



NATIONAL RADIATION PROTECTION AUTHORITY

***REQUIREMENTS FOR DESIGN
OF A DIAGNOSTIC
X-RAY FACILITY***

MINISTRY OF HEALTH AND SOCIAL SERVICES



Republic of Namibia

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1. Introduction

The National Radiation Protection Authority is mandated by the Atomic Energy and Radiation Protection Act, Act 5 Of 2005 to regulate the use of radiation generating equipments. This Act is further supported by the *Radiation Protection and Waste Disposal Regulations*.

The Act requires that a notification be made by any person or institutions that wish to engage in the use of radiation generating equipment. Such notification has to be accompanied by an application and subsequent authorisation of the premises and equipment that will be used for the intended practises, including a diagnostic x-ray facility.

Both the Act and the regulations are not specific in respect to the design and requirements of an x-ray diagnostic facility. However the authorisations are issued subject to conditions made by the issuing authority, which includes design and safety requirements that will ensure that protection against ionising radiation is guaranteed.

This document sets out minimum requirements for applicants and users in the establishment of a diagnostic x-ray facility and also forms the basis along which an inspector will conduct an inspection in consideration of a premises license.

2. Authorisation Process

The authorisation process and requirements apply to any person who uses, modifies or disposes of an electronic product, including x-ray generating equipment or premises on which it is housed.

The chronological order for an authorisation should be as follow:

- a) The person/institution that intends to introduce or modify a practise using ionising radiation must declare his intention on prescribed application form obtainable form the National Radiation Protection Authority (NRPA).
- b) The application form should include all necessary information such as facility layout and accompanied by a Radiation Management Plan (RMP) as outlined in document NRPA_AG_01. The application will be reviewed by the NRPA and followed by

consultations to reach agreement on details of the application, including premises layout.

c) Upon approval granted by the authority for a premises license construction may start.

d) An inspection must be conducted mid-way through the construction phase to ascertain that agreed plans are followed and implemented.

e) Following the satisfactory safety assessment of the physical facility, the installation of the equipment may be started.

f) As soon as the equipment has been installed, the applicant must notify the NRPA to conduct a generic safety assessment.

g) It is only after a license has been issued that the electronic product/x-ray equipment may be commissioned and brought into use for the intended practice.

3. X-Ray Facility Design Considerations and Minimum Requirements

3.1 Location

a. X-ray rooms should preferably be on the ground floor

b. It is however acceptable that the x-ray room be a levelled floor provided that evidence indicates that the structural design can support the weight of the x-ray unit.

c. For x-ray rooms on levelled floors, there must be proper shielding for above and below the room. (typically 150 mm concrete floor of 2.3 g/cm³ and 100mm concrete ceiling, if the space above is occupied).

3.2 Room Size (including control panel area)

The x-ray room layout should at minimum be:

a. 20 m² for a general radiographic room

b. 30m² for a fluoroscopy room

- c. 35m² for CT room
- d. a parking space of 3m² must be added if patients arrive in bed.
- e. 8m² for mammography

3.3 Walls

The walls of the x-ray room should at minimum be constructed with:

- a. 230 mm brick (2.3 g/cm³) or
- b. 2 mm leadsheet sandwiched between partitioning alternatively for CT rooms 2.5 mm leadsheet sandwiched between partitioning or
- c. 115 mm brick (2.3 g/cm³) with 4 mm barium plaster (1 part coarse barium sulphate, 1 part fine barium sulphate, 1 part cement).
- d. 115 mm brick or 1mm leadsheet wall protection is sufficient for mammography, dental and fixed *mobile* x-ray units.
- e. the ceiling height should be at least 2.5m
- f. Windows are acceptable only if positioned so that nobody outside can be exposed to radiation (or look into the room). A window height of 2m above ground level is recommended.
- g. Control cubicle wall should be protected with the same wall protection as above and should have a height of atleast 2.5m.

3.4 Viewing window requirements

- a. The lead glass window should be at least 35 cm x70 cm to give full view of the installed x-ray unit.
- b. A protective lead screen glass for the control console inside the X-ray room should contain 0.5 – 2mm of lead (depending on its distance from the patient, the main source of secondary radiation).
- c. The lead glass and protective material (wall) must overlap each other by at least 25mm
- d. The x-ray system control panel should be at least 1 m from the

open end nearest to the examination table

3.5 Change Cubicles

a. Protection for wall and doors leading into the x-ray room from the change cubicles must be the same as provided for the x-ray room, control cubicle and entrance door above.

3.6 Access points

a. Access points must have necessary radiation shielding. Doors should be lined with at least lead sheets of at least 2mm. CT room doors must be lined with 2.5mm lead sheets, while 1 mm lead sheet should suffice for dental or fixed *mobile* x-ray rooms.

b. Access doors should preferably be of the sliding type with at least 1.5m clearing space and 100mm overlap on each side.

c. Radiation warning signs/notices must be displayed at all entrances into the x-ray room.

d. A red light coupled to the x-ray unit exposure switch must be installed above the entrance door.

e. The darkroom must ideally have an entrance from the control panel area through a light-tight door or a light trap with double doors.

f. Doors leading into the x-ray room must be lockable from the inside to prevent inadvertent entry during examinations.

3.7 Public Protection

a. The dose rate in the reception area, adjacent offices, waiting area should be comparable with background levels even when the x-ray tube primary beam is directed to the area of interest.

b. The equipment should be positioned so that the primary radiation beam is not directed at the operator's console, windows or doors.

4. X-Ray Room Accessories

The following are accessories that must be in an x-ray room as part of the radiation protection requirements

- a. Gowns, aprons and thyroid protectors made of a material (such as vinyl) which contains lead should be part of protective gear in the x-ray room.
- b. Aprons should be equivalent to at least 0.25 mm of lead if the X Ray equipment operates up to 100 kV and 0.35 mm of lead if it operates above 100 kV.
- c. Aprons may be the wrap-around type or the height-relieving type.
- d. Gauntlets are heavy gloves. They have limited value because they are difficult to use and should therefore only be used where appropriate.
- e. Additional protective devices should be available in fluoroscopy and interventional radiology rooms which include:
 - Ceiling suspended protective screens.
 - Protective lead curtains mounted on the patient table.
 - Protective lead curtains for the operator if the X- Ray tube is placed in an over couch geometry and if the radiologist must stand near the patient.
- f. Individual dose monitoring should be undertaken for workers who are normally exposed to radiation in controlled areas.
- g. Additional accessories such as lead stand, lead strips, exposure charts and cassette positioning devices should be available.



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