

# Colorado Associates in Medical Physics

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TO: Chris Carter, Engineer III – Merit Medical

FROM: Brad Lofton, MS, DABR

SUBJECT: Radiation Scatter Survey to Evaluate Rad Board Performance

A radiation scatter survey was conducted in order to evaluate the radiation protection performance of the Rad Board by Merit Medical. The Rad Board is positioned underneath the patient during cardiac catheterization procedures, and is embedded with a 15" by 9" section of Xenolite, which is a lead-free composite element that provides 0.35 mm Pb equivalence. The survey was conducted both with and without the Rad Board in place in order to estimate the relative reduction in operator dose during catheterization procedures. The procedure was conducted for a newly manufactured Rad Board and repeated using a Rad Board which had undergone induced product aging, and again for a Rad Board constructed using a newer design that utilizes less of a footprint while in use.

The testing was performed on a Rando Phantom (Axial) positioned with the abdominal portion in the primary FOV. Air kerma to the operator was measured both at waist level and collar height at a lateral location common to physicians performing abdominal vascular repairs. Air kerma was measuring using a Ludlum 9dp ion chamber, which is a pressurized Argon chamber (units: mSv/hr). Measurements were made using 3 common FOV modes in a Philips Allura FD Cardiac Cath Lab: 19", 13", and 6", all in normal dose modes of operation.

The results are presented in the table below. In summary, as high as a 44% exposure reduction was observed at the waist level using the Rad Board (please see table for a specific breakdown) and as high as 28% reduction was observed at the collar level. Note that the observed operator dose reduction is highly dependent upon the location of the measurement, and the ion chamber was repositioned at the same general, relevant location for each series of tests.

It is also important to note that operator dose reduction is accompanied by an increase in the air kerma rate to the patient. This is due to the attenuation of the primary beam in the Rad Board and the AEC compensation of the Philips fluoroscopy unit to maintain a minimum noise level in the images.

Technical Factors	
Vert. Tilt:	0 deg.
SID (cm):	100
Phantom:	RANDO Abdomen Pelvis (Axial slices)
Table Height (cm):	80 cm from floor
Dist. from Phantom Midline to Meter (cm):	60
Pulse Rate:	15
Air Gap (cm):	22
Scatter Meter:	Ludlum 9dp
Mode:	Rate
Notes:	Pelvis to L4 in 19" FOV size
Measuring Time (sec)	20

**Waist Height Measurements (95 cm from floor)**

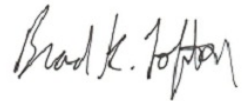
kVp	mA	Displayed AKR (mGy/min)	FOV	% AKR Increase	Physician Dose Rate (mSv/hr)	Integrated Dose (uSv)	Rad Board	% Dose Rate Reduction	% Integrated Dose Reduction
65	7.9	13.64	19"		2.240	11.640	NONE		
68	9.8	19.56	19"	30.27%	1.280	6.820	H585889 (pink)	-42.86%	-41.41%
68	10	20.11	19"	32.17%	1.340	7.080	H595516 (white)	-40.18%	-39.18%
69	10.1	20.38	19"	33.07%	1.270	6.760	New Design	-43.30%	-41.92%
69	10.4	21.49	13"		1.710	8.800	NONE		
73	12.9	30.85	13"	30.34%	1.010	5.300	H585889 (pink)	-40.94%	-39.77%
73	13.1	31.68	13"	32.17%	1.030	5.400	H595516 (white)	-39.77%	-38.64%
73	13.1	31.81	13"	32.44%	0.960	5.080	New Design	-43.86%	-42.27%
76	14.1	37.74	6"		0.810	4.520	NONE		
81	15.2	49.17	6"	23.25%	0.470	2.500	H585889 (pink)	-41.98%	-44.69%
81	15.2	49.86	6"	24.31%	0.480	2.560	H595516 (white)	-40.74%	-43.36%
81	15.2	49.58	6"	23.88%	0.450	2.500	New Design	-44.44%	-44.69%

**Collar Height Measurements (140 cm from floor)**

kVp	mA	Displayed AKR (mGy/min)	FOV	% AKR Increase	Physician Dose Rate (mSv/hr)	Integrated Dose (uSv)	Rad Board	% Dose Rate Reduction	% Integrated Dose Reduction
65	7.9	13.64	19"		1.000	5.210	NONE		
68	9.8	19.56	19"	30.27%	0.800	4.270	H585889 (pink)	-20.00%	-18.04%
68	10	20.11	19"	32.17%	0.830	4.310	H595516 (white)	-17.00%	-17.27%
69	10.1	20.38	19"	33.07%	0.750	3.950	New Design	-25.00%	-24.18%
69	10.4	21.49	13"		0.730	4.130	NONE		
73	12.9	30.85	13"	30.34%	0.580	3.050	H585889 (pink)	-20.55%	-26.15%
73	13.1	31.68	13"	32.17%	0.600	3.060	H595516 (white)	-17.81%	-25.91%
73	13.1	31.81	13"	32.44%	0.560	2.960	New Design	-23.29%	-28.33%
76	14.1	37.74	6"		0.370	1.880	NONE		
81	15.2	49.17	6"	23.25%	0.293	1.530	H585889 (pink)	-20.81%	-22.88%
81	15.2	49.86	6"	24.31%	0.300	1.550	H595516 (white)	-18.92%	-21.57%

81	15.2	49.58	6"	23.88%	0.286	1.470	New Design	-22.70%	-26.80%
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Best Regards,



Brad K. Lofton, M.S., DABR

Certified Medical Physicist