11 The control panel must be provided with a connection to an external warning lamp.

3.12 The tube head must be distinctly marked with the following information:  
location of focus; primary beam angle; and for panoramic units the cylindrical window must be marked with a colour distinctly different from  
that of the rest of the housing.

3.13 Periodic testing on the radiography equipment specified above must be carried out at

intervals not exceeding 24 months. All items of equipment which do not meet the requirements specified above, must be replaced, or repaired and retested.

- 3.14 The holder of the licence must keep documentary evidence of all of the above-mentioned tests for a period of at least 5 years. Such documents must be available for inspection purposes.
- 3.13 A brief guidance, written in one of the official languages of the country, shall accompany the unit (if convenient, in the control panel cover). The guidance shall contain a warning concerning radiation hazards, and an indication that the installation must be operated by qualified personnel only.
- 3.14 The instruction manual for the use of x-ray installations shall be written in one of the official languages of the country and shall only deal with the type of apparatus concerned.

### **SPECIFICATIONS FOR ENCLOSED EXPOSURE FACILITIES**

Any facility that does not comply with the following requirements is considered to be an open area (for example an exposure bay with walls, maze and portable equipment).

- 4.1 The remote control shall be placed outside the enclosure.
- 4.2 An enclosed exposure facility may not be located in an area zoned for domestic use.
- 4.3 The facility must be clearly marked with radiation warning signs, and the name and telephone number of a person to be contacted in the event of an emergency, must appear at the entrance to the facility.
- 4.4 The facility must incorporate a means to indicate positively that an exposure is underway. The facility must incorporate warning lights linked to the on-off mechanism of the unit.
- 4.5 Facilities in which X-ray equipment are installed must have interlock systems which prevent exposure if one of the entrance doors is opened before exposure or opened during exposure. Resumption of exposure must be possible only after manual restart at the control panel, after the door has been closed.
- 4.6 Enclosed exposure facilities must be provided with a device which makes it possible for a person accidentally left in the room, to open one of the doors easily and leave.
- 4.7 In facilities having more than one entrance door, the doors that are not controlled by the operator must be lockable from the inside, and the door under his control, lockable from the outside. If the facility has only one door it must be lockable from the outside.
- 4.8 The radiation dose rate outside the exposure facility must comply with the requirements of paragraphs 8.1 to 8.3, and at a distance of 1 m from the outer surface of an enclosed installation should preferably not exceed 2.5  $\mu\text{Sv/h}$  (0.25 mR/h), but must not exceed 7.5  $\mu\text{Sv/h}$  (0.75 mR/h) when the properties of the radiation source correspond to the maximum ratings stated for that enclosed installation.
- 4.9 Enclosed installations must be provided with a sign stating the maximum rating and limitations on the primary beam directions established for that installation.

### **TRAINING REQUIREMENTS**

#### **Responsible Person**

- 5.1.1 The Responsible Person must ensure that all persons performing industrial

radiography or who act as radiographic operators and assistants have the necessary training and are familiar with the correct operating and safety procedures. In particular the training requirements specified below must be met.

**Initial Training requirements**

- 5.2.1 Persons wishing to work as industrial radiographers must successfully complete a course in industrial radiography at an approved institution, and must subsequently undergo a practical training period of 6 months under the supervision of a qualified and authorised industrial radiographer.