

Report number:	10032009
Report date:	10 March 2009
Work Order Agreement number:	2024/09

LEAD EQUIVALENCE AT DIAGNOSTIC X-RAY BEAM QUALITIES

Client name:	Winstone Wallboards Ltd.		
Client's address:	PO Box 12256, Penrose, Auckland.		
Samples submitted by:	Mike Greig	Date received:	27/02/2009
Samples analysed by:	John Laban	Analyses completed:	5/03/2009
Sample description:	<p>10 wallboard samples measuring approximately 20 cm x 20 cm x 13 mm thick from the Gib X-block product range (an x-ray resistant board manufactured in New Zealand). This board has a nominal thickness of 13 mm, and nominal weight of 16.7 kg.m⁻².</p> <p>The markings on the 10 samples were as follows: Sample 1: "670 g" Sample 2: "676 g" Sample 3: "677 g" Sample 4: "679 g" Sample 5: "681 g" Sample 6: "682 g" Sample 7: "687 g" Sample 8: "666 g" Sample 9: "648 g" Sample 10: "655 g"</p>		
Tests requested:	Determination of the lead equivalence of the supplied samples at diagnostic x-ray energies (as described below).		

Test method:	The method used is based upon the following international standard: AS/NZS 4543.1:1999 [Protective devices against medical x-radiation: Part 1: determination of attenuation properties of materials]. This standard is equivalent to the IEC standard 61331-1 (1994).
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Test method (cont.):	<p>NRL's method differs from AS/NZS 4543.1999 in the following ways:</p> <ul style="list-style-type: none"> • Air kerma measurement (K_a) (rather than air kerma rate measurement) is used • the radiation beam size is 70 mm \pm 2 mm square at the distal side of the test object • the distance from the distal side of the test object to the reference point of the radiation detector is 400 mm • the main radiation beam qualities utilised are: <ul style="list-style-type: none"> - 4 mm Al total filtration at 80 kVp - 2 mm Al + 0.24 mm Cu total filtration at 100 kVp - 2 mm Al + 0.39 mm Cu total filtration at 125 kVp. - 2 mm Al + 0.64 mm Cu total filtration at 150 kVp <p>The measurements are made using:</p> <ul style="list-style-type: none"> - A Philips Super 80 CP medium frequency generator - An Exradin A5 ion chamber and Keithley 6517A electrometer.
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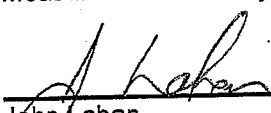
Traceability: Lead equivalence of the samples was determined by comparing the x-ray transmission of the samples against reference lead foils of greater than 99.99 % purity. The foils were supplied by Goodfellow Cambridge Limited, with nominal thicknesses provided. Actual thicknesses were determined by dividing the mass of a foil by the product of the foil area and the density of lead. Length and mass measurements were made with instruments calibrated traceable national standards. Published data was used for the density of lead.

Uncertainties: The uncertainty in the quoted results is \pm 0.1 mm Pb. This value represents the expanded uncertainty, estimated from the combined standard uncertainty with a coverage factor of 2, corresponding to a 95 % level of confidence.

Quality Statement: This test report has been produced under the controls established by a quality management system that meets the requirements of AS/NZS ISO9001:2000 which has been independently certified by TelarcSAI under registration number 2304.

**Results relate only to the samples as received.
This report, or any copy of it, is only valid if it is complete.**

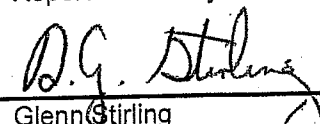
Measurement made by:



John Laban

Date: 17/3/09

Report verified by:



Glenn Stirling

Date: 17/3/09

Results

Results for 80 kVp

Sample identification (sample number as described above)	Lead equivalence at 80 kVp, 4 mm Al filtration (mm Pb)
1	0.7
2	0.7
3	0.7
4	0.7
1 + 2	1.6
3 + 4	1.6
1 + 2 + 3	2.4

Remarks

The lead equivalence of a material will vary with the energy (or quality) of radiation.

Characterisation of X-ray beam qualities

Light scatter. 80 kVp, 4 mm Al is representative of the type of x-ray scatter encountered in extremity work.

Results (cont.)

Results for 100 kVp

Sample identification (sample number as described above)	Lead equivalence at 100 kVp, 2 mm Al + 0.24 mm Cu filtration (mm Pb)
1	0.7
2	0.7
3	0.7
4	0.7
1 + 2	1.5
3 + 4	1.5
1 + 2 + 3	2.2
4 + 5 + 6	2.2
1 + 2 + 3 + 4	2.8
1 + 2 + 3 + 4 + 5	3.4

Remarks

The lead equivalence of a material will vary with the energy (or quality) of radiation.

Characterisation of X-ray beam qualities

Standard scatter. 100 kVp, 2 mm Al + 0.24 mm Cu is representative of the type of x-ray scatter encountered in general x-ray and fluoroscopy rooms.

Results (cont.)

Results for 125 kVp

Sample identification (sample number as described above)	Lead equivalence at 125 kVp, 2 mm Al + 0.39 mm Cu filtration (mm Pb)
1	0.5
2	0.5
3	0.5
4	0.5
1 + 2	1.0
3 + 4	1.0
1 + 2 + 3	1.4
4 + 5 + 6	1.4
1 + 2 + 3 + 4	1.8
5 + 6 + 7 + 8	1.9
1 + 2 + 3 + 4 + 5	2.3

Remarks

The lead equivalence of a material will vary with the energy (or quality) of radiation.

Characterisation of X-ray beam qualities

Hard scatter. 125 kVp, 2 mm Al + 0.39 mm Cu is representative of the type of x-ray scatter encountered in CT rooms.

Results (cont.)

Results for 150 kVp

Sample identification (sample number as described above)	Lead equivalence at 150 kVp, 2 mm Al + 0.64 mm Cu filtration (mm Pb)
1	0.4
2	0.4
3	0.4
4	0.4
1 + 2	0.7
3 + 4	0.7
1 + 2 + 3	1.0
4 + 5 + 6	1.0
1 + 2 + 3 + 4	1.3
All 10 layers	3.1

Remarks

The lead equivalence of a material will vary with the energy (or quality) of radiation.

Characterisation of X-ray beam qualities

The 150 kVp beam was requested by the customer, and has been set up according to AS/NZS 4543.1:1999.