

**NCRP REPORT No. 147**

# **Structural Shielding Design for Medical X-Ray Imaging Facilities**

**Recommendations of the  
NATIONAL COUNCIL ON RADIATION  
PROTECTION AND MEASUREMENTS**

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**National Council on Radiation Protection and Measurements  
7910 Woodmont Avenue, Suite 400 / Bethesda, MD 20814**

## 2.3 Shielding Design Elements

### 2.3.1 Interior Walls

Local building and fire codes, as well as state health-care licensing agencies, specify requirements for wall assemblies that meet Underwriters Laboratories, Inc. standards for life safety. Unshielded walls in contemporary health-care facilities are normally constructed of metal studs and one or more layers of 5/8 inch thick drywall (gypsum wallboard) per side. The corridor side of walls may contain two layers of gypsum wallboard. Several types of shielding materials are available for walls.

**2.3.1.1 Sheet Lead.** Sheet lead has traditionally been the material of choice for shielding medical imaging x-ray room walls. Figure 2.3 shows the thicknesses of sheet lead (in millimeters and inches) and their nominal weights (in lb foot<sup>-2</sup>) found to be commercially available from a survey of several major suppliers in the United States.<sup>6</sup> All of these thicknesses may not be available in every area. Figure 2.3 also presents the relative cost per sheet (on average) for each thickness compared to the cost per sheet for the 0.79 mm thickness. Note that the weight in pounds per square foot is equal to the nominal thickness in inches multiplied by 64. For example, ~~1/16 inch lead is equivalent to 4 lb foot<sup>-2</sup>.~~

For typical shielding applications, a lead sheet is glued to a sheet of gypsum wallboard and installed lead inward with nails or screws on wooden or metal studs. X-ray images of wall segments show that insertion of the nails or screws does not result in significant radiation leaks.<sup>7</sup> In fact, the steel nails or screws generally attenuate radiation equally, or more effectively, than the lead displaced by the nails. Therefore, steel nails or screws used to secure lead barriers need not be covered with lead discs or supplementary lead. However, where the edges of two lead sheets meet, the continuity of shielding *shall* be ensured at the joints (Section 2.4.2)

**2.3.1.2 Gypsum Wallboard.** Gypsum wallboard (sheetrock) is commonly used for wall construction in medical facilities. As Glaze *et al.* (1979) pointed out, the gypsum in each sheet is sandwiched

<sup>6</sup>Archer, B.R. (2003). Personal communication (Baylor College of Medicine, Houston, Texas).

<sup>7</sup>Gray, J.E. and Vetter, R.J. (2002). Personal communication (Landauer, Inc., Glenwood, Illinois) and (Mayo Clinic, Rochester, Minnesota), respectively.