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RADIATION SHIELDING FOR DIAGNOSTIC RADIOLOGY

Manufacturing standards for lead sheet

In the BIR Working Party Report on Radiation Shielding for Diagnostic Radiology we discussed (Section 3.1.1, page 25) two types of lead sheet: milled or rolled lead and machine-cast lead. With reference to milled/ rolled lead sheet, we wrote that it was the type "that should be used for protection" and that "it is prudent to specify "Code 3 lead manufactured to BS EN 12588:2006" or something similar". That section of the report is specific to lead sheet rather than fabricated products such as lead plywood or plaster board. However, since these incorporate lead sheet, the statement regarding compliance with BS EN 12588:2006 is applicable to the lead sheet used in the manufacture of those products.

Since the report was published we have been contacted by a manufacturer of machine-cast lead to point out that BS EN 12588:2006 only applies to rolled lead. There is no equivalent BS EN standard that applies to machine-cast lead. Our recommendation, therefore, effectively excludes such material from use for X-ray shielding either in sheet form or incorporated in a fabricated product. That was not our intention; we only sought confirmation that lead thickness was manufactured to a ±5% thickness standard.

In regard to machine-cast material we also stated that as well as "variability in thickness, it is also more likely to crack when bent". In the construction industry, where lead sheet is used principally for roofing, the concern over variability in thickness is based on the risk of cracking. Cracking in an installed lead sheet is caused by thermal expansion and contraction and is more likely with sheet of variable thickness and with the particular grain structure associated with machine-casting. However, the temperature variations within the radiology environment are very much less than those on a roof and cracking in the installed product is unlikely to be an issue.

Shielding designers need to know the degree of manufacturing tolerances and are advised to specify lead materials manufactured to a ±5% thickness standard. For Code 3 lead (1.32 mm) the ±5% standard corresponds to a potential reduction of 0.066 mm. Based on a limiting HVL of 0.2 mm at 85 kV (see Table 4.1) this would lead to an increased transmission of 20%. At 125 kV (limiting HVL=0.31 mm) and Code 5 lead (2.24 mm) it would correspond to 21% increased transmission. That level of uncertainty is reasonable because, a) shielding tends to be over specified, and b) it is generally less than the conservative allowances made for other factors used in the calculation such as workload and occupancy.

We continue to recommend a ±5% thickness standard for lead sheet and products fabricated from lead sheet. That can be assured if the manufacturer works to the BS EN 12588:2006 standard for rolled or milled material. If that standard does not apply to a particular production method then an alternative manufacturing assurance standard should be sought. The British Board of Agrément (BBA) was established by the UK government for the provision of a certification process for products used in the construction industry. **We accept that BBA certification of product specification and quality assessment may be used as an alternative to the BS EN standard to provide sufficient evidence that the thickness specification has been achieved.**

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21 August 2015