TABLE 7. IRDFF-II recommended (recomm.) nuclear decay data for pure beta emitters. (DD eval.) refers to the latest Chechev compilation at https://www-nds.iaea.org/IRDFFtest/RCM3/Chechev-RCM3.pdf. New DDEP evaluations undertaken within this project are highlighted in blue. Numbers in parentheses indicate the absolute uncertainties, *e.g.*, 12.312(25) ≡ 12.312 ± 0.025.

				Beta Data	
Reaction Product	Half-life (recomm.)	Half-life (DD eval.)	Time unit	Aver.E_β [keV]	Emiss. Prob. [%]
^{3}H	12.32(2)	12.312(25)	a	5.68(1)	100.
^{32}P	14.263(36)	14.284(36)	d	695.5(3)	100.
^{106}Ru	371.8(18)	371.5(21)	d	10.03(6)	100.

C. Nuclear Decay Data

This Sec. addresses the IRDFF-II nuclear decay data used in reaction evaluations for activation and fission products. Tables 7 (beta emitters) and 8 (gamma emitters) give the recommended half-lives and emission probabilities associated with the residual nuclei (activation products) for all of the library radionuclides according to the detected decay radiation. Those recommended values (recomm.) were used in reaction evaluations. It also shows the most recently evaluated gamma and beta decay data, namely the emission energies and emission probabilities for all of the residual nuclei associated with the reactions addressed within IRDFF-II.

Note that recommended data usually agree within uncertainties with the latest decay data evaluations (labelled **DD eval.** in Table headers). The only discrepant data at the three sigma level is the half-life of ^{24}Na, users should exercise special care when using this radionuclide for dosimetry. The latest decay data evaluations have been compiled into associated IRDFF-II decay data file that is released together with the IRDFF-II neutron metrology library.

TABLE 8: IRDFF-II recommended nuclear decay data content for gamma emitters. (DD eval.) refers to the latest Chechev compilation at https://www-nds.iaea.org/IRDFFtest/RCM3/Chechev-RCM3.pdf. (*) indicates data taken from ENSDF. New DDEP evaluations undertaken within this project are highlighted in blue. Numbers in parentheses indicate the absolute uncertainties, *e.g.*, 109.734(14) ≡ 109.734 ± 0.014.

					Gamma/Xray		
Reaction Product	Half-life (recomm.)	Half-life (DD eval.)	Time unit	Gamma/X-ray Energy[keV]	Emiss.Prob. [%] (recomm.)	Emiss.Prob. [%] (DD eval.)	Source Document
^{18}F	109.77(5)	109.734(14)	m	511.	193.72(38)		BIPM
				0.525 XK_α1	0.013(4)		
				0.525 XK_α2	0.007(2)		
^{22}Na	2.6018(22)	2.6020	a	1274.537(7)	99.94(13)	99.940(14)	BIPM
				511.	180.7(2)	180.76(4)	
^{24}Na	14.997(12)	14.958(2)	h	1368.630(5)	99.9934(5)	99.9936(15)	BIPM
				2754.049(13)	99.862(3)	99.855(5)	
^{27}Mg	9.458(12)		m	843.76(10)	71.800(20)	71.8(4)	ENSDF
				1014.52(10)	28.200(20)	28.0(4)	
^{26g}Al	717 000(24)		a	11129.67(10)	2.5(2)		ENDSF
				1808.65(7)	99.76(4)		
				511.0	163.5(4)		
^{28}Al	(*)2.245(2)	2.245(2)	m	1778.987(15)	100.0		ENSDF
^{31}Si	(*)157.36(26)		m	1266.2(14)	0.0554(7)		ENSDF
^{46}Sc	83.787(16)	83.787(16)	d	889.271(2)	99.98374(25)		BIPM
				1120.537(3)	99.97(2)		
^{47}Sc	3.3485(9)	3.3485(9)	d	159.373(12)	68.1(5)		BIPM
^{48}Sc	(*)43.67(9)	43.70	h	983.526(12)	100.1(6)		ENSDF
				1037.522(12)	97.6(7)		
				1312.120(12)	100.1(7)		
^{45}Ti	(*)184.8(5)	184.8	m	511.0	169.6(3)		ENSDF
^{51}Cr	27.704	27.704	d	320.0835(4)	9.89(2)		BIPM
^{54}Mn	312.12(10)	312.19(3)	d	834.855(3)	99.9997(3)	99.976(1)	BIPM
^{56}Mn	2.5785(2)	2.57878(46)	h	846.7638(19)	98.85(3)	98.87(30)	BIPM
				1810.726(4)	26.9(4)	27.189(791)	
				2113.092(6)	14.2(3)	14.336(395)	
^{53}Fe	(*)8.51(2)		m				ENSDF
^{59}Fe	44.495(9)	44.494(12)	d	1099.245(3)	56.51(31)	56.6(18)	BIPM
				1291.590(6)	43.23(33)	43.2(14)	
^{57}Co	(*)271.74(6)	271.81	d	14.41295(31)	9.18(12)		BIPM
				122.06065(12)	85.49(14)	85.60(17)	
				136.47356(29)	10.71(15)	10.68(8)	
^{58}Co	70.86(6)	70.85(3)	d	810.7602(20)	99.44(2)	99.450(10)	BIPM
^{60}Co	5.2711(8)	5.2711(8)	a	1173.228(3)	99.85(3)		BIPM
				1332.492(4)	99.9826(6)		
^{57}Ni	35.60(6)	35.60(6)	h	127.164(3)	16.0(5)		BIPM

TABLE 8: (continued). IRDFF-II recommended nuclear decay data content for gamma emitters. (DD eval.) refers to the latest Chechev compilation at https://www-nds.iaea.org/IRDFFtest/RCM3/Chechev-RCM3.pdf. (*) indicates data taken from ENSDF. New DDEP evaluations undertaken within this project are highlighted in blue.

Reaction Product	Half-life (recomm.)	Half-life (DD eval.)	Time unit	Gamma/X-ray Energy[keV]	Gamma/Xray Emiss.Prob. [%] (recomm.)	Gamma/Xray Emiss.Prob. [%] (DD eval.)	Source Document
				1377.62(4)	81.2(6)	81.7(24)	
				1757.55(3)	6.1(4)		
				1919.62(14)	12.5(5)	12.3(4)	
^{62}Cu	9.73(3)	9.67(3)	m	1172.97(10)	0.342		ENSDF
				511.0	195.66(5)	2 x 94.86(5)	
^{64}Cu	12.701(2)	12.7004(20)	h	1345.77(6)	0.4748(34)		BIPM
				511.	35.2(4)	34.8(4)	
^{67}Cu	(*)61.83(12)	61.86	h	184.577(10)	48.7(3)		ENSDF
^{74}As	(*)17.77(2)		d	595.83(8)	59(3)		ENSDF
^{88}Y	(*)106.626(21)	106.63	d	1836.070(8)	99.346(25)	99.2(3)	BIPM
				898.042(11)	93.7(3)		
^{89}Zr	78.41(12)	78.42(13)	h	908.97(3)	99.03(2)	99.04(1)	BIPM
				511.	45.6(6)	45.5(5)	
^{95}Zr	64.032(6)	64.032(6)	d	756.729(12)	54.38(22)		BIPM
				724.193(3)	44.27(22)		
^{95}Nb	34.991(6)	34.991(6)	d	765.803(6)	99.808(7)		BIPM
^{94}Nb	20 300(16)	20 200	a	871.091(18)	99.892(0)		ENSDF
				702.65(6)	99.814(0)		
^{94m}Nb	(*)6.263(4)		m	871	0.50(6)		ENSDF
^{93m}Nb	16.1(2)	16.12(15)	a	30.77(2)	0.000591(9)		BIPM
				16.5213 X$K_\alpha 2$	3.32(8)		
				16.6152 X$K_\alpha 1$	6.34(15)		
				18.67 X$K_\beta 1$	1.64(4)		
				18.967 X$K_\beta 2$	0.246(11)		
^{92m}Nb	10.15(2)		d	934.44(10)	99.15(4)	99.07(4)	ENSDF
^{99}Mo	(*)65.924(6)		h	739.500(17)	12.20		ENSDF
^{103}Ru	(*)39.247(13)		d	610.333(10)	5.76(6)		ENSDF
				497.085(10)	91.0(12)		
^{103m}Rh	(*)56.114(9)		m	39.755(12)	0.068(5)		ENSDF
				20.073 X$K-L_2$	2.00(18)		
				20.215 X$K-L_3$	3.8(3)		
				22.699–22.912 X$K-M_{2,3,4}$	1.03(9)		
				22.699–23.215 X$K-MN$	1.20(11)		
				23.167–23.172 X$K-N_{2,3,4,5}O_{2,3}$	0.171(16)		
^{110m}Ag	249.78(2)		d	1505.028(2)	13.16(16)		BIPM
				1384.2931(20)	24.7(5)		
				937.485(3)	34.51(27)		
				884.6781(13)	74.0(12)		
				763.9424(17)	22.31(9)		
				706.6760(15)	16.48(8)		
				657.7600(11)	94.38(8)		
^{113m}In	(*)99.476(23)	99.48	m	391.698(3)	64.94(17)		ENSDF
^{114m}In	(*)49.51(1)	49.51	d	190.27(3)	15.56(15)		ENSDF
				24.002	9.8(3)		
				24.21	18.2(6)		
^{115m}In	4.486(4)		h	336.244(17)	45.9(1)		ENSDF
^{116m}In	54.29(17)		m	1293.56(2)	84.8(12)		ENSDF
				1097.28(2)	58.5(8)		
^{126}I	(*)12.93(5)	12.93	d	666.331(12)	32.9(7)		ENSDF
				388.633(11)	35.6(6)		
^{137m}Ba	(*)2.552(1)	2.552	m	661.657(3)	90.07(20)		BIPM
^{137}Cs	(*)30.08(9)		a	661.657(3)	84.99(20)		BIPM
^{140}La	1.6781(3)	1.67855(12)	d	1596.203(13)	95.40(5)	95.40(8)	BIPM
				815.784(6)	23.72(20)		
				328.761(4)	20.8(3)		
^{140}Ba	(*)12.7527(23)	12.7527	d	537.261(25)	24.6(5)		BIPM
^{144}Ce	(*)284.91(5)		d	133.5152(20)	10.83(12)		BIPM

TABLE 8: (continued). IRDFF-II recommended nuclear decay data content for gamma emitters. (DD eval.) refers to the latest Chechev compilation at https://www-nds.iaea.org/IRDFFtest/RCM3/Chechev-RCM3.pdf. (*) indicates data taken from ENSDF. New DDEP evaluations undertaken within this project are highlighted in blue.

Reaction Product	Half-life (recomm.)	Half-life (DD eval.)	Time unit	Gamma/X-ray Energy[keV]	Gamma/Xray Emiss.Prob. [%] (recomm.)	Gamma/Xray Emiss.Prob. [%] (DD eval.)	Source Document
^{140}Pr	(*)3.39(1)	3.39	m	1596.1(2)	0.49		ENSDF
				511.0	102.0(6)		
				39.258	3.68(8)		
^{167}Tm	(*)9.25(2)	9.25	d	207.801(5)	42(8)		BIPM
^{168}Tm	(*)93.1(2)		d	815.89(5)	50.95(16)	48.99(150)	ENSDF
				447.515(3)	23.98(11)	23.06(71)	
				198.251 (2)	54.49(16)	53.4(16)	
^{182}Ta	114.43	114.74(12)	d	1221.395(3)	27.35(27)		BIPM
				1189.040(3)	16.66(16)		
				1121.290(3)	35.30(33)		
^{187}W	23.72(6)	24.00	h	685.81(1)	33.2(5)	27.30(93)	ENSDF
				551.55(1)	6.14(10)		
				479.53(1)	26.6(4)	21.84(71)	
^{196}Au	6.183(10)	6.1669(6)	d	333.03(5)	22.9(9)		ENSDF
				355.73(5)	87.		
				426.10(6)	6.6		
^{198}Au	2.6943(8)	2.6943(3)	d	411.80205(17)	95.62(6)		BIPM
				675.8836(7)	0.804(7)		
				1087.6842(7)	0.1591(21)		
^{199m}Hg	42.6(2)	42.67(9)	m	158.3(1)	52.3		ENSDF
				374.1(1)	13.8(11)		
^{204m}Pb	67.2(3)	66.93(10)	m	374.76(7)	94.20(14)	89.253(14876)	ENSDF
				911.74(15)	91.5(13)	90.0691(2999)	
^{204}Bi	11.22(10)	11.28	h	1755.28(6)	1.23(16)		ENSDF
				1703.27(5)	2.00(24)		
				983.98(3)	59(6)		
				899.15(3)	99(12)		
				670.72(3)	11.4(13)		
^{205}Bi	15.31(4)	15.11	d	703.45(5)	31.1		ENSDF
				987.66(5)	16.1(3)		
				1764.30(10)	32.5(7)		
^{206}Bi	6.243(3)		d	803.10(5)	99.0(14)		ENSDF
				537.45(4)	30.5(4)		
				343.51(3)	23.5(4)		
^{207}Bi	32.9(14)	31.55(4)	a	1063.656(3)	74.58(22)	74.6(5)	BIPM
				1770.228(9)	6.871(26)	6.87(3)	
				569.698(2)	97.76(3)		
^{208}Bi	(*)368 000(4)		a	2614.5	99.785		ENSDF
^{233}Th	(*)21.83(4)	22.15(8)	m	595.39(6)	0.1178(16)		BIPM
				170.60(6)	0.507(9)		
				86.477(10)	1.843(22)		
^{233}Pa	(*)26.975(13)	26.98(2)	d	415.764(5)	1.97(12)		BIPM
				311.904(5)	68.9(12)		
				300.129(5)	12.3(4)		
^{237}U	(*)6.752(2)	6.749(16)	d	332.376(16)	1.199(16)		BIPM
				208.00(1)	21.3(3)	21.2(3)	
				59.54091(10)	34.1(9)	34.5(8)	
^{239}U	23.46		m	844.10(3)	0.139(3)		BIPM
				662.28(2)	0.170(5)		
				74.664(1)	51.6(13)		
^{239}Np	2.356(3)		d	106.125(2)	25.9(3)		BIPM
				228.183(1)	11.32(22)		
				334.310(3)	2.04(2)		

[1] International Reactor Dosimetry File 2002 (IRDF-2002), Technical Report Series **452**, IAEA, (2006); numerical data: https://www-nds.iaea.org/irdf2002/.