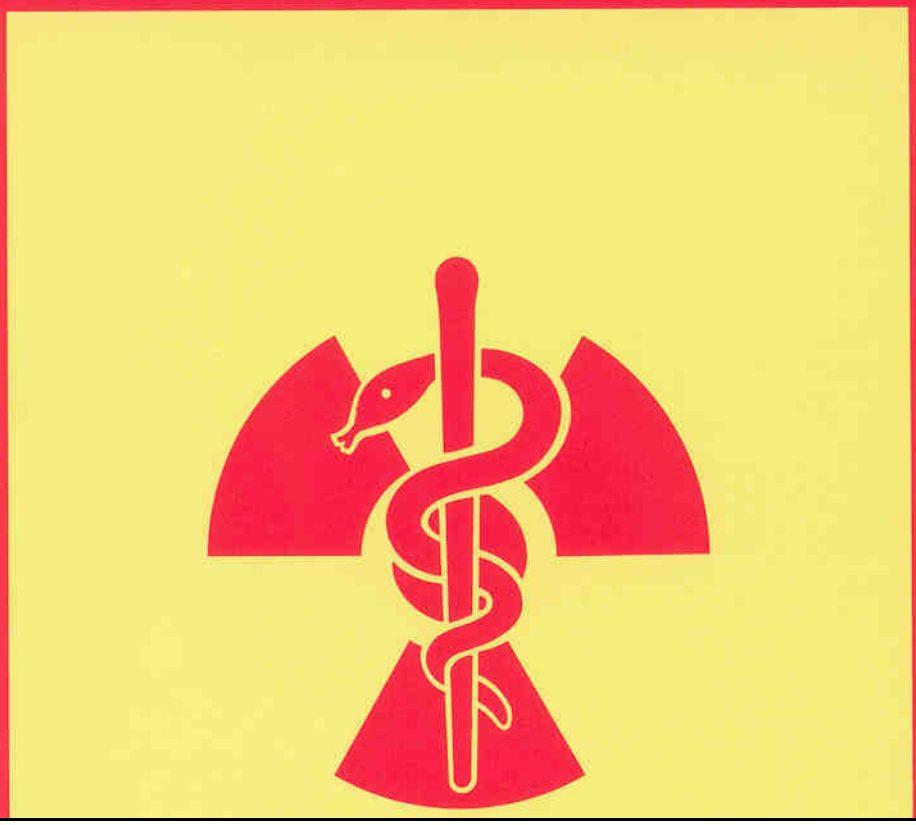
Statement on enclosed X-ray equipment for special applications (1987)



NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL

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APPENDIX XVIII

Statement on enclosed X-ray equipment for special applications (1987)

Contents

1. Introduction

This statement applies to X-ray equipment in a shielded enclosure into which articles, products or other materials may be placed, or through which they may pass for examination, testing or sorting, and in which the dose rate in the X-ray beam may be sufficiently high to produce serious injury to part of a person's body after a short exposure. The high dose rate may be the result of any of the following:

(a) use of an X-ray tube intended for X-ray analysis or radiotherapy;

(b) low filtration tube windows;

(c) short distance between tube focus and area of concern; or

(d) operating conditions of the tube (kVp and mA).

Compliance of such equipment with the requirements of this statement will render it highly unlikely that a person using it in the proper manner will be exposed to harmful levels of radiation.

The statement does not apply to X-ray analysis equipment or to cabinet X-ray equipment. These are the subjects of a separate code and statement respectively.

2. Radiation shields

Radiation shields installed to achieve compliance with the external radiation limits in section 3 shall be made of lead attached to supporting material having substantially greater resistance to distortion than lead, or of other dense material with appropriate X-ray attenuation properties such as steel, brass or lead glass.

Reduction of radiation emitted through a port* to the level permitted in this statement may be achieved by the use of baffles, tunnels providing distance protection or other equivalent method.

* A 'port' means any opening in the outside surface of the equipment for the purpose of conveying materials to be irradiated into and out of the equipment.

3. External radiation

The radiation level at any accessible point 5 centimetres from the external surface of the equipment shall not exceed 5 microgray in one hour when averaged over an area of 100 square centimetres. Compliance with this requirement shall be determined with the X-ray tube operated at any of the permissible ratings specified by the manufacturer of the equipment.

4. Safety interlocks

A safety interlock is a device intended to prevent exposure of any part of the body to the primary X-ray beam or to intense scattered radiation by de-energising the X-ray tube under either of the following conditions:

(a) when a door or access panel is opened; or

(b) when two components or pieces of equipment interconnected by electrical or mechanical means are separated.

Any safety interlock fitted in accordance with this statement shall be so designed that it is difficult to render it ineffective or to operate it except by means of the appropriate door, panel or component.

5. Access

Where entry ports are provided for insertion of items or materials to be examined, the equipment shall be so designed that insertion of any part of the body into the primary beam or into an intense beam of scattered radiation is not possible.

Any panel or door which could permit access to the X-ray tube housing or any enclosure attached to it shall be provided with at least one safety interlock and shall comply with at least one of the following:

(a) it shall require the use of tools to open it; or

(b) it shall require the use of a key to open it and this shall not be the same key required in section 6 of this statement.

Where access to components associated with or adjacent to the tube housing and enclosures is required for maintenance purposes when the X-ray tube is energised, a key operated switch may be provided for exclusive use by authorised maintenance personnel to inactivate specified interlocks fitted to doors and access panels. This switch shall not inactivate any interlock referred to in section 8 of this statement. The key required for this switch shall not be the same key as any other key required in this statement. This key operated switch shall not permit access to the primary X-ray beam or to an area of intense scattered radiation.

6. Controls

Controls referred to in this section are those which initiate and terminate the generation of X-rays, other than by the functioning of a safety interlock or mains power control.

- There shall be a key operated mains control so connected that X-rays cannot be produced when the key is removed.
- There shall be a separate switch for the control of the X-ray beam. Additional switches may be provided for remote operation.
- Where the X-ray tube is de-energised by the operation of a safety interlock, it shall not automatically be re-energised by restoration of the interlock but shall require the operation of a control switch.

7. Ground fault

An accidental earthing of an electrical conductor shall not result in the production of X-rays.

8. Tube housing

An X-ray tube incorporated in an X-ray equipment to which this statement applies shall be enclosed in a tube housing which satisfies the following requirements:

(a) It shall be constructed of material of sufficient strength and thickness to ensure that it cannot be fractured or deformed by normal use, accidental impact or misuse.

(b) The radiation level at any accessible point 5 centimetres from the surface of the tube housing and any enclosure attached to it shall not exceed 25 microgray in one hour when the X-ray tube is operated at any of the permissible ratings specified by the manufacturer of the equipment. Where any part of the tube housing and any enclosure attached to it form part of the external surface of the equipment, then the requirement of section 3 shall prevail.

(c) Each aperture in the tube housing shall be covered by:

- a radiation shield;
- a completely shielded enclosure, any entrances to which are provided with safety interlocks, so that opening one entrance immediately de-energises the tube; or
- a shielded enclosure within which there are permanently fixed baffles, shields or tunnels such that the external radiation level at any port which allows access to the enclosure is in compliance with section 3.

(d) Each enclosure or radiation shield specified in clause 8(c) shall comply with at least one of the following:

- it shall be interlocked with the tube housing so that the detachment of the enclosure or shield from the housing de-energises the X-ray tube; or
- it shall be attached to the tube housing so that it can only be removed using tools and it shall be provided with a warning label with the following or similar wording:

DANGER
High radiation levels inside.
DO NOT remove when X-ray tube is energised.

(e) The X-ray tube and tube housing shall be interlocked so that removal of one from the other or the removal of protective covers from any aperture or service opening will immediately de-energise the tube.

(f) A safety interlock which uses a microswitch, fitted in accordance with this section, shall incorporate dual microswitches. Any other type of device used in a safety interlock shall be of high reliability and comply with the appropriate Australian Standard.

9. Filtration

Where practicable, permanent filtration shall be fixed in the X-ray beam to reduce the intensity of the beam to the minimum consistent with the proper operation of the equipment for its intended purpose. Permanent filtration shall only be removable using tools. Where the equipment is intended for purposes which may require this filtration to be changed periodically, interlocks shall be provided so that the X-ray tube cannot be energised unless filtration appropriate to the selected operating conditions is in place.

10. X-Ray indicator lights

The equipment shall be fitted with an illuminated sign or combination of a sign and light which displays the words 'X-RAYS ON' or wording of similar meaning and shall be activated only when the X-ray tube is energised. The words shall be legible and readily discernible for at least two metres on all accessible sides of the equipment. The sign or light specified in this section shall be designed to be 'fail safe' (i.e. to de-energise the X-ray tube if

the light fails). Alternatively, adequate warning that a light has failed shall be indicated in a clear and unambiguous manner.

Where that part of the equipment containing the X-ray tube is separate from the main control unit, the sign or combination of sign and light referred to in the preceding paragraph shall be fitted to the part containing the tube. An additional sign or combination of sign and light shall be fitted to the main control and any other remote control but these do not require to be discernible on all accessible sides of the control.

11. Warning sign

A clearly visible sign bearing an ionizing radiation warning symbol (trefoil) and the word 'CAUTION' shall be fixed to the equipment near the control panel, but it shall be fixed to the part of the equipment containing the X-ray tube if this is separate from the control panel. In addition, the following or similar wording shall be included on the sign:

X-RAY EQUIPMENT
This Unit produces radiation when energised.
Access by unauthorised user and maintenance personnel prohibited.

The lettering and symbol shall be black on a yellow background. The statutory authority (see Annex) should be consulted with respect to this requirement.

12. Instructions

Manufacturers and suppliers of X-ray equipment to which this statement applies shall provide the purchaser with adequate written instructions on the operation of the equipment and on radiation safety procedures.

Annex

Statutory authorities

Where advice or assistance is required from the relevant statutory authority, it may be obtained from the following officers:

1. **Australian Capital Territory**
   Consultant, Radiation Safety
   ACT Community and' Health Services
   PO Box 825
   CANBERRA CITY ACT 2601
   Telephone (062) 47 2899
   Fax (062) 47 2851
2. **New South Wales**
   Officer-In-Charge
   Radiation Health Services
   Department of Health
   PO Box 163
   LIDCOMBE NSW 2141
   Telephone (02) 646 0222
   Fax (02) 646 0333
3. **Northern Territory**
   Director
   Occupational and Environmental Health
   NT Department of Health and
   Community Services
   GPO Box 1701
   DARWIN NT 5794
   Telephone (089) 80 2911
   Fax (089) 41 0560
4. **Queensland**
   Director
   Division of Health and Medical Physics
   Department of Health
   535 Wickham Terrace
   BRISBANE QLD 4000
   Telephone (07) 224 5611
   Fax (07) 839 5847

5. **South Australia**
   Senior Health Physicist
   Occupational Health and Radiation
   Control Branch
   South Australian Health Commission
   GPO Box. 1313
   ADELAIDE SA 5001
   Telephone (08) 226 6521
   Fax (08) 232 0334

6. **Tasmania**
   Health Physicist
   Division of Public Health
   Department of Health Services
   PO Box 191B
   HOBART TAS 7001
   Telephone (002) 30 6421

7. **Victoria**
   Chief Radiation Officer
   Radiation Safety Section
   Health Department Victoria
   555 Collins Street
   MELBOURNE VIC 3000
   Telephone (03) 616 7777
   Fax (03) 616 7147

8. **Western Australia**
   The Director
   Radiation Health Branch
   Health Department of Western Australia
   Verdun Street
   NEDLANDS WA 6009
   Telephone (09) 389 2713
   Fax (09) 381 1423

For after hours emergencies only, the police will provide the appropriate emergency contact number.