

**Table 1: Effective Dose Equivalent (HE) values for common procedures involving the use of radiopharmaceuticals. Listings (last column) are averaged over both sexes, and are computed for adult subjects. Values are not necessarily appropriate for pediatric subjects. Instructions for the use of the table are listed below.**

<b>Nuclide</b>	<b>Chemical Form</b>	<b>Route of Admin.</b>	<b>Condition</b>	<b>HE mrem/mCi</b>
$^3\text{H}$	Water	Any		59.2
$^3\text{H}$	Inulin	IV	Normal renal function	4.44
$^3\text{H}$	Inulin	IV	Abnormal renal function	8.14
$^3\text{H}$	Glucose	IV	Normal	8.29
$^{11}\text{C}$	Carbon Monoxide	Inhalation	Single inhalation with 20 s breath-hold	24.4
$^{11}\text{C}$	Carbon Monoxide	Inhalation	Continuous inhalation for 1 h	15.9
$^{11}\text{C}$	Carbon Dioxide	Inhalation	Single inhalation with 20 s breath-hold	6.29
$^{11}\text{C}$	Carbon Dioxide	Inhalation	Continuous inhalation for 1 h	4.07
$^{11}\text{C}$	Carfentanil	IV		17.5
$^{11}\text{C}$	COHb-Labelled Erythrocytes	IV		25.5
$^{11}\text{C}$	Doxepin	IV		30.2
$^{11}\text{C}$	Methyl Spiperone	IV		30.0
$^{11}\text{C}$	Pyrilamine	IV		36.4
$^{11}\text{C}$	PK 11195	IV		32.6
$^{11}\text{C}$	Raclopride	IV		66.0
$^{11}\text{C}$	RO-15-1788 (Flumazenil)	IV		9.96
$^{11}\text{C}$	SCH23390	IV		51.2
$^{11}\text{C}$	Thymidine	IV		10.0
$^{11}\text{C}$	WIN 35428	IV		49.0
$^{14}\text{C}$	Inulin	IV	Normal renal function	40.7
$^{14}\text{C}$	Inulin	IV	Abnormal renal function	70.3
$^{13}\text{N}$	Ammonia	IV		9.99
$^{15}\text{O}$	Carbon Monoxide	Inhalation	Single inhalation with 20 s breath-hold	4.07

$^{15}\text{O}$	Carbon Monoxide	Inhalation	Continuous inhalation for 1h	2.81
$^{15}\text{O}$	Carbon Dioxide	Inhalation	Single inhalation with 20 s breath-hold	2.00
$^{15}\text{O}$	Carbon Dioxide	Inhalation	Continuous inhalation for 1 h	1.48
$^{15}\text{O}$	Oxygen Gas	Inhalation	Single inhalation with 20 s breath-hold	1.44
$^{15}\text{O}$	Oxygen Gas	Inhalation	Continuous inhalation for 1 h	1.59
$^{15}\text{O}$	Water	IV		4.3
$^{18}\text{F}$	Fluoride ion	IV		99.9
$^{18}\text{F}$	2-Fluoro-2-Deoxy-D-Glucose (FDG)	IV		99.9
$^{22}\text{Na}$ ,	Sodium ion	IV or Oral		10400
$^{24}\text{Na}$	Sodium ion	IV		1260
$^{24}\text{Na}$	Sodium ion	Oral		1330
$^{34\text{m}}\text{Cl}$	Chloride ion	IV or Oral		31.8
$^{36}\text{Cl}$	Chloride ion	IV or Oral		2960
$^{38}\text{Cl}$	Chloride ion	IV or Oral		59.2
$^{38}\text{K}$	Potassium ion	IV		99.9

<b>Nuclide</b>	<b>Chemical Form</b>	<b>Route of Admin.</b>	<b>Condition</b>	<b>HE mrem/mCi</b>
<sup>42</sup> K	Potassium ion	IV		703
<sup>42</sup> K	Potassium ion	Oral		851
<sup>43</sup> K	Potassium ion	IV		629
<sup>43</sup> K	Potassium ion	Oral		666
<sup>45</sup> Ca	Calcium ion	IV		7770
<sup>45</sup> Ca	Calcium ion	Oral		4440
<sup>47</sup> Ca	Calcium ion	IV		5180
<sup>47</sup> Ca	Calcium ion	Oral		5920
<sup>51</sup> Cr	Chromium-Labelled Erythrocytes	IV		962
<sup>66</sup> Ga	Gallium Citrate	IV		1260
<sup>67</sup> Ga	Gallium Citrate	IV		444
<sup>68</sup> Ga	Gallium Citrate	IV		99.9
<sup>72</sup> Ga	Gallium Citrate	IV		1300
<sup>81m</sup> Kr	Krypton	Inhalation, IV		0.1
<sup>82</sup> Rb	Rubidium ion	IV		17.8
<sup>85</sup> Sr	Strontium ion	IV		3150
<sup>87m</sup> Sr	Strontium ion	IV		24.8
<sup>89</sup> Sr	Strontium ion	IV		10730
<sup>99m</sup> Tc	Ceretec	IV		37.3
<sup>99m</sup> Tc	NeuroLite	IV		28.8
<sup>99m</sup> Tc	Teboroxime	IV		38.3
<sup>99m</sup> Tc	Technetium-Labelled Albumin (HSA)	IV		29.2
<sup>99m</sup> Tc	Technetium-Labelled Albumin	Intrathecal	Lumbar injection	40.7
<sup>99m</sup> Tc	Technetium-Labelled Albumin	Intrathecal	Cisternal injection	25.2
<sup>99m</sup> Tc	Technetium-Labelled Large Colloids (100-1000 nm)	IV	Normal Liver function	51.8

<b><math>^{99m}\text{Tc}</math></b>	<b>Labelled Small Colloids (&lt; 100 nm)</b>	<b>IV</b>	<b>Normal Liver function</b>	<b>51.8</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Technetium-DMSA</b>	<b>IV</b>		<b>59.2</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Technetium-DTPA</b>	<b>IV</b>	<b>Normal renal function</b>	<b>23.3</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Technetium-DTPA</b>	<b>IV</b>	<b>Abnormal renal function</b>	<b>19.6</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Technetium-DTPA</b>	<b>Intrathecal</b>	<b>Lumbar injection</b>	<b>40.7</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Technetium-DTPA</b>	<b>Intrathecal</b>	<b>Cisternal injection</b>	<b>24.4</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Gluconate, Glucoheptonate</b>	<b>IV</b>		<b>33.3</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Pertechnetate ion</b>	<b>IV</b>	<b>No blocking agent</b>	<b>48.1</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Pertechnetate ion</b>	<b>IV</b>	<b>Blocking agent given</b>	<b>19.6</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Pertechnetate ion</b>	<b>Oral</b>	<b>No blocking agent</b>	<b>55.5</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Tc-Labelled Iminodiacetic Acid (IDA) Derivatives</b>	<b>IV</b>	<b>Normal liver function</b>	<b>88.8</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Tc-Labelled Iminodiacetic Acid (IDA) Derivatives</b>	<b>IV</b>	<b>Parenchymal Liver Disease</b>	<b>48.1</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Tc-Labelled Iminodiacetic Acid (IDA) Derivatives</b>	<b>IV</b>	<b>Occlusion of the cystic duct</b>	<b>66.6</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Tc-Labelled Iminodiacetic Acid (IDA) Derivatives</b>	<b>IV</b>	<b>Occlusion of the common bile duct</b>	<b>35.5</b>
<b><math>^{99m}\text{Tc}</math></b>	<b>Technetium-Labelled Erythrocytes</b>	<b>IV</b>		<b>31.5</b>

Nuclide	Chemical Form	Route of Admin.	Condition	HE mrem/mCi
$^{99m}\text{Tc}$	Tc-Labelled Phosphates and Phosphonates	IV		29.6
$^{99m}\text{Tc}$	Tc labelled Sestamibi	IV		51.0
$^{99m}\text{Tc}$	Tc-Labelled Aerosols	Inhalation	Substances with fast lung clearance	25.9
$^{99m}\text{Tc}$	Tc-Labelled Aerosols	Inhalation	Substance with slow lung clearance	55.5
$^{99m}\text{Tc}$	Tc-Labelled Non-Absorbable Markers	Oral	Fluid form	88.8
$^{99m}\text{Tc}$	Tc-Labelled Non-Absorbable Markers	Oral	Solid form	88.8
$^{99m}\text{Tc}$	Tc-Labelled Albumin Microspheres	IV		40.7
$^{111}\text{In}$	Indium ion	IV		962
$^{113}\text{In}$	Indium ion	IV		48.1
$^{111}\text{In}$	Indium-DTPA	IV	Normal renal function	92.5
$^{111}\text{In}$	Indium-DTPA	IV	Abnormal renal function	178
$^{113}\text{In}$	Indium-DTPA	IV	Normal renal function	51.8
$^{113}\text{In}$	Indium-DTPA	IV	Abnormal renal function	24.4
$^{113}\text{In}$	Indium Hydroxide (Colloidal)	IV	Normal liver function	62.9
$^{113}\text{In}$	Indium Hydroxide (Colloidal)	IV	Early to intermed. diffuse parenchymal liver disease	70.3
$^{113}\text{In}$	Indium Hydroxide (Colloidal)	IV	Intermed. to advanced diffuse parenchymal disease	88.8
$^{111}\text{In}$	In-DTPA	Intrathecal	Lumbar injection	518
$^{111}\text{In}$	In-DTPA	Intrathecal	Cisternal injection	444
$^{111}\text{In}$	Indium-Labelled Platelets (thrombocytes)	IV		2590
$^{111}\text{In}$	In-Labelled White Blood Cells (Leukocytes)	IV		2180
$^{111}\text{In}$	Indium antimyosin antibody	IV		990
$^{123}\text{I}$	Iodide ion	IV, Oral	Thyroid blocked, uptake 0%	48.1
$^{123}\text{I}$	Iodide ion	IV, Oral	Thyroid uptake 55%	851
$^{124}\text{I}$	Iodide ion	IV, Oral	Thyroid blocked, uptake 0%	407
$^{124}\text{I}$	Iodide ion	IV, Oral	Thyroid uptake 55%	51800
$^{125}\text{I}$	Iodide ion	IV, Oral	Thyroid blocked, uptake 0%	44.4

<b>125<sub>I</sub></b>	<b>Iodide ion</b>	<b>IV, Oral</b>	<b>Thyroid uptake 55%</b>	<b>59200</b>
<b>131<sub>I</sub></b>	<b>Iodide ion</b>	<b>IV, Oral</b>	<b>Thyroid blocked, uptake 0%</b>	<b>266</b>
<b>123<sub>I</sub></b>	<b>Hippuran</b>	<b>IV</b>	<b>Normal renal function</b>	<b>55.5</b>
<b>125<sub>I</sub></b>	<b>Hippuran</b>	<b>IV</b>	<b>Normal renal function</b>	<b>37</b>
<b>131<sub>I</sub></b>	<b>Hippuran</b>	<b>IV</b>	<b>Normal renal function</b>	<b>244</b>
<b>131<sub>I</sub></b>	<b>Iodide ion</b>	<b>IV, Oral</b>	<b>Thyroid uptake 55%</b>	<b>88800</b>
<b>123<sub>I</sub></b>	<b>Iodine-Labelled Amphetamine</b>	<b>IV</b>		<b>118</b>
<b>123<sub>I</sub></b>	<b>Iodine-Labelled Albumin (HSA)</b>	<b>IV</b>		<b>96.2</b>
<b>125<sub>I</sub></b>	<b>Iodine-Labelled Albumin (HSA)</b>	<b>IV</b>		<b>1260</b>
<b>131<sub>I</sub></b>	<b>Iodine-Labelled Albumin (HSA)</b>	<b>IV</b>		<b>3182</b>
<b>123<sub>I</sub></b>	<b>Metaiodobenzylguanidine (MIB)</b>	<b>IV</b>		<b>66.6</b>
<b>131<sub>I</sub></b>	<b>Metaiodobenzylguanidine (MIB)</b>	<b>IV</b>		<b>740</b>
<b>123<sub>I</sub></b>	<b>Dexetimide</b>	<b>IV</b>		<b>59.2</b>
<b>123<sub>I</sub></b>	<b>RTI-55</b>	<b>IV</b>		<b>132.5</b>

Nuclide	Chemical Form	Route of Admin.	Condition	HE mrem/mCi
$^{127}\text{Xe}$	Xenon	IV, Inhalation	Single inhalation or IV inj., with 30 s breath-hold	0.52
$^{127}\text{Xe}$	Xenon	IV, Inhalation	Rebreathing for 5 minutes	2.85
$^{127}\text{Xe}$	Xenon	IV, Inhalation	Rebreathing for 10 minutes	4.44
$^{133}\text{Xe}$	Xenon	IV, Inhalation	Single inhalation or i.v. inj., with 30 s breath-hold	0.70
$^{133}\text{Xe}$	Xenon	IV, Inhalation	Rebreathing for 5 minutes	2.96
$^{133}\text{Xe}$	Xenon	IV, Inhalation	Rebreathing for 10 minutes	4.81
$^{201}\text{Tl}$	Thallium ion	IV		851

**Instructions:** For a given radiopharmaceutical procedure, select the table value corresponding to the nuclide and the route of administration. In some cases, particular conditions related to pathology or other variables are listed which will influence the dose to the subject. Use the dose for the particular condition (column 4) where appropriate. To compute the effective dose equivalent, multiply the table value by the activity administered in milliCuries (mCi). Effective dose equivalent values may be summed from different radiological procedures.

**Table 2:** Effective Dose Equivalent ( $H_E$ ) values common radiographic procedures on adult subjects, assuming a beam filtration of 3.0 mm aluminum<sup>1</sup>. For a given x-ray procedure, sum the table value for  $H_E$ , for each repetition of each projection used. (Skin doses are provided for reference only, do not sum skin doses.)

PROJECTION	kVp	SKIN DOSE (mrem)	$H_E$ (mrem)*
Skull AP	70	223	2.3
Skull PA	70	223	1.8
Skull Lateral	60	69	0.6
C-Spine AP	70	62	1.8
C-Spine Lateral	80	53	0.3
Shoulder AP, Oblique.	60	152	0.9
Chest AP	100	10	1.5
Chest PA	120	14	1.8
Chest Lateral	120	67	5.4
T-Spine AP	80	286	16.2
T-Spine Lateral	80	893	19.0
Kidneys AP	70	267	8.7
Kidneys PA	70	267	8.8
Abdomen AP	80	291	26.4
Abdomen PA	80	291	23.0
L-Spine AP	80	359	27.3
L-Spine Oblique	80	697	18.0
L-Spine Lateral	90	1773	37.7
L-S Joint Lateral	90	2260	24.1
Pelvis AP	80	304	46.0
Hip(one) AP	80	222	13.2
Urinary Bladder AP	70	267	13.2

**Table 3:** Effective Dose Equivalent ( $H_E$ ) values for CT Scanners used on adult subjects. Values are expressed in mrem, normalized to 100 mAs with abutted slices at the widest slice setting for adult subjects. See below).

Scan Type	Siemens	Siemens		GE 9800		
	125 kV	120 kV	137 kV	80 kV	120 kV	140 kV
Head	32	35	44	16	40	54
Neck	70	76	95	33	83	108
Chest	227	248	306	93	155	216
Upper Abdomen	173	197	247	66	134	187
Complete Abdomen	370	420	527	141	286	399
Pelvis, Hips	214	243	305	82	166	231

<sup>1</sup>Jones, D.J & Wall, B.F: "Organ Doses from Medical X-ray Examinations Calculated Using Monte Carlo Techniques", National Radiological Protection Board, 1985, NRPB - R186 (HMSO, London).

**Instructions for CT HE:** For a given CT procedure, the mAs, kVp, slice width and slice spacing must be known. (Available from the CT technologist). Select the value from Table 3 for the particular scanner, kVp setting and scan type. Use the following formula to calculate HE:

$$HE = V \times T \times I$$

where: V is the table value for the CT system and kVp, T and I are the slice width and slice spacing, respectively in mm. For example, a head scan with the Siemens DR3, using 125 kVp, 450 mAs, slice width of 8 mm and slice spacing of 8 mm, the table value is 32 mrem/100 mAs. The HE is then:  $HE = 32 \times 4.5 \times 8 = 144 \text{ mrem}$