ACCREDITATION STANDARDS

Patient Safety

RADIATION SAFETY

Definitions

**mobile equipment**  
X-ray equipment that is moved between incidents of use and/or portable equipment affixed with wheels for mobile application. Mobile X-ray equipment routinely used in one location is considered a fixed installation and the shielding needs for the equipment and room are determined accordingly.

**radiographic equipment**  
X-ray equipment that implements a technique in which the information contained in the X-ray pattern is obtained, recorded and optionally processed.

**radioscopic equipment**  
X-ray equipment that implements a technique in which continuous or periodic sequences of X-ray patterns are produced and simultaneously and continuously displayed in the form of visible images. Fluoroscopic equipment is another commonly used term and includes radio fluoroscopy, fluoroscopy and C-arm equipment.

The term medical X-ray equipment refers to any or all of the different types of X-ray equipment such as mobile, radiographic and radioscopic equipment.

Administrative control measures ensure the safe use of X-ray equipment

INDICATORS:

- Acceptance testing of all new, used and refurbished medical X-ray equipment confirms compliance with Health Canada regulatory requirements, Radiation Emitting Devices (RED) Regulations
- Existing X-ray equipment is upgraded to incorporate as many as possible of the safety and performance features required of new medical X-ray equipment
- X-ray equipment is registered with the College’s Non-Hospital Medical and Surgical Facilities Accreditation Program (NHMSFAP)
○ The medical director ensures the safe use of X-ray equipment in the facility and retains a responsible user and a radiation safety officer (RSO)/medical physicist*
  *A responsible user can also be the RSO

○ The medical director ensures that the responsible user and the RSO/medical physicist are appropriately qualified and that they fulfil their respective responsibilities in accordance with Health Canada Safety Code 35

○ The responsible user is a licensed physician, technologist or facility administrator and demonstrates competency in the duties of the responsible user

○ The responsible user manages the radiation safety program and ensures that personnel requirements, equipment performance and safety procedures are followed

○ The responsible user ensures that all personnel operating X-ray equipment are appropriately qualified, trained and experienced

○ The RSO* acts as an advisor for all aspects of the facility’s radiation safety program and is suitably trained and experienced in the work, hazards and control measures necessary to perform the duties of a RSO
  *
The RSO may be contracted

### The radiation safety program minimizes the radiation exposure to staff, visitors and patients

**INDICATORS:**

○ Radiation safety program policy and procedures are in place and include:
  - safe use of X-ray equipment
  - listing of authorized X-ray equipment operators
  - radiation protection and safety practices
  - protection of female patients of childbearing age (11 to 55 years) and pregnant staff
  - education and training of personnel
  - exposure monitoring (dosimetry), as required by WorkSafeBC
  - maintenance schedule

○ The RSO/medical physicist ensures shielding calculations are performed by trained individuals with current in-depth knowledge of structural shielding design

○ The RSO/medical physicist ensures that the appropriate personal protective equipment and radiation shielding barriers (e.g. permanent structural material within the walls, floor, ceiling and/or moveable shields) are in place

○ Personnel radiation monitoring is established, as determined by the RSO/medical physicist, and records of exposure monitoring and personal dosimetry data retained for the period that the worker is employed plus 10 years

○ Each known or suspected case of excessive of abnormal exposure to patients or staff is investigated by the RSO/medical physicist and action taken to prevent recurrence
X-ray equipment checks, safety procedure checks and radiation surveys are regularly performed by the RSO/medical physicist.

Radiation protection surveys are conducted every four years to detect equipment problems or any trends toward a decrease in the level of radiation safety.

Radiation protection surveys are conducted prior to new X-ray equipment being put into use, when X-ray equipment is repaired or modified, if there is an indication of an unusually high radiation exposure of a worker and if there are renovations or damage to radiation shielding barriers.

Radiation protection surveys are retained for at least 10 years.

A copy of Health Canada Safety Code 35 is readily available in the X-ray area.

**Occupational exposure to radiation is monitored**

**INDICATORS:**

- The medical director implements a personnel radiation monitoring service (e.g. Health Canada National Dosimetry Services) as directed by the RSO/medical physicist.
- Monitoring of personnel exposure is carried out for a period of at least one year to establish exposure levels when there is no existing information on staff doses following which WorkSafeBC will determine whether personnel radiation monitoring is required.
- Facilities not monitoring staff exposure limits have WorkSafeBC approval on file confirming that personnel radiation monitoring services are not required.
- All staff with an exposure level that exceeds or may exceed the action level (1 mSv/year), established by WorkSafeBC Occupational Health and Safety Regulation, are provided with a personal dosimeter.
- A dosimeter is assigned to a specific individual; dosimeters are not loaned or exchanged with another person.
- Personal dosimeters are worn and stored according to the recommendations of the dosimetry service provider.
- The personal dosimeter is worn under the apron when a protective apron is worn.
- Personal dosimeter monitoring records are maintained and reviewed by the RSO/medical physicist.
- Staff exposure to ionizing radiation does not exceed an annual effective dose of 20 mSv.

**Environmental and procedural control measures ensure staff and visitor exposure to radiation is minimized**

**INDICATORS:**

- X-ray equipment is operated in a controlled access area.
Warning signs are posted to alert personnel to potential radiation hazards at entrances to operating/procedure rooms when radiological equipment is in use.

Warning signs incorporate the X-ray warning symbol which is displayed in two contrasting colors, is legible from a distance, and bears the words “CAUTION: X-RAYS.”

Doors to the operating room remain closed when X-ray equipment is in use.

Except for those individuals whose presence is essential, all individuals leave the room when the irradiation is carried out.

Direct radiation exposure of staff by the primary beam is not allowed.

Deliberate irradiation of an individual for training purposes or equipment evaluation is not permitted.

Personal protective devices (shielding) are worn by all staff during radioscopy and spotfilm operation.*

*As determined by the RSO/medical physicist X-ray exposure from mini C-arm procedures may not require that personal protective devices be worn.

Slings, traction devices and sandbags are used to maintain patient position during radiation exposure. Manual holding of the patient is avoided.

Lead acrylic screens and moveable shields are used as directed by the RSO/medical physicist.

Operator/user manuals and facility policy and procedures are readily available in the X-ray area.

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### Personal protective equipment minimizes or controls radiation exposure hazards associated with X-ray use

**INDICATORS:**

- The lead equivalent thickness of the protective material used is permanently and clearly marked on all protective equipment and apparel.

- Protective lead aprons have a lead equivalent thickness of 0.5 mm.

- Protective gonad shields for patients have a lead equivalent of 0.5 mm at 150 kVp.

- The attenuation value is clearly marked on all protective screens and shields.

- Lead acrylic screens and moveable shields provide protection equivalent to at least 0.50 mm Pb.

- Protective equipment is stored and maintained according to manufacturers’ recommendations (e.g. aprons hung on designated hangers).

- Lead protective apparel testing is conducted and documented annually, at a minimum, and when damage is suspected.

- Lead protective apparel is decommissioned and properly disposed of when radiographic holes or cracks exceed the maximum aggregate area as published by the BC Centre for Disease Control.
Diagnostic imaging equipment is safely operated by qualified personnel

**INDICATORS:**

- X-ray equipment is operated only by personnel approved by the medical director, in consultation with the responsible user.

- Physicians who operate ultrasound units, to perform limited scope obstetrical and gynecological ultrasound services, are licensed to practise obstetrics and gynecology or perinatology and approved by the College to perform this restricted service.

- Physicians who operate ultrasound units, to perform limited scope vascular ultrasound services, are licensed to practise vascular surgery and approved by the College to perform this restricted service.

- Physicians who operate miniature mobile fluoroscopy units (e.g. mini C-arm) have documented training in: the safe operation of the X-ray equipment and accessories used in the facility; the radiological procedure being performed; and radiation protection procedures and measures.

- Competency of the physician operator is assessed by a medical radiation technologist who is certified with the Canadian Association of Medical Radiation Technologists (CAMRT) prior to independent work on patients and at regular intervals.

- Physicians do not operate conventional or full-size X-ray equipment (e.g. full-size C-arm).

- Radiation Technologists who operate X-ray equipment are certified with the CAMRT or are graduates of an accredited training school of radiology and are eligible to write the CAMRT certification examinations or are certified combined laboratory/X-ray technologists (CLXT).

- The X-ray equipment is used in accordance with its intended purpose and within the operators scope of practice, education and individual competence.

- The operator has a clear view of the patient during every X-ray examination and is able to communicate with the patient and/or attendants.

- The operator notifies personnel present in the operating room before activating the X-ray equipment.

- X-ray machines which are energized and ready to produce radiation are not left unattended.

Patient exposure to radiation is minimized

**INDICATORS:**

- The X-ray operator performs only an examination which has been requested by an authorized individual (e.g. physician).

- The X-ray beam is well-collimated to restrict the beam as much as practicable to the area of interest.

- During radioscopic exposures, the operator has a clear line of sight to the output display at all times.

- Female patients of childbearing age (11 to 55 years) are asked whether there is any chance that they may be pregnant; this may be performed at time of admission.
Shielding is used where appropriate and practicable to limit the exposure of body tissues and when clinical objective will not be compromised.

Gonadal shielding is used during X-ray exams, including those performed on the abdomen, hips and upper legs if the clinical objectives of the examination will not be compromised.

Thyroid shielding is used during X-ray exams, including those performed on upper extremities, trunk and head if the clinical objectives of the examination will not be compromised.

All new radioscopic and radiographic equipment records can record patient dose in the form of the dose-area product (DAP) or reference point air kerma (Kar).

**X-ray documentation provides an accurate account of the patient’s status, the actions of the perioperative team and the patient’s outcome**

**INDICATORS:**

- The following parameters are documented in the patient’s medication record:
  - pregnancy status, of female patients of childbearing age (11 to 55 years), is recorded in the patient’s medical record
  - type of patient protection and area(s) protected
  - an indicator of patient dose, either fluoroscopy time or preferably DAP is recorded in the patient’s medical record

**References**


Operating Room Nurses Association of Canada (ORNAC). Recommended standards, guidelines, and position statements for perioperative registered nursing practice. 10th ed. [place unknown]: ORNAC; 2011. Section 4, Environmental hazards and responsibilities – physical hazards: 1.3 Radiation safety; p. 256-60.
