



On-line Fig 1. The numbered levels and positions correspond to RPL dosimeter (bright rods) sites identified in On-line Table 1.

On-line Table 1. Location of the RPL dosimeters in phantom

Organ or Tissue	Phantom Level	Position of Numbered Dosimeters	ICRP 60 ^h	ICRP 103 ⁱ
			W _T 0.12	W _T 0.12
Active bone marrow ^a				
Mandible body (dex, sin)	7	22, 24		
Calvaria (post, dex, sin, ant)	2	5, 6, 7, 8		
Cervical vertebrae C1-C5	6	20		
All thoracic vertebrae	11, 19	33, 54		
Clavicles	11	32		
Sternum + ribs	14, 15, 19	42, 44, 52		
Lumbar vertebrae L1-L4	27	68		
Sacrum	30	71		
Breast dex	16, 18	75, 77	0.05	0.12
Breast sin	16, 18	78, 80		
Colon ^b			0.12	0.12
Upper large intestine	24, 25	64, 66, 67		
Lower large intestine	27	69		
Lung dex	12, 13, 14, 15, 16, 17, 18	34, 37, 40, 43, 46, 48, 50	0.12	0.12
Lung sin	13, 15	38, 45		
Stomach	20, 21, 22, 23	56, 58, 61, 63	0.12	0.12
Ovaries (female gonads)	30	72, 73	0.20	0.08
Liver	19, 20, 21, 22	53, 55, 57, 59	0.05	0.04
Esophagus	9, 12, 14	28, 35, 41	0.05	0.04
Thyroid	9, 10	27, 29, 31	0.05	0.04
Urinary bladder	-		0.05	0.04
Brain			r	0.01
Midbrain	2, 3	3, 4, 14, 15		
(ant, dex, post, sin)	2	1, 2		
Bone surface ^c	See active bone marrow	See active bone marrow	0.01	0.01
Salivary glands	5, 7	17, 23, 25	-	0.01
Skin ^d	2, 3, 4, 5, 7, 9, 13, 17	9, 10, 11, 16, 19, 26, 30, 39, 76, 79	0.01	0.01
Adrenals	23	62	r	0.12/13
Extrathoracic airways ^e	6, 7, 9	21, 23, 28	r	0.12/13
Gallbladder	22	59	-	0.12/13
Heart	16, 17, 18	47, 49, 50	-	0.12/13
Kidneys	23, 24	62, 65	r	0.12/13
Lymph nodes ^f	6, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 30	Comments ^f	-	0.12/13
Muscle ^g	3, 5, 6, 7, 9, 12	12, 13, 17, 20, 23, 28, 35	r	0.12/13
Oral mucosa	6	21	-	0.12/13
Pancreas	24	64	r	0.12/13
Small intestine	27	70	r	0.12/13
Spleen	22	60	r	0.12/13
Thymus	12	36	r	0.12/13
Uterus	30	74	r	0.12/13

Note:—ant, indicates anterior; dex, dexter; post, posterior; sin, sinister; lat, lateral.

^a The dose for active bone marrow was calculated by using the sum of the individual weighted doses based on the distribution of active bone marrow throughout the adult body D(active bone marrow) = 0.28*D(mandible body) + 0.056*D(calvaria) + 0.027*D (cervical vertebrae)+ 0.17*D(thoracic vertebrae) + 0.008*D(clavicles)+0.192*D(ribs+sternum)+0.098*D(lumbar vertebrae)+0.333*D(sacrum).¹⁶

^b The dose in colon was calculated according to ICRP Publication 67 from formula D(colon) = 0.57*D(ULI) + 0.43*D(LLI). D(ULI) is the average dose of the ascending and transverse colon and D(LLI) is that of the descending colon.¹⁷

^c Bone surface dose was calculated by multiplying active bone marrow dose with 4.64.¹⁸

^d Skin surface dose was determined by calculating the mean dose of 10 detection points; breast (sin, dex), midline shoulder, thyroid (sin), neck (sin), cheek (dex), head (lat sin), head (back), lens of the eye. The dose to the skin was estimated 5%¹⁸ in cerebral acquisition and 15% in cervicocerebral acquisition of the whole body skin.

^e Nasal sinuses, trachea, and pharynx were used to represent the extrathoracic airways.¹⁹

^f The dose in lymphatic nodes was calculated as a weighted average of several surrogate organs from formula D (lymph nodes) = 0.13*D(extra thoracic airways) + 0.08*D(salivary glands) + 0.05*D(thyroid) + 0.04*D(esophagus) + 0.03*D(stomach) + 0.15*D(pancreas) + 0.10*D(gallbladder) + 0.07*D(lungs) + 0.05*D(total body) + 0.04*D(heart) + 0.25*D(small intestine) + 0.01*D(gonads).¹⁹

^g The dose in muscles was determined from the doses in surrogate organs: Left and right orbit, parotid dexter, center cervical spine, sublingual gland, and esophagus. The dose to the muscles was estimated 5% of the whole body muscles.¹⁸

^h Weighting factors labelled as "r" mean remainder tissues of ICRP Publication 60. The organs labelled as "-" are not included in the calculation of the ICRP 60. The tissue weighted factor of the ICRP 60 is 0.05 and is applied to the mass-averaged dose in the remainder organs and tissues. Tissue weighted factor 0.025 is applied to a remainder organ, if it receives a dose that is higher than the dose to any 12 organs that are not included in remainder organs and have their own tissue weighting factor. The rest of the weighting factor, 0.025, is applied to the mass-averaged dose in the other remainder organs and tissues.²⁰

ⁱ The weighting factors that are shown as the fraction 0.12/13 represent the remainder organ of the ICRP Publication 103. The new weighting factor 0.12 is applied to the arithmetic average dose in the remainder organs and tissues.²¹

On-line Table 2: Calibration accuracy for dose measurement equipment

Characteristics of the Dosimeters	Calibration of GD-352M dosimeter against an Ionization Chamber in this Study	Calibration of Ionization Chamber Model 9015 with Beam Chamber, Model 10 × 6–6	Calibration of DAP Meter for Integris Allura Imaging Equipment
Linearity range	20 μ Gy–10 Gy ($R^2 = 1$)	100 nGy–516 Gy	
Detection threshold	20 μ Gy (CV% = 12.2%)	100 nGy	
Calibration accuracy	4.9% (1 mGy–11 mGy), 6% (20 μ Gy–11 mGy), using x-rays 90 kVp, 2.9 mmAl + 0.1 mmCu	\pm 4% using x-rays 60 kVp and 2.8 mm Al HVL	+8.2% using x-rays 77 kVp (frontal tube); +9.4% using x-rays 84 kVp (lateral tube)
Reproducibility	0.3% after 10 repeated measurements	1.8% after 3 repeated measurements (measured in present study)	
Energy response	6% at maximum (75–125 keV), using x-rays, 2.9 mmAl + 0.1 mmCu	\pm 5% (30 keV to 1.33 MeV)	
Stability	<0.8% fading at 25 days, at 20°C (< 15 mGy)		
Angle dependence	Direction of the element: horizontal \pm 3%		

Note:—Al indicates aluminum; Cu, copper; HVL, half-value layer.

On-line Table 3: The mean equivalent doses H_T (mSv) and the effective doses E (mSv) for diagnostic cerebral and cervicocerebral angiography examinations

Protocols	1) CTA with AEC	2) CTA without AEC	1) DSA with AEC	2) DSA with AEC
Organ or tissue	Cerebral vessels	Cervicocerebral vessels	Cerebral vessels	Cervicocerebral vessels
Active bone marrow (total)	1.12	5.38	5.48	6.24
Bone surface (total)	5.19	24.95	25.40	28.52
Brain	9.41	16.90	73.51	51.81
Salivary glands	4.71	20.40	23.41	35.60
Thyroid	0.67	22.34	3.46	10.96
Esophagus	0.66	18.94	1.62	4.40
Lung	1.03	7.91	0.68	1.41
Stomach	0.08	0.52	0.06	0.10
Colon	0.01	0.13	0.01	0.03
Liver	0.15	0.87	0.11	0.18
Breasts	0.33	1.73	0.18	0.27
Extra thoracic airway	2.83	20.94	13.34	28.97
Oral mucosa	5.95	20.53	31.13	42.61
Lymph nodes	1.05	7.07	4.58	8.20
Thymus	0.53	14.67	1.66	5.10
Heart	0.54	3.27	0.32	0.57
Gonads	—	0.03	—	—
Skin (total)	0.42	2.24	2.61	4.62
Skin (highest dose)	10.19	25.17	166.22	97.97
Eyes (lens)	9.13	14.45	6.86	5.39
Eyes (orbit)	9.91	14.61	21.84	18.09
Effective doses (mSv):				
ICRP 60	0.66	4.24	3.16	3.40
ICRP 103	0.67	4.85	2.71	3.60
DAP (Gy-cm ²)			48.7	50.7
DLP (mGy-cm)	262	495		
CTDI (mGy)	14.1	12.3		
Conversion factors ^a	mSv/mGy-cm	mSv/mGy-cm	mSv/Gy-cm ²	mSv/Gy-cm ²
ICRP 60	0.0025	0.0086	0.065	0.067
ICRP 103	0.0026	0.0098	0.056	0.071

Note: — Indicates that the dose is under the detectable range; DAP, dose-area product; CTDI, CT dose index; H_T = equivalent dose.

^a Effective dose divided by DAP or DLP unit.