

Radiation Protection Services has frequently received inquiries from staff in diagnostic x-ray facilities about the correct type of lead apron for their job, how to store aprons when not in use and how to deal with damaged lead aprons. There are specific sections in various Health Canada safety codes that address the type and correct use of protective clothing: For operators- Code 35 (medical) Sect. 4.1; Code 28 (veterinary medicine) Sect. 6.2; Code 30 (dentistry) Sect. 8.1.5. For patients- Code 30 (dental) Sect. 9.2.7. Users may benefit from receiving further clarification and guidance concerning selection, care, quality control, and disposal.

Proper Selection

Lead aprons are available in different sizes. In selecting an apron, make sure that there is good fit. Lead aprons also vary in lead equivalence. A lead equivalence of 0.5 mm recommended in the safety codes limits the x-ray transmission through the lead apron to less than 10% at 150 kVp. At 70 kVp, this apron would provide greater protection, limiting the transmission to less than 1%! (**Please refer to Table 1 below for transmission factors for details**). But the thicker the lead apron, the heavier it is. Therefore, users might optimize their choice of lead aprons according to the maximum x-ray tube potential used during their procedures. Where local advice is not readily available, suggested lead equivalents of protective aprons for different applications are as follows:

APPLICATION	LEAD EQUIVALENT
General medical diagnostic x-ray (procedures at 150 kVp)	0.50 mm
Computed Tomography (CT) (100-140 kVp)	0.35 mm
General medical diagnostic x-ray (100-140 kVp)	0.35 mm
General medical diagnostic x-ray (below 100 kVp)	0.25 mm
DXA (DEXA) type bone mineral densitometry units	no lead apron required
Veterinary x-ray (below 100 kVp used)	0.25 mm
Dental x-ray, patient protection (below 100 kVp used)	0.25 mm

For workers involved in interventional radiology procedures, the dual type aprons (with front and back shielding) should be provided to ensure that the wearer has all-round protection. For mini C-arm radioscopic units, please refer to RPS [RIN#14](#).

Proper Care

Lead aprons are expensive protective items that should be kept in good condition for as long as possible. Apart from deterioration due to aging, very often lead aprons are damaged due to incorrect handling. A lead apron (even with the latest improved material) tends to crack when being folded (cross folding would even be worse!), or laid over a pointed object. When not in use, aprons should be hung carefully on designated hangers or wrapped over a reinforced towel bar.

Quality Control

Aprons used in medical and veterinary facilities should be tested annually or as required under existing regulations or accreditation programs, and when damage is suspected. Select 80 kVp and the mAs you would use for a knee or a small animal radiograph without bucky using a 14"X17" film to demonstrate the central portion of the apron. If your x-ray machine is equipped with AEC function, use photo-timing with bucky. When any cracks or holes are demonstrated by the radiograph, the apron should be replaced if the sum or aggregate area of the holes or cracks in the apron exceeds 10 cm². In addition, replace the apron if any hole(s) or crack(s) in the reproductive region exceeds 0.2 cm² (20 mm²) and for aprons with built-in thyroid collar, if any hole(s) or crack(s) in the thyroid region exceeds 1 cm². The basis and method used in determining the limits on the sizes of the hole(s) or crack(s) in the lead apron and in other protective apparel such as thyroid shields and gauntlets can be found in the **RPS Report (2003)**, [Rejection Criteria for Defects in Lead Apparel Used for Radiation Protection of X-ray Workers](#). For dental facilities where aprons are mainly deployed for patient protection, replacement should be considered only when extensive physical damage is noticed.

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RIN #10 Proper Selection, Care, Quality Control and Disposal of Lead Aprons

Proper Disposal

Lead is included in the Toxic Substances List under the *Canadian Environmental Protection Act* (CEPA) Registry. It should not be disposed of as conventional garbage but as hazardous wastes. Coordinate with the officer in your organization who is responsible for disposal of such wastes.

Table 1 - Percentage Transmission of X-rays through Various Thickness of Lead at Different kVp

kVp	Thickness of Lead		
	0.25 mm	0.35 mm	0.5 mm
50	0.51%	0.13%	0.02%
70	4.1%	2.0%	0.82%
100	11.4%	7.1%	3.9%
120	14.2%	9.1%	5.2%
140	17.2%	11.3%	6.6%

Transmission data derived from CALKUX © 1990 Douglas J. Simpkin

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