

Policy on x-ray protective clothing

Department of Environment,
Climate Change and Water NSW

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Department of
Environment, Climate Change and Water NSW



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A1 Conditions for use

A1.1 General

A1.1.1 All staff in a radiographic room during x-ray exposures who are not standing behind protective screens must wear protective clothing. A safety assessment must be undertaken to ensure all staff wear an appropriate lead-equivalent apron giving consideration to the type of procedure, kVp and position of the person in relation to the x-ray source.

A1.1.2 Protective gloves should also be worn if it is essential for the hands to be placed in the direct beam at any time, although there may be cases where this is impractical.

A1.1.3 Aprons and gloves must have radiation attenuation of not less than 0.3 mm lead equivalence at 100 kVp.¹

Where a maximum tube potential exceeds 100 kVp the suitability of using non-lead garments at this kVp must be considered.

A1.1.4 Aprons must cover the full width of the front of the body from the throat to within 10 cm of the knees, as well as the sides of the body. Wrap-around types of aprons must cover from the shoulder blades to below the buttocks. Fastenings must be provided to keep aprons closed.¹ Refer to part A3 for different types of x-ray protective clothing.

Where aprons have two overlapping front panels each panel must not be less than 0.3 mm in lead equivalence at 100 kVp.

A1.1.5 All staff working in a room where fluoroscopy or cineangiography is being performed must wear protective clothing.

A1.1.6 If the operator's eyes or thyroid are likely to be exposed when working in the immediate vicinity of the patient, then it is advisable to wear additional protection for these organs. The patients' thyroid should be protected where appropriate.

A1.1.7 Where appropriate, protection for the patient should also be provided in the form of protective clothing, such as an apron or gonad shield.

A1.1.8 Personal dosimeters must be worn under the lead apron. A dosimeter must not be worn outside the apron unless it is additional to one worn underneath and this fact is appropriately reported to the organisation issuing the dosimeter.

A1.1.9 An appropriately qualified person – for example, a consulting radiation expert, a radiation safety officer, a medical physicist or a senior radiographer – must be consulted before the purchase of x-ray protective clothing.

A1.1.10 The manufacturer's recommendations regarding the handling and storage of protective clothing must be strictly observed. Lead aprons must be stored either flat or on hangers to prevent the development of cracks in the protective material.

A1.1.11 Inspection and testing of protective clothing must be performed as described in section A2 of this policy.

¹ For the purpose of this policy, section 4.2 AS/NZS 4543.1 (1999) does not apply and lead equivalence is to be determined according to clause 6.3 of this standard.

A2 Inspection and testing requirements

A2.1 Identification

A2.1.1 Each item of protective clothing must be identified by the purchaser (facility) with a locally unique identifier that is indelibly marked on the article.

A2.1.2 A record must be kept that includes the identification number, usual location, date of purchase, lead equivalence, style, testing dates and test results.

A2.2 Visual inspection

A2.2.1 Each user must visually inspect each article of x-ray protective clothing at the time of each use and be confident of its integrity. Clothing must not be used if the surface appears cracked or damaged. (Note that most aprons have a non-shielding protective cover that may appear undamaged even if the shielding material underneath is faulty.)

A2.2.2 If there is a suspicion that protective clothing is faulty, it must be tested by a licensed radiographer, medical physicist or other appropriate person such as a radiation safety officer or a consulting radiation expert. Any person undertaking screening must have an appropriate radiation licence issued by the authority.

A2.3 Shielding integrity testing procedures

A2.3.1 All new protective clothing must be tested for shielding integrity before use.

A2.3.2 Protective clothing must be tested at regular intervals of no more than 12 months, or more frequently if indicated.

A2.3.3 A licensed radiographer or other appropriate person such as a licensed medical physicist, radiation safety officer or consulting radiation expert or must carry out the testing.

A2.3.4 Testing may be performed using fluoroscopy at approximately 60 kVp (ideally with a floating-top table), which gives good radiographic contrast. Faults or inhomogeneities in shielding should be easily observed. (Note that the lead equivalence cannot be measured or verified by this method.)

A2.3.5 If faults are found, an image of the region must be taken and must be kept and the apron marked as faulty. The article must be immediately removed from use and returned to the radiation safety officer, medical physicist or chief radiographer or another appropriately qualified person. Refer to part A4 for examples of aprons with shielding defects.

A.2.3.6 Based on the cost of replacing lead protective aprons and the estimated radiation dose received from a defect, it is suggested that lead aprons be replaced if a defect is greater than 15 mm² (Lambert *et al*). If the defect is clearly not over a critical organ then continued use of the lead apron may continue, provided the location of the defect is clearly marked on the lead apron and the size, location and date that the defect was identified logged in the accompanying documentation. Defects not in close proximity of critical organs, which are along the seam, or in overlapped areas, or on the back of the lead protective apron should be subject to a less conservative rejection criterion.

In these cases, it is suggested that lead aprons be replaced if a defect is greater than 670 mm² (Lambert *et al*). Thyroid shields with defects greater than 11 mm² (Lambert *et al*) should be replaced. (Extract from Advisory Information on the testing of lead aprons, Department of Human Services, State Government of Victoria)

A2.3.7 All protective garments must be marked in accordance with Standards Australia/Standards New Zealand. Protective Devices Against Diagnostic Medical X-Radiation. Part 3: Protective clothing and protective devices for gonads. AS/NZS 4543.3.2000.

A3 Different types of protective clothing

Standard apron

Straps cross the waist and tie securely in front, a velcro shoulder strap prevents slippage.

Back view



Overlap skirt with vest

Provides full protection, splits the weight between the shoulders and hips.

Wrap-around apron

Full front and rear protection with the addition of a wide belt which, when properly adjusted, transfers the weight from the shoulders to the hips.



Apron with thyroid shield
To protect front, rear and thyroid.



OH2H



Thyroid collar

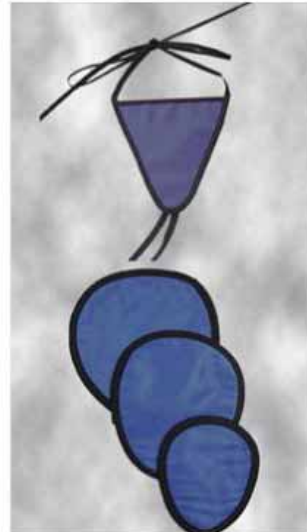


Protective leaded eyewear
Lead glasses provide x-ray protection for the eyes.



Moulded gloves
To protect hands and wrists.

Gonad shields
Protect the reproductive organs.



Leaded protective masks
Provide eye protection against scatter radiation.

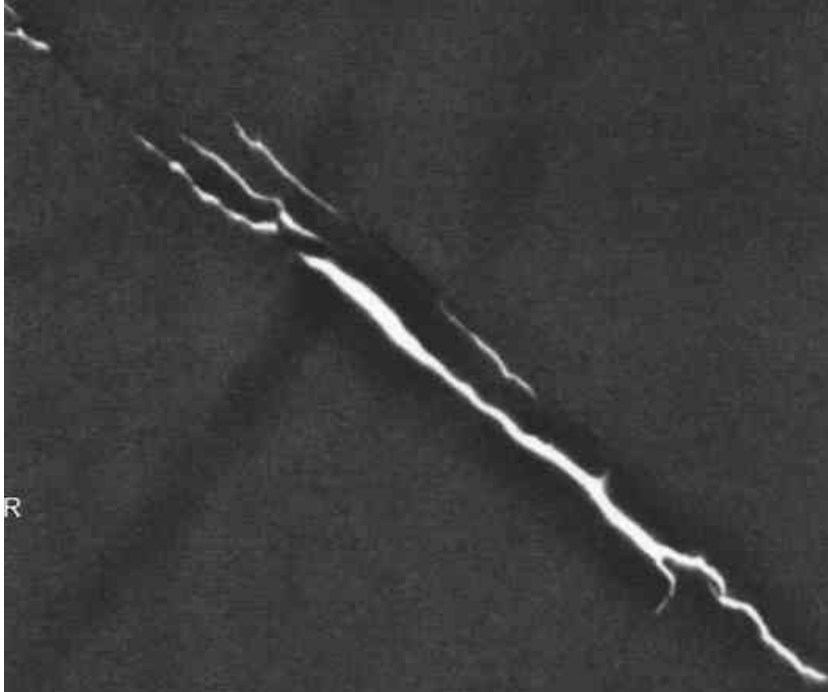


A4 Examples of aprons with shielding defects (white sections)

Digital images of light lead gowns, captured from a fixed fluoroscopy unit.



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R

960 x 960

EE 10%

A5 More information

For further information, the following Australian Standards should be consulted:

Standards Australia/Standards New Zealand (1999). *Protective devices against diagnostic medical x-radiation. Part 1: determination of attenuation properties of materials.* AS/NZS 4543.1 Sydney/Wellington

Standards Australia/Standards New Zealand (2000). *Protective devices against diagnostic medical x-radiation. Part 3: protective clothing and protective devices for gonads.* AS/NZS 4543.3. Sydney/Wellington.

– Radiation Advisory Council (June 2009)

Reference

Lambert K and McKeon T, 2001, 'Inspection of lead aprons: criteria for rejection', Operational radiation safety, *Health physics*, 80, supplement 5, May 2001, S67–S69.